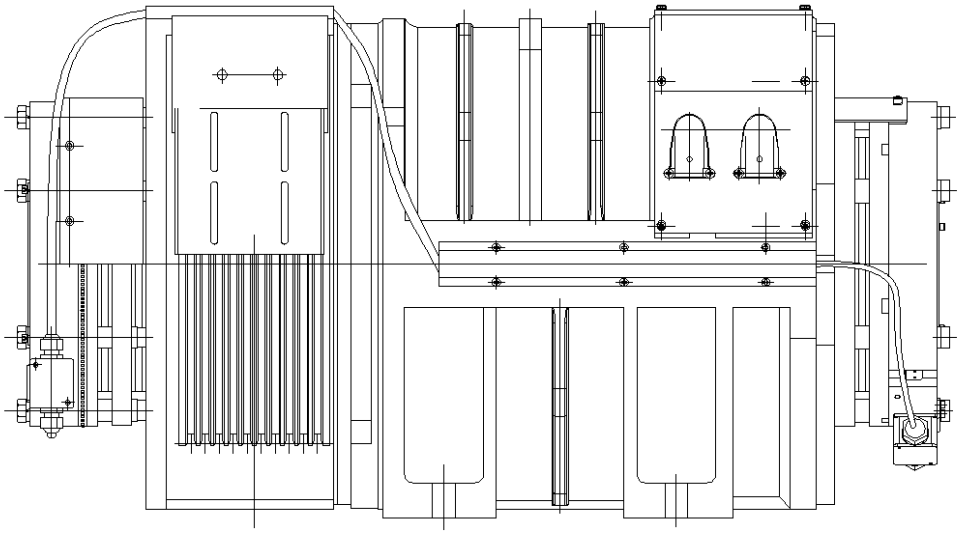
TSM/TMGL1/TMGL2/TMGL2A Series

PMS Gearless Elevator Traction Machine

Complete Operation and Service Manual



SUZHOU TORIN DRIVE EQUIPMENT CO., LTD.

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.

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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.

(Revised Full/PDF Doc Version of Expr

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 only by qualified elevator personnel. In the interest of your personal safety and the safety of others, do NOT attempt ANY procedures 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.

1.2General 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 because high voltage may 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**.

1.8Product Specific Warnings

The TMGL2/TMGL2A Machine MUST be balanced during hoisting. See Hoisting Methods 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.

2.2Storing

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

The TMGL2/TMGL2A machine can be lifted by using a combination of hooks, chains & slings designed to safely carry the weight of the machine. See Figure 1and 2.

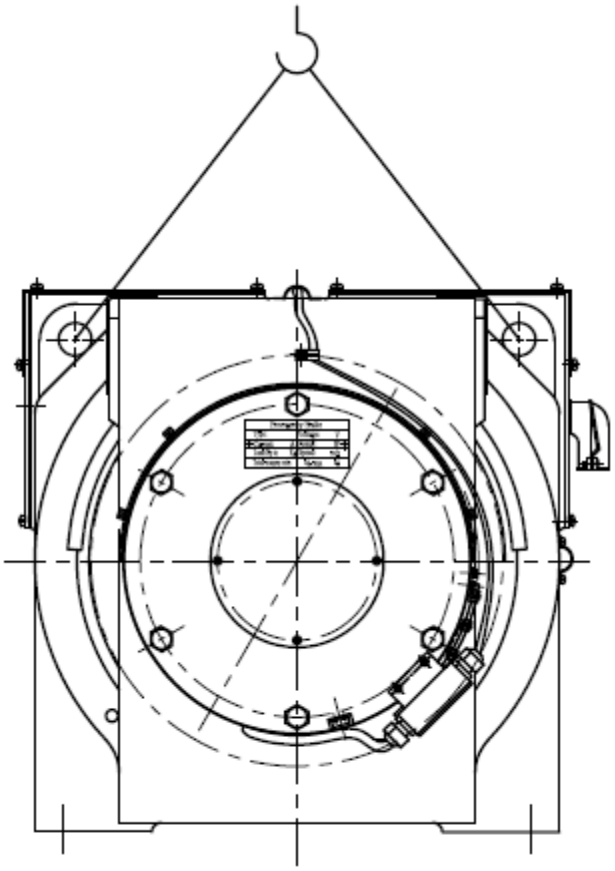


Figure 1: TSM/TMGL1 Machine Recommended Hoisting Methods

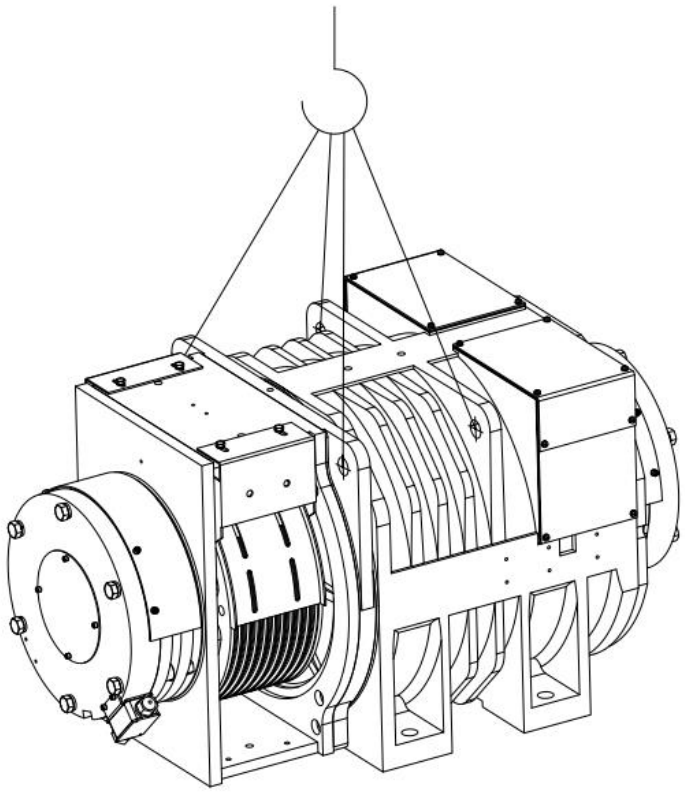


Figure 2: TMGL2/TMGL2A Machine Recommended Hoisting Methods

3.0 Applications

3.1Overview

TMGL2 Machine is a synchronous permanent magnet gearless machine designed for elevators. Its configuration allows elevator speed up to 500 fpm (2.54m/s) and an elevator capacity up to 3500 lbs with 1 to 1 roping (TMGL2) and single wrap applications.

Each machine has two independent clutch-disc brakes: normal and emergency brake.

3.2Codes 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.

3.3Environmental 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

3.4Machine Specifications

Maximum Sheave Shaft Load: Up to 12814 lbs (57 kN) (TSM)

Maximum Sheave Shaft Load: Up to 16000 lbs (72 kN) (TMGL1)

Maximum Sheave Shaft Load: Up to 18000 lbs (80kN) (TMGL2)

Maximum Sheave Shaft Load: Up to 18000 lbs (80kN) (TMGL2A)

Maximum Speed: Up to 500 fpm (2.54 m/s) (TSM/TMGL1/TMGL2)

Maximum Speed: Up to 350 fpm (1.78 m/s)(TMGL2A)

Maximum Capacity: Up to 5000 lbs (2273 Kg) @ 50% Counterweighting (2:1 Roping) (TSM)

Maximum Capacity: Up to 2500 lbs (2273 Kg) @ 50% Counterweighting (1:1 Roping) (TMGL1/TMGL2A)

Maximum Capacity: Up to 3500 lbs (1591 Kg) @ 50% Counterweighting (1:1 Roping) (TMGL2)

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

Sheave Diameter: 20 in (508 mm) (TMGL2A)

Sheave Diameter: 17.32 in (440 mm) (TSM/TMGL1)

Sheave Diameter: 16.14 in (410 mm) (TMGL2)

Rope Size: 10 mm (TSM/TMGL1/TMGL2); 0.5in(12.7mm)(TMGL2A)

Maximum Power: Up to 45HP (33.5 KW) (TSM)

Maximum Power: Up to 22.3HP (16.6 KW) (TSM)

Maximum Power: Up to 32.4 HP (24.2KW) (TMGL2)

Maximum Power: Up to 16.2HP (12.1KW) (TMGL2A)

Motor Voltage: 350VAC (suitable for 460VAC inverter drives) (TSM/TMGL1/TMGL2A)

Motor Voltage: 330VAC (suitable for 460VAC inverter drives) (TMGL2)

Normal Brake Model Number PZ1600: Gap (Stroke): 0.23 - 0.31mm

Pick Voltage/Current: 90VDC/2.05A

Hold Voltage/Current: 45VDC/1.0A (TSM)

Normal Brake Model Number PZ1600A: Gap (Stroke): 0.23 - 0.31mm

Pick Voltage/Current: 90VDC/2.8A

Hold Voltage/Current: 45VDC/1.4A (TMGL1)

Normal Brake Model Number SPZ1600A: Gap (Stroke): 0.34 - 0.42mm

Pick Voltage/Current: 90VDC/2.05A

Hold Voltage/Current: 45VDC/1.0A (TMGL2/TMGL2A)

Emergency Brake Model Number SPZ1600A: Gap (Stroke): 0.34 - 0.42mm

Pick Voltage/Current: 90VDC/2.05A

Hold Voltage/Current: 45VDC/1.0A (TSM/TMGL1)

Emergency Brake Model Number SPZ1600B: Gap (Stroke): 0.34 - 0.42mm

Pick Voltage/Current: 90VDC/2.05A

Hold Voltage/Current: 45VDC/1.0A (TMGL2/TMGL2A)

Recommended Lubrication: Shell Gadus S3 V220C or any equivalent EP2 grease

Table 1: Detailed Machine Specifications

Model number		**TSM-3535**	**TSM-5035**	**TSM-3550**	**TSM-5050**	**TSM-5020**
Roping		2:1	2:1/1:1	2:1	2:1	2:1/1:1
Elevator capacity	lbs	Up to 3500	5000/2500	Up to 3500	5000	5000/2500
Elevator speed	fpm	Up to 350	350/700	500	500	200/400
Sheave diameter/grooves	inch	17.32 / 7	17.32 / 8	17.32 / 7	17.32 / 8	17.32 / 8
Rated power	HP	21.8	31.2	31.2	44.6	17.6
Rated torque	Ft-lbs	742.6	1061.2	742.6	1061.2	1061.2
Acceleration torque	Ft-lbs	1856.5	2653	1856.5	2653	2653
Rated speed	rpm	155	155	221	221	87
Rated amps	A	32.9	46.9	46.5	67	27.6
Rated voltage (+/-5%)	V	350	350	350	350	350
Rated frequency	Hz	25.8	25.8	36.8	36.8	14.5
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps
Min. normal brake torque	Ft-lbs	1099	1530	1099	1530	1530
Min. emergency brake torque	Ft-lbs	1456	2046	1456	2046	2046
Max. shaft load	lbs	12814	12814	12814	12814	12814
Total moment of inertia	lbs-ft2	143	161	143	161	161

Model number		**TMGL1-2520**	**TMGL1-2535**	**TMGL1-2550**
Roping		1:1	1:1	1:1
Elevator capacity	lbs	Up to 2500	Up to 2500	Up to 2500
Elevator speed	fpm	Up to 200	Up to 350	Up to 500
Sheave diameter/grooves	inch	17.32 / 8	17.32 / 8	17.32 / 8
Rated power	HP	9.1	15.8	22.3
Rated torque	Ft-lbs	1061	1061	1061
Acceleration torque	Ft-lbs	2.5 x Rated torque	2.5 x Rated torque	2.5 x Rated torque
Rated speed	rpm	45	78	111
Rated amps	A	15.4	24.5	34.2
Rated voltage (+/-5%)	V	350	350	350
Rated frequency	Hz	7.5	13.0	18.5
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps
Min. normal brake torque	Ft-lbs	2275	2275	2275
Min. emergency brake torque	Ft-lbs	2775	2775	2775
Max. shaft load	lbs	16000	16000	16000
Total moment of inertia	lbs-ft2	161	161	161

Model number		**TMGL2-3520**	**TMGL2-3535**	**TMGL2-3550**
Roping		1:1	1:1	1:1
Elevator capacity	lbs	Up to 3500	Up to 3500	Up to 3500
Elevator speed	fpm	Up to 200	Up to 350	Up to 500
Sheave diameter/grooves	inch	16.14/ 10	16.14 / 10	16.14/ 10
Rated power	HP	12.9	22.7	32.4
Rated torque	Ft-lbs	1438	1438	1438
Acceleration torque	Ft-lbs	2.5 x Rated torque	2.5 x Rated torque	2.5 x Rated torque
Rated speed	rpm	47	83	118
Rated amps	A	22.3	36.5	50.0
Rated voltage (+/-5%)	V	330	330	330
Rated frequency	Hz	7.9	13.8	19.7
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps
Min. normal brake torque	Ft-lbs	2087	2087	2087
Min. emergency brake torque	Ft-lbs	2773	2773	2773
Max. shaft load	lbs	18000	18000	18000
Total moment of inertia	lbs-ft2	185	185	185

Model number		**TMGL2A-2520-LV**	**TMGL2A-2520-HV**	**TMGL2A-2535-LV**	**TMGL2A-2535-HV**
Roping		1:1	1:1	1:1	1:1
Elevator capacity	lbs	Up to 2500	Up to 2500	Up to 2500	Up to 2500
Elevator speed	fpm	Up to 200	Up to 200	Up to 350	Up to 350
Sheave diameter/grooves	inch	20/ 12.7	20/ 12.7	20/ 12.7	20/ 12.7
Rated power	HP	9.3	9.3	16.2	16.2
Rated torque	Ft-lbs	1272	1272	1272	1272
Acceleration torque	Ft-lbs	2.5 x Rated torque	2.5 x Rated torque	2.5 x Rated torque	2.5 x Rated torque
Rated speed	rpm	38	38	67	67
Rated amps	A	30.7	14.8	52.4	24.5
Rated voltage (+/-5%)	V	160	350	160	360
Rated frequency	Hz	6.4	6.4	11.1	11.1
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps
Min. normal brake torque	Ft-lbs	2087	2087	2087	2087
Min. emergency brake torque	Ft-lbs	2773	2773	2773	2773
Max. shaft load	lbs	18000	18000	18000	18000
Total moment of inertia	lbs-ft2	185	185	185	185

4.0 Machine Overview

The following is a list of major components of 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.

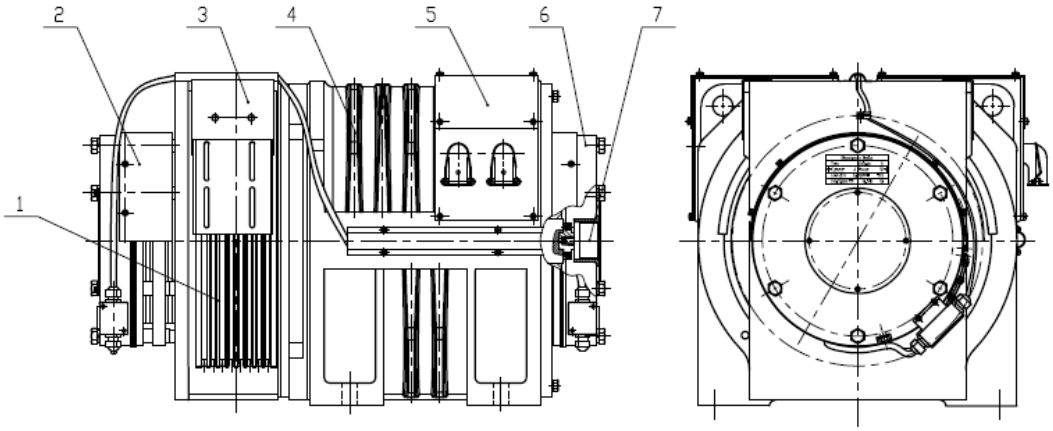


Figure 3: Machine Assembly

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. **Emergency Brake -** The electromechanical device is used to prevent the elevator from moving at emergency state.
3. **Sheave cover -** Keep the rope out of touch after hang up the ropes.
4. **PMS Motor -** The part is used to provide the necessary torque and speed to move the elevator in operation.
5. **Motor/ Brake Wires –** Junction box for motor and brake wires.
6. **Normal Brake -** The electromechanical device is used to prevent the elevator from moving when the car is at rest.
7. **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 the elevator controller.

5.0 Installation

5.1Motor Connection

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

WARNING! Direct connection to the three-phase power is forbidden, it may destroy 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.

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. See Figure 4.

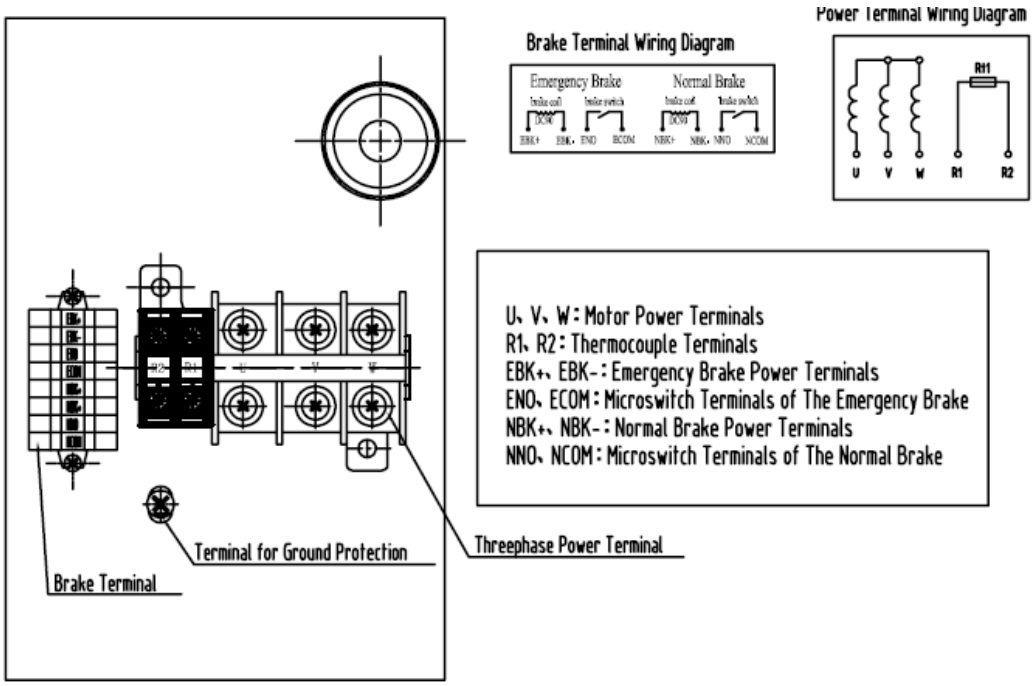


Figure 4: Motor and Brake Connections

5.2Brake 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 5.

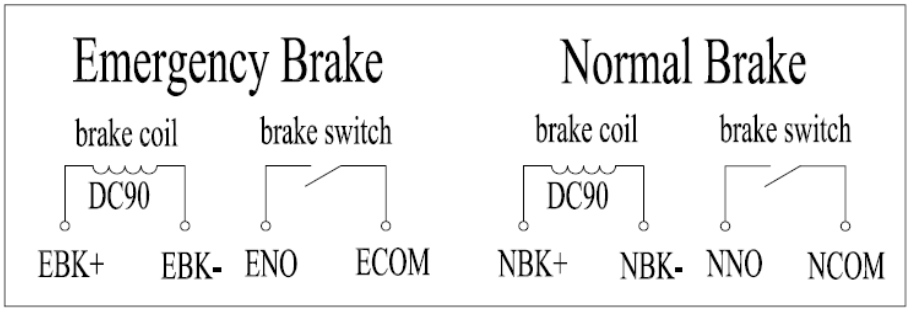


Figure 5: Normal & Emergency Brake Wiring

There are two micro switches 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). User can connect it according to your control system requests.

5.3Absolute Encoder Connection

These machines are supplied with Heidenhain Endat absolute encoder ECN413 with sub D dual-row 15-pin connector (2 meters in length). The sine/cosine incremental resolution is 2048 pulses per revolution. See Figure 6.

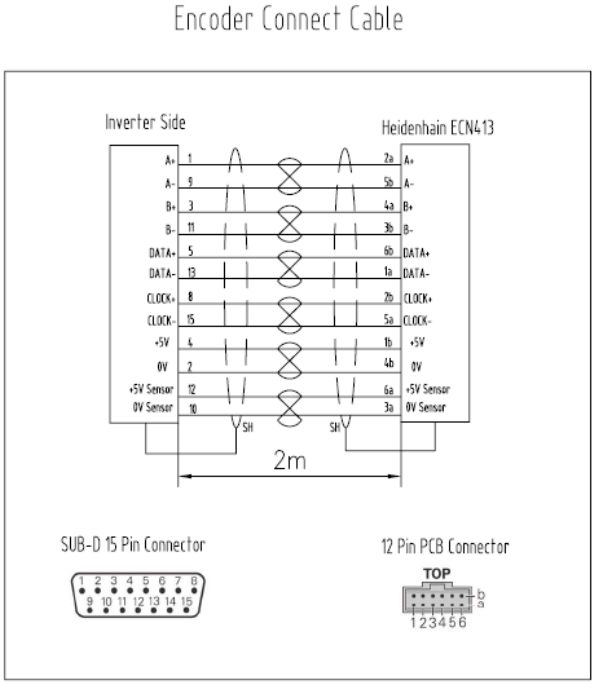


Figure 6: Encoder wiring

6.0 Adjustments

6.1Brake 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.

Please pay close attention to the value of brake stroke as described in the following pictures in the course of routine maintenance.

WARNING! If the brake lining wears out, the brake stroke will be increased; if the brake stroke ≥1mm, the brake may be disabled.

6.1.1 Emergency Brake Stroke Adjustment

Required Tools & Materials:

Open End Wrench: 24mm

Hex wrench: 5mm

Feeler Gauges: 0.34mm, 0.43mm, 0.50mm

Emergency Brake Stroke Check & Readjust for maintenance purpose

Check: With the elevator secured and power removed from the machine, loosen the screw M6x16 and lock washer6 (4 pieces) using the hex wrench (5mm), then remove the dustproof ring and rubber ring which is used to prevent dust from contaminating the brake gaps. See Figure 7.

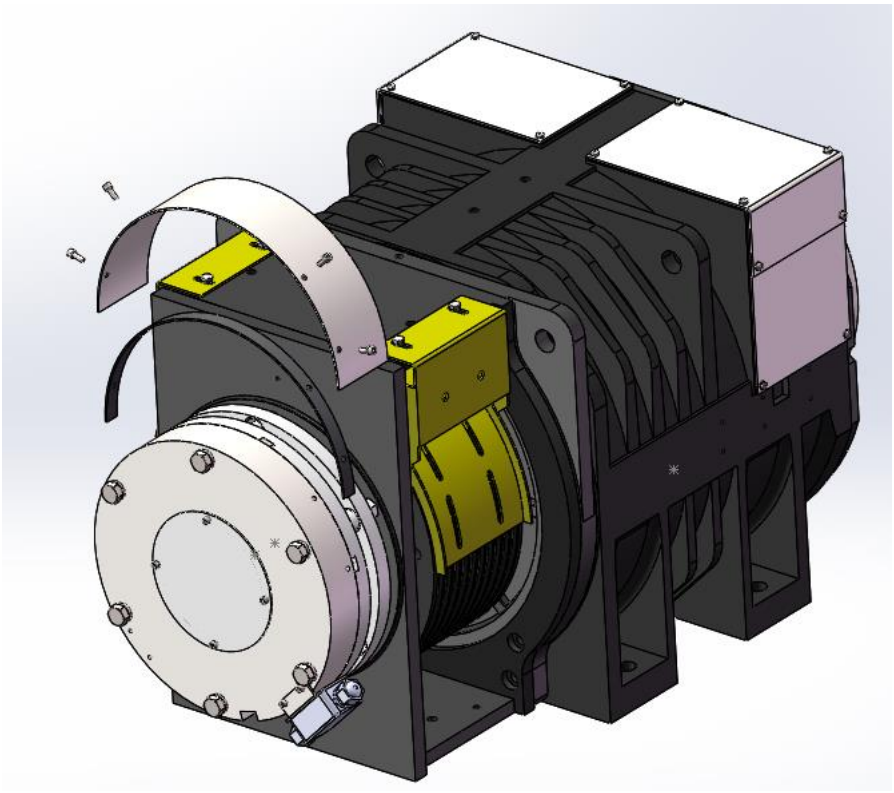


Figure 7: Emergency Brake Dust Cover Removal

Then check the brake stroke "A" (the gap between the anchor disc and brake coil body) 6 points (10°~20°left side of bolt)as shown in Figures 8 and 9 below by feeler gauge.

