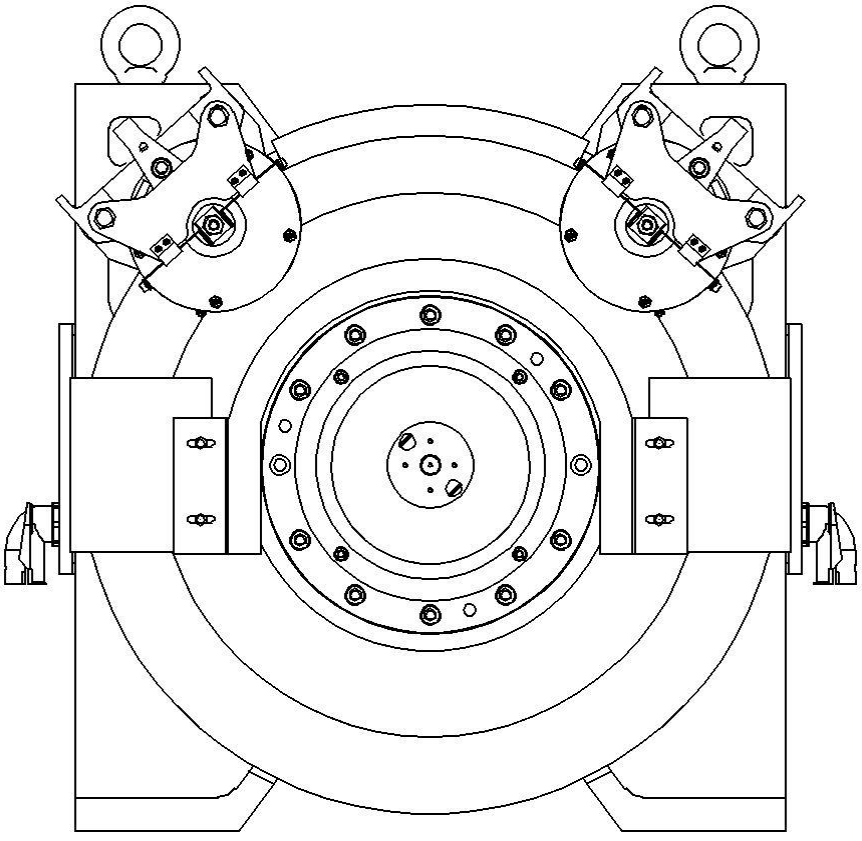
TPM2/TPM3/TPM4 Series

With Self-Adjust Brakes

PMS Gearless Elevator Traction Machine

Complete Operation and Service Manual



SUZHOU TORIN DRIVE EQUIPMENT CO., LTD.

Manual No. TDI-002A-TPM2/3/4 **Revision 4.1/March 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 of qualified elevator personnel. In the interest of your personal safety and the safety of others, do NOT attempt ANY procedure that you are NOT qualified to perform.

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

1.1 Terms in This Manual

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

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

1.2 General Safety

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

1.3 Electrical Safety

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

1.4 Electrical Hazards

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

1.5 Mainline Disconnect

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

1.6 Test Equipment Safety

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

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

1.7 When Power Is On

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

1.8 Product Specific Warnings

TPM2, TPM3 and TPM4 Series 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

TPM1/2/4 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.

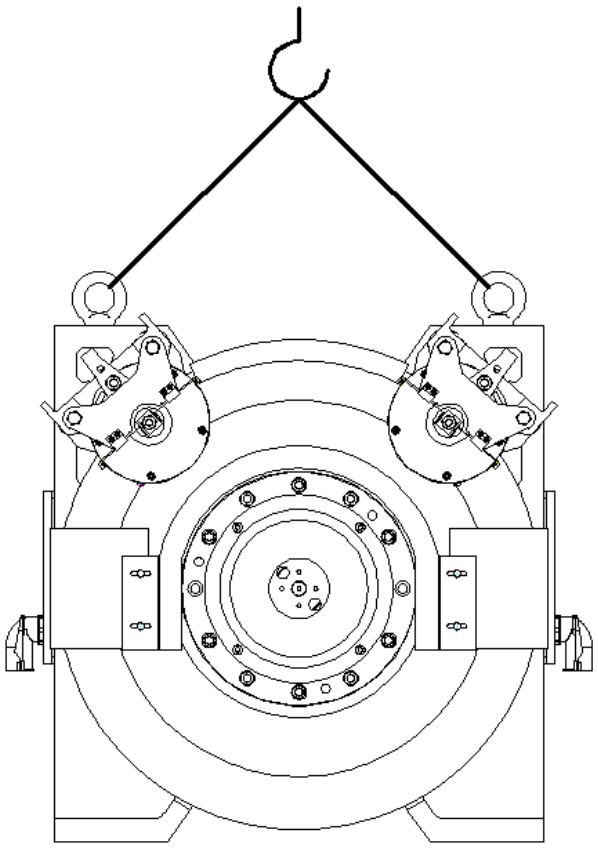


Figure 1: TPM2/3/4 series Machine Recommended Hoisting Methods

3.0 Application

3.1 Overview

TPM2/3/4 series Machine is a synchronous permanent magnet gearless machine designed for elevators. Its configuration allows speeds up to 350 fpm (maximum) and an elevator capacity up to 3500 lbs with 2 to 1 roping and single wrap arrangement.

TPM2/3/4 machine brake system with self-adjust capability uses two independent disc brakes: normal brake and emergency brake.

3.2 Codes and Standards

These machines are designed to comply with ASME A17.1-2007 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: 6587 lbs (29.3 kN) for TPM2 and 7868 lbs (35 kN) for TPM3/TPM4

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

Maximum Capacity: 2500 lbs (1150 Kg) for TPM2

3500 lbs (1600 Kg) for TPM3/TPM4

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

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

Sheave Diameter: 13.39 in (340 mm) and 15.75 in (400 mm)

Rope Size: 8 mm and 10 mm

Maximum Power: Up to 21.6 HP (16.1 KW)

Motor Voltage options: -HV option is suitable for 460VAC inverter drives

-LV option is suitable for 208-240VAC inverter drives

Normal and Emergency Self-Adjust Brake Model Number PZD140MA1:

Brake Stroke: 0.30 - 0.34mm

Pick Voltage/Current: 90VDC/0.87A

Hold Voltage/Current: 45VDC/0.45A

Normal and Emergency Self-Adjust Brake Model Number PZD140MB1:

Brake Stroke: 0.35 - 0.39mm

Pick Voltage/Current: 90VDC/1.08A

Hold Voltage/Current: 45VDC/0.55A

Table 1: Detailed Machine Specifications

TPM2 Series-8mm Ropes PM Gearless Machines For Single Wrap Applications

Model Number		TPM2-2520-HV-8mm	TPM2-2520-LV-8mm	TPM2-2535-HV-8mm	TPM2-2535-LV-8mm
Roping		2:1	2:1	2:1	2:1
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 dia/No. Of grooves	Inch	13.39/7 grooves	13.39/7 grooves	13.39/7 grooves	13.39/7 grooves
Rated power	HP	10.6	10.6	18.7	18.7
Rated torque	Ft-lbs	494	494	494	494
Acceleration torque	Ft-lbs	988	988	988	988
Rated speed	Rpm	112	112	198	198
Rated amps	A	17.7	35.8	30.4	61.5
Rated voltage (+/-5%)	V	328	160	328	160
Rated frequency	Hz	18.7	18.7	33	33
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps
Total moment of inertia	Lb-ft2	117	117	117	117
Min. Normal brake torque	Ft-lbs	653	653	653	653
Min. Emergency brake torque	Ft-lbs	790	790	790	790
Max. shaft load	Lbs	6587	6587	6587	6587

TPM2 Series-10mm Ropes PM Gearless Machines For Single Wrap Applications

Model Number		TPM2-2520-HV-10mm	TPM2-2520-LV-10mm	TPM2-2535-HV-10mm	TPM2-2535-LV-10mm
Roping		2:1	2:1	2:1	2:1
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 dia/No. Of grooves	Inch	15.75/6 grooves	15.75/6 grooves	15.75/6 grooves	15.75/6 grooves
Rated power	HP	9	9	15.7	15.7
Rated torque	Ft-lbs	494	494	494	494
Acceleration torque	Ft-lbs	988	988	988	988
Rated speed	Rpm	96	96	167	167
Rated amps	A	15.7	30.6	26.7	53.7
Rated voltage (+/-5%)	V	328	160	328	160
Rated frequency	Hz	16	16	27.8	27.8
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps
Total moment of inertia	Lb-ft2	138	138	138	138
Min. Normal brake torque	Ft-lbs	710	710	710	710
Min. Emergency brake torque	Ft-lbs	926	926	926	926
Max. shaft load	Lbs	6587	6587	6587	6587

TPM3 Series-8mm Ropes PM Gearless Machines For Single Wrap Applications

Model Number		TPM3-3520-HV-8mm	TPM3-3520-LV-8mm	TPM3-3535-HV-8mm	TPM3-3535-LV-8mm
Roping		2:1	2:1	2:1	2:1
Elevator capacity	Lbs	Up to 3500	Up to 3500	Up to 3500	Up to 3500
Elevator speed	Fpm	Up to 200	Up to 200	Up to 350	Up to 350
Sheave dia/No. Of grooves	Inch	13.39/7 grooves	13.39/7 grooves	13.39/7 grooves	13.39/7 grooves
Rated power	HP	12.6	12.6	22.3	22.3
Rated torque	Ft-lbs	590	590	590	590
Acceleration torque	Ft-lbs	1180	1180	1180	1180
Rated speed	Rpm	112	112	198	198
Rated amps	A	20.3	42.8	35.2	70.4
Rated voltage (+/-5%)	V	328	160	328	160
Rated frequency	Hz	18.7	18.7	33	33
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps
Total moment of inertia	Lb-ft2	120	120	120	120
Min. Normal brake torque	Ft-lbs	888	888	888	888
Min. Emergency brake torque	Ft-lbs	1098	1098	1098	1098
Max. shaft load	Lbs	7868	7868	7868	7868

TPM4 Series-10mm Ropes PM Gearless Machines For Single Wrap Applications

Model Number		TPM4-3520-HV-10mm	TPM4-3520-LV-10mm	TPM4-3535-HV-10mm	TPM4-3535-LV-10mm
Roping		2:1	2:1	2:1	2:1
Elevator capacity	Lbs	Up to 3500	Up to 3500	Up to 3500	Up to 3500
Elevator speed	Fpm	Up to 200	Up to 200	Up to 350	Up to 350
Sheave dia/No. Of grooves	Inch	15.75/6 grooves	15.75/6 grooves	15.75/6 grooves	15.75/6 grooves
Rated power	HP	12.3	12.3	21.6	21.6
Rated torque	Ft-lbs	676	676	676	676
Acceleration torque	Ft-lbs	1352	1352	1352	1352
Rated speed	Rpm	96	96	167	167
Rated amps	A	21.1	40.0	34.0	67.0
Rated voltage (+/-5%)	V	328	160	328	160
Rated frequency	Hz	16	16	27.8	27.8
Max. allowable amps	A	6 x Rated amps	6 x Rated amps	6 x Rated amps	6 x Rated amps
Total moment of inertia	Lb-ft2	142	142	142	142
Min. Normal brake torque	Ft-lbs	977	977	977	977
Min. Emergency brake torque	Ft-lbs	1299	1299	1299	1299
Max. shaft load	Lbs	7868	7868	7868	7868

4.0 Machine Overview

The following is a list of major components of the TPM2/3/4 series Machines. Along with a description of their functions, there is an overview of some of the critical adjustments and maintenance information. See Installation and Maintenance for detail.

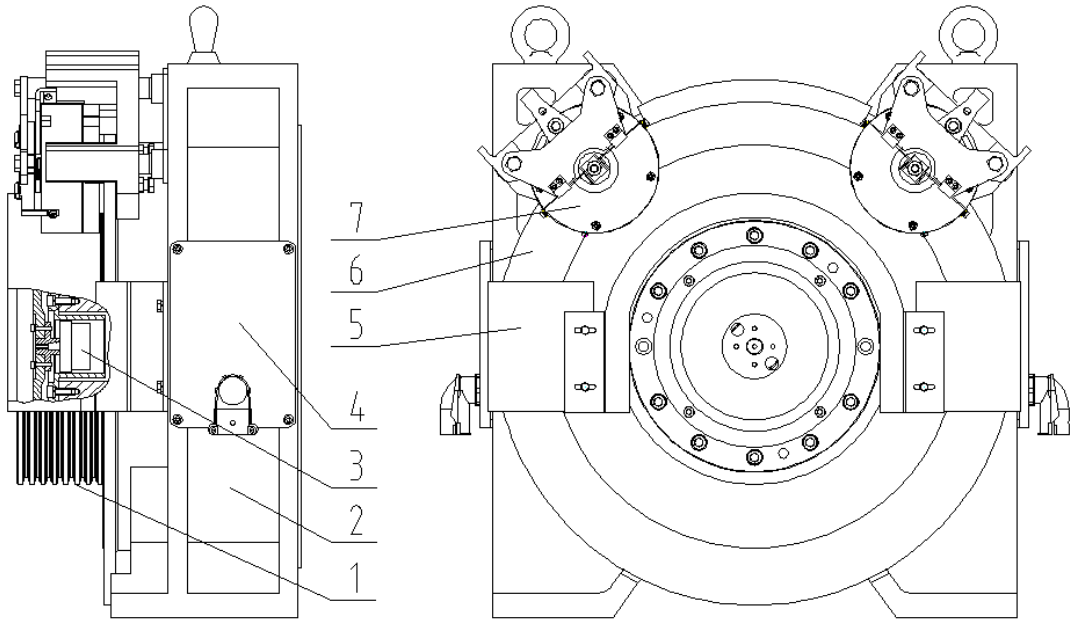


Figure 2: TPM2/3/4 series Machine Assembly

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. **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.
4. **Nameplate –** Show the machine rated data and manual factory serial No. information.
5. **Sheave cover -** Keep the rope out of touch after hang up the ropes.
6. **Brake Disc** - The smooth surfaced disc is connected to the main shaft. When the brake is energized, the brake is released from the brake disc.
7. **Brake -** The electromechanical device is used to prevent the elevator from moving when the car is at rest.

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! 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.

Connect the motor cable via U, V, W, and GND terminals inside the motor junction box to three phase AC reactor then to frequency inverter output terminal, and check the short-circuiting between the windings and the ground before power-up.

5.2 Brake Connection

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

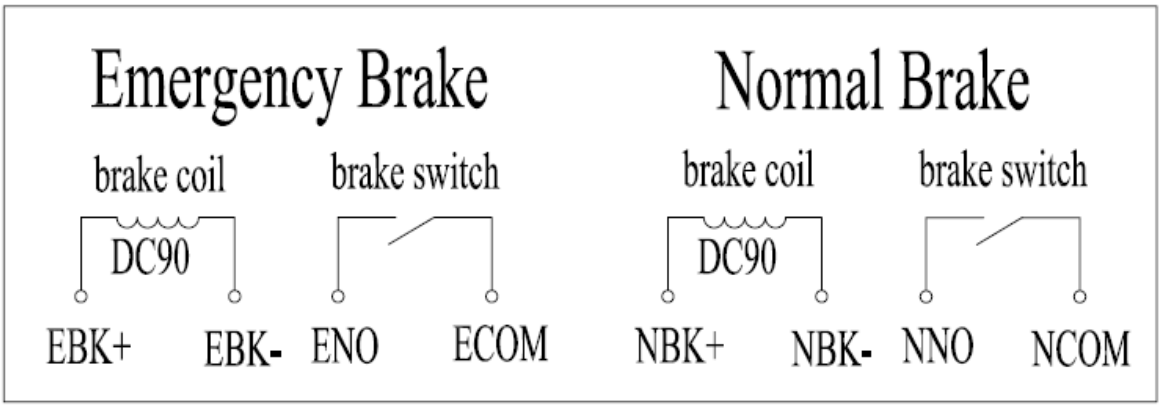


Figure 3: Normal and Emergency Brake Wiring

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). User can connect it according to your control system requests.

5.3 Absolute 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.

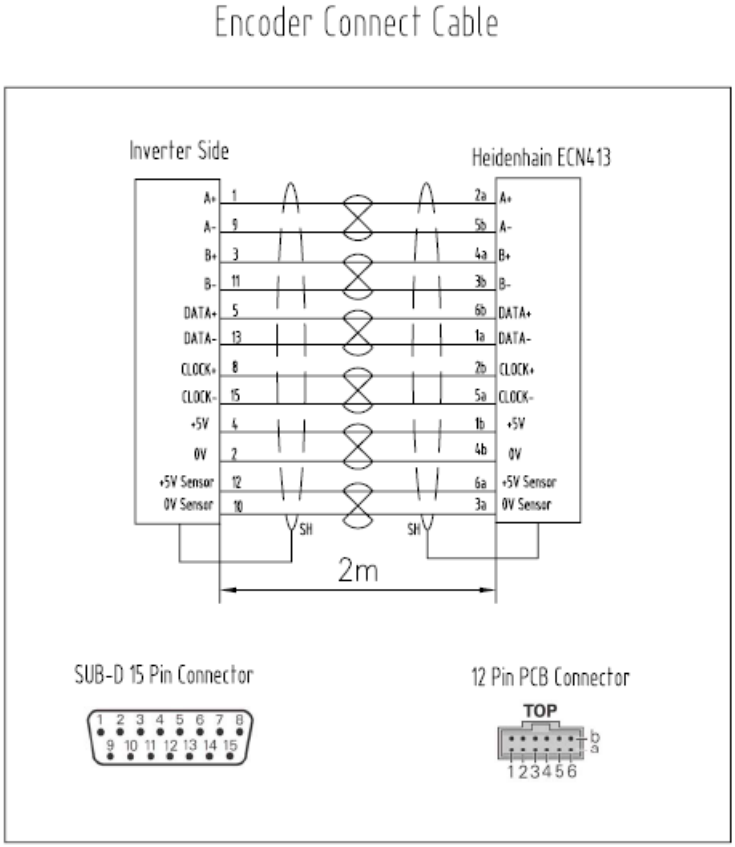


Figure 4: Encoder Wiring

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: 18mm (2 pieces)

Feeler gauges: 0.30mm, 0.35mm, 0.4mm, 0.45mm

6.1.1 Adjustment Procedure

1. Remove the elevator from service.
2. Check the gap “A” (brake stroke) at point 1 and 2, with feeler gauge. Maximum Gap “A” after wear should be <0.4mm (0.016”) for PZD140MA1; 0.45mm (0.018”) for PZD140MB1, otherwise the gap must be readjusted. See Figure 5.
3. Go to Step 4 only if the gap is bigger than specified. Otherwise the stroke is good.
4. Loosen the locknuts, and then adjust the bolt slowly to ensure the gap “A” is within:
   PZD140MA1: 0.30~0.34mm (0.012” – 0.013”). Use the 0.30 mm (0.012”) feeler gauge as a “go gauge”, and the 0.35 mm (0.014”) as a “no go gauge”.
   PZD140MB1: 0.35~0.39mm (0.014” – 0.015”). Use the 0.35 mm (0.014”) feeler gauge as a “go gauge”, and the 0.40 mm (0.016”) as a “no go gauge”.
   Note: Feeler gauge should be able to be inserted to 1 inch depth.
5. If the gap is too big, tighten the bolt clockwise to reduce it. If the gap is too small, loosen the bolt counter-clockwise to increase the gap.
6. Remeasure and confirm that the value of gap “A” is good.
7. Tighten the locknut then apply Loctite 271 between the locknuts and the bolt threads.

WARNING! **After the adjustment, do NOT forget to tighten the lock nut. Hold the adjustment bolt while tightening the locknut.**

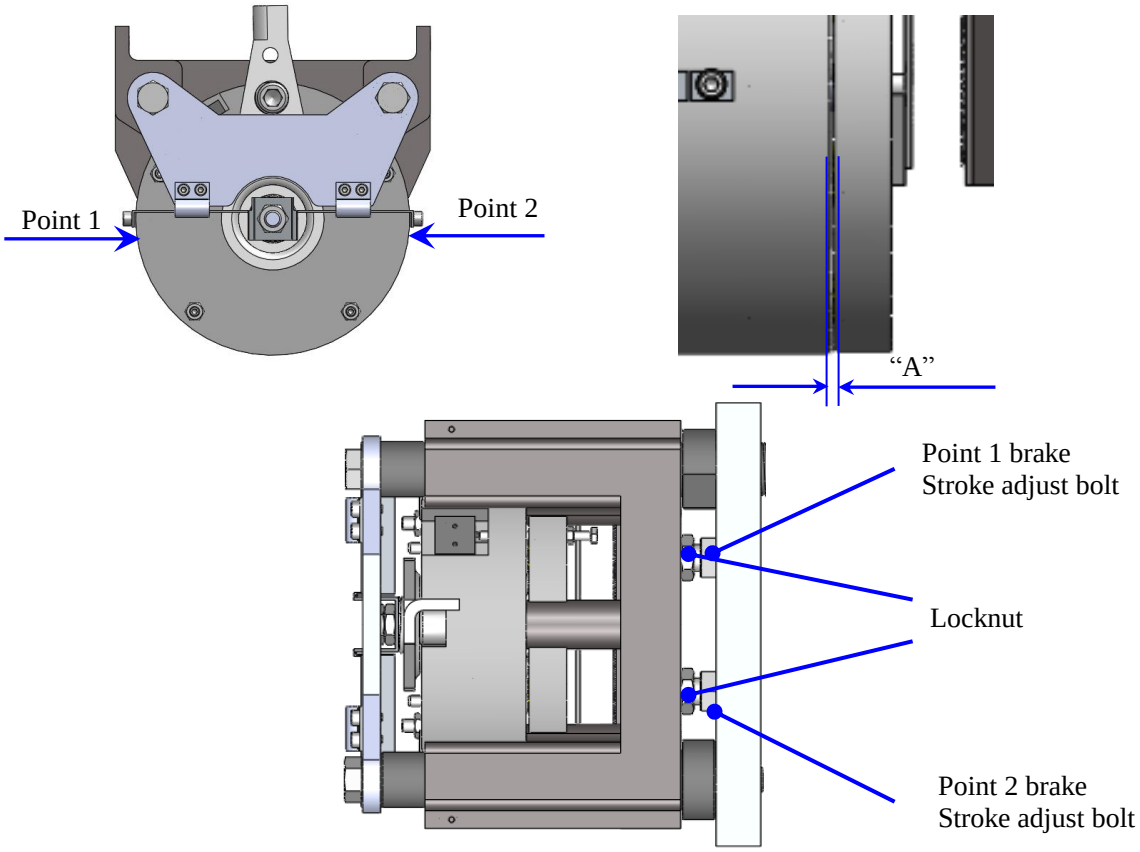


Figure 5: Brake Stroke Adjustment

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

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 6.
2. Tighten the bolt M6 60° with 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 6.
4. Retest the brake open noise until the noise level is acceptable. If not, repeat step 2.
5. Make sure the hold current (voltage) can hold the brake.
6. 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.

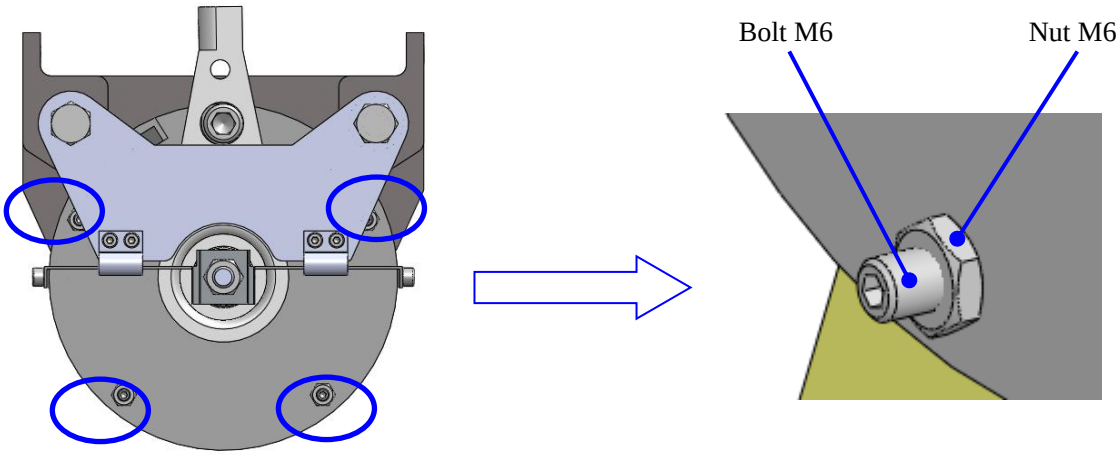


Figure 6: Brake Noise Adjustment

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 8.3.3 Brake Switch Adjustment.

7.0 Maintenance

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

7.1 Brake Stroke Check

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

If the brake lining wears out, the brake stroke will increase. If the brake stroke is ≥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 install in the fist 6 months. Every 1 year afterwards.

Benchmark Criteria

The brake stroke "A" should <0.4mm (0.016") for PZD140MA1, <0.45mm (0.018") for PZD140MB1.

7.2 Brake Lining Wear Check

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 <1mm (0.04"). Use 1mm feeler gauges to check gap "a1","a2",and "b" between brake disc and brake lining frame. The feeler must be able to be inserted into all 3 gaps. Otherwise replace the brake lining or replace the whole brake assembly.