No adjustment is required unless Gap "A" is greater than 0.50mm. If the gap is over 0.50mm, it must be re-adjusted to the recommended range of 0.34~0.42mm as shown below.

The normal gap "A" as shown in the picture below should be 0.34~0.42mm (Use 0.34 mm feeler gauge as a "GO" gauge, and then use 0.43 mm feeler gauge as a "NO GO" gauge).

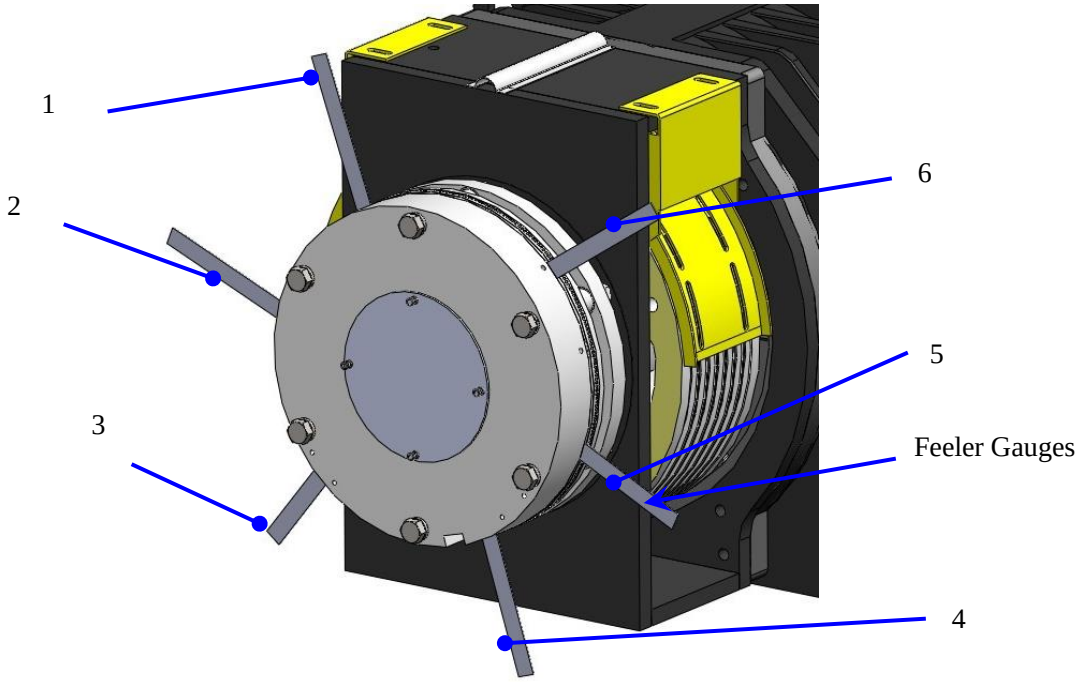


Figure 8: Emergency Brake Stroke Check locations

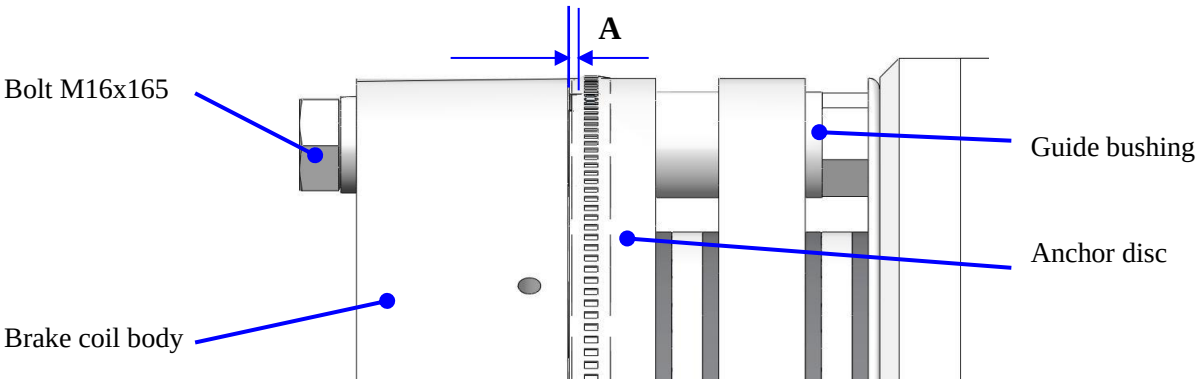


Figure 9: Emergency Brake Gap

Adjustment Procedure:

1. Loose the bolt M16using the open end wrench (24mm) about 1 turn.
2. Then adjust the guide bushing slowly using the open end wrench (24mm). If the gap is too big, turn the guide bushing (the pitch of guide bushing is 2mm) counter-clockwise to reduce it. Otherwise, turn the guide bushing clockwise to increase. **Anticipate turning the bushing a very small amount (approximately 1/18th of a turn).**
3. Then tighten the bolts M16use open end wrench (24mm) to 190 Nm (140 ft-lb).
4. Test the clearance again to make sure the gap is between0.34~0.42mm.
5. Adjust the other points where the gap is out of range using the same method.

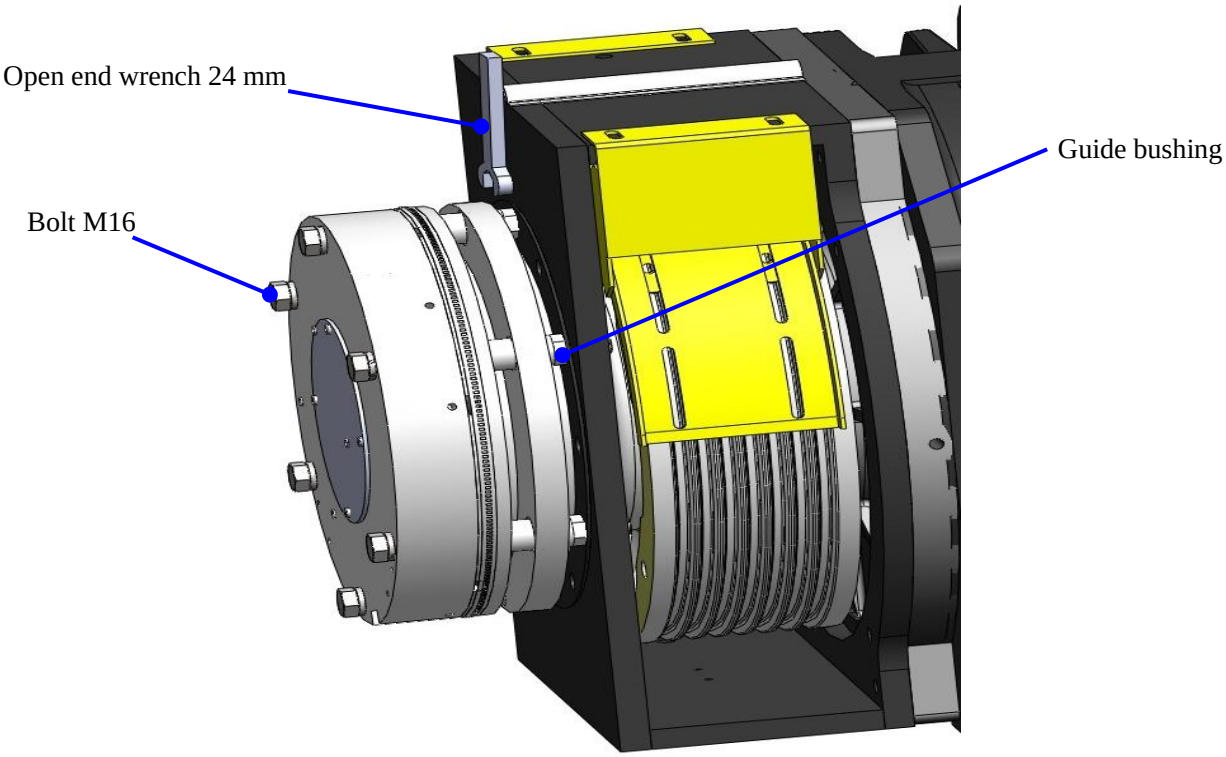


Figure 10: Emergency Brake Stroke Adjustment

6.1.2 Normal Brake Stroke Adjustment

Required Tools & Materials:

Special Open End Wrench: 24mm

Hex wrench: 5mm

Feeler Gauges:

0.23mm, 0.32mm, 0.36mm (TSM/TMGL1)

0.34mm, 0.43mm, 0.5mm (TMGL2/TMGL2A)

Normal Brake Stroke Check & Readjust for maintenance purpose

To check and adjust the normal brake gap, use the same method as the emergency brake.

The difference is the open end wrench. You must use the special open end wrench as shown in Figure 12 below.

TSM/TMGL1:No adjustment is required unless Gap "B" is greater than 0.36mm. If the gap is over 0.36mm, it must be re-adjusted to the recommended range of 0.23~0.31mm as shown in Figure 11.

The normal gap "B" as shown in Figure 11 should be 0.23~0.31mm (Use 0.23 mm feeler gauge as a "GO" gauge, and then use 0.32 mm feeler gauge as a "NO GO" gauge).

TMGL2/2A: No adjustment is required unless Gap "B" is greater than 0.5mm. If the gap is over 0.5mm, it must be re-adjusted to the recommended range of 0.34~0.42mm as shown in Figure 12.

The normal gap "B" as shown in Figure 11 should be 0.34~0.42mm (Use 0.34 mm feeler gauge as a "GO" gauge, and then use 0.43 mm feeler gauge as a "NO GO" gauge).

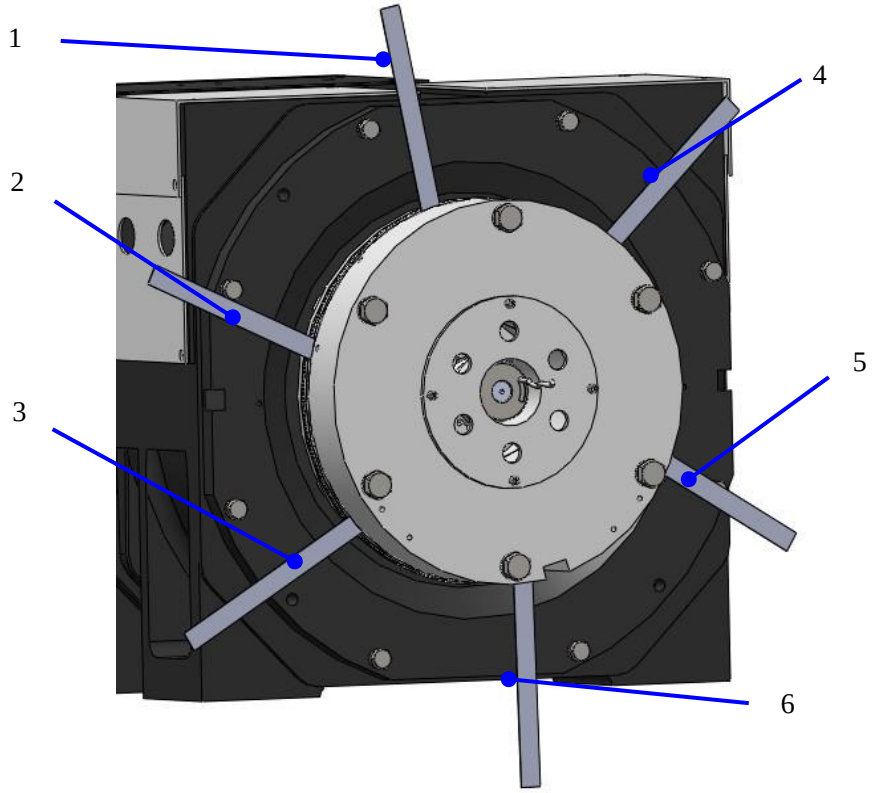


Figure 11: Normal Brake Stroke Check Locations

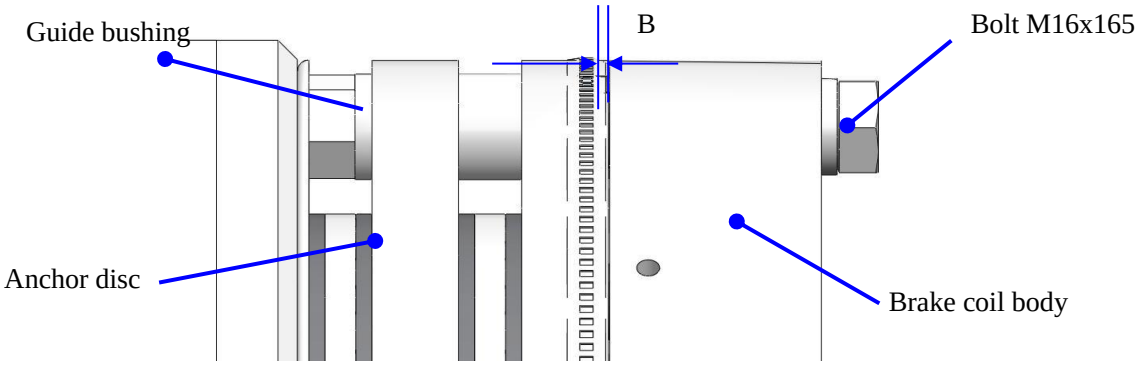


Figure 12: Normal Brake Stroke Gap

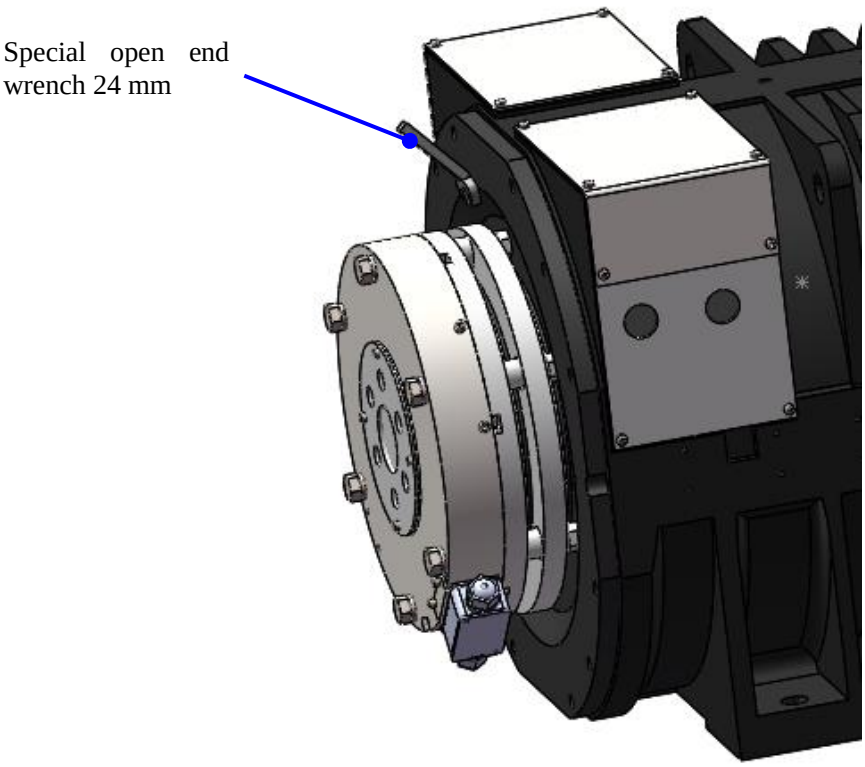


Figure 13: Special Open End 24 mm Wrench

6.2 Brake Noise Adjustment

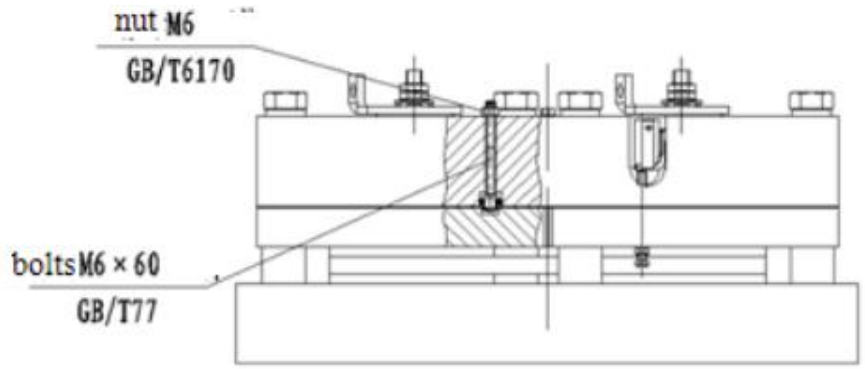
Generally brake noise adjustment has been performed at the factory and there is no need to be adjusted anymore; however, after few months of operation there may be a need to perform brake noise adjustment to optimize the brake noise absorber height for noise reduction purpose.

Required Tools & Materials:

Open End Wrench: 8mm, 10mm

6.2.1 Brake PZ1600A of TMGL1 Noise Adjustment

Adjustment: Loosen nut M6 with the open-ended wrench (10mm).Adjust bolts M6 ×60. Six location bolts should be adjusted uniformly. Retest the brake open noise until the noise level is acceptable, then lock the nut M6. After adjustment check the hold current (voltage) can hold the brake.



6.2.2 Other Brake Noise Adjustment

Note: It is important for the teeth of the six (6) brake absorber pads to be in the slots of the brake adjustment band.

If the brake noise is too high, the brake absorb pad height should be readjusted as follows:

1. Loosen the nut M5 II.
2. Tighten the nut M5 I one turn at a time to increase the height of noise absorb pad.
3. Retest the brake open noise until the noise level is acceptable. If not, repeat step 2.
4. Make sure the hold current (voltage) can hold the brake.
5. Re-tighten the M5 II.

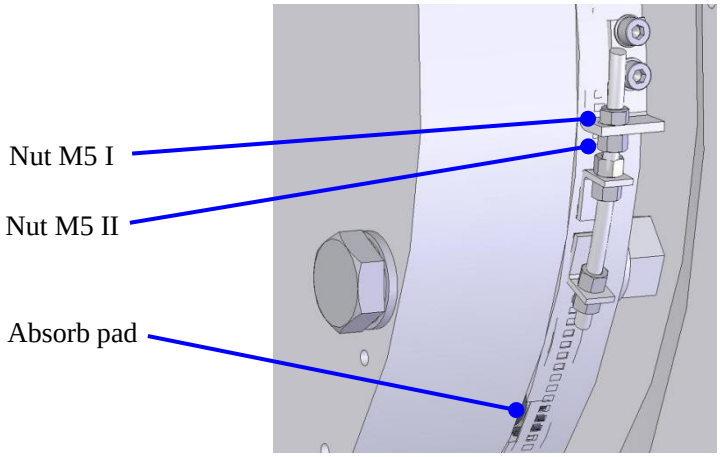


Figure 14: Brake noise adjustment

6.3 Brake Switch Adjustment

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

See Section 8.2.3 Brake Switch Adjustment for adjustment instructions.

7.0 Maintenance

WARNING! Only qualified personnel are allowed to perform any maintenance work. The persons who do the maintenance work must be very careful due to some work must done when the machine running.

7.1Brake Stroke Check

Suggest check cycle

Every 6 months

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

Criteria benchmark

Emergency brake: < 0.50mm (emergency brake gap (stroke) "A" should be less than 0.50mm)

See **Section 6.1.1, Emergency Brake Stroke Adjustment**

Normal Brake PZ1600/PZ1600A of TSM/TMGL1: < 0.36mm

Normal brake SPZ1600A of TMGL2/TMGL2A: < 0.5mm

See **Section 6.1.2, Normal Brake Stroke Adjustment**

7.2 Brake Lining Check

Suggest check cycle

Every 12 months

WARNING! **If the brake lining wears too much (Total abrasion ≥1mm), the brake maybe disabled.**

Criteria benchmark

Total abrasion of the brake lining wear must be <1mm.

Check the distance A between the anchor disc 1 and the 2, it must >15mm (original distance is 16mm). See Figure 15 on next page.

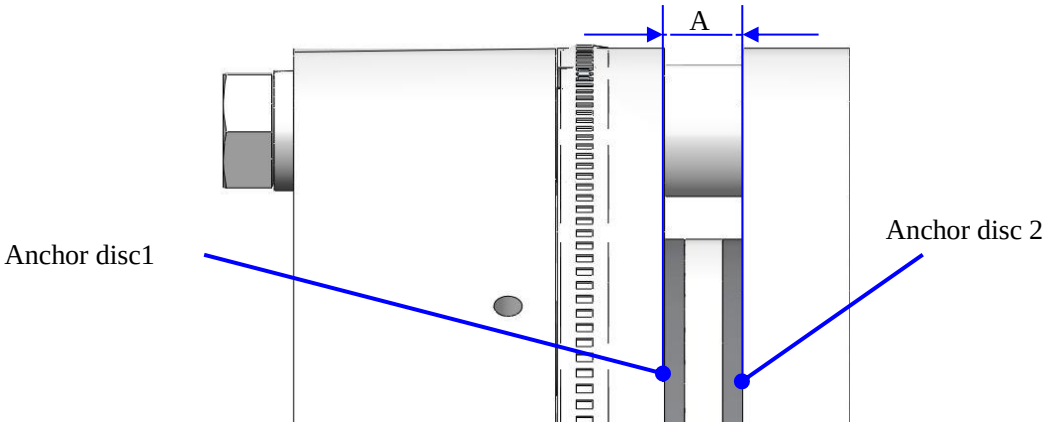


Figure 15: Brake Lining Wear Check

8.0 Replacement

WARNING! The user who does the replacement must make sure that the machine is powered off and the elevator is secure and will not be moved unexpectedly.

Only qualified personnel are allowed to perform the replacement work.

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

8.1Encoder Replacement

Required Tools & Materials:

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

3mm Hex wrench or wide blade screwdriver

Inner hexagon bolt M10x1.5x50 (Supplied with new encoder)

Clean cloth

8.1.1 Encoder Removal

1. Remove the end cover using either the 3mm hex wrench or the wide blade screwdriver. See Figure 16.

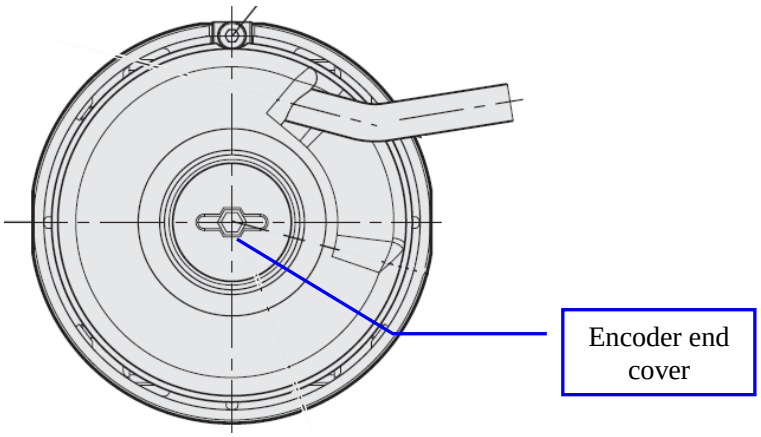


Figure 16: Remove end cover

2. Remove the encoder cable (only for ECN1313 model). ECN413 model does not have the connector as shown below. See Figure 16.