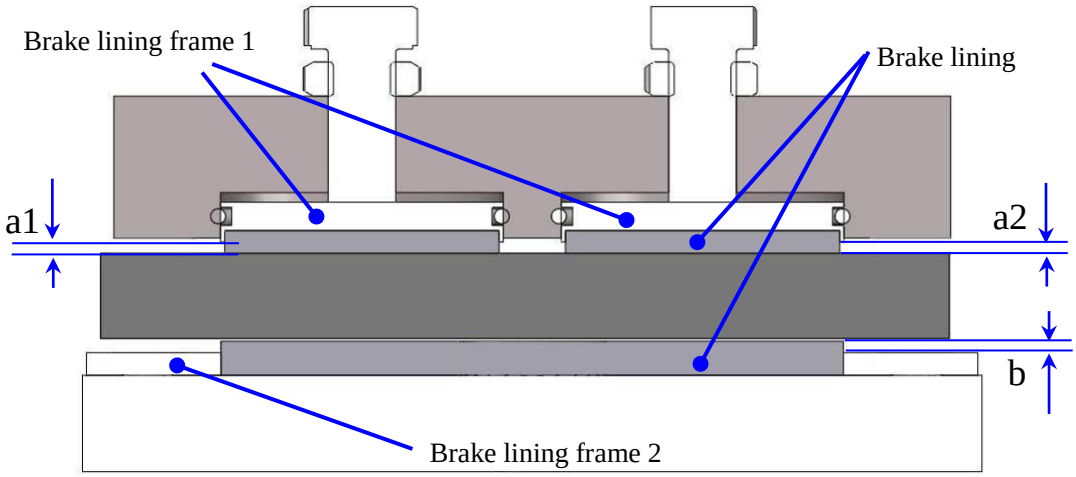


Figure 7: Brake Lining Wear Check

8.0 Replacement

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

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

8.1 Encoder Replacement

Note: To determine if the machine has a front mount encoder or a rear mount encoder rotate the sheave so the encoder locking screw should be visible through the encoder cover as shown in Figure 9. If the locking screw is not visible, the encoder is a rear mount encoder.

8.1.1 Front Mount Encoder

Required Tools & Materials:

Encoder (ECN413/ECN1313)

Hex wrench (2mm, 4mm, 6mm, 8mm)

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

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

8.1.1.1 Encoder removal

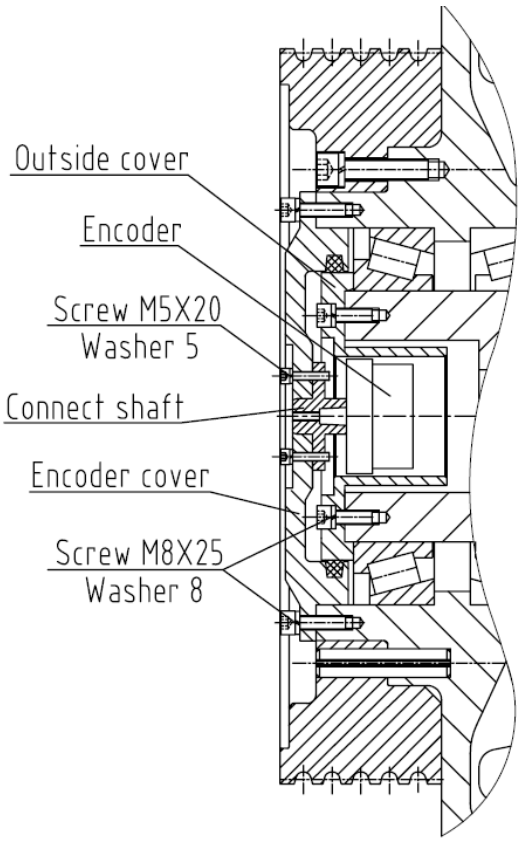


Figure 8: Encoder removal

1. Rotate the machine so that the encoder locking screw is visible from the access hole on the encoder cover, as shown in Figure 9.
2. Loosen the encoder locking screw M2.5, as shown in Figure 9, with hex wrench (2mm) through the encoder cover hole. The screw does not need to be removed.

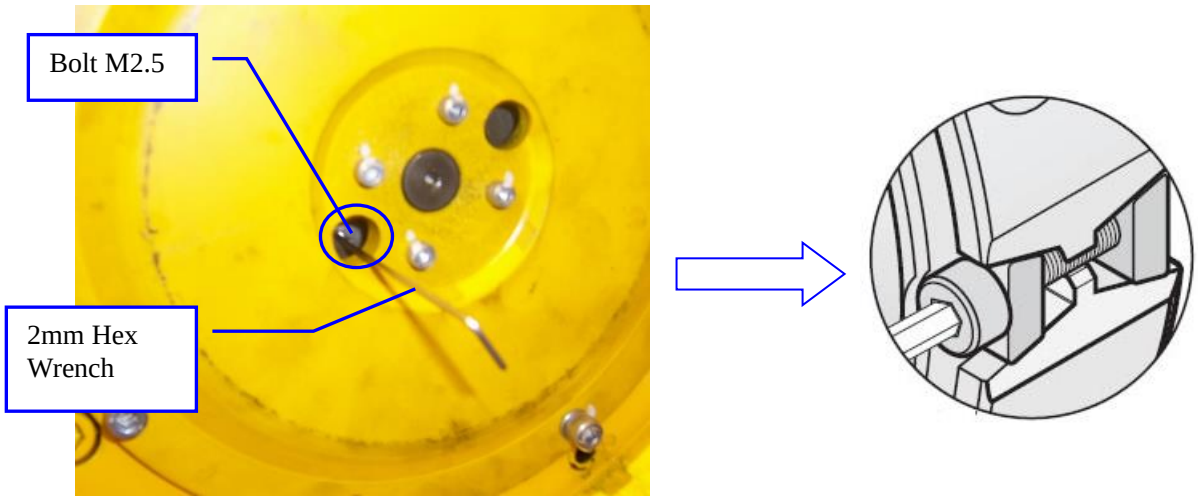


Figure 9: Loosen M2.5 locking screw

3. Ensure there is enough cable to be pulled through machine.

4. Remove the four bolts (M8x25) using the hex wrench (6mm). See Figure 10.

5. Insert 2 bolts (M8x25) in jacking holes and jack the cover off.

   Note: Do not apply excessive pressure on the cable. It may destroy the encoder cable.

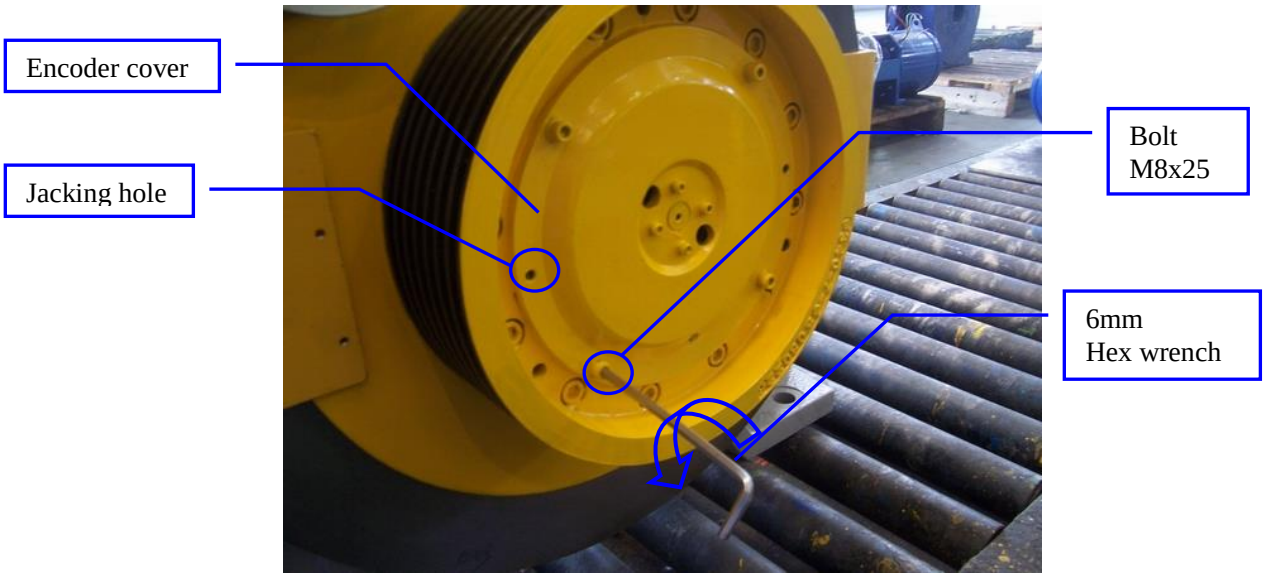


Figure 10: Remove Encoder cover

6. Remove the encoder end cover using the hex wrench (4mm). See Figure 11.

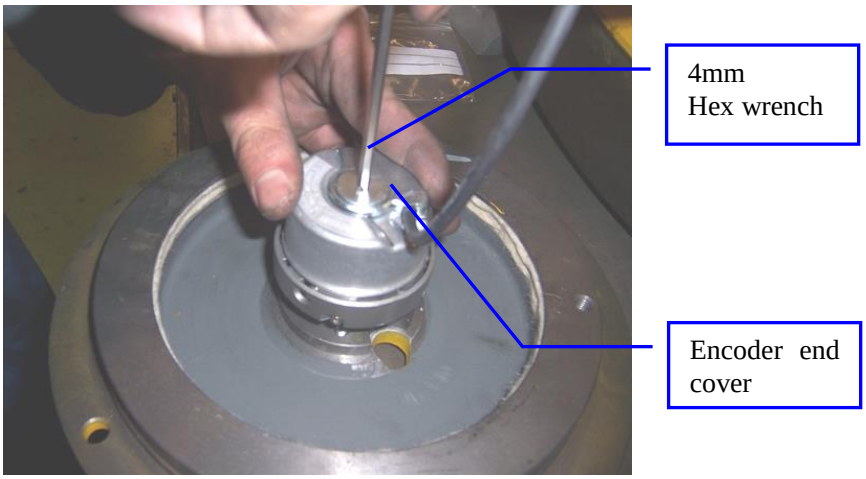


Figure 11: Remove Encoder end cover

7. Loosen the bolt M5 inside by hex wrench (4mm) 1~2 turns only. See Figure 12.

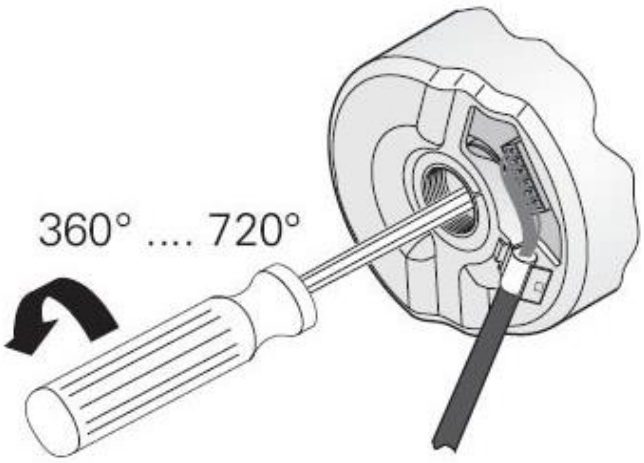


Figure 12: Loosen M5 bolt

8. Turn the M10 bolt against the M5x50 bolt to push the encoder from the shaft. Remove both bolts and the encoder. **Note: Steps 7 and 8 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.)** Remove the encoder. See Figure 13.

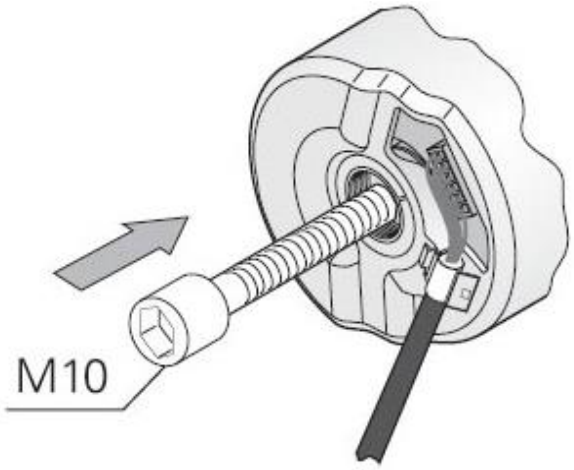


Figure 13: Use M10 bolt to loosen the encoder

8.1.1.2 Encoder installation

1. Loosen the bolt M2.5 and nut assembly in the new encoder, flip the screw and nut assembly, and then reinstall it as Figures 14 to 16 show, so that the screw can be accessed from outside the machine.