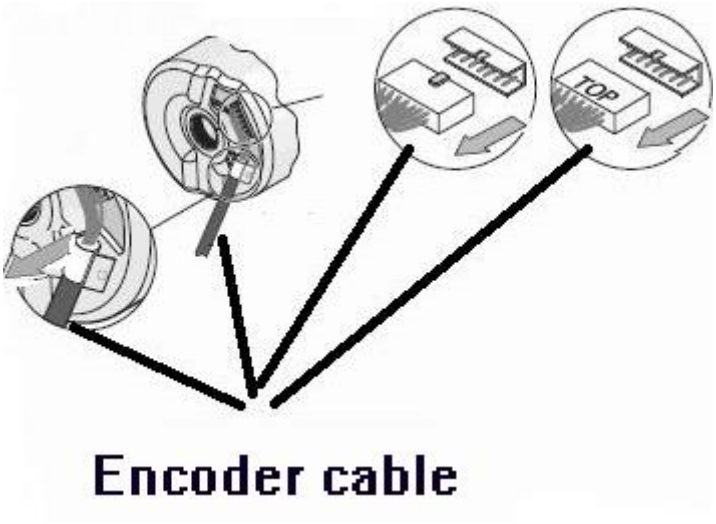


Figure 17: ECN1313 Encoder Cable Removal

3. Loosen the bolt M2.5 with hex wrench (2mm). It does not have to be removed. See Figure 18.

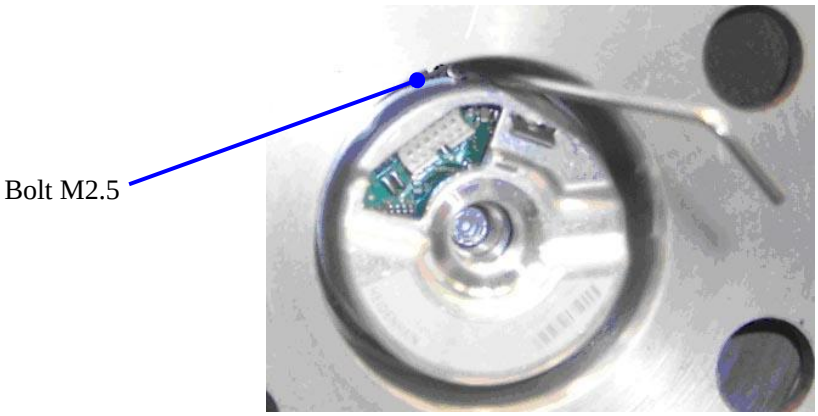


Figure 18: Loosen M2.5 bolt

4. Loosen bolt M5x50 with hex wrench (4mm) 1~2 turns.
5. Tighten the M10x1.5x50 bolt into the encoder to push the encoder out of encoder shaft (about 0.8-1.6mm) using the hex wrench (8mm). Remove the bolt M10 and bolt M5, and remove the encoder when it can be easily pulled loose.

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.)

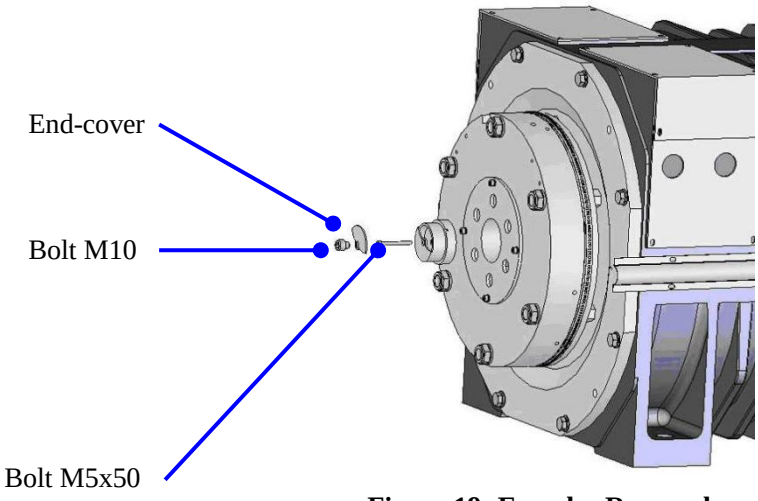


Figure 19: Encoder Removal

8.1.2 Encoder installation

1. Remove the encoder end-cover using the 3mm hex wrench or flat blade screwdriver.
2. Install the encoder to the encoder cover, tighten the bolt M5x50with hex wrench (4mm) to 44 in-lbs.
3. Install the encoder cable and secure it, install the encoder end-cover. Tighten to 44 in-lbs.
4. Tighten the M2.5 with hex wrench (2mm) to 9 in-lbs.

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

8.2Brake 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

Hex wrench (2.5mm)

Philips head screw driver

Straight head screw driver

Torque screw driver (Need to measure1.8, 8.8 in-lb)

Breakable blue Loctite 243

Multi-meter

Feeler gauges (0.1mm, 0.2 mm)

Rubberized electrical tape

8.2.1 Brake Switch Removal

1. Open the brake junction box using a Philips head screw driver.
2. Take off the brake side cable in brake terminal using a straight head screwdriver, then remove the cable through the connecter. See Figures 20 and 21.

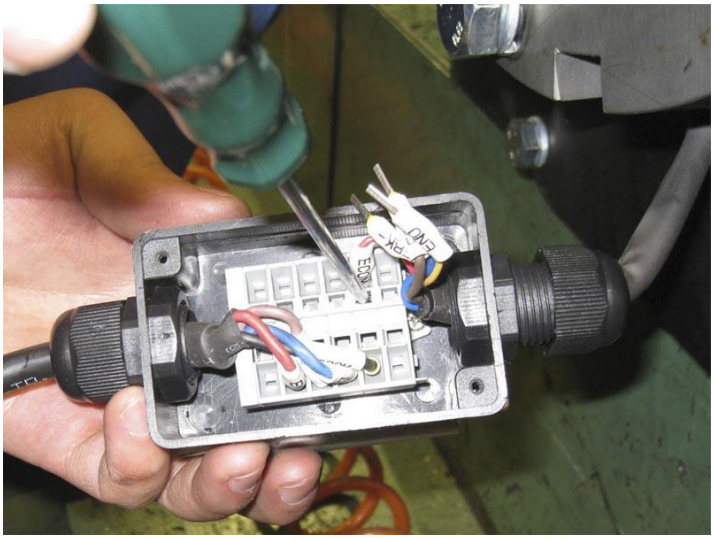


Figure 20: Brake Switch Terminal

Notes: For machines manufactured after July 2009, there is no terminal inside the box; therefore, cut off the cable then remove it through the connector.

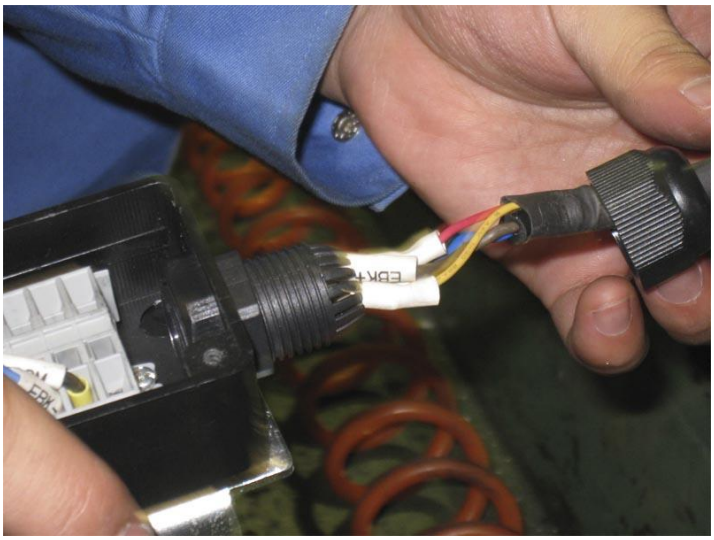


Figure 21: Brake Switch Connection

3. Remove the bolt M3x14 with the hex wrench (2.5mm), then take off the brake switch from brake. See Figure 22.

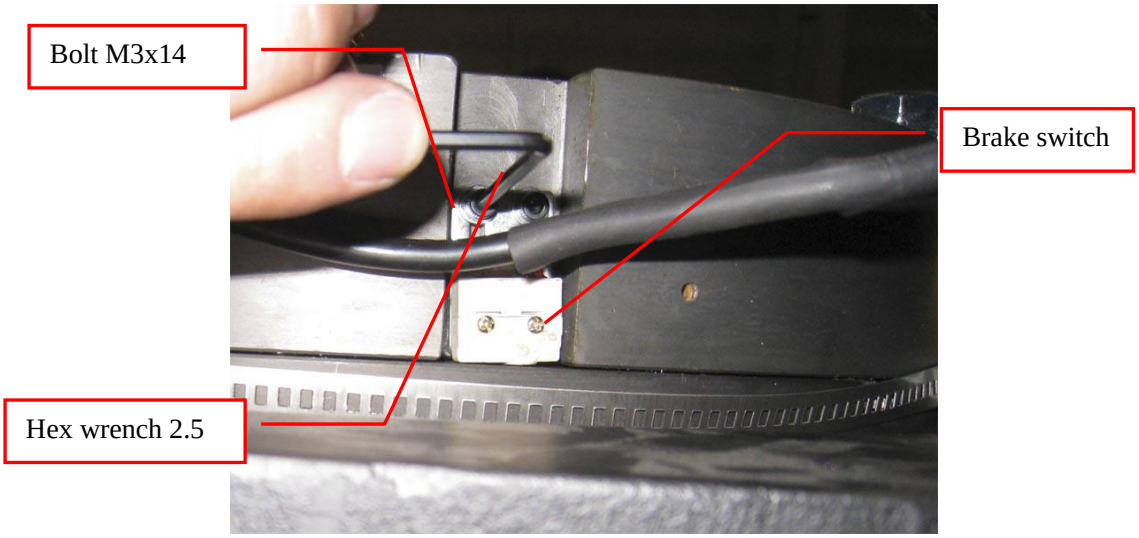


Figure 22: Brake Switch removal

4. Cut off the heat shrink tubing which protects the brake cable using scissors. See Figure 23.

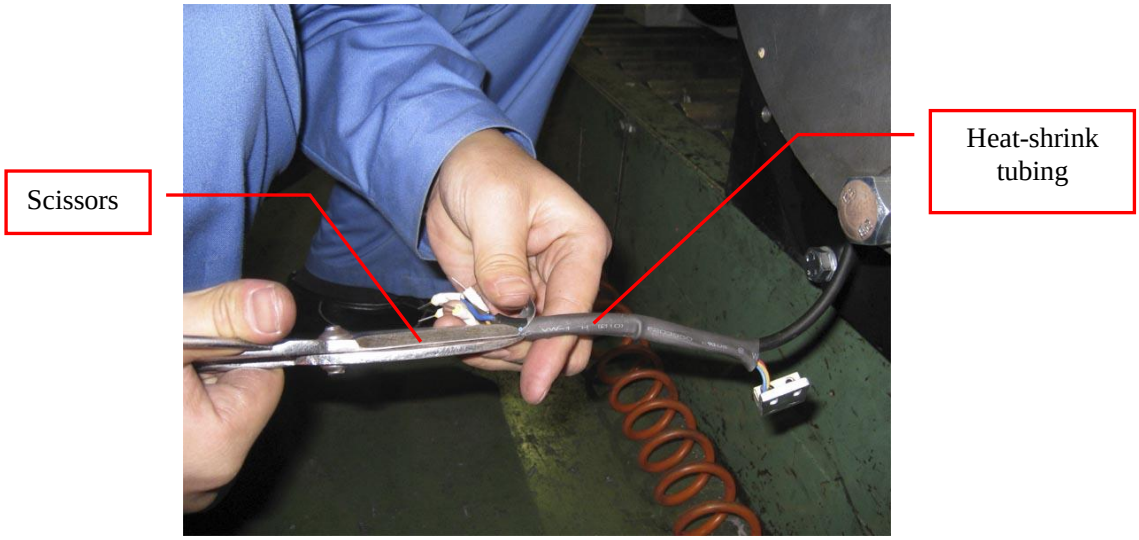


Figure 23: Heat-shrink tubing removal

5. Loosen the screws M2x10 using a Philips head screw driver. The switch is secured with glue, so use the straight head screwdriver to separate it from the bracket. See Figures 24 and 25.

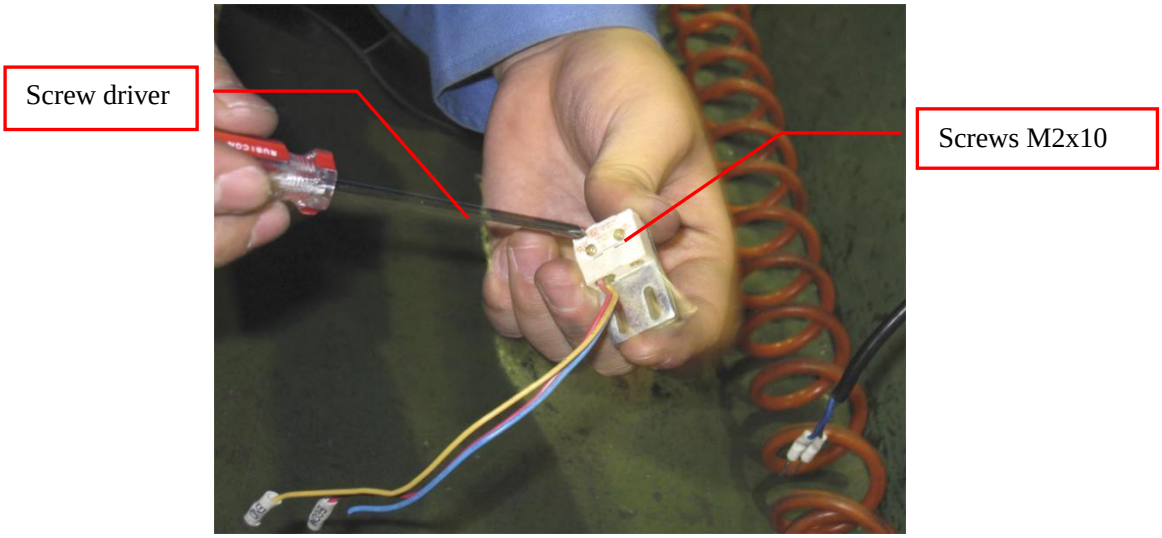


Figure 24: Removing brake switch from bracket

Figure 25: Separating brake switch and bracket

8.2.2 Brake Switch Installation

1. Clean the brake switch bracket surface. See Figure 26.

Figure 26: Clean brake switch bracket

2. Apply the coating sealant (Loctite 243 or equivalent) on brake switch and bracket surface. See Figure 27.

Figure 27: Applying sealant to brake switch

3. Install the new switch to the bracket using screws M2x10 with a Philips head screw driver. Use torque screw driver to tighten the bolt to 1.8 in-lb. Then apply blue Loctite 243 or equivalent between the screw head and the switch body for anti-vibration purpose. See Figure 28.

Figure 28: Apply Loctite 243 or equivalent

4. Install the switch and bracket to the brake body but do not tighten the bolts. See Figure 29.

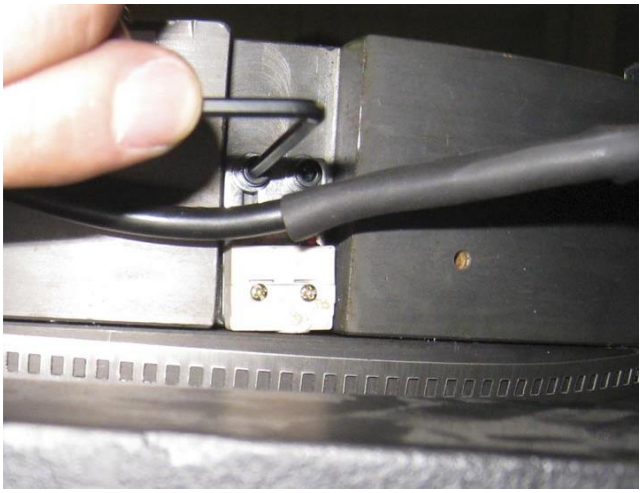


Figure 29: Reinstall brake switch and bracket

5. Cover the brake switch cable with and brake power lines with electrical tape. See Figure 30.

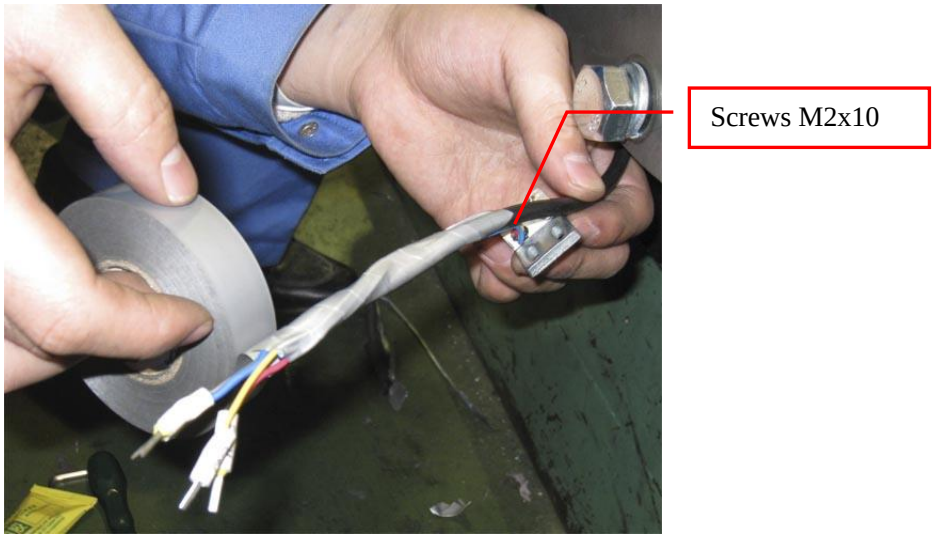


Figure 30: Electrical tape wrap

6. Install the brake cable to the brake box, and then properly connect the cable according to the marking. Close the junction box cover.

8.2.3 Brake switch adjustment

1. Use a multi-meter to make sure the new switch is functional by inserting feeler gauges between the brake plate and switch. The switch should not be activated when inserting a 0.1mm (0.004'') feeler gauge and should be activated when inserting a 0.2mm (0.008'') feeler gauge. Otherwise the brake switch bracket position must be readjusted. See Figure 31.

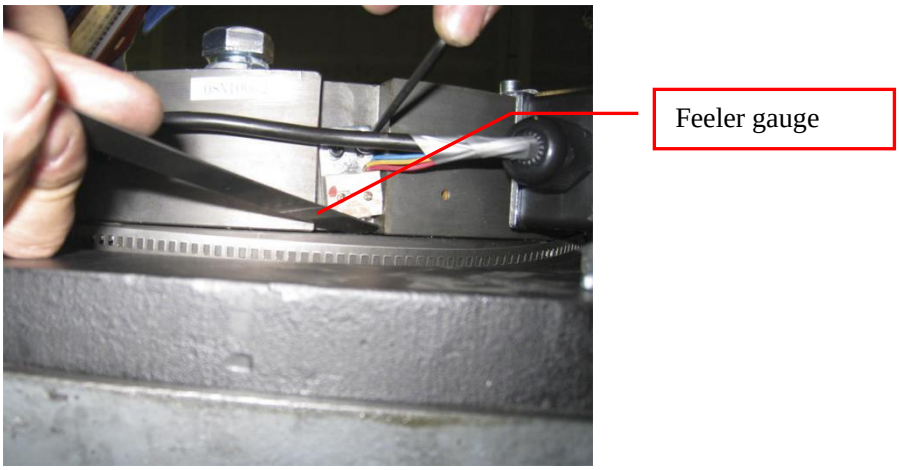


Figure 31: Brake Switch Adjustment

2. After the adjustment is correctly confirmed, tighten the screws M3 with hex wrench 2.5.Usetorquescrew driver to tighten the bolt to 9 in-lb. Then apply red Loctite 480 or equivalent between the screw head and the installing plate for anti-vibration purpose. See Figure 32.

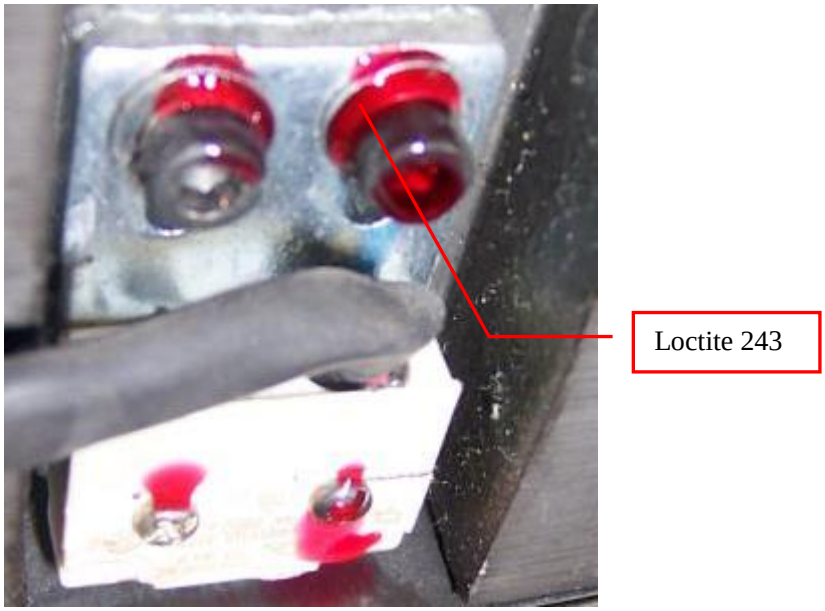


Figure 32: Brake Switch after applying Loctite 243

8.3 Emergency Brake & Friction Lining Replacement TSM & TMGL1/2/2A

Required Tools & Materials:

Open end wrench: (24mm)

Hex wrench (4mm, 5mm)

Screwdriver

Clean cotton fabric

Hoisting ropes

Cleanser (alcohol based)

Vaseline

Threaded rod M16x2x320 (12.5")

8.3.1 Emergency brake and friction lining removal

1. Disconnect the brake cable from emergency brake junction box.
2. Remove the screws M5x12 and washer5 (4 pieces) with hex wrench (4mm), and remove the 4 screws M6x16 and lock washer6 (4 pieces) with hex wrench (5mm), then remove the cover, dustproof ring and rubber ring. See Figure 33 and Table 2.
3. Remove the bolt M16x165 with open end wrench (24mm).

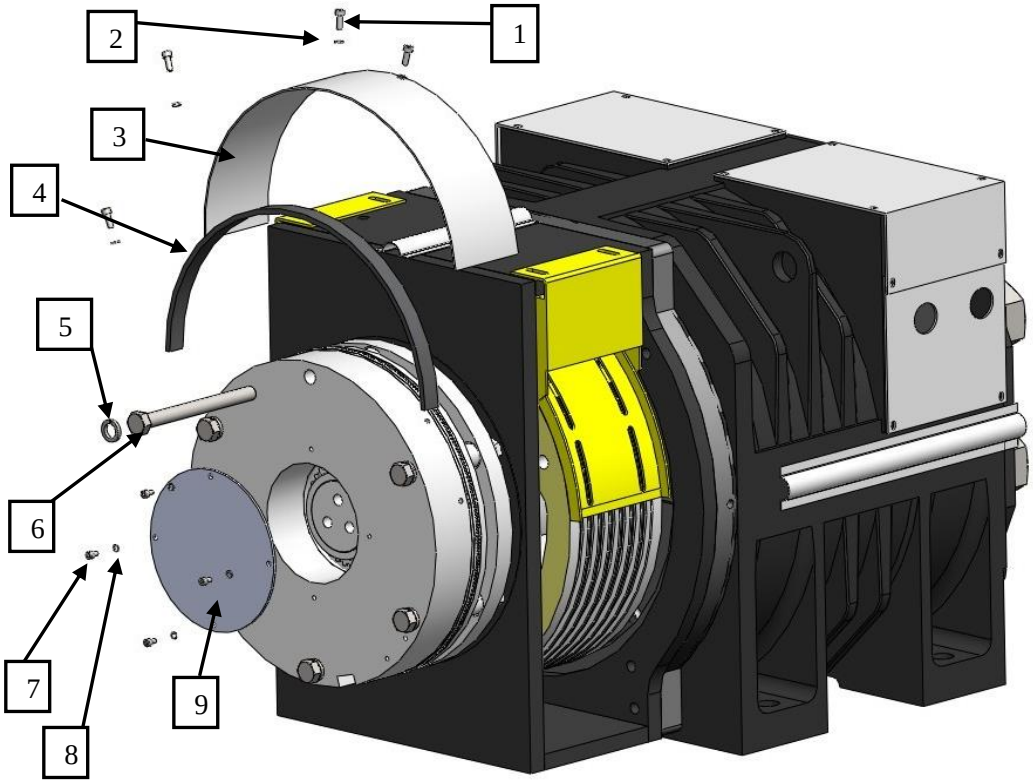


Figure 33: Emergency Brake Cover Parts

Table 2: TSM & TMGL1/2/2A Emergency Brake Cover Parts

No.	Name	No.	Name
1	Screw M6x165	6	Bolt M16x165
2	Lock washer 6	7	Screw M5x12
3	dustproof ring	8	Lock washer 5
4	Rubber ring	9	Cover
5	Lock washer 16		

4. Then install the threaded rod M16x2x320 into the hole. See Figure 34.

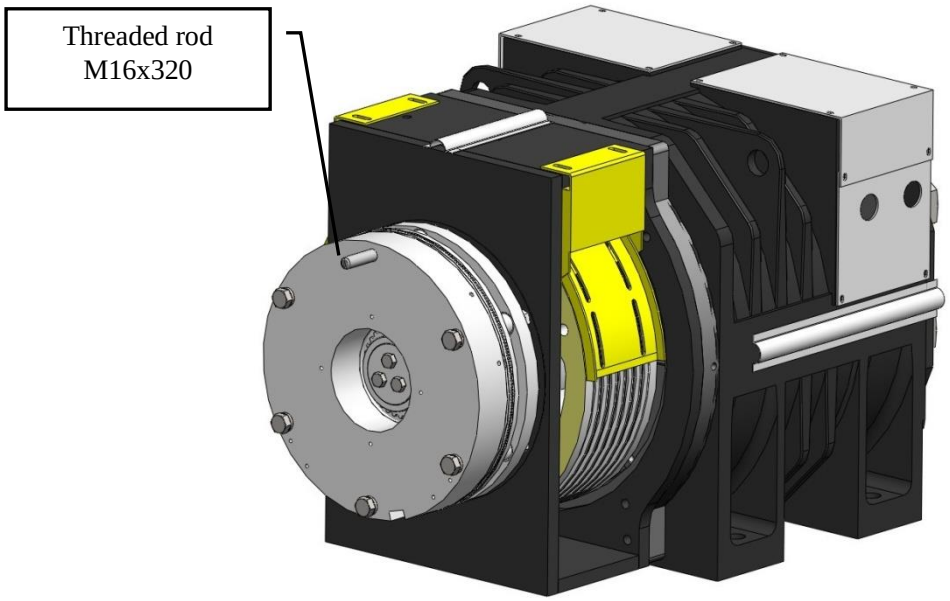


Figure 34: Install Threaded rod

5. Loosen other 5 bolts M16x165 evenly; move out the emergency brake; then hoist out the brake with hoisting ropes (See Figures 35& 36 and Table 3). Remove the brake coil body, friction lining part A, anchor disc and friction lining part B.