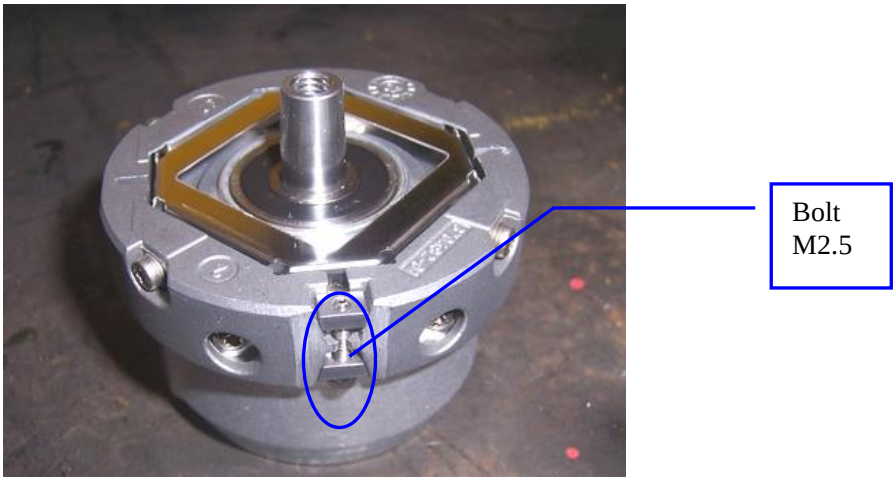


Figure 14: Remove Bolt M2.5

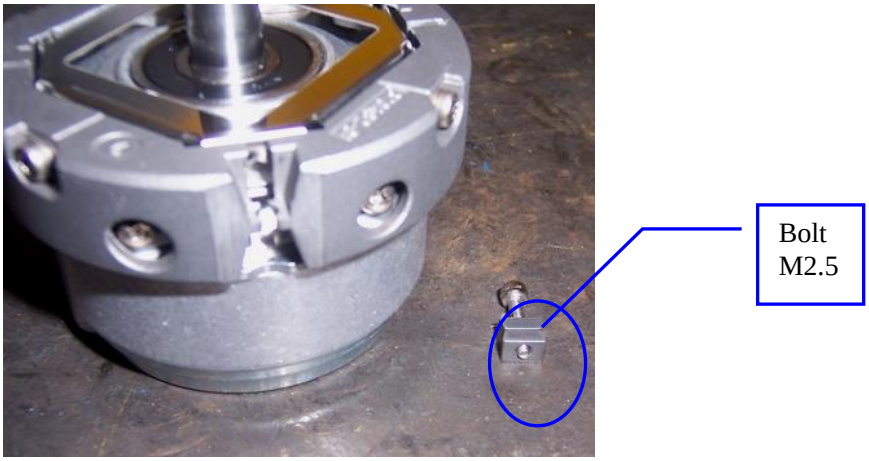


Figure 15: Bolt M2.5 removed

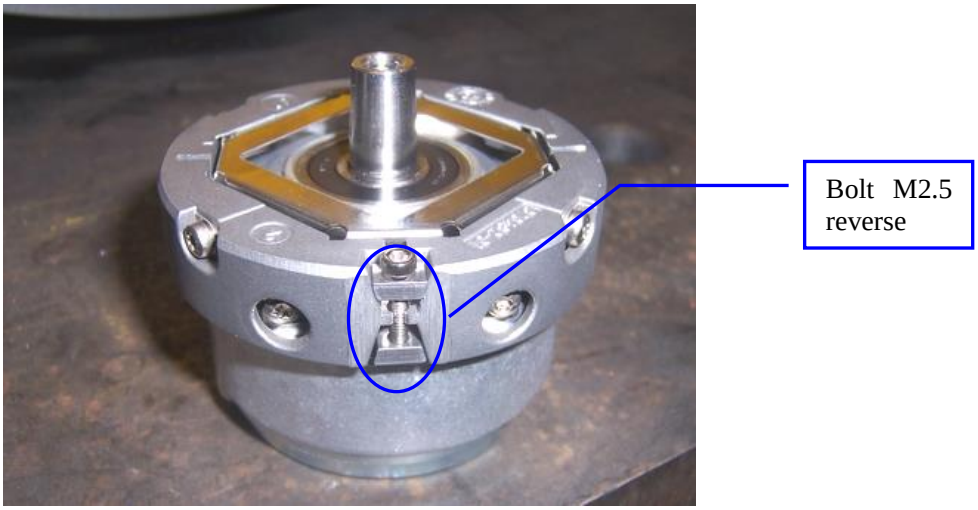


Figure 16: Bolt M2.5 reinstalled

2. Remove the encoder end cover by hex wrench (4mm). See Figure 17.

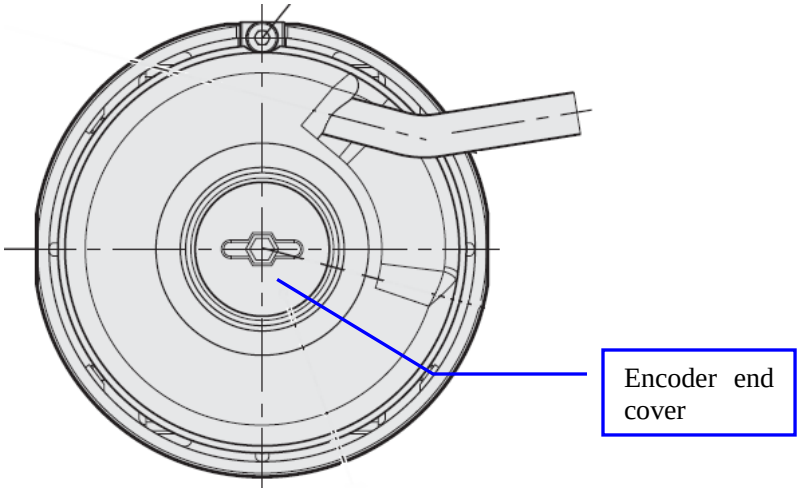


Figure 17: Remove Encoder end cover

3. Install the encoder to the encoder cover. Use the bolt M5 to secure the encoder to the encoder cover by hex wrench (4mm). Use 4mm socket Allen and torque wrench to tighten the bolt to 44 in-lb. See Figure 18.

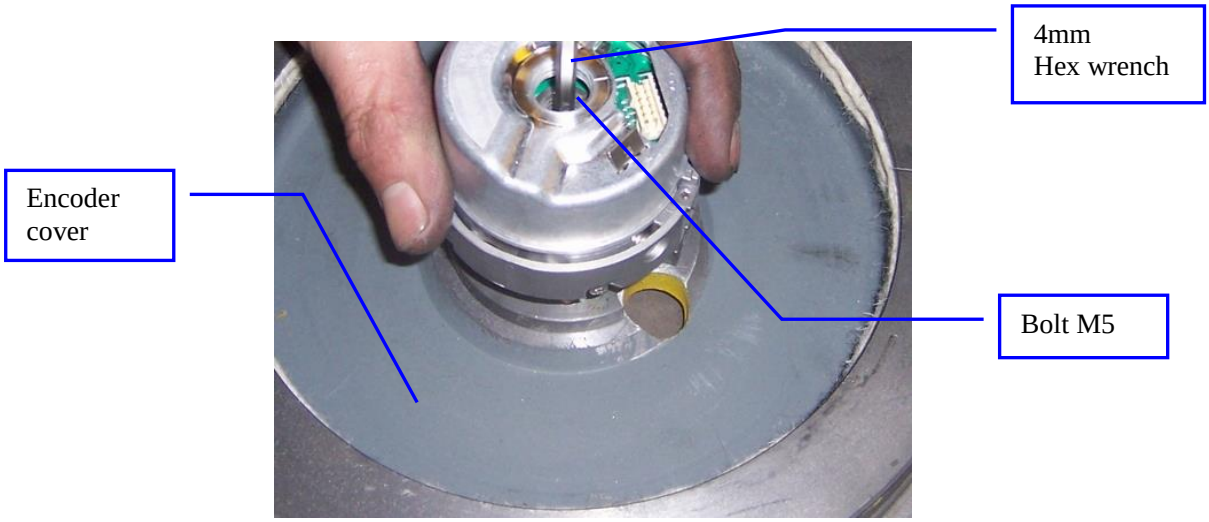


Figure 18: Install encoder on encoder cover

4. Put the encoder cable through the hole in the machine base.
   Insert the cable plug into the encoder. Feed the cable through the cable retainer. (For ECN1313 encode only). See Figure 19.

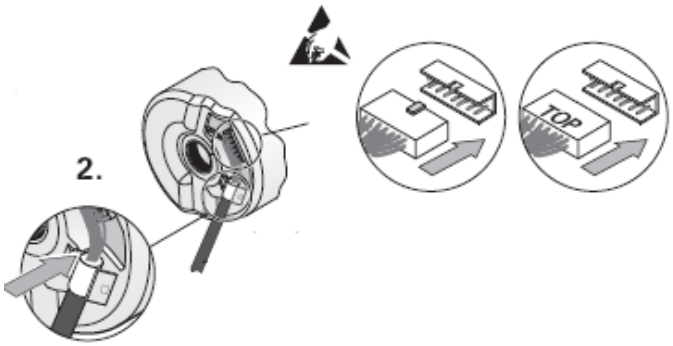


Figure 19: Install Encoder cable (if applicable)

Note: Verify no encoder wiring is pinched by cover.

5. Install the encoder cover into the brake wheel, and tighten the four bolts (M8x25) with the lock washers using a 6mm hex wrench. See Figure20.

   Note: Align the M2.5 Bolt on the encoder with the hole on the encoder cover so that the M2.5 Bolt is visible and accessible from outside of the machine.

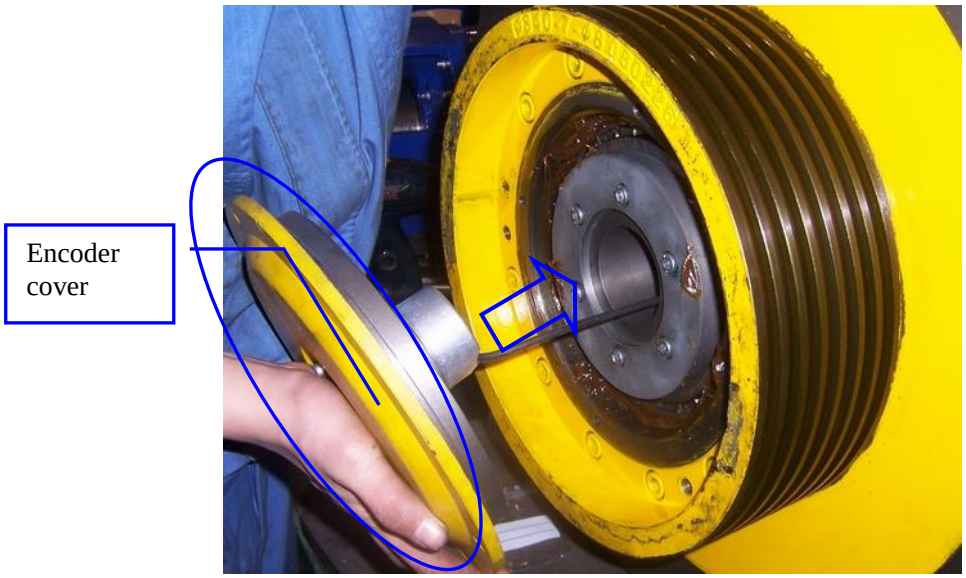


Figure 20: Reinstall Encoder cover

6. Tighten the bolt (M2.5) of the encoder collar with the torque wrench and socket Allen wrench (2mm) to 9 in-lb through the encoder cover hole.
7. Connect the power supply of machine, and test it.
8. Align the encoder per controller instructions.

8.1.2 Rear Mount Encoder

Required Tools & Materials:

Encoder (ECN413)

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)

8.1.2.1 Rear Mount Encoder removal

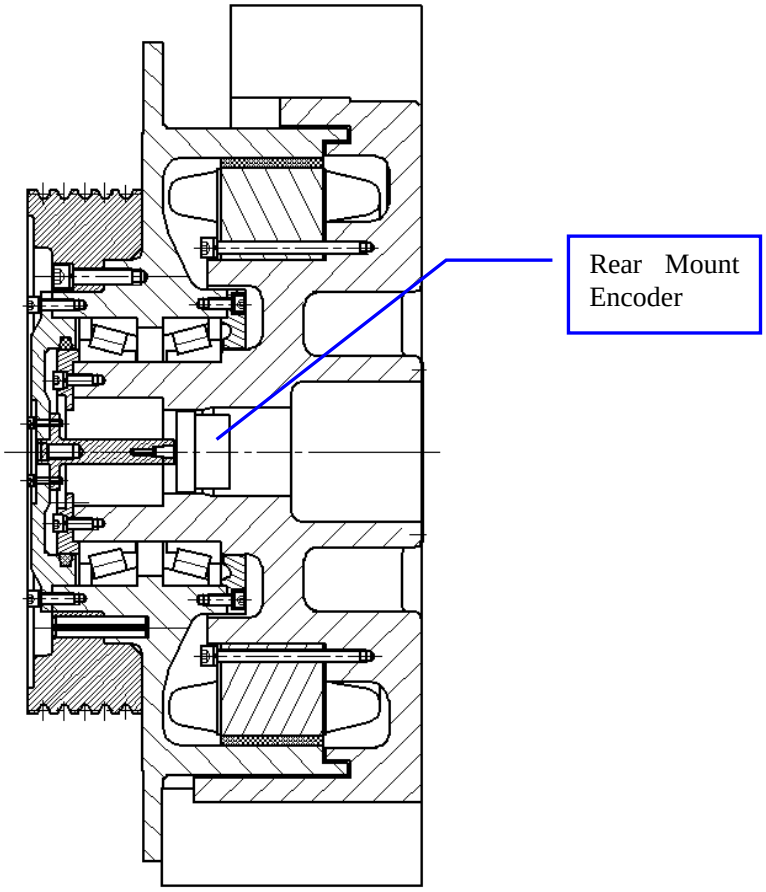


Figure 21: Rear Mount Encoder location

1. Remove the encoder end cover of encoder using the hex wrench 4mm. See Figure 22.

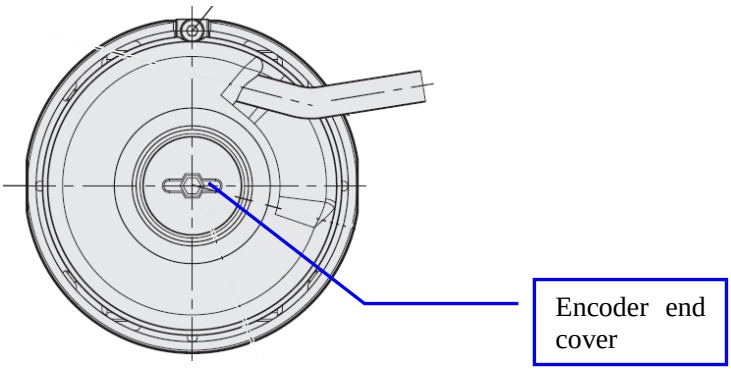


Figure 22: Remove Encoder end cover

2. Loosen the bolt M2.5 using the hex wrench 2mm. It does not have to be removed. See Figure 23.

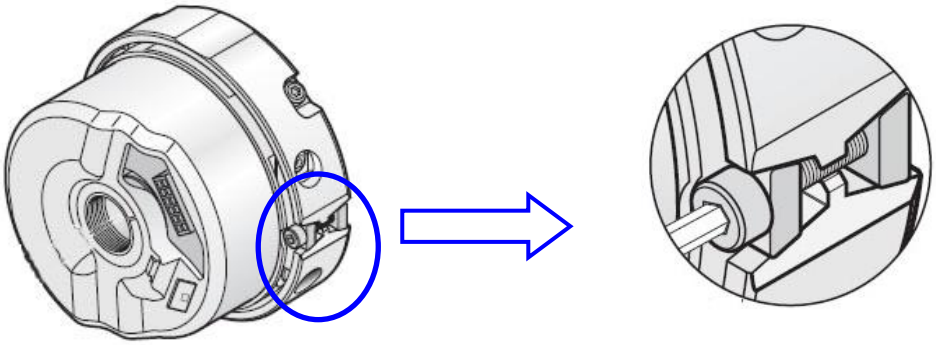


Figure 23: Loosen (do not remove) M2.5 bolt

3. Loosen the bolt M5 inside by hex wrench (4mm) 1~2 turns only. See Figure 24.

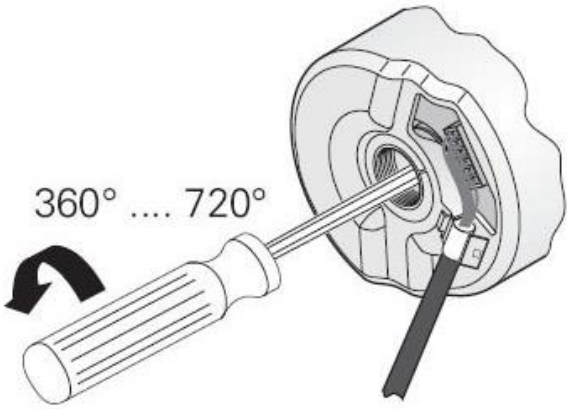


Figure 24: Loosen M5 bolt

4. Turn the M10 bolt against the M5c50 bolt to push the encoder from the shaft. Remove both bolts and the encoder. **Note: Steps 3 and 4 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.)** Remove the encoder. See Figure 25.

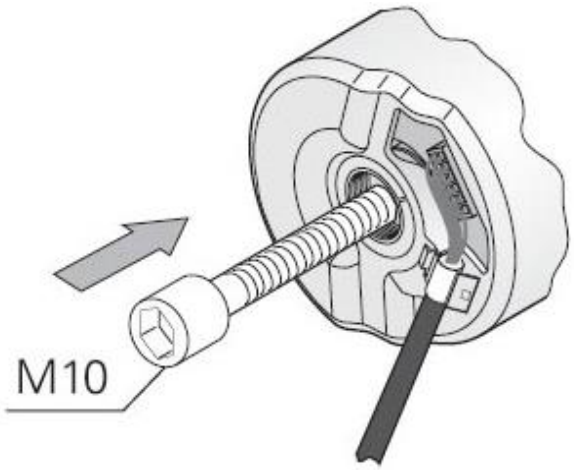


Figure 25: Use the M10 bolt to loosen the encoder

8.1.2.2 Rear Mount Encoder installation

1. Remove end cover of the encoder using the hex wrench (4mm). See Figure 26.

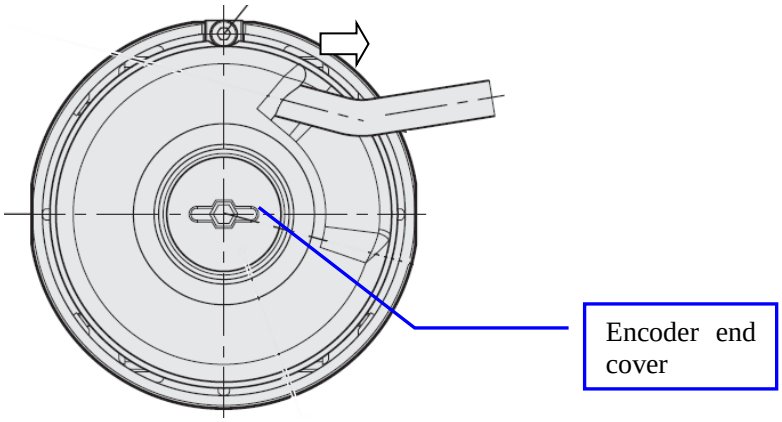


Figure 26: Remove Encoder end cover

2. Reconnect the encoder cable for the ECN1313 only. See Figure 27.

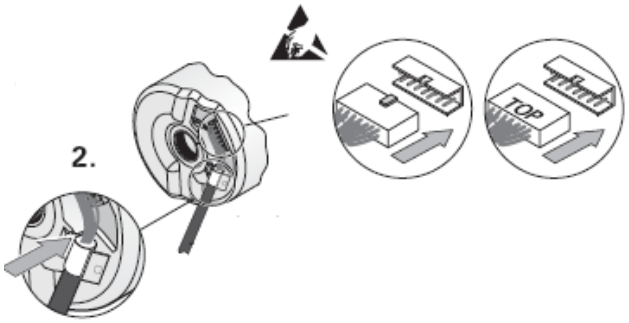


Figure 27: Attach encoder cable

3. Install the encoder to the encoder shaft. Use the bolt M5 to secure the encoder to the encoder shaft using the hex wrench (4mm). Use 4mm Allen socket and torque wrench to tighten the bolt to 44 in-lb. See Figure 28.

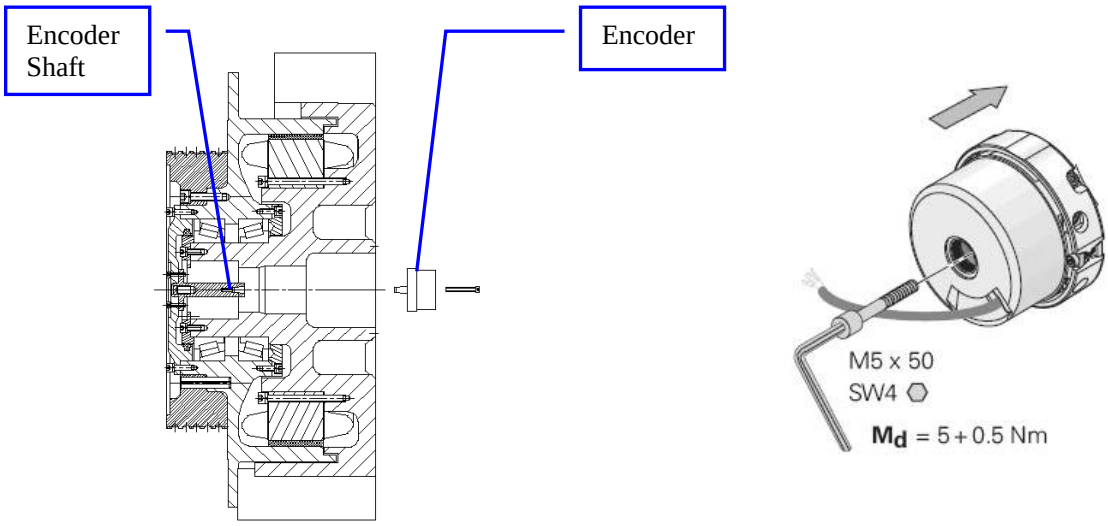


Figure 28: Install encoder

4. Install the end cover, and then tighten the end cover-bolt. Use 4mm Allen socket and torque wrench to tighten the bolt to 44 in-lb. See Figure 29.
5. Tighten the M2.5 with hex wrench (2mm) to 9 in-lbs.

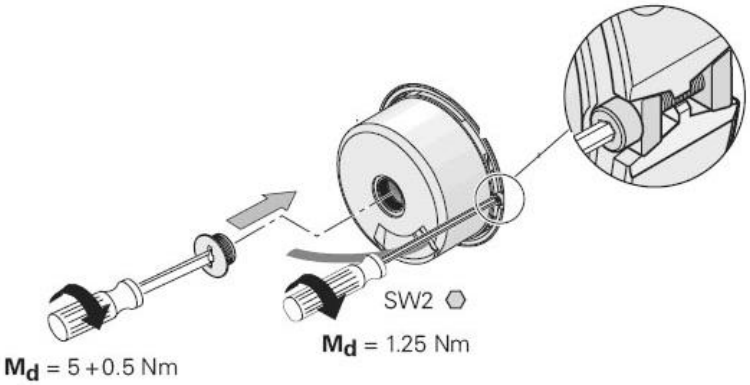


Figure 29: Install end cover and tighten M2.5mm bolt

6. Power supply for the machine, and test the machine.

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 (10mm, 18mm, 30mm)

Hex wrench (10mm, 16mm)

Torque wrench (need to measure 75 ft-lb.)

Straight head screw driver

Phillips head screw driver

Feeler gauges

Clean cotton fabric (rags)

Loctite 271 or equivalent

8.2.1 Brake removal

1. Loosen the bolts M5x20 and lock washers (4 pieces) in the brake terminal box using the Phillips head screw driver, and remove the terminal box cover.
2. Remove the brake wire cable of the brake being replaced from the brake terminal box, and then move it out from the hole in the machine body.
3. Use the open end wrench (18mm) to remove the bolt M12x20. (Let's take the right side brake for example shown in the following figure 30.)

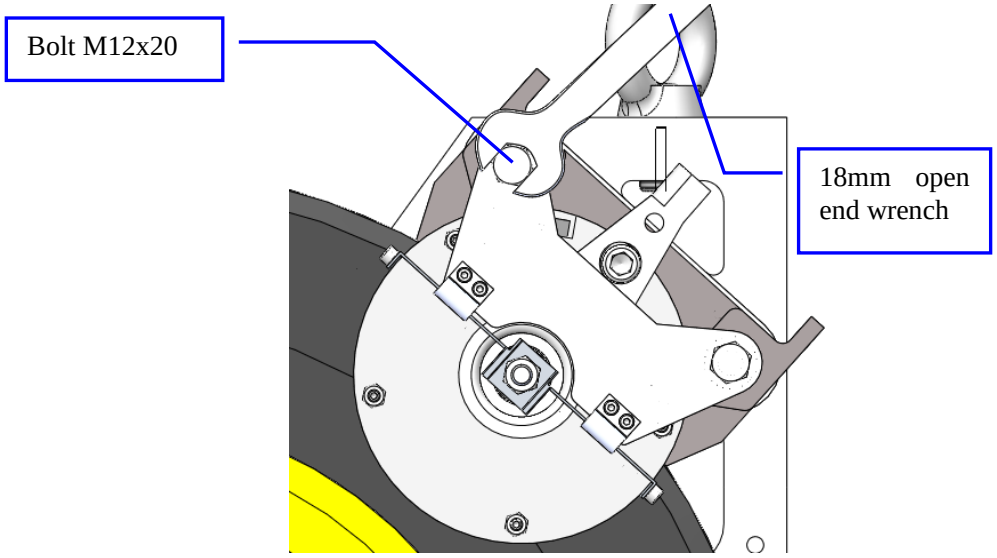


Figure 30: Remove Bolt M12x20

4. Use the open end wrench (18mm) to remove the bolt M12x190. See Figure 31.

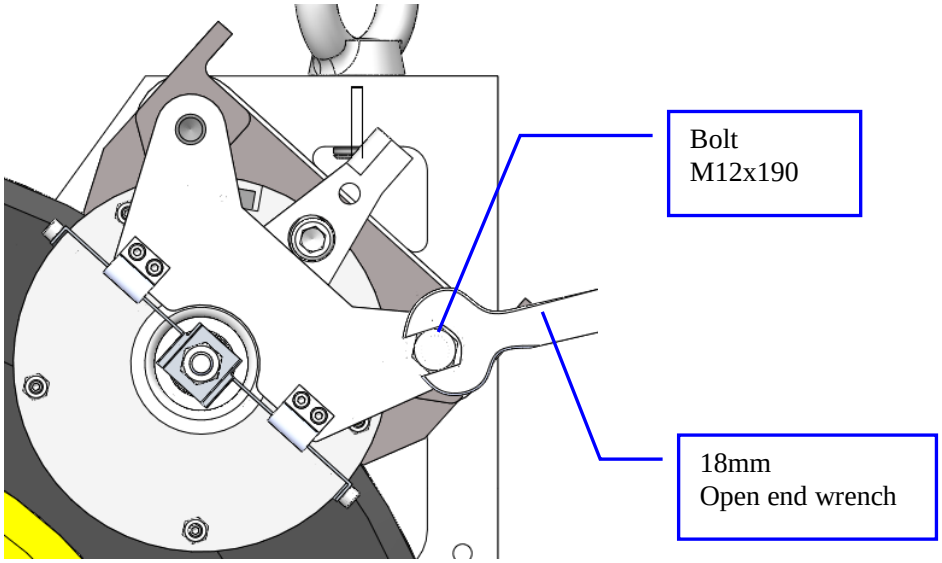


Figure 31: Remove Bolt M12x190

5. Using vise grips to manually pick the brakes.
6. Rotate the brake assembly and slide off the guide pole 2. See Figure 32.