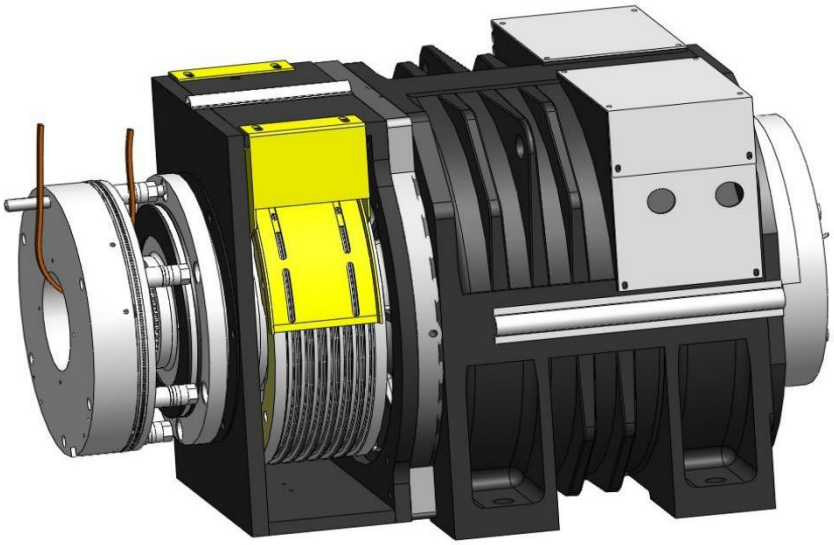


Figure 35: Removing the Emergency Brake

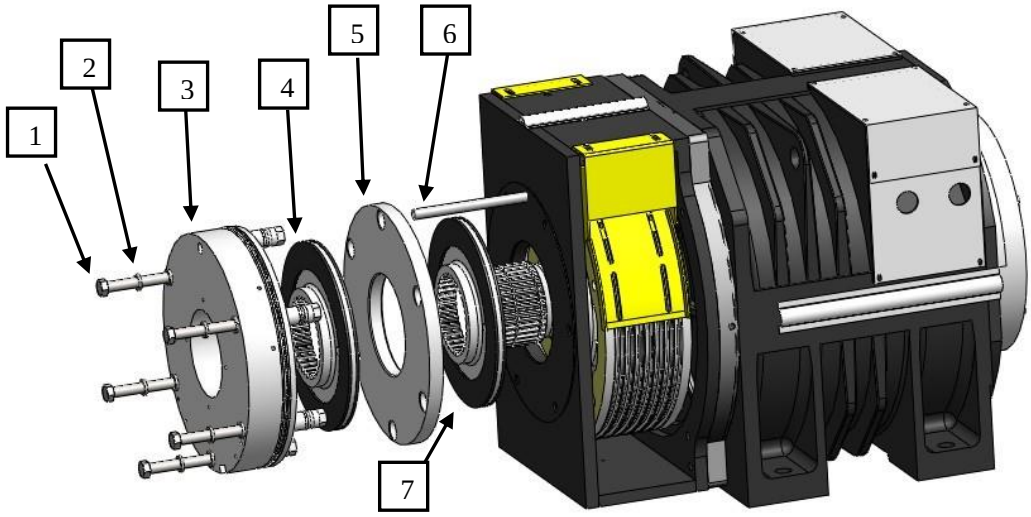


Figure 36: Emergency Brake Parts

Table 3: TSM & TMGL1/2/2A Emergency Brake Parts

No.	Name	No.	Name
1	Bolt M16x165	5	Anchor disc
2	Lock washer 16	6	Threaded rodM16x320
3	Brake coil body	7	Friction lining part B
4	Friction lining part A		

6. Replace the O-ring (Ø109x3.1) if necessary. See Figure 37.

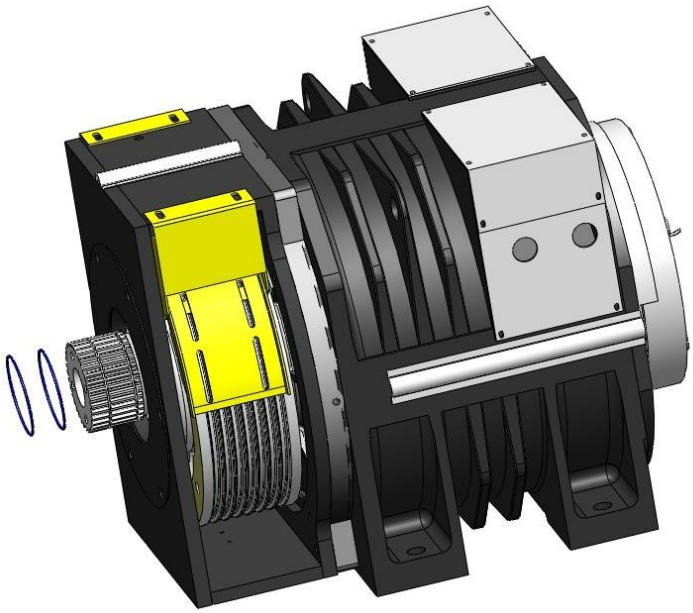


Figure 37: Install O-rings

8.3.2 Emergency brake and friction lining installation

1. Coat Vaseline on the new O-rings，then install them to the O-ring groove of the shaft.
2. Clean the spline, brake frame, and friction lining part with cleanser.
3. Then install the new friction lining part B. It is OK to apply a little force using rubber hammer to press it in and move it forward through the spline (Be careful not to damage the O-ring.); make sure the friction lining part moves easily. See Figure 38.

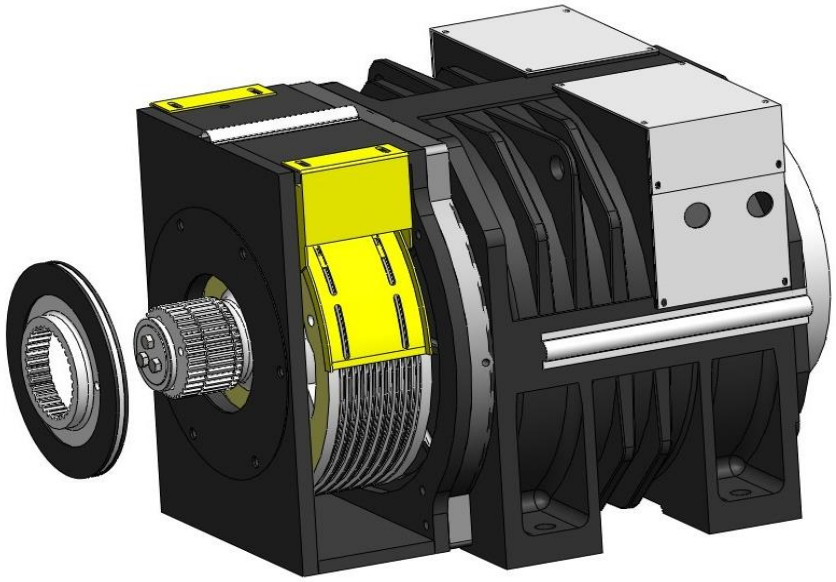


Figure 38: Installing Friction Lining Part B

4. Install the threaded rodM16x320into the top-hole of brake frame as shown by item 6 in Figure 39 and Table 4.
5. Install the anchor disc using the guide bolt.
6. Install the friction lining part A. It is OK to apply a little force using rubber hammer to press it in and move it forward through the spline (Be careful not to damage the O-ring.); make sure the friction lining part moves easily.
7. Then install the other brake components according to isometric assembly picture below (Figure 39).
8. Tighten bolts M16x165 and lock washer 16 (5 pieces) diagonally and evenly.

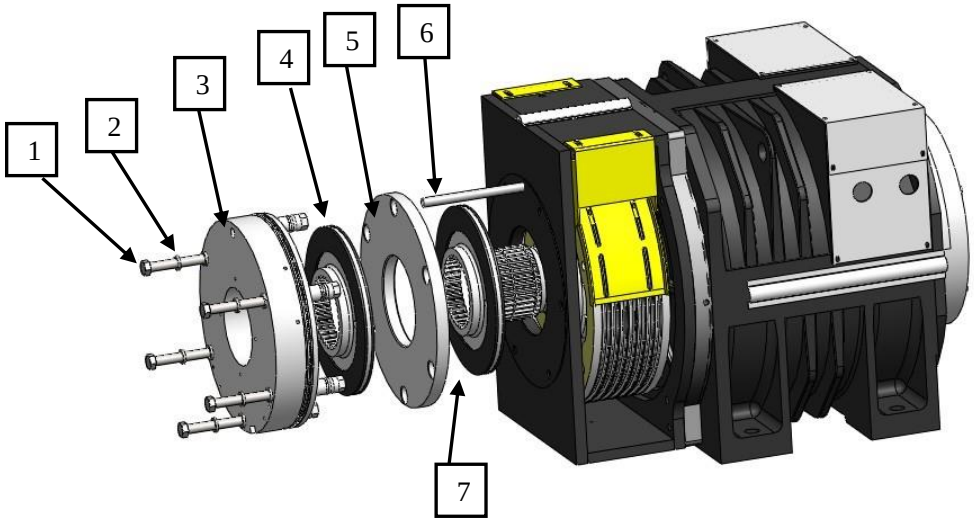


Figure 39: Re-installing Emergency Brake

Table 4: TSM & TMGL1/2/2A Emergency Brake Parts

No.	Name	No.	Name
1	Bolt M16x165	5	Anchor disc
2	Lock washer 16	6	Threaded rodM16x320
3	Brake coil body	7	Friction lining part B
4	Friction lining part A		

9. Remove the threaded rodM16x320; tighten remaining bolt M16x165 and lock washer 16. See Figure 40.

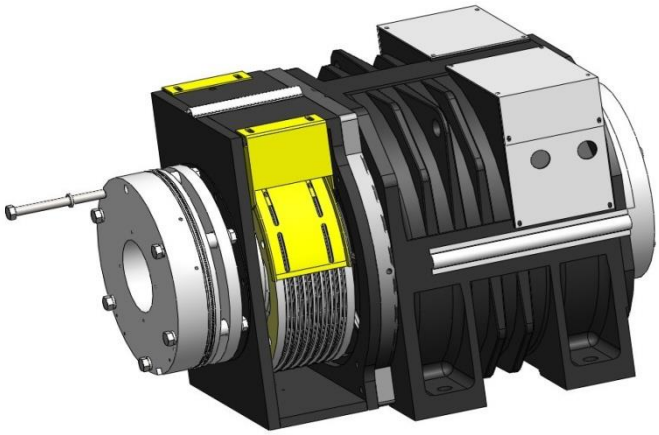


Figure 40: Final Bolt installation

10. Re-connect the brake cable.
11. Re-install dust proof cover.

8.3.3 Emergency Brake Adjustment

After the installation, the brake stroke must be rechecked and readjusted. See Section 6.1.1 Emergency Brake Stroke Adjustment for the procedure.

8.3.4 Test brake

Retest and confirm the new brake holding ability with regard to loading before using the elevator.

8.4 TSM & TMGL1 Normal Brake & Friction Lining Replacement

Required Tools & Materials:

Open end wrench: (24mm)

Hex wrench (4mm）

Screwdriver

Clean cotton fabric

Hoisting ropes

Cleanser (alcohol based)

Vaseline

Threaded rod M16x2x320

8.4.1 Normal brake & friction lining removal

1. Remove the encoder (Refer to Section 8.1, Encoder Replacement).
2. Disconnect the brake cable from normal brake junction box.
3. Loosen the 4 screws M6x16 and lock washer 6 (4 pieces) with hex wrench (5mm), and then remove the cover, dustproof ring and rubber ring. See Figure 41 and Table 5.

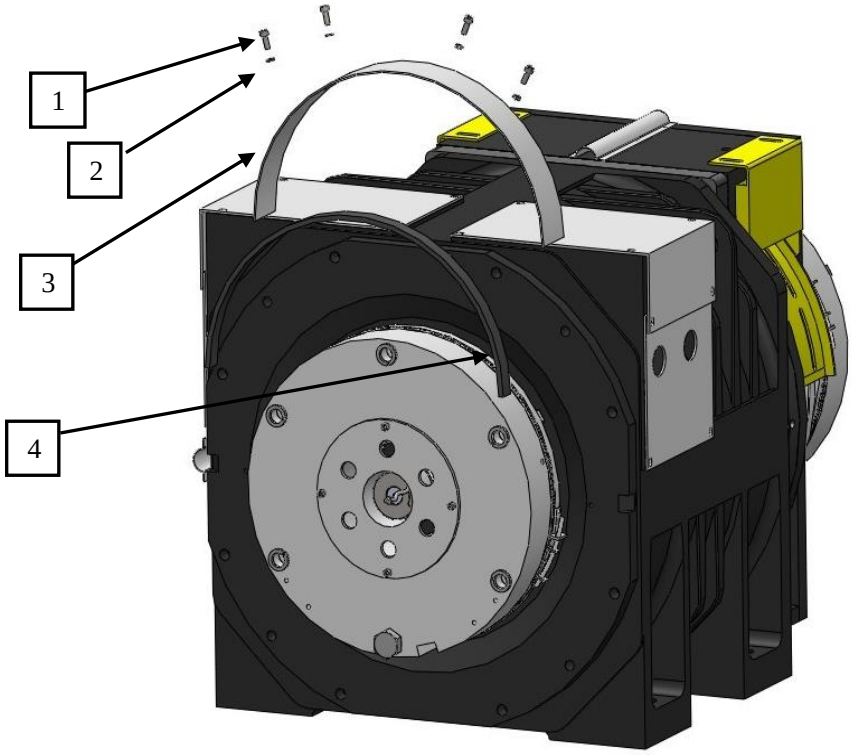


Figure 41: Normal Brake Dust Cover removal

Table 5: Normal Brake Dust Cover Parts

No.	Name	No.	Name
1	Screw M6x16	3	Dustproof ring
2	Lock washer 6	4	Rubber ring

4. Remove the bolt M16x165 with open end wrench (24mm). See Figure 42.

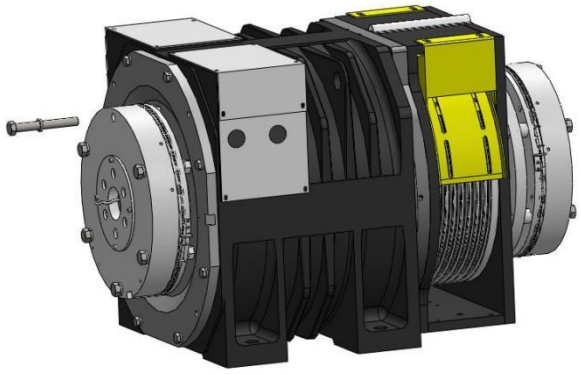


Figure 42: M16x130 bolt removal

5. Then install the threaded rod M16x320 into the hole. See Figure 43.

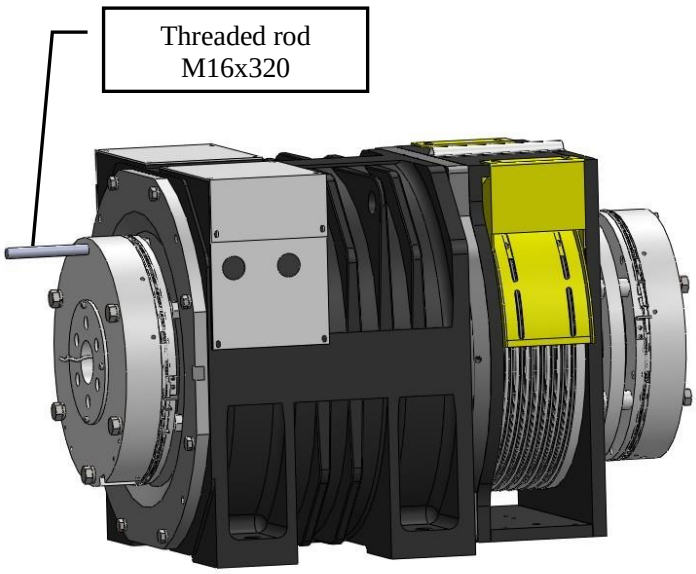


Figure 43: Install Threaded rod

6. Remove other 5 bolts M16x165 evenly, move out the normal brake; and then hoist out the brake with hoisting ropes and remove brake coil body and friction lining. See Figure 44.
7. Replace the O-ring (Ø60x2.65) if necessary.

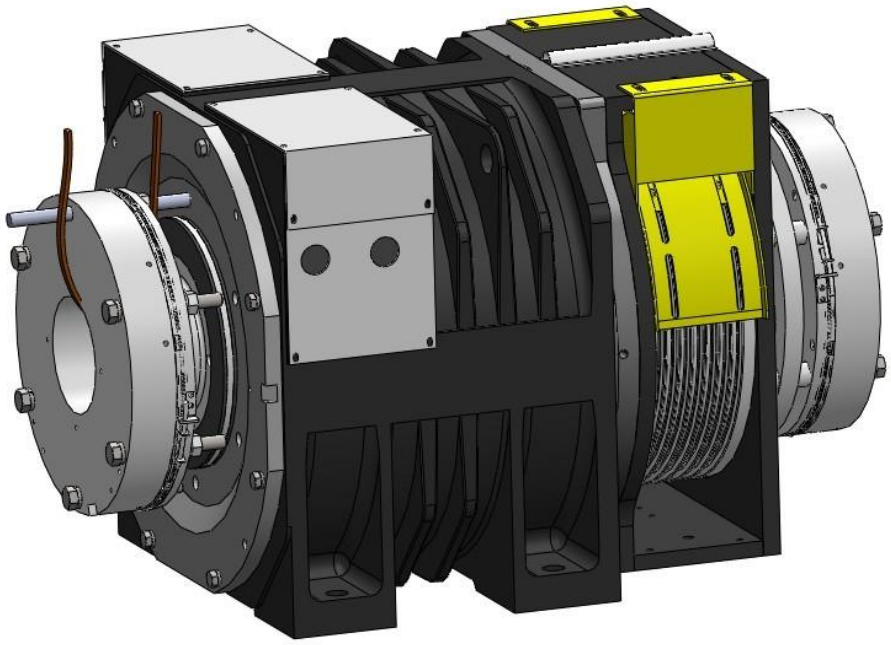


Figure 44: Removing Normal Brake

8.4.2 Normal brake & friction lining installation

1. Coat Vaseline in the new O-rings, then install them to the O-ring groove of the shaft.
2. Clean the spline, brake frame, and friction lining with cleanser.
3. Install the new friction lining. It is OK to apply a little force using rubber hammer to press it in and move it forward through the spline (Be careful not to damage the O-ring.); make sure the friction lining moves easily. See Figure 45.

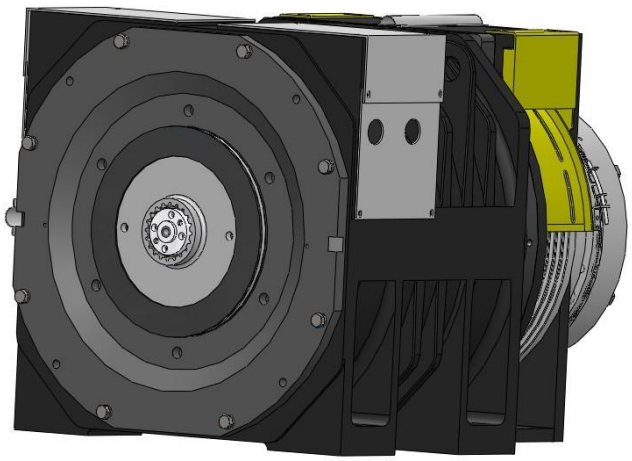


Figure 45: Friction lining reinstalled

4. Install the threaded rod M16x320 into the top-hole of the end-cover. Figure 46.
5. Install the brake coil body through the threaded rod.
6. Tighten bolt M16x165with lock washer16 (5 pieces) diagonally and evenly.

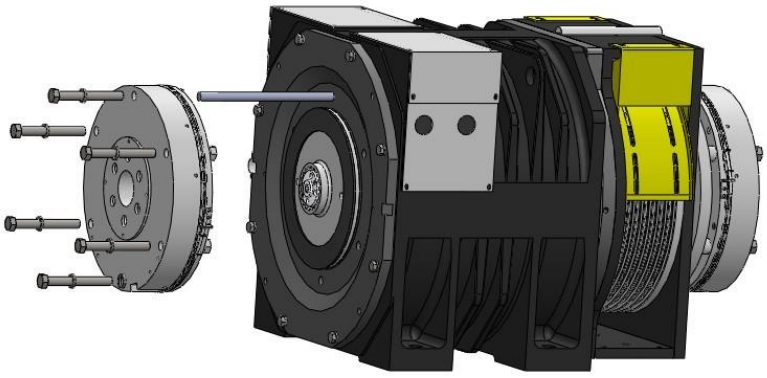


Figure 46: Normal Brake Reinstallation

7. Remove the threaded rod M16x320, and tighten remaining bolt M16x165 with lock washer16.
8. Re-connect the brake cable.
9. Re-install dust proof cover.
10. Re-install the encoder. (See Section 8.1.2 Encoder installation).

8.4.3 Normal Brake Adjustment

After the installation, the brake stroke must be rechecked and readjusted. See Section 6.1.2 Normal Brake Stroke Adjustment.

8.4.4 Test brake

Retest and confirm the new brake holding ability with regard to loading before using the elevator.

8.5 TMGL2/TMGL2A Normal Brake & Friction Lining Replacement

Required Tools & Materials:

Open end wrench: (24mm)

Hex wrench (4mm, 5mm)

Screwdriver

Clean cotton fabric

Hoisting ropes

Cleanser (alcohol based)

Vaseline

Threaded rod M16x2x320 (12.5")

8.5.1 Normal brake & friction lining removal

1. Disconnect the brake cable from emergency brake junction box.

2. Remove the screws M5x12 and washer5 (4 pieces) with hex wrench (4mm), and remove the 4 screws M6x16 and lock washer6 (4 pieces) with hex wrench (5mm), then remove the cover, dustproof ring and rubber ring. See Figure 47 and Table 6.