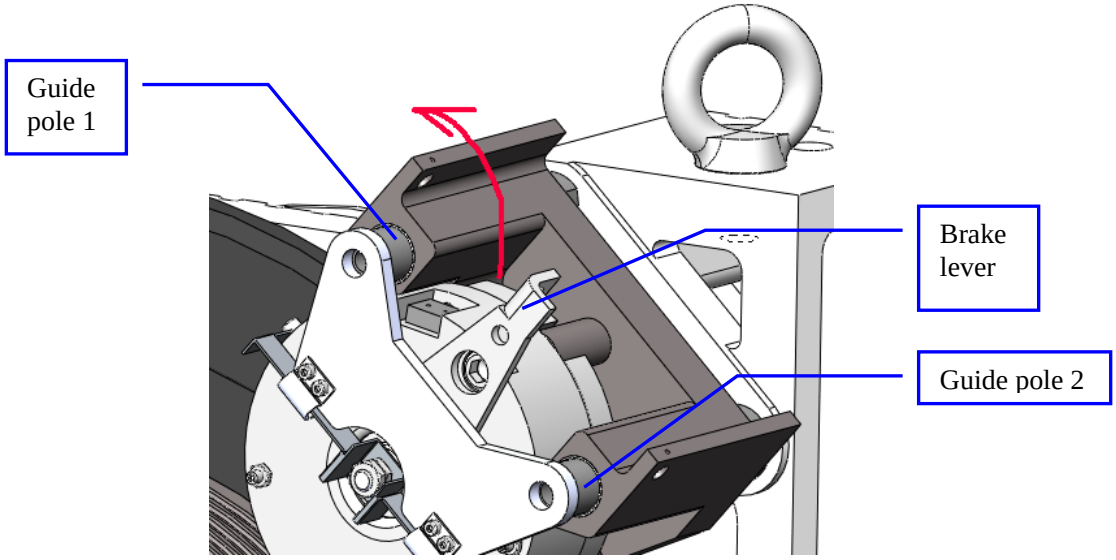


Figure 32: Rotate the brake

7. Use the open end wrench (30mm) to loosen and remove the guide pole 1. See Figure 33.

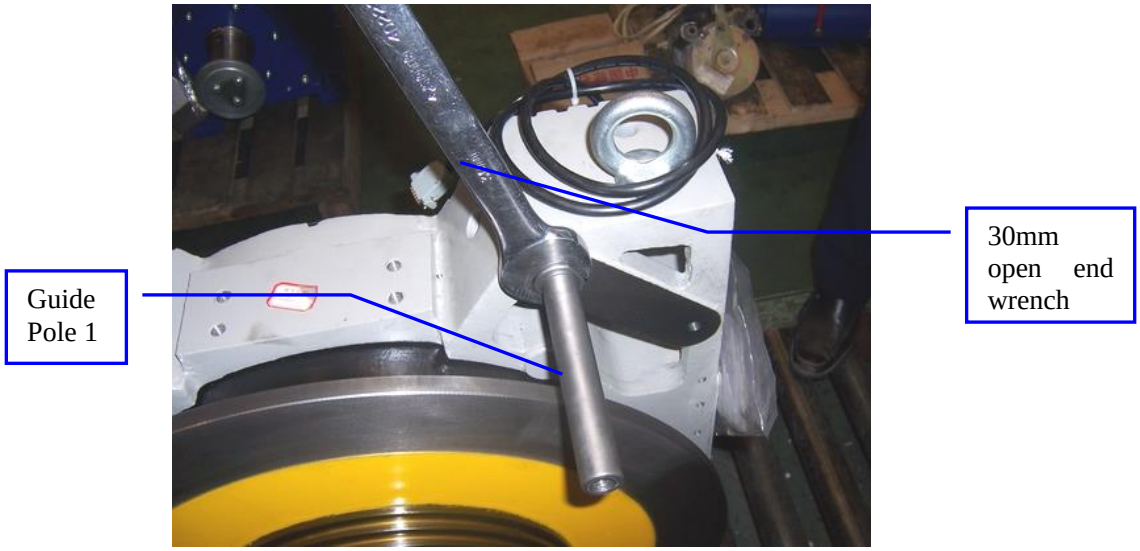


Figure 33: Remove guide pole 1

8.2.2 Brake installation

1. Clean the guide poles 1 and 2. Install guide pole 1 using the 33mm open end wrench. Also install Guide pole 2 into the brake mechanism. See Figure 34.

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

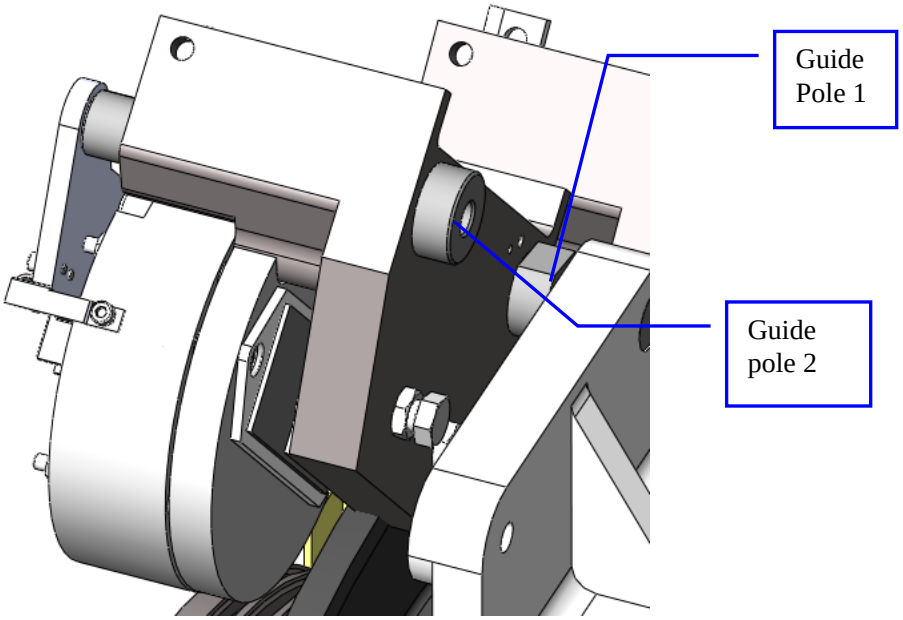


Figure 34: Install brake on guide pole 1

2. Tighten both brake gap adjustment bolts by 2 turns in order to clear base when installing brake assembly.
3. Install the brake assembly on guide pole 1 and rotate the brake onto brake sheave. (Using vise grips to manually pick the brakes) See Figure 35.

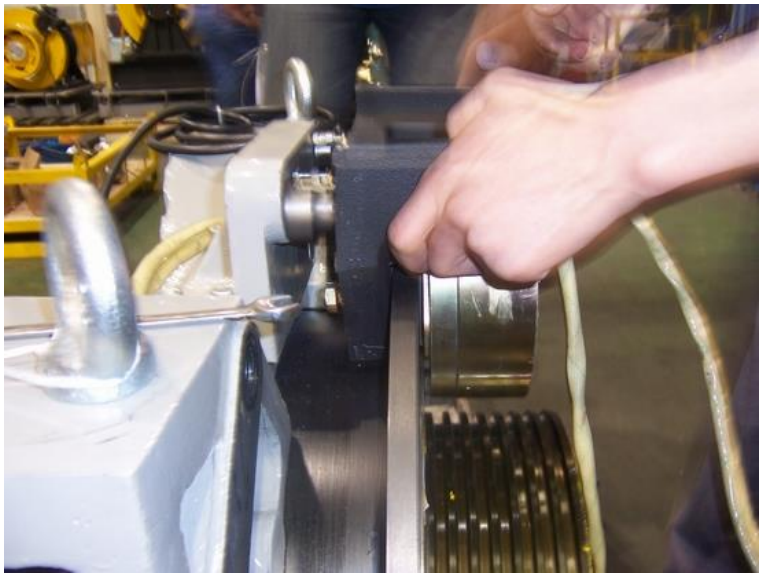


Figure 35: Rotate brake onto brake sheave

4. Apply Loctite on bolt M12x190 as Figure 30 shows. Tighten bolt to ≥75ft-lb. See Figures 36 and 37.

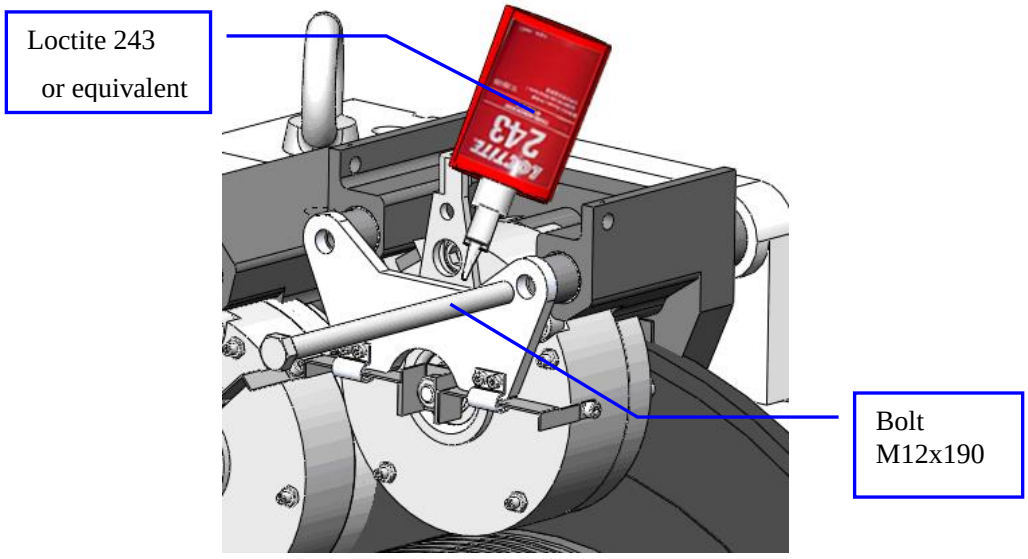


Figure 36: Apply Loctite 243 to M12x190 bolt

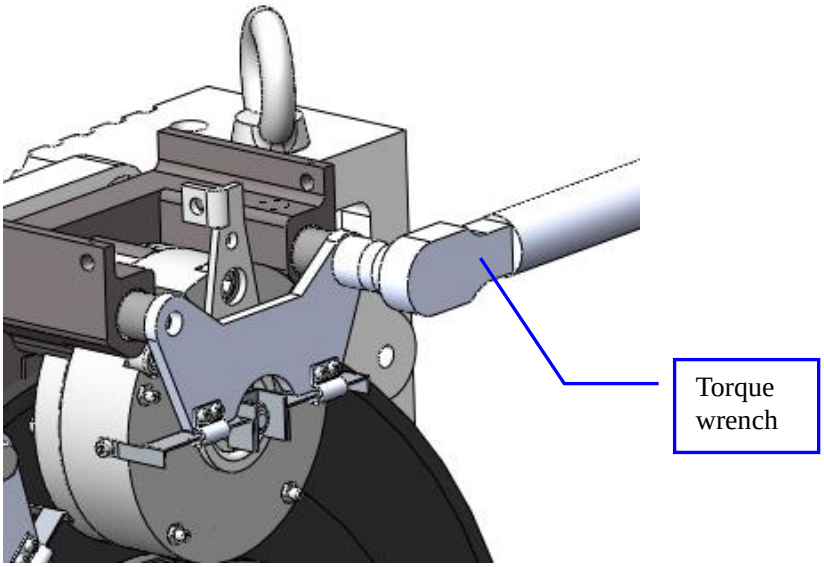


Figure 37: Tighten M12x190 bolt to torque spec

5. Apply Loctite on bolt M12x20 as the picture shows. Then tighten the bolt by open end wrench 18mm. See Figures 38 and 39.

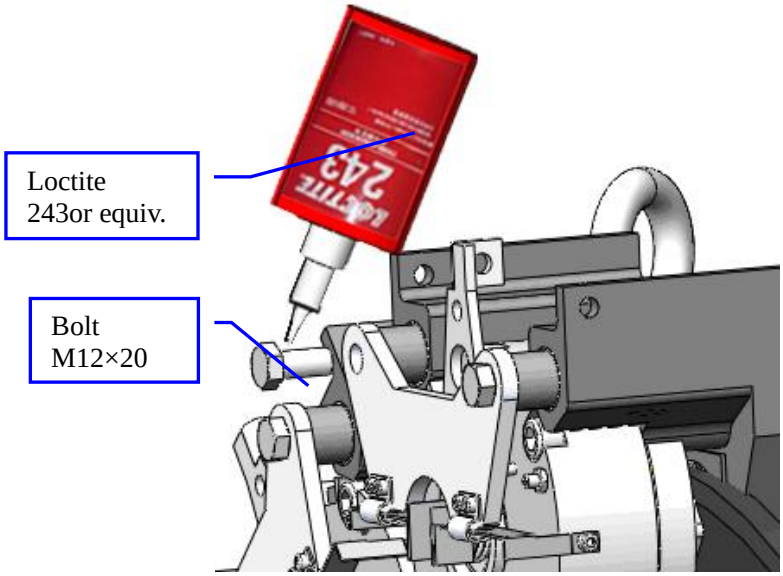


Figure 38: Apply Loctite 243 to M12x20 bolt

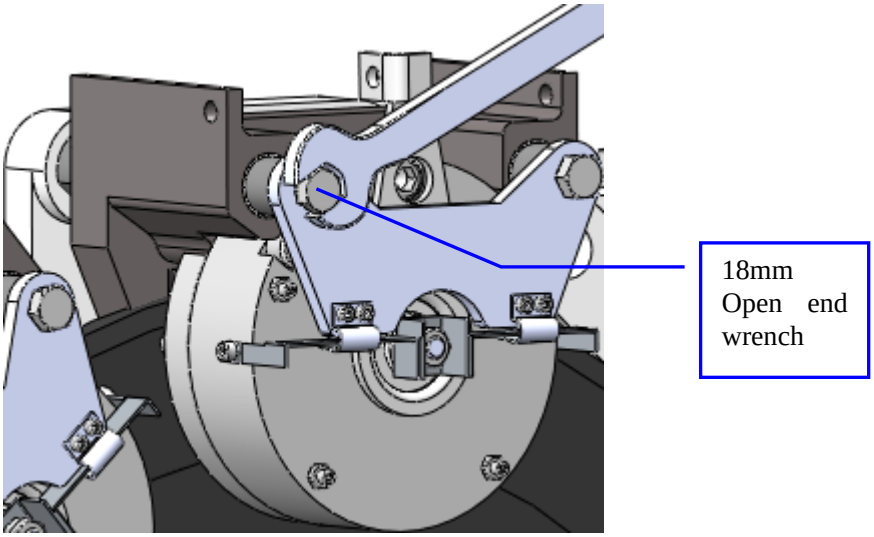


Figure 39: Tighten M12x20 bolt

6. Remove the vise grips to allow brake to set on sheave.
7. Pull the brake cable through the hole in machine housing and connect wires.

8.2.3 Brake adjustment

After relocating the brake, the brake gap must be readjusted. Please refer to Section 6.1.1 Brake Gap Adjustment.

8.2.4 Test brake

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

8.3 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 (7mm, 8mm) 2 pieces each

Loctite 271 or equivalent

Cable ties

Multimeter

Feeler gauges (0.25 mm)

8.3.1 Brake switch removal

1. Loosen 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 secure the brake switch cable.
3. Remove the brake switch cable of the switch being replaced from the brake terminal using a straight head screw driver and then move it out from the hole in the machine body.
4. Loosen the screws M2x10 using the Philips head screw driver, then remove the broken switch. See Figure 40.

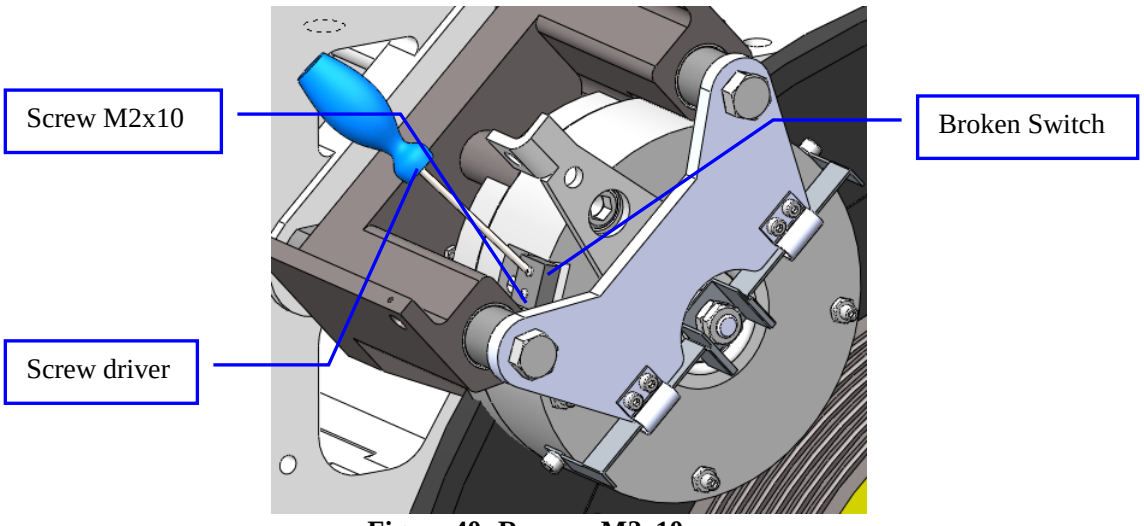


Figure 40: Remove M2x10 screws

8.3.2 Brake switch installation

1. Clean the brake switch mating surface. See Figure 41.

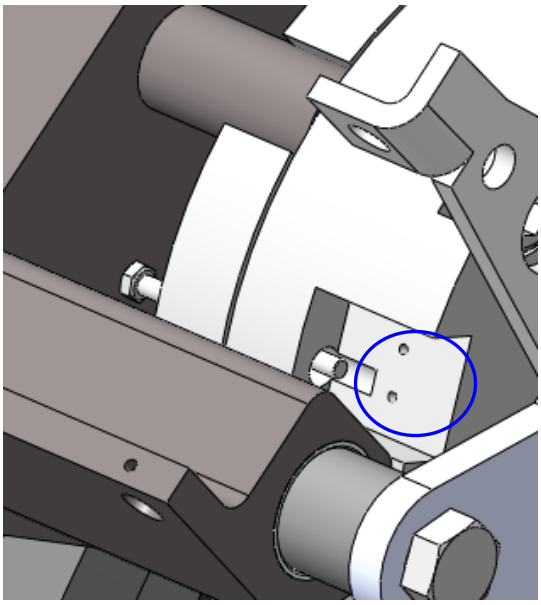


Figure 41: Clean mating surface

2. Apply a thin layer of sealant (Loctite 480 or equivalent) on the brake switch mating surface. See Figure 42.

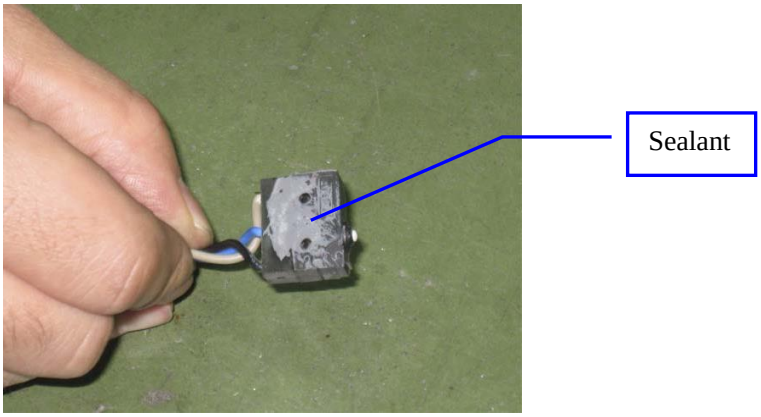


Figure 42: Apply sealant to brake switch

3. Install the brake switch on the brake body by tightening the screws M2x10 using the 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 43.

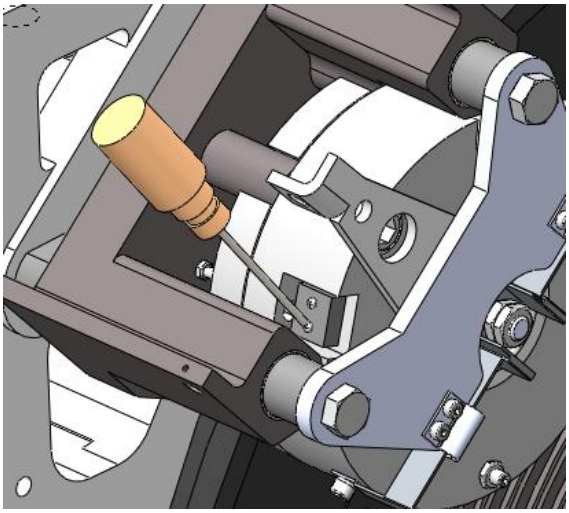


Figure 43: Install brake switch

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

8.3.3 Brake switch adjustment

1. Use the open end wrench 7mm to loosen the lock nut M4 and the activation bolt. See Figure 44.

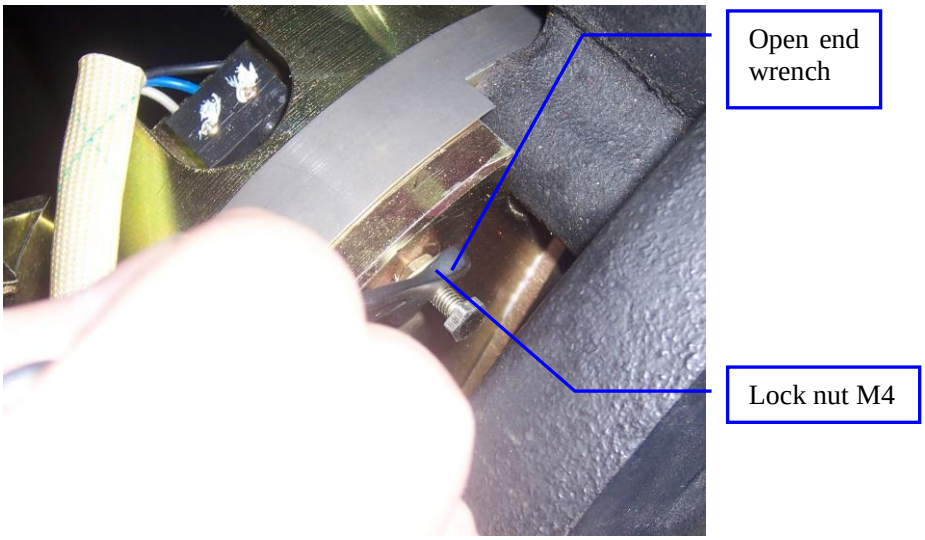


Figure 44: Brake switch adjustment

2. Apply Loctite 271 or equivalent on the bolt thread for anti-vibration purpose. See Figure 45.

Figure 45: Apply Loctite 271

3. Adjust the bolt M4x50 with the open end wrench (7mm) clockwise slowly until you hear the switch action sound.
4. Then adjust bolt M4 counter clockwise about 90° (0.17mm).
5. Use open end wrench 7mm to hold the bolt M4x50, then use another open end wrench 7mm to tighten the lock nut M4. See Figure 46.

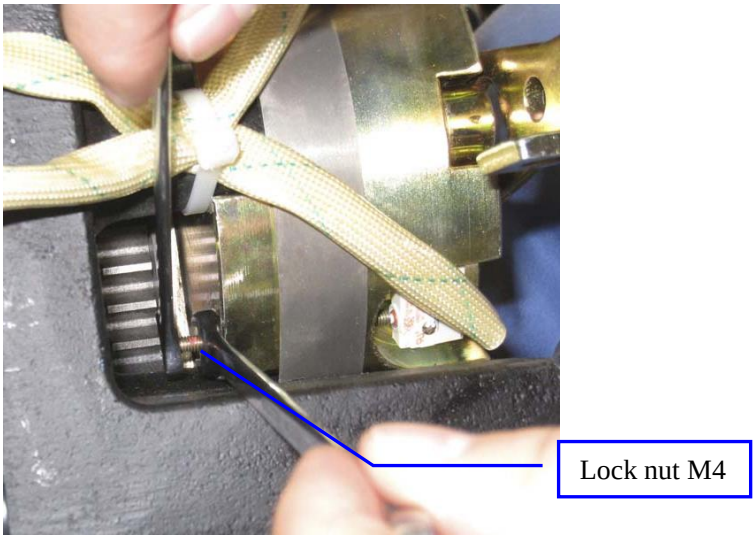


Figure 46: Tighten the Lock nut M4

6. Use multimeter 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 0.1mm (0.004'') feeler gauge and should activate when inserting 0.2mm (0.008'') feeler gauge. See Figure 47.