3. Remove the bolt M16x165 with open end wrench (24mm).

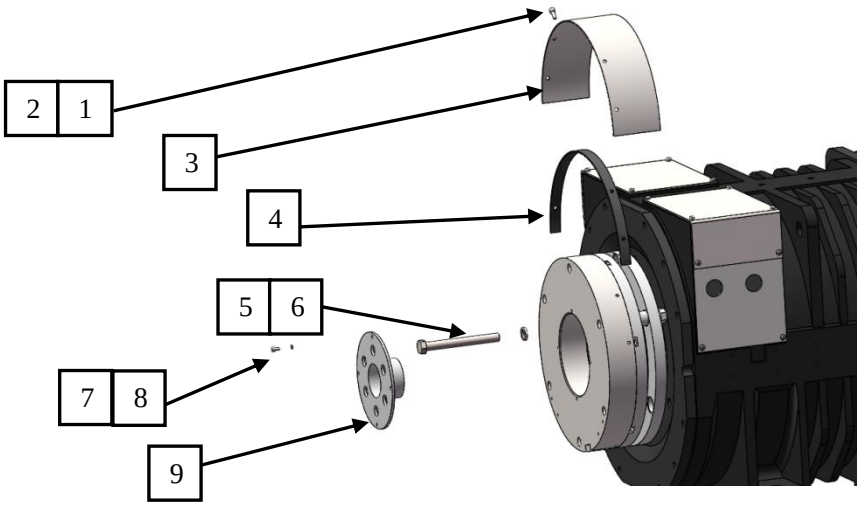


Figure 47: Normal Brake of TMGL2/TMGL2A Cover removal

Table 6: TMGL2/TMGL2A Normal Brake Cover Parts

No.	Name	No.	Name
1	Screw M6x165	6	Bolt M16x165
2	Lock washer 6	7	Screw M5x12
3	dustproof ring	8	Lock washer 5
4	Rubber ring	9	Cover
5	Lock washer 16		

8. Then install the threaded rod M16x320 into the hole. See Figure 48.

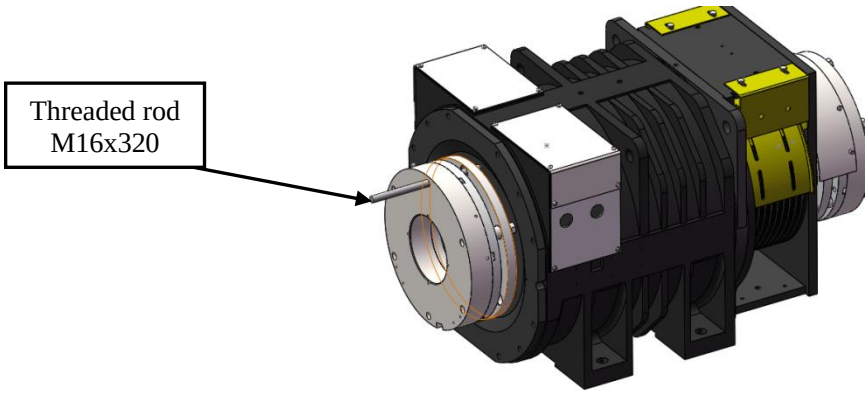


Figure 48: Install Threaded rod (TMGL2/TMGL2A)

9. Loosen other 5 bolts M16x165 evenly, move out the normal brake, then hoist out the brake with hoisting ropes and remove brake coil body and friction lining. See Figure 49.
10. Replace the O-ring (Ø60x2.65) if necessary.

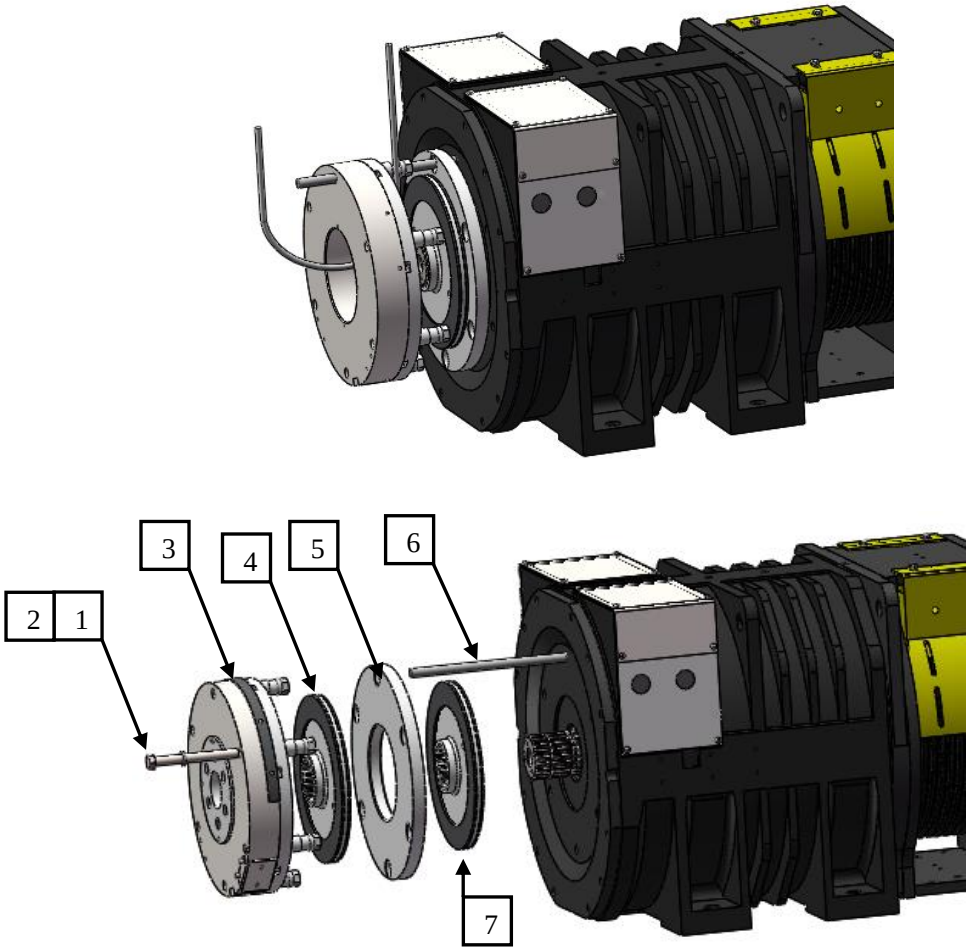


Figure 49: Removing Normal Brake Parts (TMGL2)

Table 7: Normal Brake Parts of TMGL2

No.	Name	No.	Name
1	Bolt M16x165	5	Anchor disc
2	Lock washer 16	6	Threaded rodM16x320
3	Brake coil body	7	Friction lining part B
4	Friction lining part A		

Replace the O-ring (Ø60x2.65if necessary. See Figure 50.

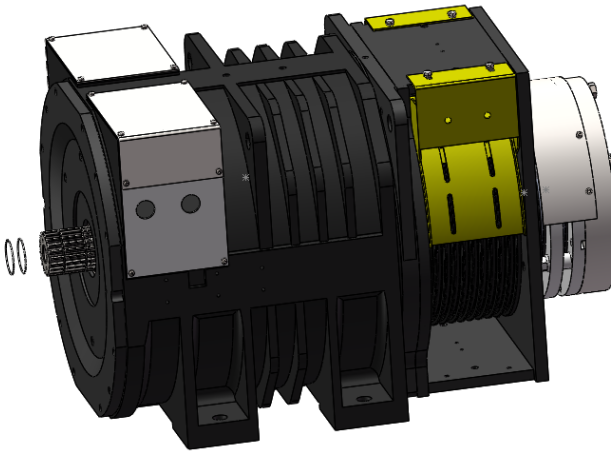


Figure 50: Install O-rings

8.5.2 Normal brake & friction lining installation

1. Coat Vaseline on the new O-rings, then install them to the O-ring groove of the shaft.
2. Clean the spline, brake frame, and friction lining with cleanser.
3. Install the new friction lining. It is OK to apply a little force using rubber hammer to press it in and move it forward through the spline (Be careful not to damage the O-rings.); make sure the friction lining moves easily. See Figure 51.

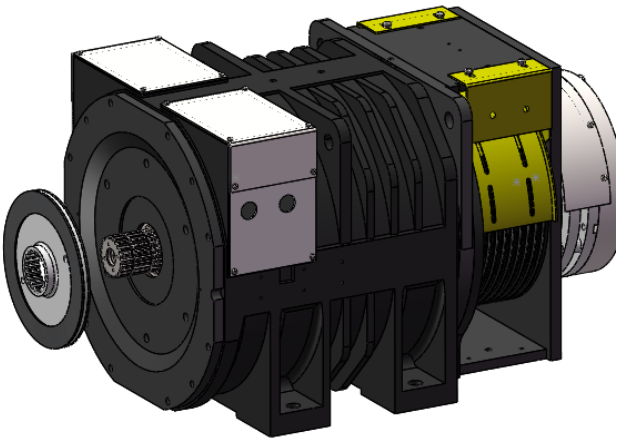


Figure 51: Friction lining B reinstalled

4. Install the threaded rodM16x320into the top hole of brake frame as shown by item 6 in Figure 52 and Table 8.
5. Install the anchor disc using the guide bolt.
6. Install the friction lining part A. It is OK to apply a little force using rubber hammer to press it in and move it forward through the spline (Be careful not to damage the O-ring.); make sure the friction lining part moves easily.
7. Then install the other brake components according to isometric assembly picture below (Figure 52).

8. Tighten bolts M16x165 and lock washer 16(5 pieces) diagonally and evenly.

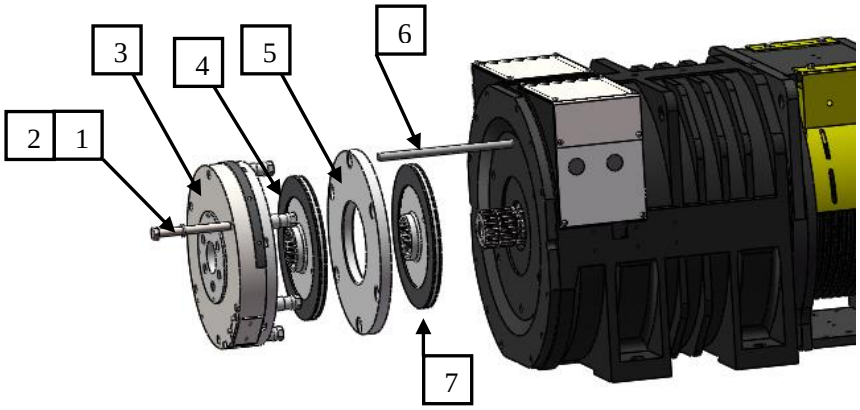


Figure 52: Re-installing Normal Brake

Table 8: TMGL2 Normal Brake parts

No.	Name	No.	Name
1	Bolt M16x165	5	Anchor disc
2	Lock washer 16	6	Threaded rodM16x320
3	Brake coil body	7	Friction lining part B
4	Friction lining part A		

9. Remove the threaded rodM16x320; tighten remaining bolt M16x165 and lock washer 16. See Figure 53.

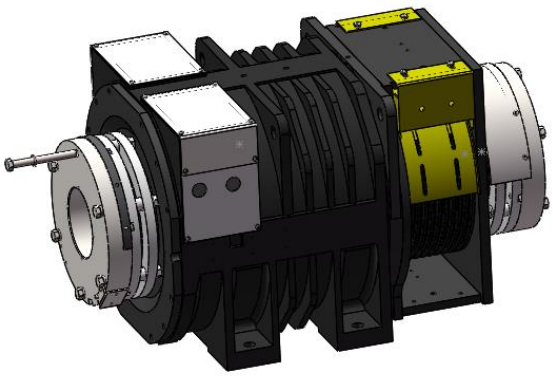


Figure 53: Final Bolt installation

10. Re-connect the brake cable.
11. Re-install dust proof cover.

8.5.3 Normal brake adjustment

After the installation, the brake stroke must be rechecked and readjusted. See Section 6.1.2 Normal Brake Stroke Adjustment.

8.5.4. Normal Brake test

CAUTION! Retest and confirm the new brake holding ability with regard to loading before using the elevator.

8.6 Sheave Replacement

Required Tools & Materials:

Open end wrench (18mm)

Internal hexagonal wrench (10mm)

Dial gauge

Hydraulic jack (15T)

File device

Clean cloth

Underprop-plate

Thick nut M16 (2 pieces)

Loctite 609

Threaded rod M16x2x500 (19.625”) (2 pieces)

Stow-stick

Eye bolts (M12 - 2 pieces) (M16 - 1 piece)

Hoist chain

Hoisting plate

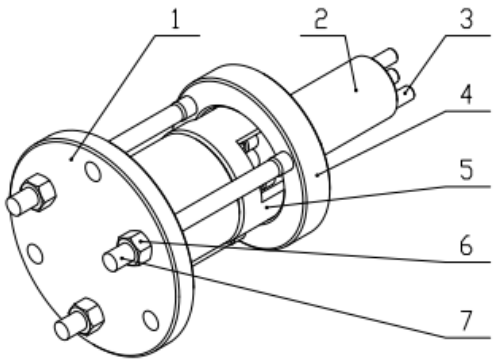


Figure 54: Sheave repress apparatus

No.	Name	No.	Name
1	Hydraulic jack pedestal	5	Sheave press block
2	Bearing block	6	Hex nut M16
3	Hex socket head cap screw M12x160	7	Threaded rodM16x230
4	Block		

8.6.1 Sheave Removal

1. Remove the emergency brake. See Section 8.3.1 Emergency brake& friction lining removal.
2. Hoist lightly the brake frame with the hoist chain, remove the screws M12 with open end wrench (18mm); hoist out the brake frame. See Figure 55.

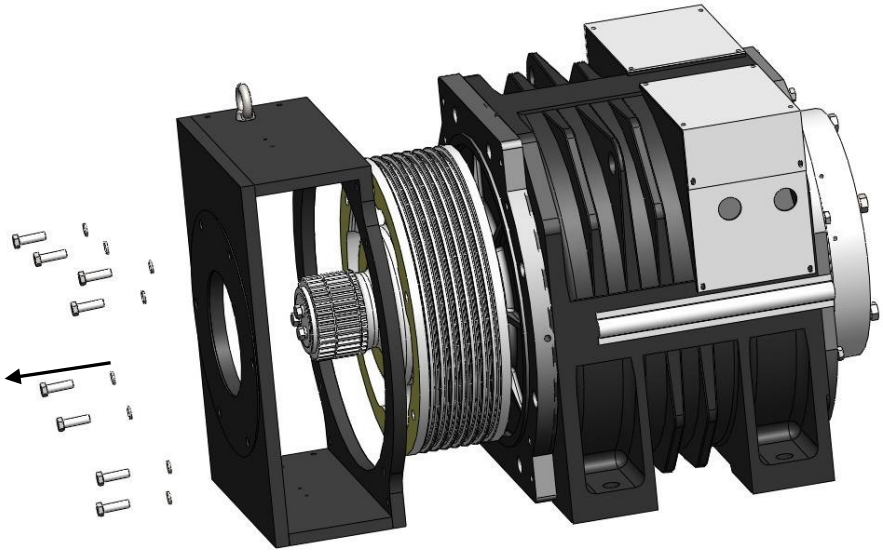


Figure 55: Sheave Removal

3. Remove the 3 bolts M12x150 and lock washer12 (3 pieces), remove the shaft cover. See Figure 56.

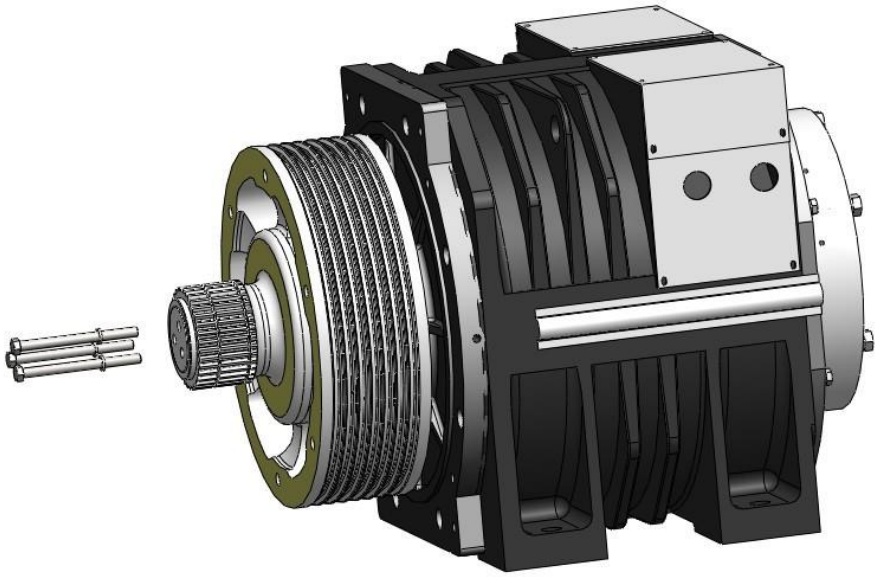


Figure 56: Shaft Cover removal

5. Hoist lightly the sheave with the hoisting equipment. See Figure 57 and Table 9.
6. Install 2 threaded rods M16x500 (item 4) into the M16 hole of sheave opposite each other.
7. Put the stow-stick (item 5) into the center-hole of the sheave, install the Underprop-plate (item 1) through the threaded rods, and install the hydraulic jack, and tighten the thick nuts M16 (item 2), make sure the hydraulic jack is steady.
8. Operate the hydraulic jack to loosen the sheave slowly.

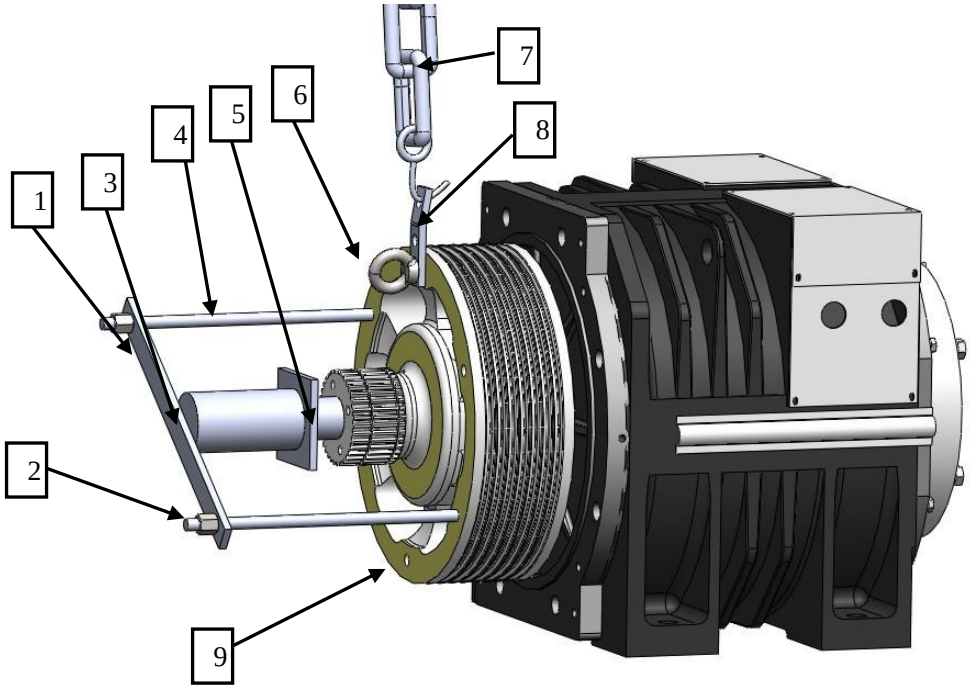


Figure 57: Sheave removal

Table 9: Sheave removal parts

No.	Name	No.	Name
1	Underprop-plate	6	Eye bolts M16 ring
2	Thick nut M16	7	Hoist chain
3	Hydraulic-jack	8	Hoisting plate
4	Threaded rod M16x500	9	Sheave
5	Stow-stick		

9. After the sheave is loosened, remove the hydraulic jack and other tools. Then hoist out the sheave. See Figure 58.

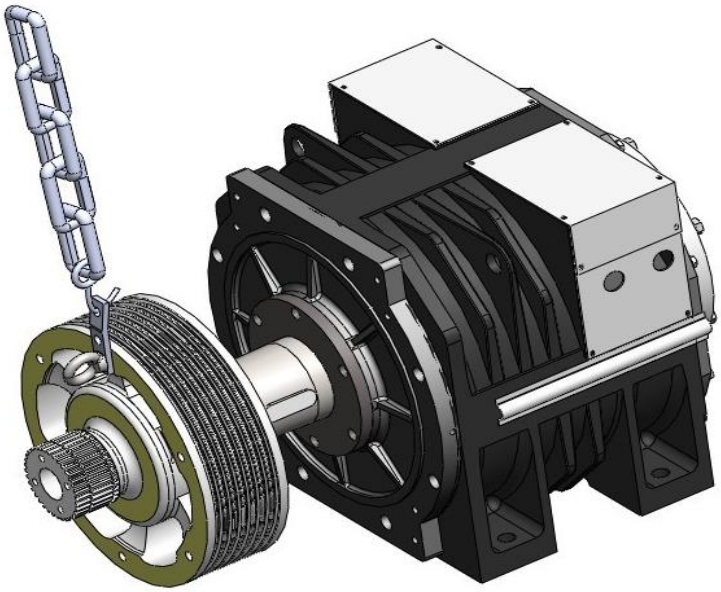


Figure 58: Hoisting the sheave

8.6.2 Sheave Installation

1. De-burr the key and sheave with a file, then clean the shaft and sheave; put Loctite 609 on the bottom of the key and seat it in the keyway.
2. Hoist the sheave and align the keyway of the sheave with the key, then pull it into the machine shaft. Use the hydraulic jack apparatus to press the sheave on with 15 tons of pressure. See Figures 59 and 60.

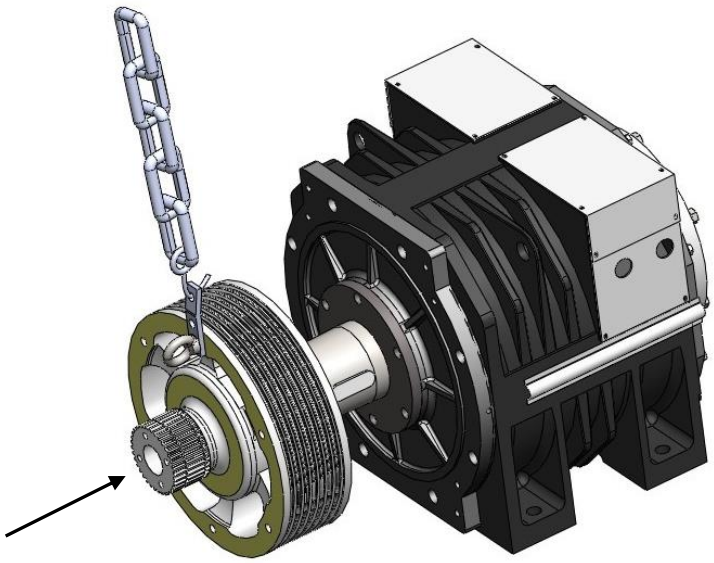


Figure 59: Locate sheave

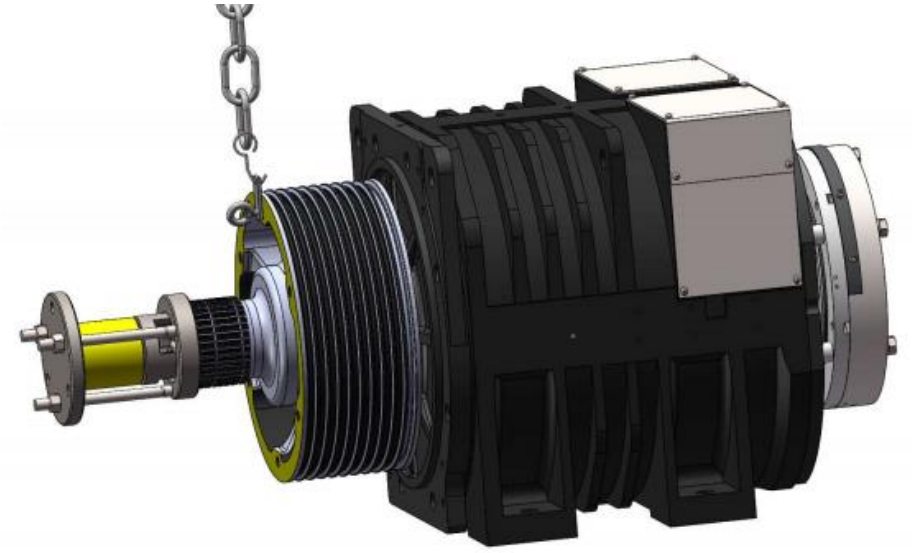


Figure 60: Press sheave onto shaft

3. Install the cover and tighten the bolts M12x150 with lock washer12 (3 pieces) use open end wrench (18mm) and then remove the hoisting equipment. See Figure 61.

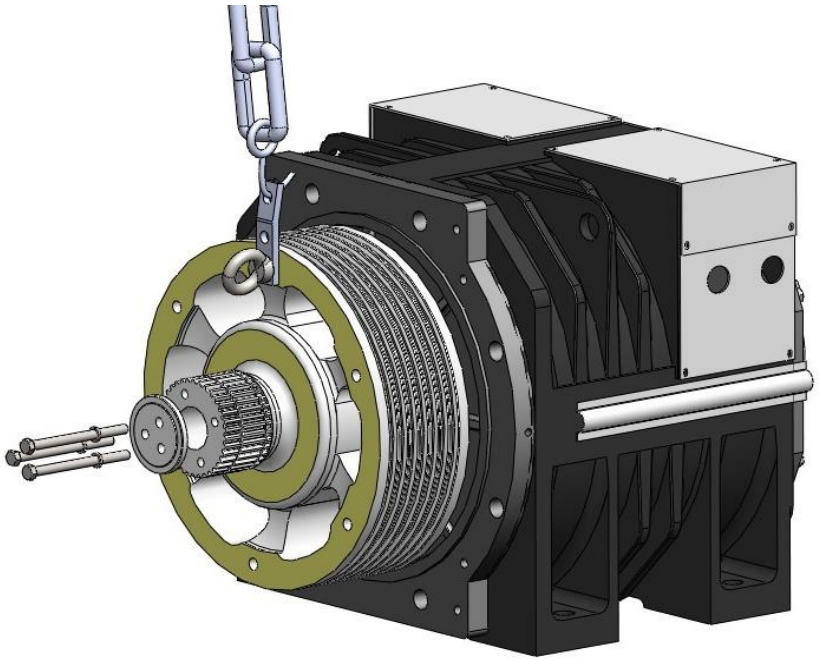


Figure 61: Sheave cover installation

4. Test the sheave groove weave. It shall not exceed 0.12mm (0.005") and groove run out shall not exceed 0.10mm (0.004") as measured with a dial gauge. See Figure 62.

Figure 62: Groove weave and run out check

5. Hoist the brake frame of brake and install it, tighten eight bolts M12x40 (TMGL2/TMGL2A hexagon socket screw M12) with lock washer12.See Figure 63.
6. Install the Emergency Brake (Refer to Section 8.3.2 Emergency Brake & Friction Lining Installation).

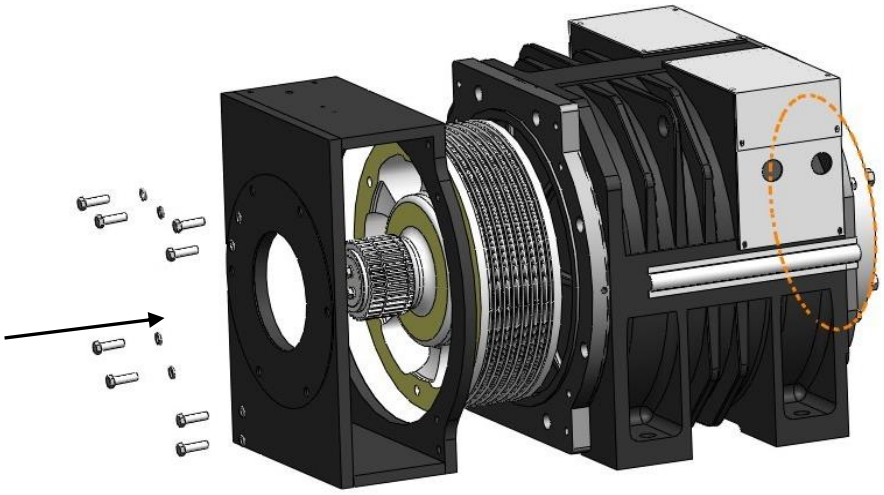


Figure 63: Brake frame installation

7. Connect the mainline and test the machine.

8.7 Bearing Replacement

WARNING! The bearing replacement work must be done on the ground, so the machine must be lifted and moved out of the hoist way when performing the bearing replacement work! (Applies to MRL installations)

8.7.1 Rear Bearing Replacement

Required Tools & Materials:

Open end wrench (18mm)

Hex wrench (4mm)

Owatonna (bearing) puller

Retainer ring plier

Rubber hammer

Clean cloth

Threaded rod M12x1.75x220 (8.625") (2 pieces)

Bearing heater

Bolt M12x1.75x80 (3.25") (2 pieces)

Nut M12

Hoist chain

Hoisting plate

Loctite

Bearing grease (a quality EP2 grade)

8.7.1.1 Rear Bearing Removal

Remove the encoder (See Section 8.1.1 Encoder Removal)

Remove the normal brake (See Section 8.4.1 Normal brake& friction lining removal)

Note: Make a reference mark for the friction lining and spline.

1. Make a mark for the end-cover and machine base. Then loosen eight bolts M12x40 with open end wrench (18mm). See Figure 64.

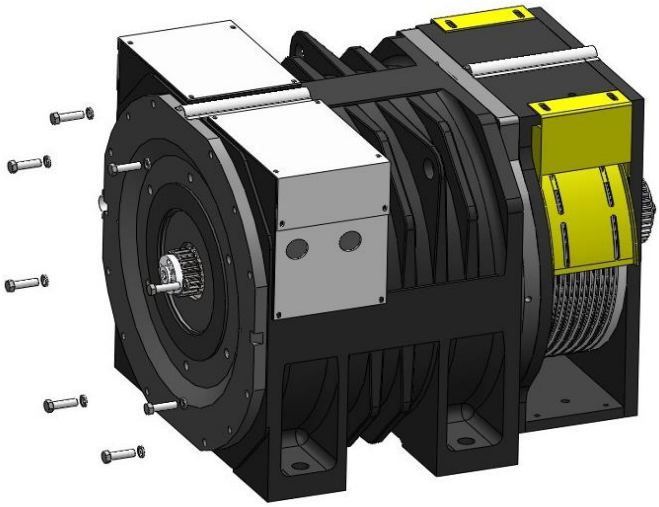


Figure 64: End Cover removal

2. Screw the 2 pieces threaded rod M12x200 into the M12 hole of machine base opposite each other. See Figure 65.
3. Screw the 2 bolts M12x80 into the M12 hole of end cover on the diagonal line. Tighten the 2 bolts M12x80 evenly and slowly with end wrench (18mm) to move out the end cover.

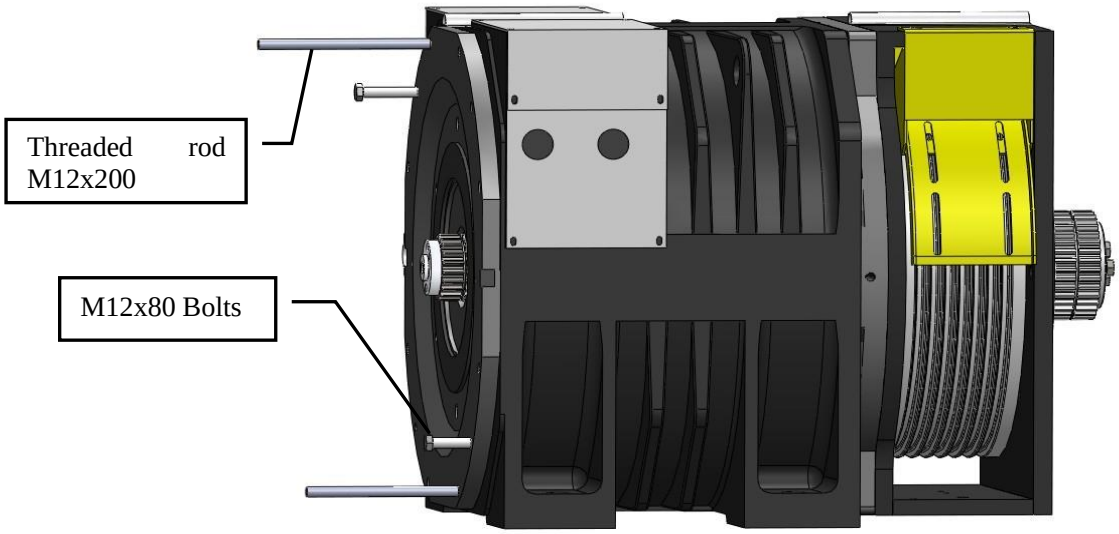


Figure 65: M12 bolt placement

4. Hoist out the end cover with hoisting equipment, until the end cover is out of the bearing. Then take out the wave-spring. See Figure 66.

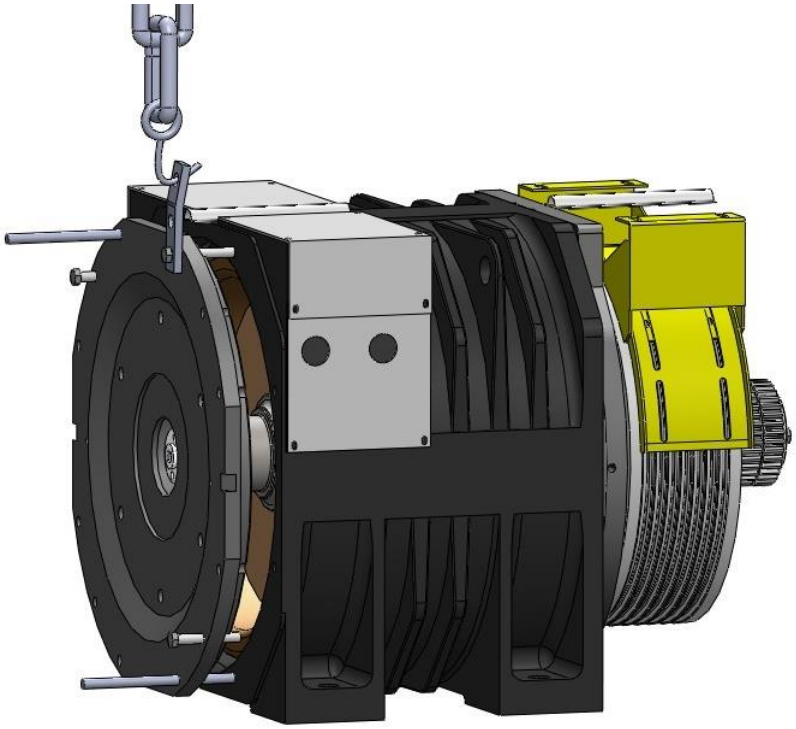


Figure 66: End cover removal

5. Then take off the threaded rod.
6. Make a mark for encoder shaft and spline, loosen 4 screws M5x16 with hex wrench (4mm), and take off shaft of encoder shaft. See Figure 67.

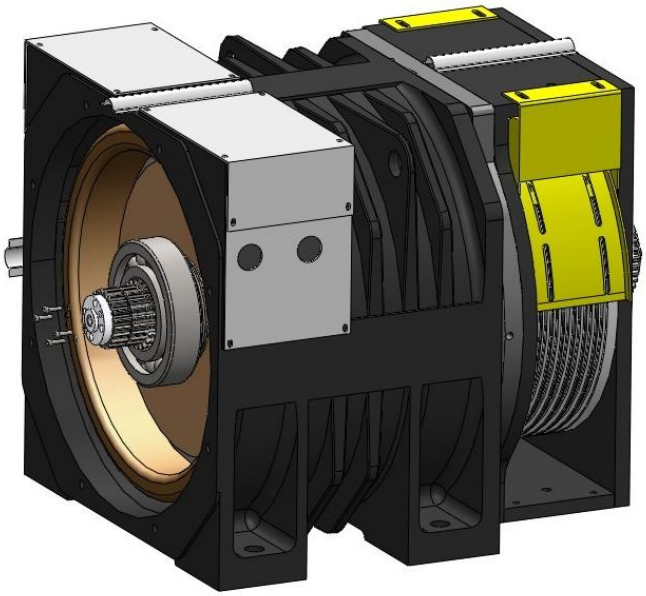


Figure 67: Encoder shaft removal

7. Take off the retainer ring 90 with the retainer ring plier then take off the bearing (6318-DDU) with the Owatonna (bearing) puller. (It is permissible to cut the bearing off.) See Figure 68.

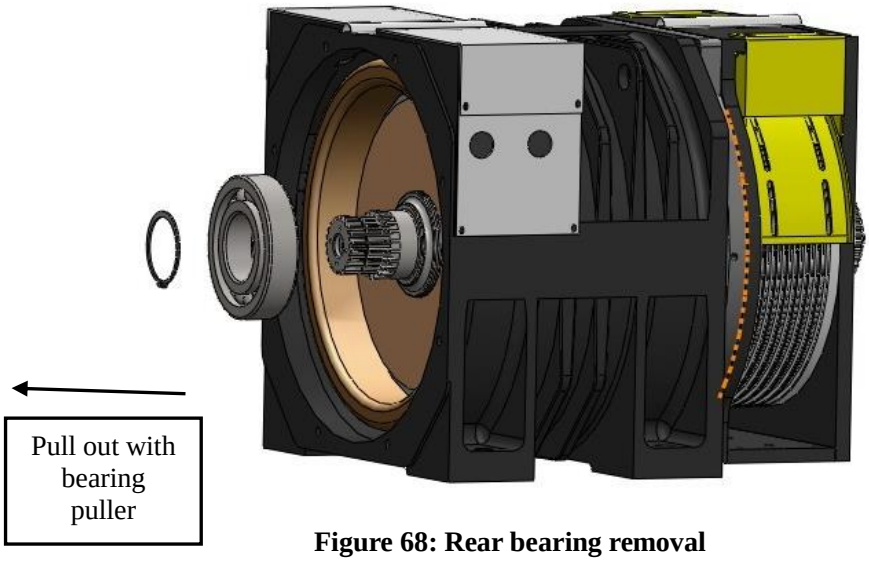


Figure 68: Rear bearing removal

8.7.1.2 Rear Bearing Installation

1. Clean the main shaft and machine base, heat the bearing to 80°C (176°F) with the bearing heater. Then install the new bearing into the main shaft.

2. When the bearing has cooled to room temperature, pack it with grease (a quality EP2 grade).
3. Then install the retainer ring 90 with retainer ring plier. See Figure 69.

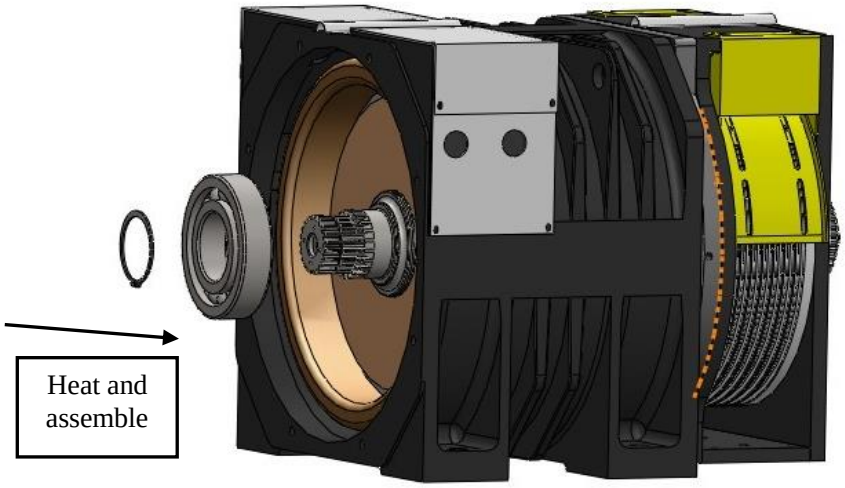


Figure 69: Rear bearing installation

4. Clean the end cover and install a wave-spring in it; then hoist the end-cover using hoisting equipment, and install it in the bearing through the threaded rods (Note: Align the mark made in the disassemble process); then take off hoisting equipment.
5. Hammer the end cover with the rubber hammer evenly, and make the end cover fit in the bearing well. See Figure 70.

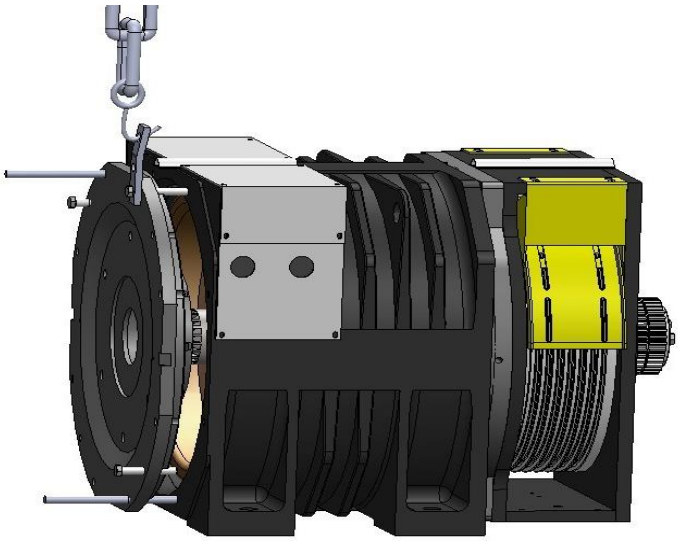


Figure 70: End cover installation

6. Take off the threaded rod. Tighten the bolts M12x40 with lock washer 12 (8 pieces), install encoder shaft (align the mark) and tighten screws M5x16 (4 pieces) (coat with Loctite) with lock washers 5. Figure 71 and Table 10.

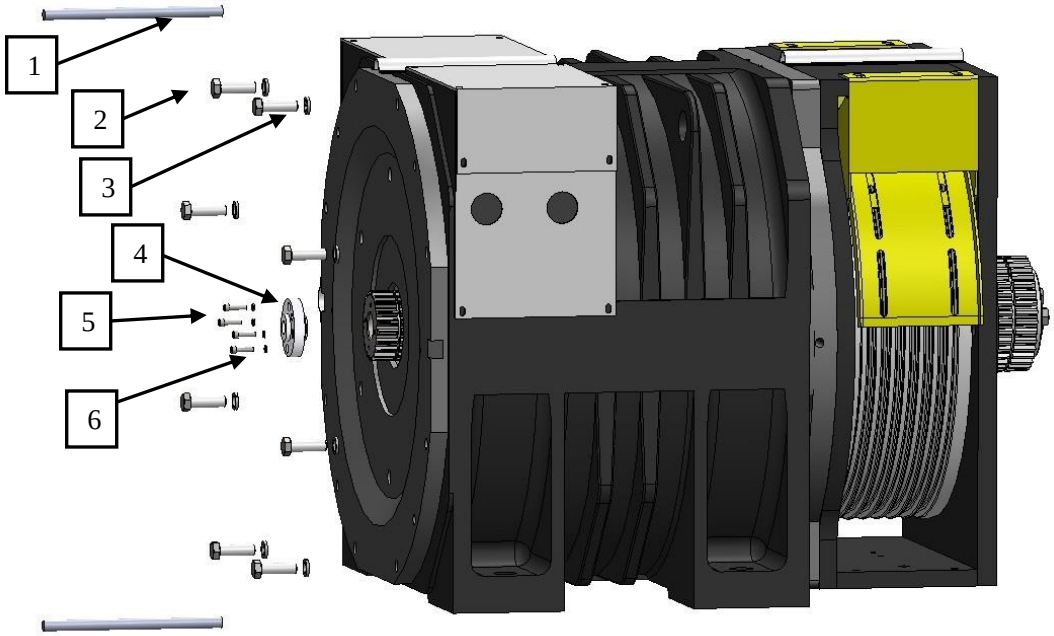


Figure 71: Encoder shaft installation

Table 10: Encoder Shaft parts

No.	Name	No.	Name
1	Threaded rod M12x200	4	Encoder shaft
2	Bolt M12x40	5	Screw M5X16
3	Lock washer 12	6	Lock washer 5

7. Install the normal brake (See Section 8.4.2 Normal Brake & Friction lining installation).
8. Install the encoder (See Section 8.1.2 Encoder installation).
9. Test the machine.

8.7.2 Front Bearing Replacement

Required Tools & Materials:

Open end wrench (18mm)

Hex wrench (10mm, 14mm)

Bearing puller

Rubber hammer

Clean cloth

Cleanser

Bearing heater

Bearing grease (a quality EP2 grade)

Sealant

Loctite 480

Threaded rod M16x2x200 (7.875") (2 pieces)

Bolt M12x1.75x100 (2 pieces)

Guide cover of bearing

Hoist chain

Hoisting plate

Nut M16x2

Bolt M16x2x55

Bolt M12x2x60

8.7.2.1 Front bearing removal

1. Remove the Emergency Brake (See Section 8.3.1 Emergency Brake & Friction Lining Removal).
2. Remove the brake frame and sheave (See Section 8.5.1 Sheave removal.) Take off the key on the main shaft.
3. Loosen the Screw M12x35 (8 pieces) with hex wrench (10mm), and remove the Junction plate. See Figure 72. **(This step is only for TMGL2A)**

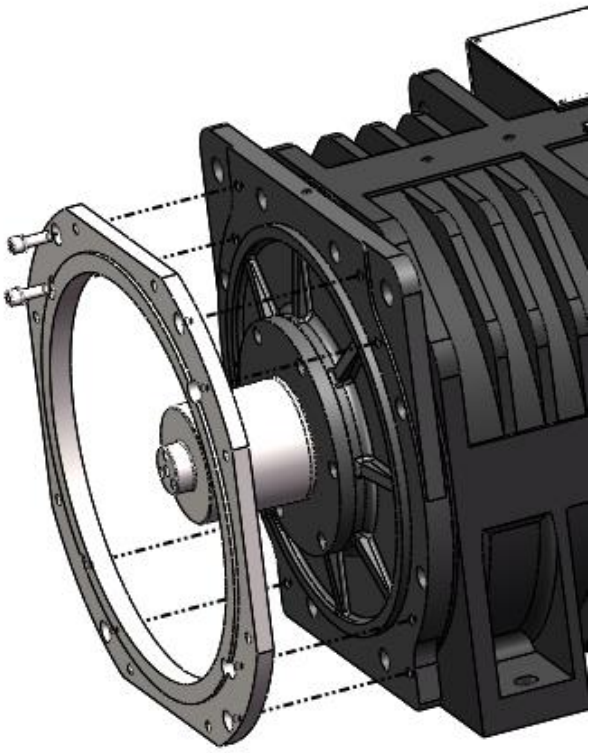


Figure 72: Junction plate removal (only for TMGL2A)

4. Loosen the bolts M12x105 (6 pieces) with hex wrench (10mm), and take off the Outer cover. See Figure 73.

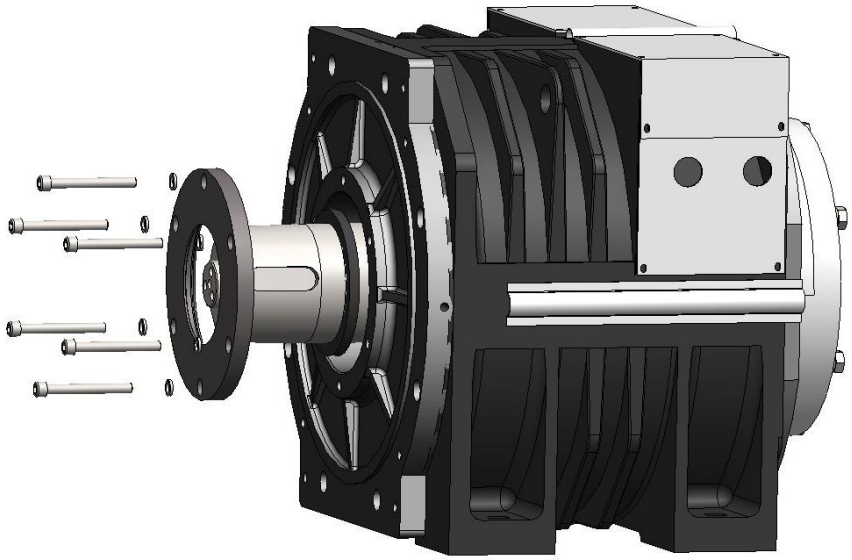


Figure 73: Outer cover removal

5. Replace the oil seal SC Ø140xØ170x14 if necessary.
6. Make a mark in the front-cover and machine base. Loosen 8 hex screws M16x40 with hex wrench (14mm). See Figure 74.

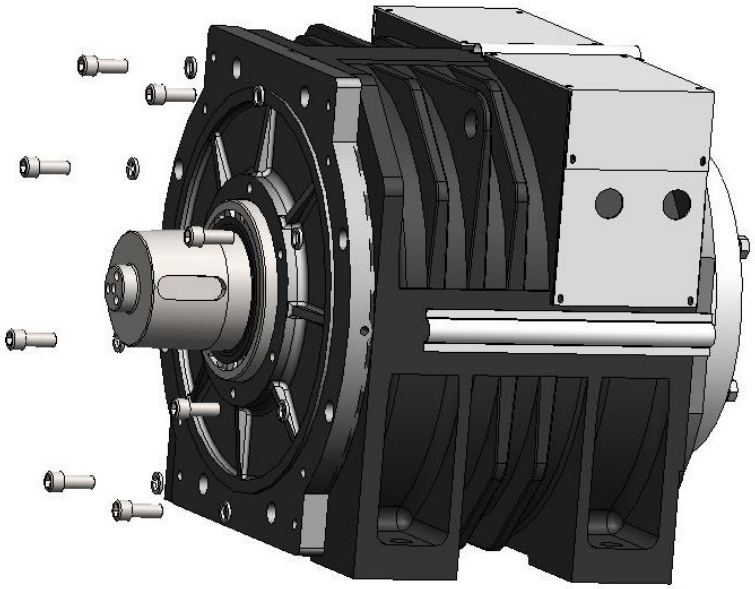


Figure 74: Front cover removal

7. Screw the threaded rod M16x200 (2 pieces) into the M16 hole of machine base opposite each other. Screw the bolts M12x100 into the M12 hole of Front cover opposite each other. Tighten the bolt M12x100 (2 pieces) evenly and slowly with open end wrench (18mm) until the Front cover is out of the bearing. See Figures 75 and 76.

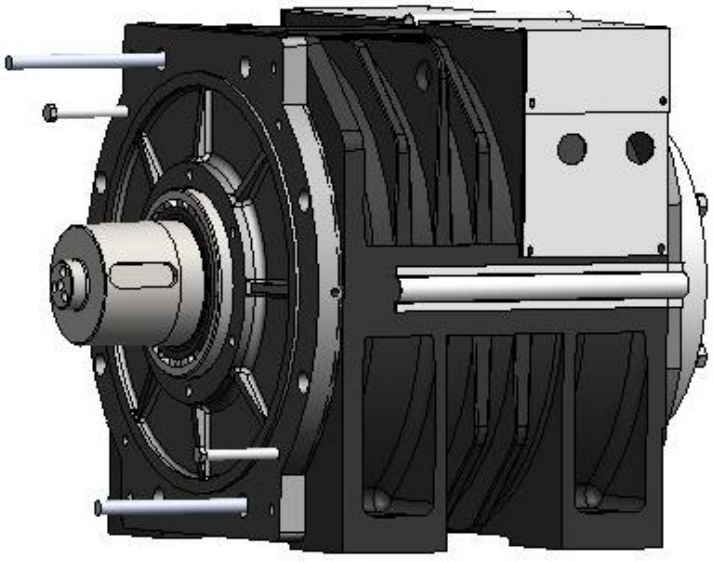


Figure 75: Loosen the front cover

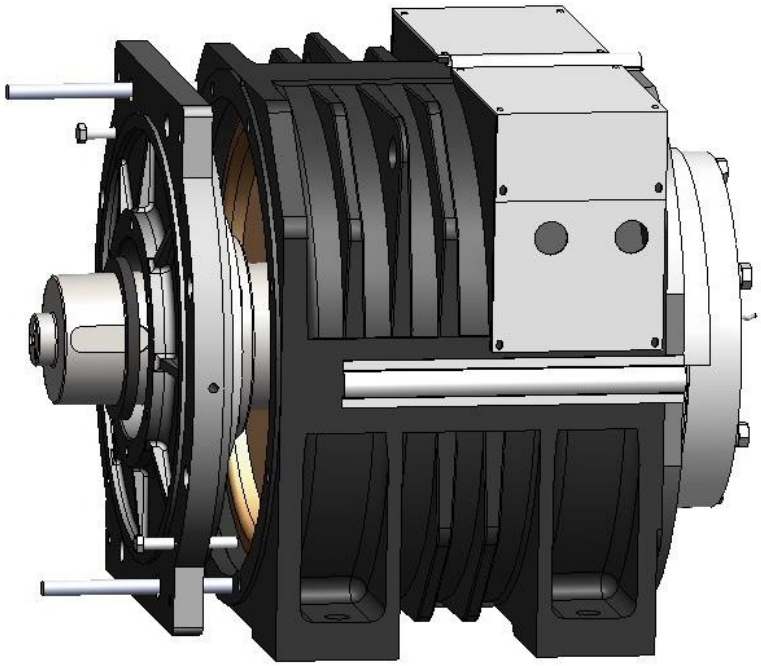


Figure 76: Front cover removal

8. Hoist out the Front cover with hoisting equipment, take off the threaded rod. See Figure 77.

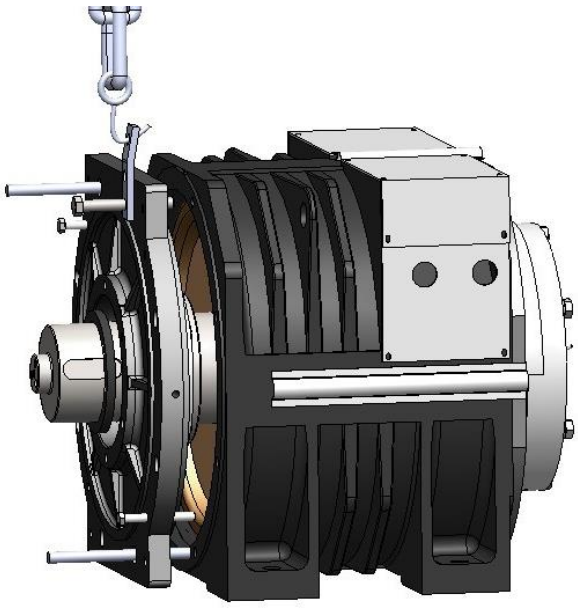


Figure 77: Front cover hoisting

9. Pull out the bearing with the bearing puller. (It is permissible to cut the bearing off.) See Figure 78.

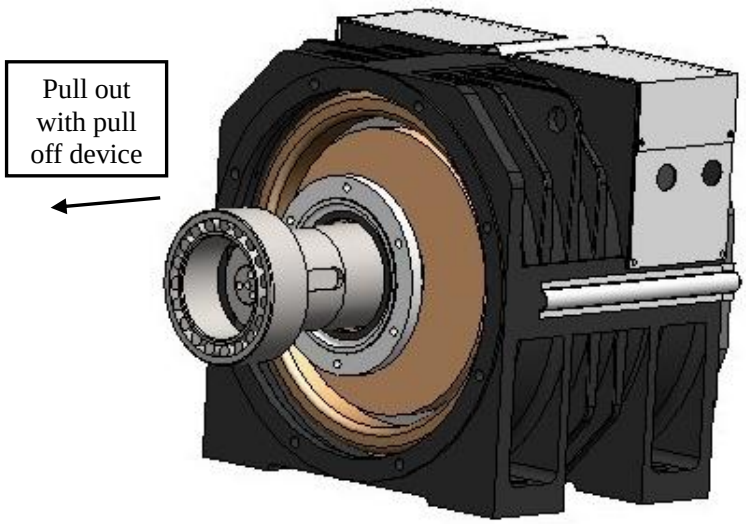


Figure 78: Front bearing removal

10. Take off the inner cover and clean it.
11. Replace the oil seal SC Ø155xØ190x14 if necessary.

8.7.2.2 Front Bearing Installation

1. Clean the main shaft; put bearing grease in the inner cover and then install it in the main shaft. See Figure 79.

Figure 79: Inner cover

2. Heat the bearing to 80°C (176°F) with the bearing heater, then install it in the main shaft. See Figures 80and 81. When the bearing has cooled to room temperature pack bearing grease in the bearing cone.

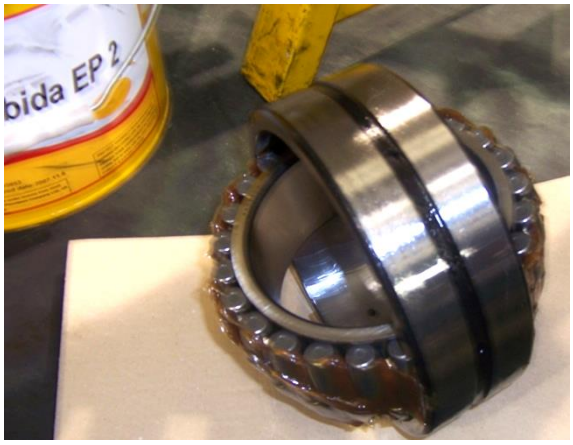


Figure 80: Front bearing

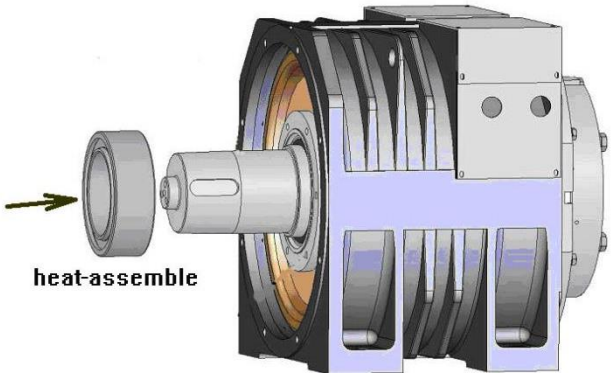


Figure 81: Front bearing installation

3. Install the guide cover of bearing in the main shaft, and then tighten the bolt M12x60 Screw the threaded rod M12x220 to the inner cover. See Figure 82 and Table 11.

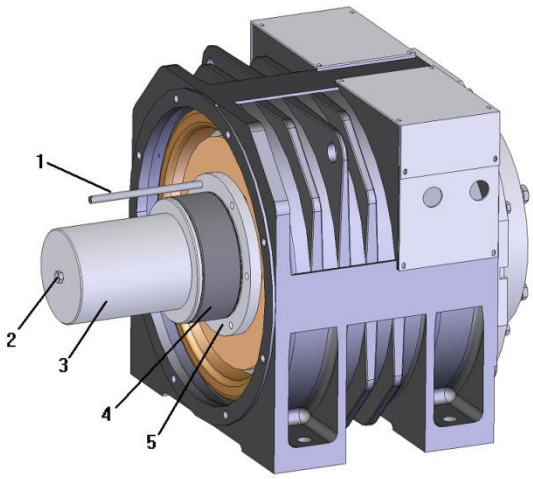


Figure 82: Guide cover installation

Table11: Guide cover parts

No.	Name	No.	Name
1	Threaded rodM12x220	4	Bearing NSK 24028 W33
2	Bolt M12x60	5	Inner cover
3	Guide cover of bearing		

4. Coat the sealant on the inner cover face. See Figure 83.

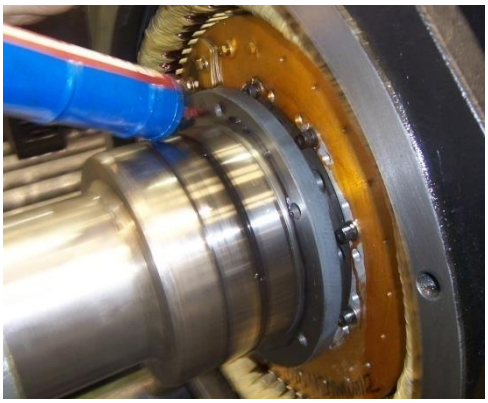


Figure 83: Apply sealant on the inner cover face

5. Clean the Front cover and hoist it with the hoisting equipment, then fit it onto the bearing through the threaded rod (align the mark made earlier). See Figure 84 and Table 12.

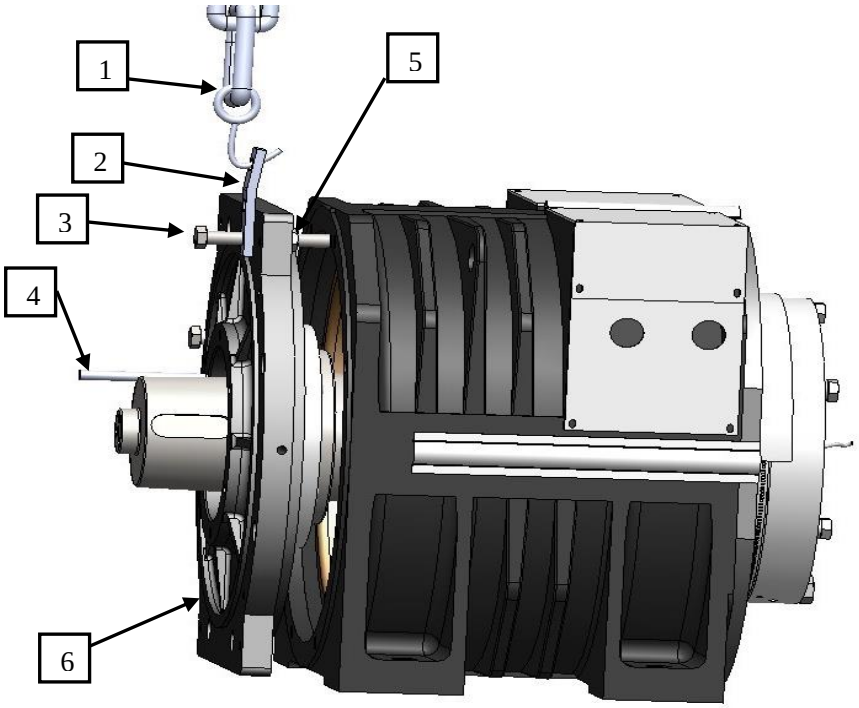


Figure 84: Re-installing front cover

Table 12: Front cover parts

No.	Name	No.	Name
1	Hoist chain	4	Threaded rodM12x220
2	Hoisting plate	5	Nut M16
3	Bolt M16x60	6	Front cover

6. Take off the hoisting equipment. Hammer the Front cover with the rubber hammer, and make the Front cover fit in the bearing well; tighten 8 hex screws M16x40 with lock washer16 with hex screw (14mm). Then take off the guide cover of bearing. See Figure 85.

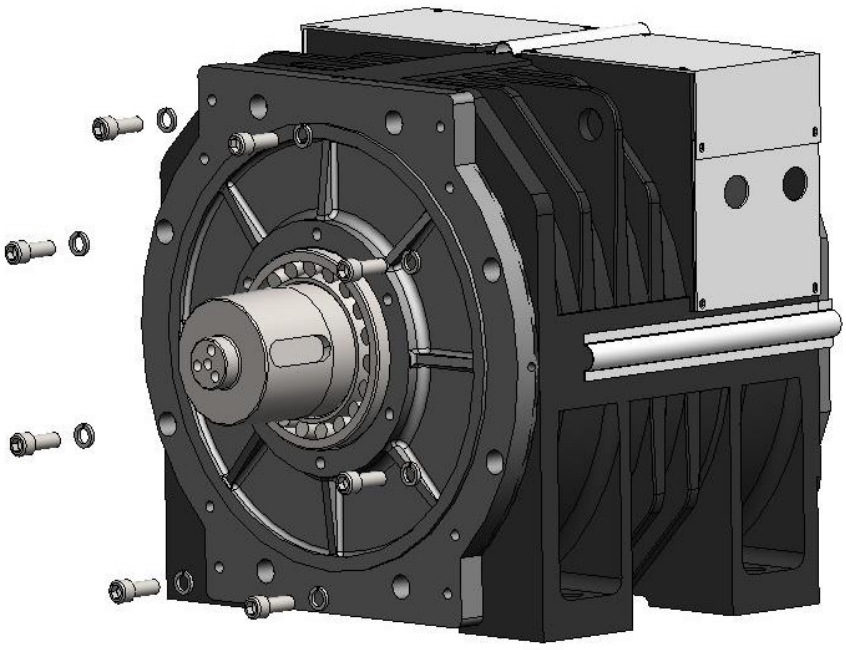


Figure 85: Secure the Front cover

7. Clean the outer cover, coat the sealant on the Front cover surface which mates with the Outer cover surface. See Figure 86.

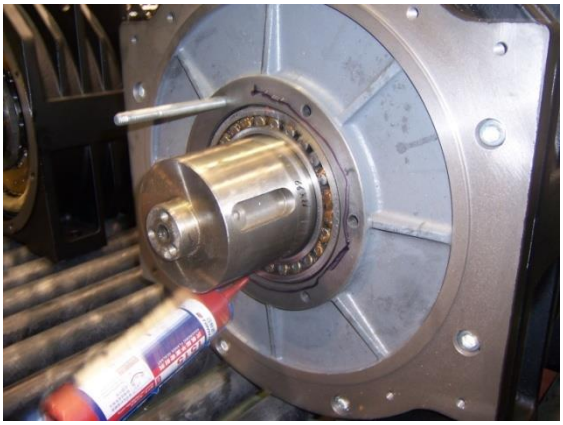


Figure 86: Apply sealant on Front cover surface

8. Put the bearing grease (a quality EP2 grade) in the outer cover. See Figure 87.

Figure 87: Apply grease to Outer cover

9. Then install the Outer cover on the Front cover through the threaded rod; tighten (5) hex screws M12x105 with lock washer12. See Figure 88 and Table 13.

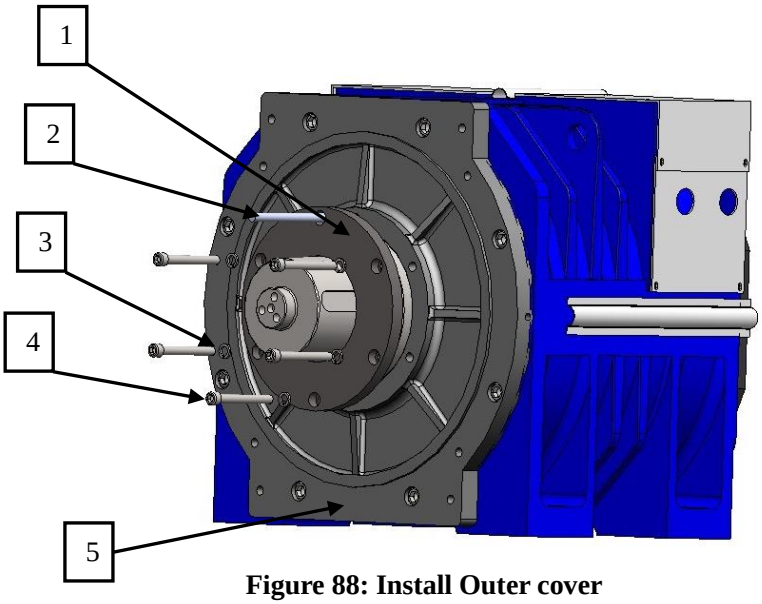


Figure 88: Install Outer cover

Table 13: Outer cover parts

No.	Name	No.	Name
1	Outer cover	4	Hex screw M12x105
2	Guide screw M12x220	5	Front cover
3	Lock washer 12		

10. Take off the guide screw and tighten the remaining hex screw M12x105 with lock washer12. See Figure 89.

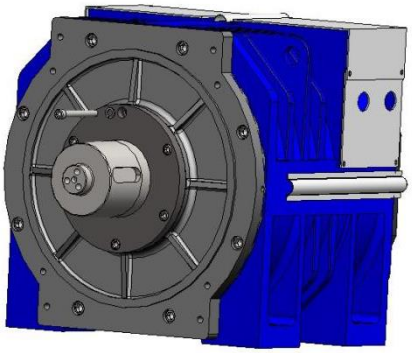


Figure 89: Install remaining M12x105 bolt

11. Let the main shaft rotate, add grease at the A until the grease overflows from the B, then apply the coating sealant on screw (Loctite 480 or equivalent). See Figure 90.

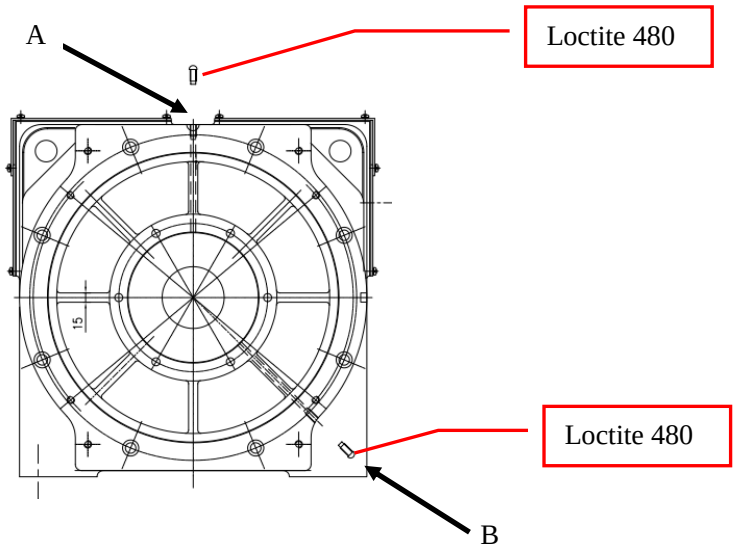


Figure 90: Add grease

12. Install the sheave (See Section 8.5.2 Sheave installation).
13. Install the emergency brake (See Section 8.3.2 Emergency brake and friction lining installation).
14. Test the machine.

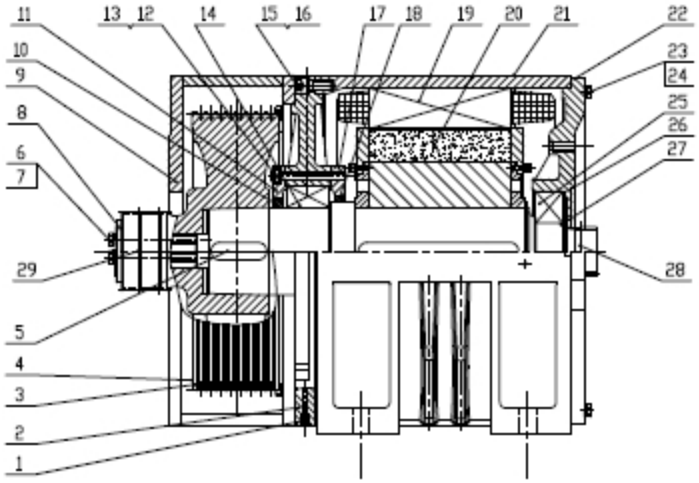
9.0 Troubleshooting Chart

The proper maintenance of the gearless lift machines requires adequately trained specialist 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 TSM/TMGL1

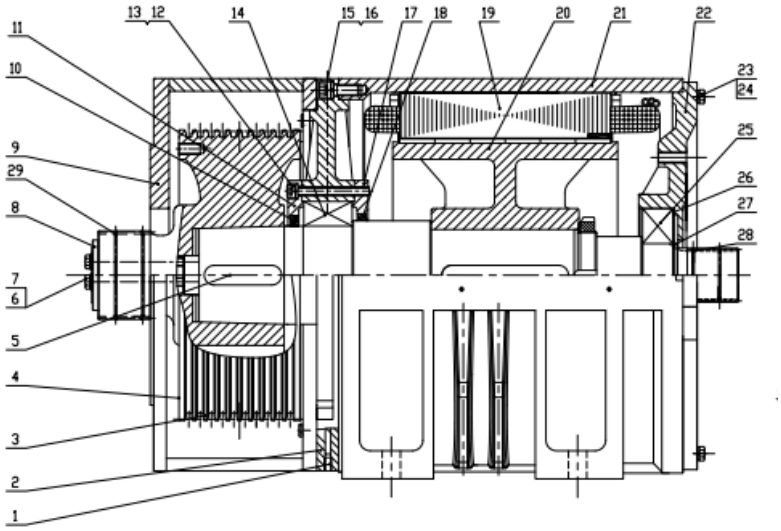


(*) Indicates a non-stock item of TSM/TMGL1

No.	Torin Drive Part No.	Description
1	*	screw M10x20
2	*	front-cover
3	*	sheave
4	*	sheave nameplate
5	*	key 28x85
6	*	bolt M12x150
7	*	lock washer 12
8	*	cover
9	*	brake frame
10	PBR003	Sheave side oil seal FBØ140xØ170x12
11	*	outer cover
12	*	screw M12x105
13	*	lock washer 12
14	PBR012	Sheave side bearing NSK 24028W33
15	*	screw M16x40
16	*	lock washer 16
17	*	inner cover
18	PBR007	Motor side oil seal FBØ155xØ175x12
19	*	stator
20	*	rotor
21	*	machine-base (frame)

22	*	back-cover
23	*	bolt M12x40
24	*	lock washer 12
25	PBR013	Motor side bearing NSK 6318-2RS
26	*	wave spring D190
27	*	snap ring 90
28	POR006	Motor side O-ring Ø60*2.65
29	POR007	Sheave side O-ring Ø109*2.65
	MSHV-TSM/TMGL1-440	Machine Sheave, 440 mm

10.2 TMGL2

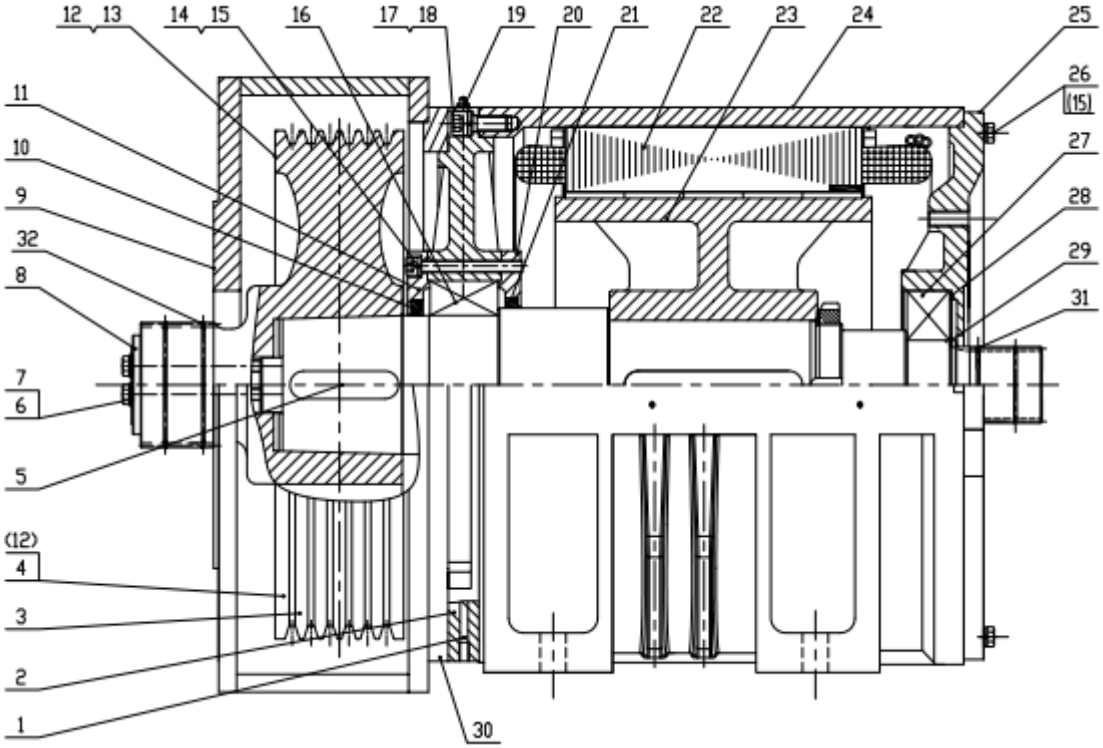


(*) Indicates a non-stock item of TMGL2

No.	Torin Drive Part No.	Description
1	*	screw M10x20
2	*	front-cover
3	*	sheave
4	*	sheave nameplate
5	*	key 28x85
6	*	bolt M12x150
7	*	lock washer 12
8	*	cover
9	*	brake frame
10	PBR003	Sheave side oil seal SCØ140xØ170x12
11	*	outer cover
12	*	screw M12x105
13	*	lock washer 12
14	PBR012	Sheave side bearing NSK 24028 CAME4
15	*	screw M16x40
16	*	lock washer 16
17	*	inner cover
18	PBR007	Motor side oil seal FBØ155xØ175x12
19	*	stator
20	*	rotor
21	*	machine-base (frame)
22	*	back-cover

23	*	bolt M12x40
24	*	lock washer 12
25	PBR013	Motor side bearing NSK 6318 DDU
26	*	wave spring D190
27	*	snap ring 90
28	POR006	Motor side O-ring Ø60ID*2.65
29	POR007	Sheave side O-ring Ø109ID*2.65
	MSHV-TMGL2-410	Machine Sheave, 410 mm

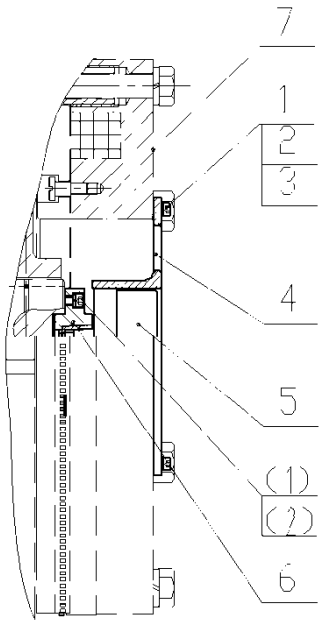
10.3 TMGL2A



No.	Torin Drive Part No.	Description
1	*	screw M10x20
2	*	front-cover
3	*	sheave
4	*	sheave nameplate1
5	*	key 28x110
6	*	bolt M12x150
7	*	lock washer 12
8	*	cover
9	*	brake frame
10	*	NOK oil seal SCØ140xØ170x14
11	*	outer cover
12	*	sheave nameplate 2
13	*	Rivets for nameplate 3x6
14	*	screw M12x105
15	*	lock washer 12
16	PBR012	Sheave side bearing NSK 24028 CAME4

17	*	screw M16x40
18	*	lock washer 16
19	*	Oil level indicator M10x1
20	*	inner cover
21	*	NOK oil seal SC Ø155xØ190x14
22	*	stator
23	*	rotor
24	*	machine-base (frame)
25	*	back-cover
26	*	bolt M12x40
27	PBR013	Motor side bearing NSK 6318 DDU
28	*	wave spring D190
29	*	snap ring 90
30	*	Junction plate
31	POR006	Motor side O-ring Ø60ID*2.65
32	POR007	Sheave side O-ring Ø109ID*2.65
	TMGL2A-508	Machine Sheave, 508 mm

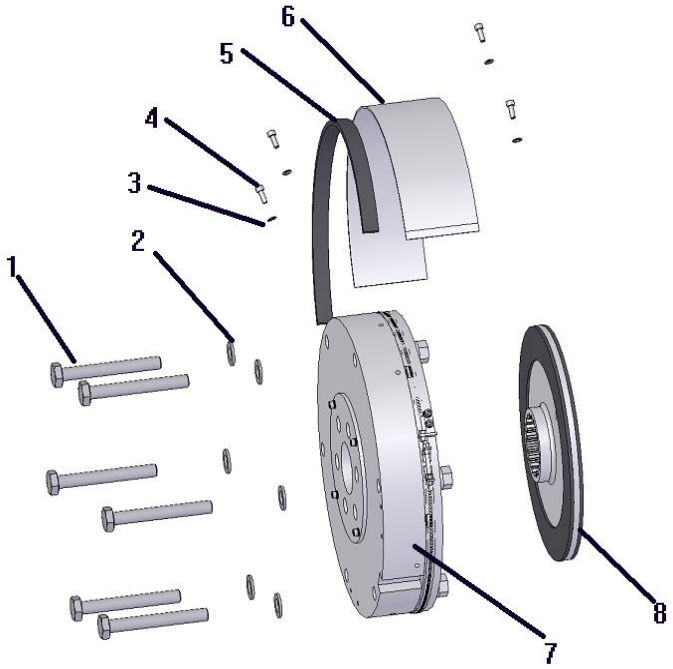
11.0 Encoder Assembly



(*) Indicates a non-stock item

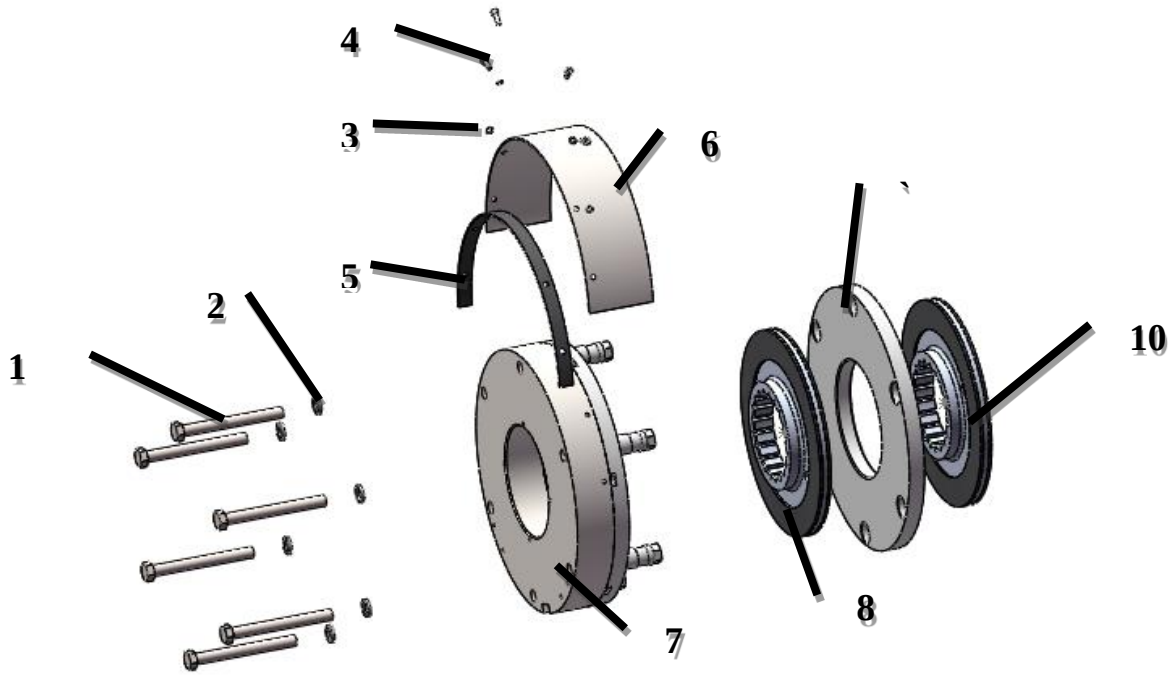
No.	Torin Drive Part No.	Description
1	*	bolt M5X16
2	*	lock washer 5
3	*	washer 5
4	PEN010	Setting of encoder
5	PEN003	Haidenhain Absolute Encoder
6	*	Connect Shaft
7	*	Normal brake

12.0 Normal Brake Assembly



(*) Indicates a non-stock item of PZ1600 and PZ1600A

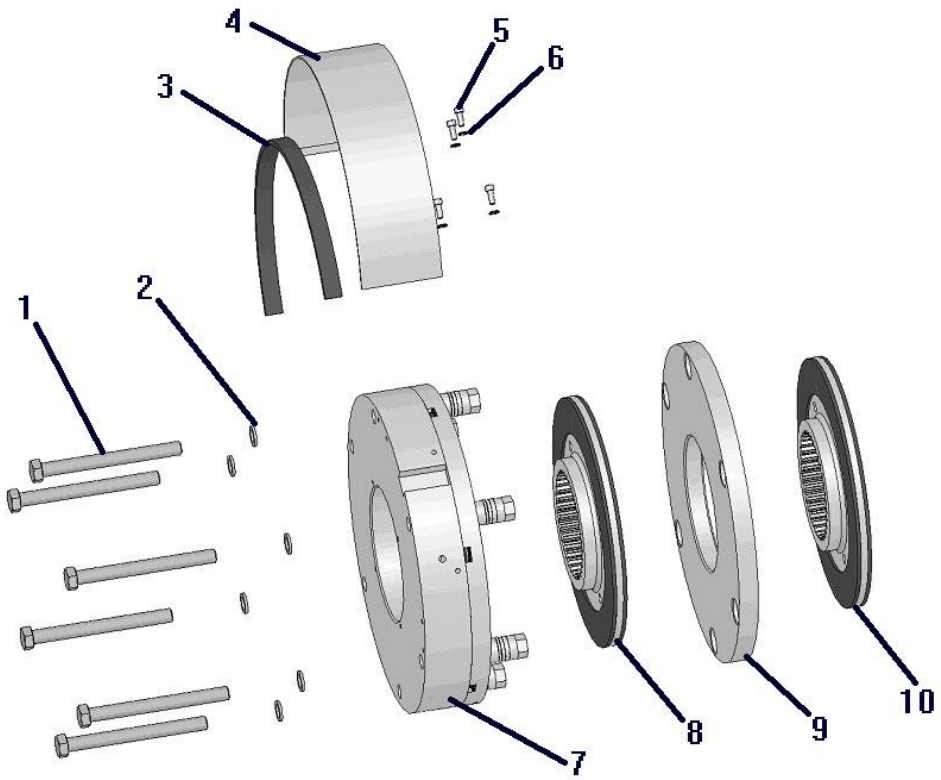
No.	Torin Drive Part No.	Description
1	*	bolt M16x130
2	*	lock washer 16
3	*	lock washer 6
4	*	screw M6x16
5	*	rubber ring
6	*	dustproof ring
7	PBK042	TSM/TMGL1 normal brake assembly
8	PBK009	TSM/TMGL1 brake disc, Normal
9	PSW001	TSM/TMGL1 brake switch
10	PBK008	TSM/TMGL1 brake assembly kit, Normal (includes all components above)
	PTO003	TSM/TMGL1 Normal Brake adjustment wrench, 24 mm
	PTO002	TSM/TMGL1 Feeler gauge set



(*) Indicates a non-stock item of SPZ1600A

No.	Torin Drive Part No.	Description
1	*	bolt M16x165
2	*	lock washer 16
3	*	lock washer 6
4	*	screw M6x16
5	*	rubber ring
6	*	dustproof ring
7	PBK042	TMGL2 normal brake assembly
8,10	PBK009	TMGL2 brake disc(set of 2) , Normal
9	PSW001	TMGL2 brake switch
	PBK008	TMGL2 brake assembly kit, Normal (includes all components above)
	*	ER7 Normal Brake adjustment wrench, 24 mm
	*	ER7 Feeler gauge set

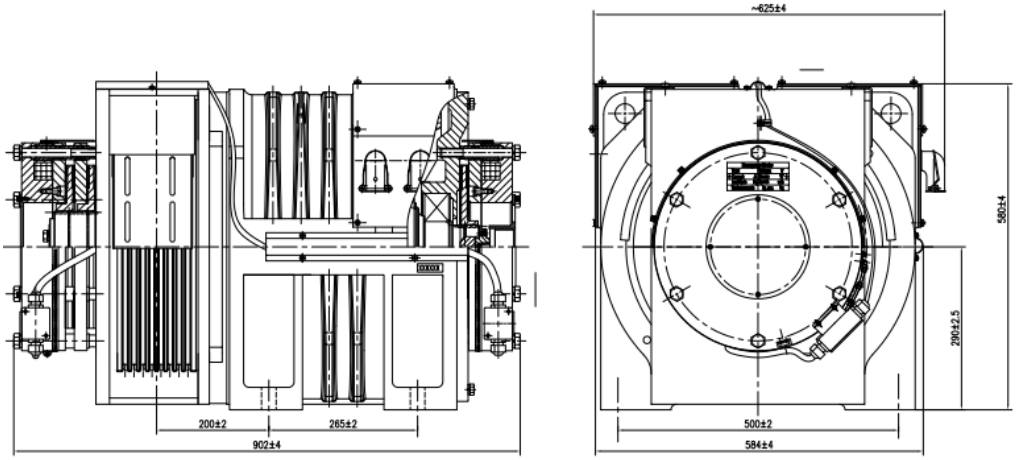
13.0 Emergency Brake Assembly



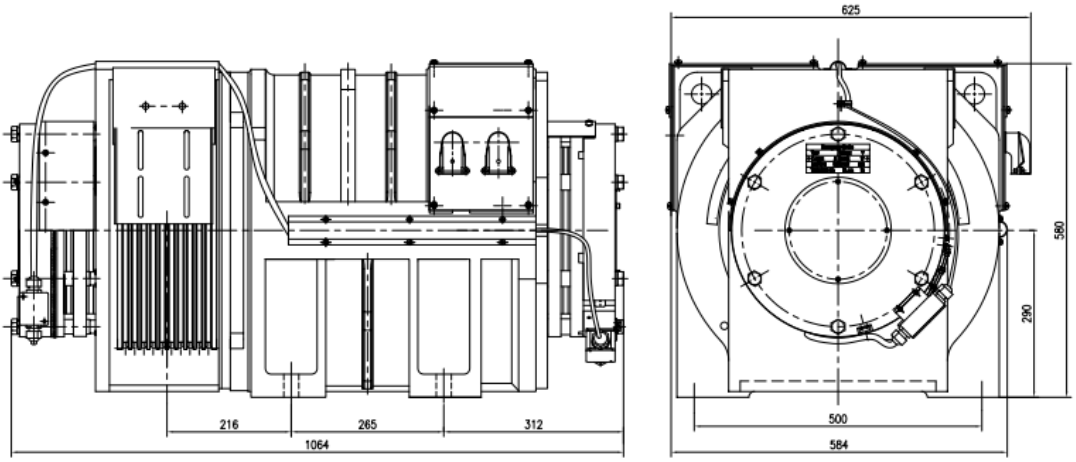
(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	bolt M16x165
2	*	lock washer 16
3	*	rubber ring
4	*	dustproof ring
5	*	screw M6x16
6	*	lock washer 6
7	PBK043	Emergency brake assembly
8, 10	PBK007	Emergency Brake Disc (set of 2)
9	ER6.2-3	Brake plate
	PSW001	brake switch
	PBK006	brake assembly kit, Emergency (includes all components above)

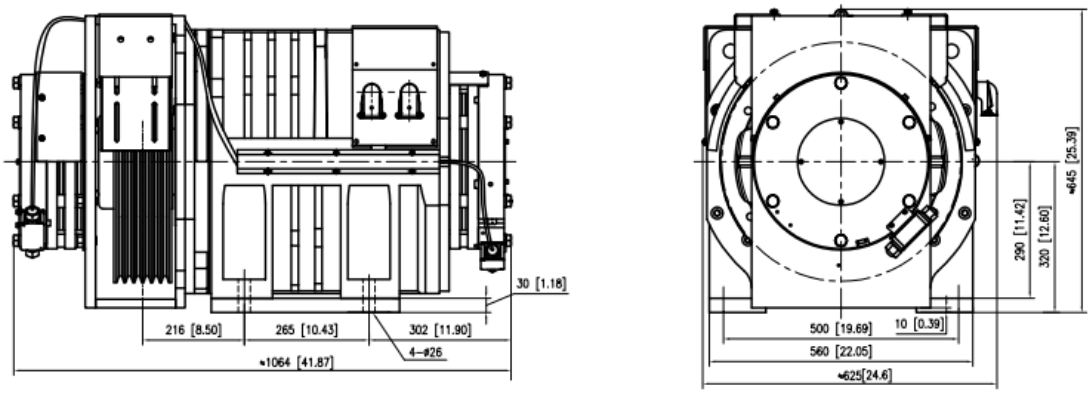
14.0 MACHINE DIMENSIONS



TSM/TMGL1



TMGL2



TMGL2A

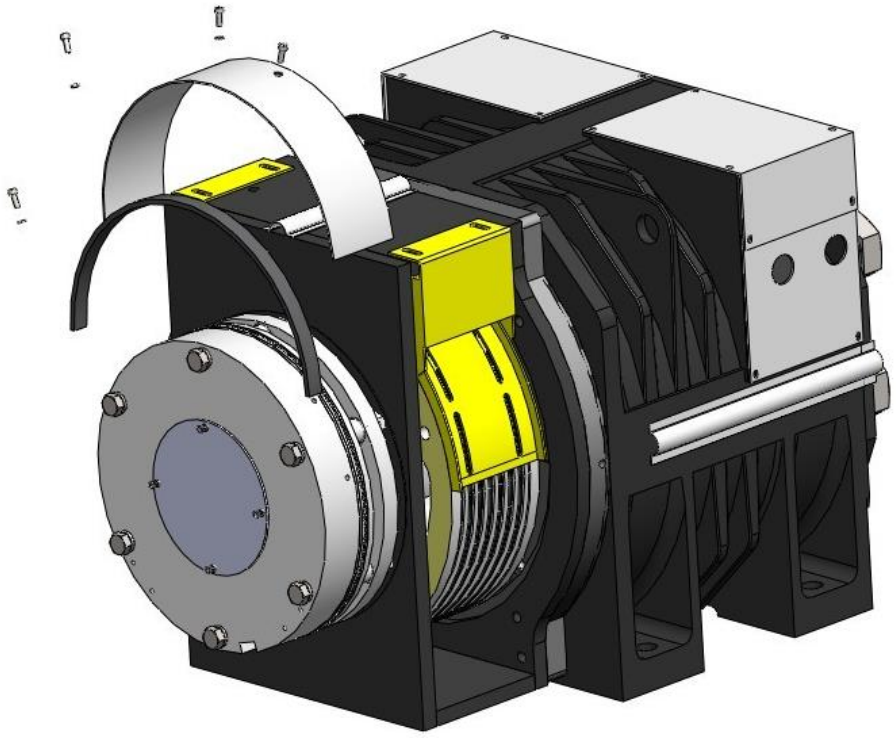
15.0Addendum

Suggested Methods of Opening Sticky Brakes during Start-up

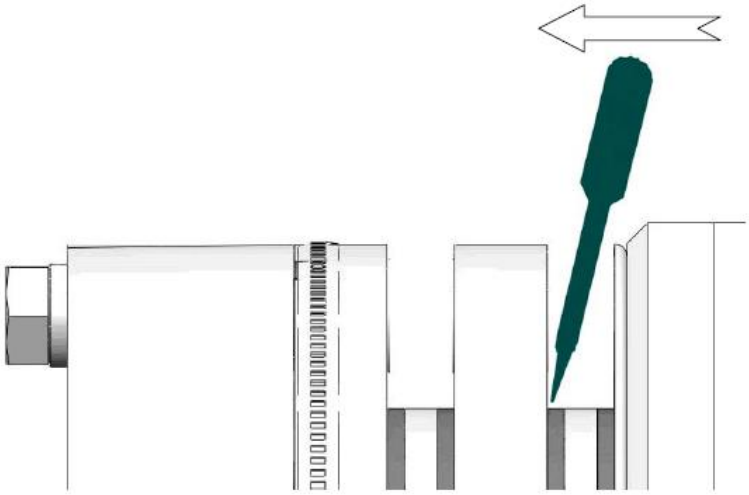
Method 1. Perform "dynamic encoder alignment procedure" again allowing the sheave to move.

Method 2. Use a flat head screw driver as shown below.

1. Loosen the screw M6x16 and lock washer 6 (4 pieces) by hex wrench (5mm), then remove the dustproof ring and rubber seal.



2. Energize both Normal and Emergency brake coils. Use a flat head screw driver to pry open the brake lining from its braking surface as shown in the following picture. Then repeat it for both sides of lining surfaces and for both brakes.



Method 3. Rotate the sheave with torque wrench.

Required Tools & Materials:

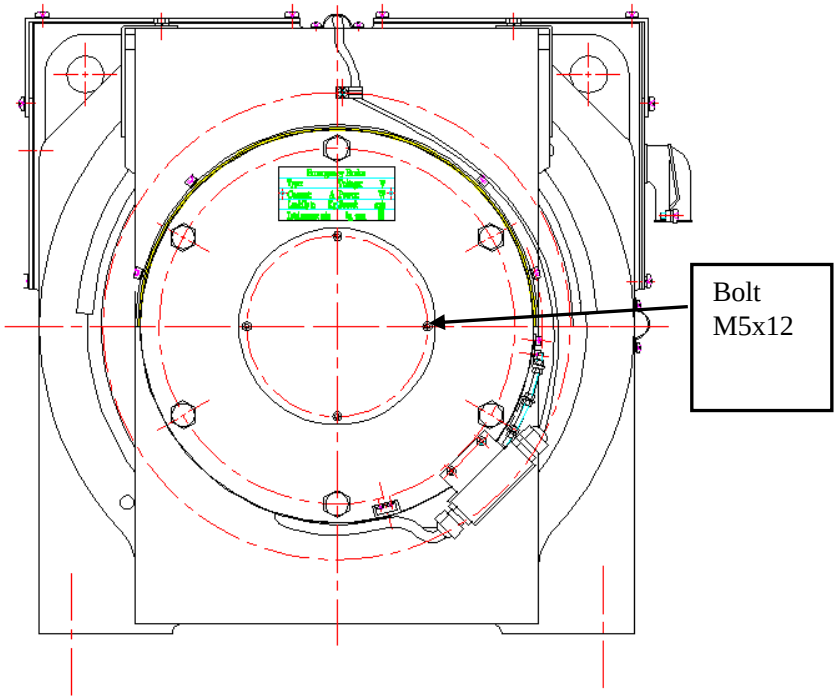
Hex wrench (4mm)

Long type socket 18mm

Socket wrench

Procedure:

1. Loosen the screws M5x12 and washer 5 (4 pieces) with hex wrench (4mm), then remove the front protect cover piece.



2. Connect both emergency and normal brake cable to the brake power supply and energize the brakes.

3. Install the long type (deep well) 18mm socket at top of M12 bolt in the main shaft as the following picture show.

4. Install the socket wrench to rotate the shaft to open the sticky brake.

5. Reinstall the front protect cover piece.

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