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

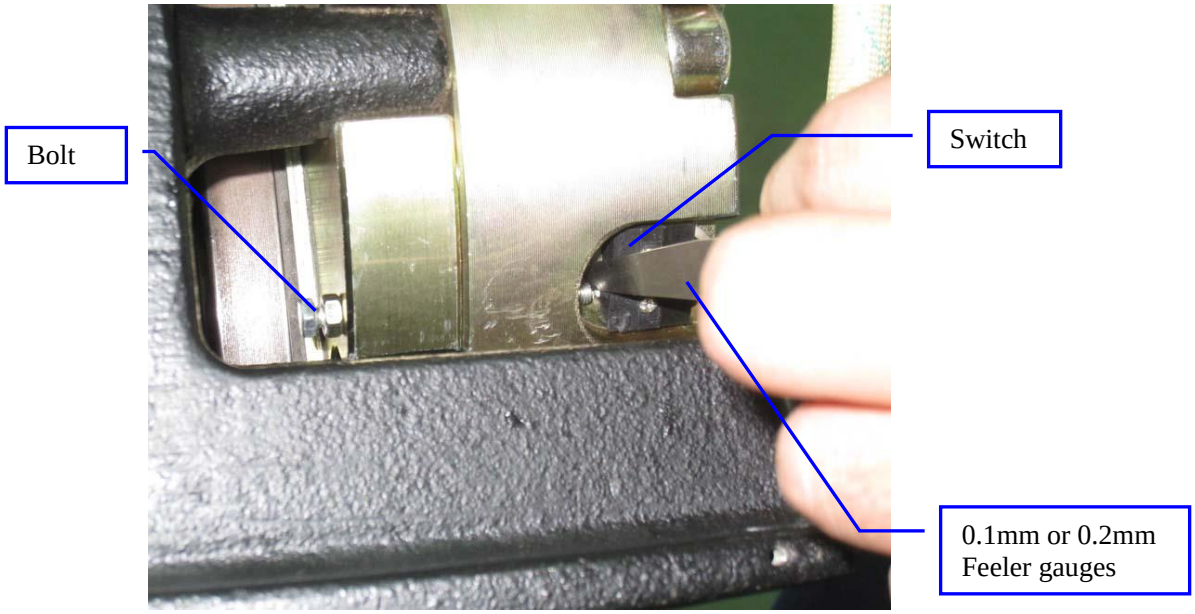


Figure 47: Use feeler gauges to check brake switch operation

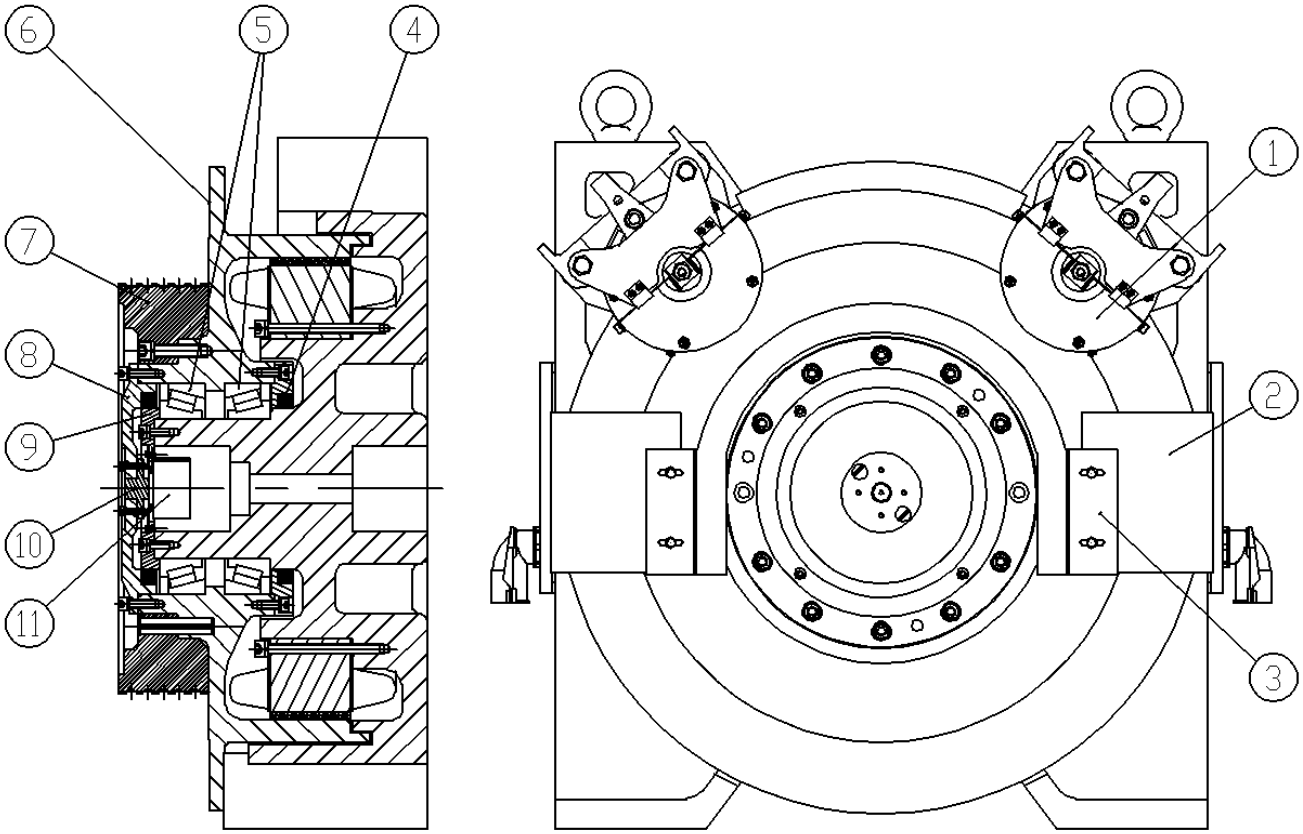
7. Otherwise readjust the bolt until it works.
8. Use open end wrench 8mm to hold the bolt M4 steady then use another open end wrench 8mm to tighten the locknut.

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

Machine Assembly



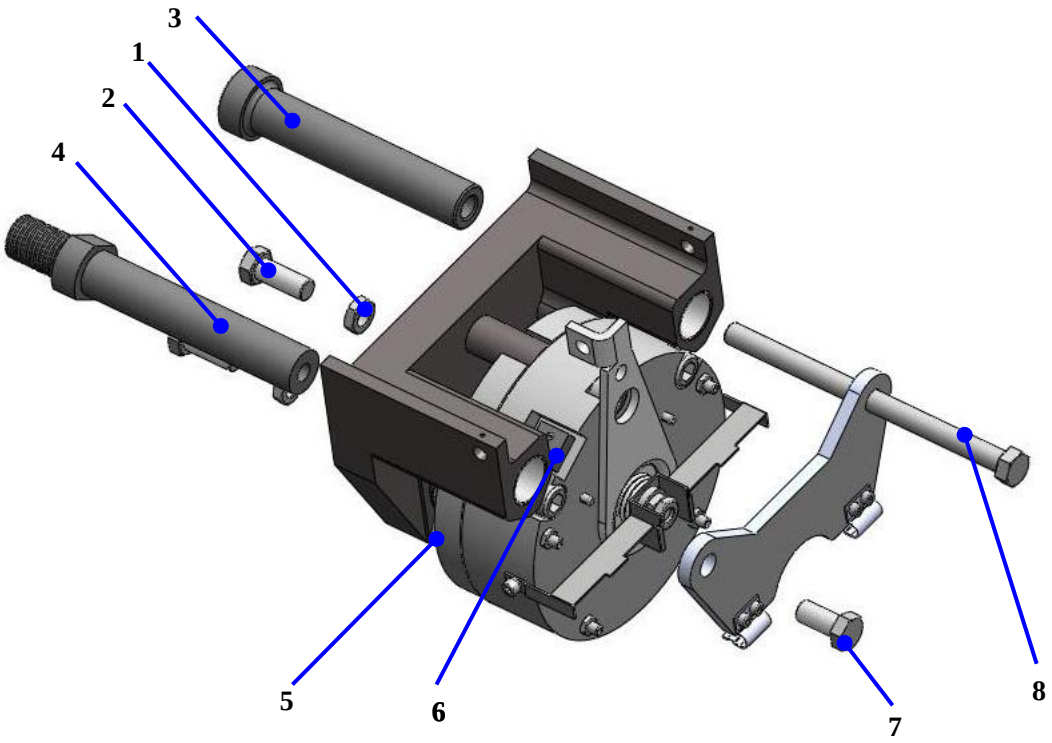
(*) Indicates non-stock item

No.	Torin Drive Part No.	Description
1	See Brake Assembly	Brake
2	*	Sheave cover1
3	*	Sheave cover 2
4	*	Inner cover
5	PBR034	Bearing HR32028 XJ
6	*	Brake Disc
7	MSHV-TPM-400	Machine Sheave, 400mm
	MSHV-TPM-340	Machine Sheave, 340mm
8	*	Encoder Cover
9	*	Outside Cover
10	*	Connect Shaft
11	PEN003	Encoder

Brake Assembly

(PZD140MA1 for TPM2-8mm and TPM4 E-Brake*2)

(PZD140MB1 for TPM2-10mm and TPM3-8mm, TPM4 N-Brake)



(*) Indicates non-stock item

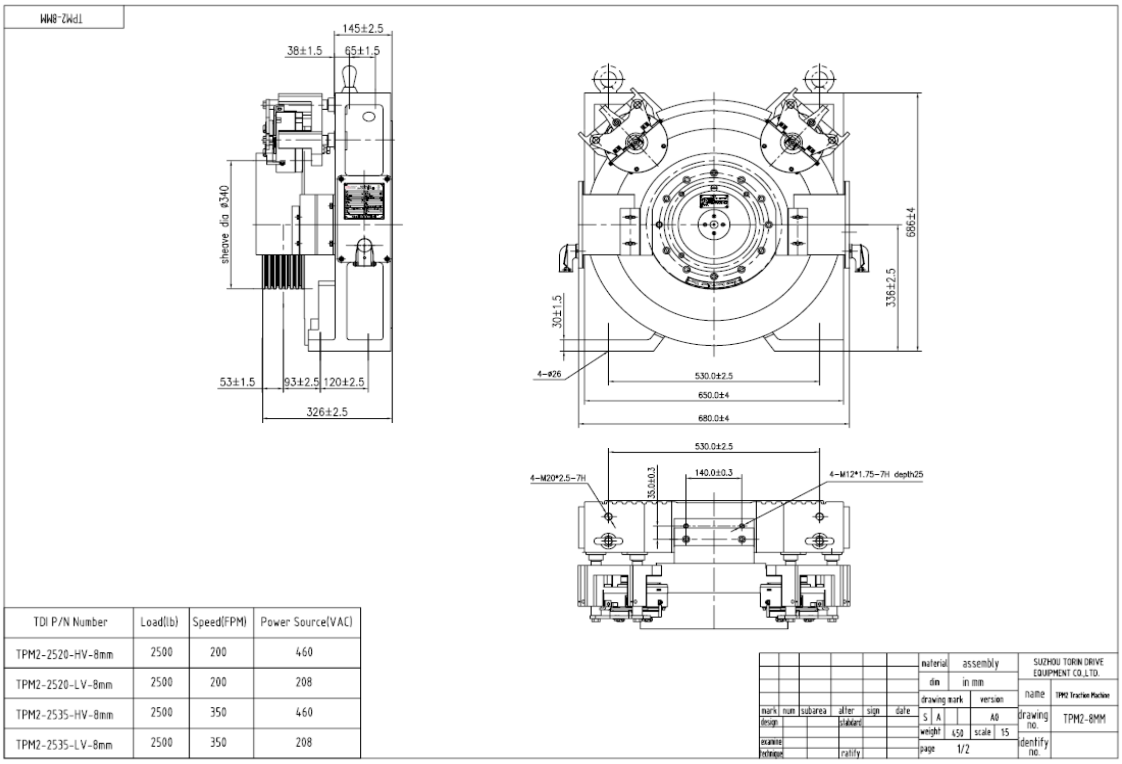
No.	Torin Drive Part No.	Description
1	*	Nut M12
2	*	Bolt M12
3	*	Guide pole1 GTW3H.2-6 for PZD140MB1
		Guide pole1 GTW3.2A-3 for PZD140MA1
4	*	Guide pole2 GTW3H.2-7 For PZD140MB1
		Guide pole2 GTW3.2A-4 for PZD140MA1
5	*	Brake body GTW3H2.1 for PZD140MB1
		Brake body GTW3H2.1 for PZD140MB1
6	PSW002	Brake Switch
7	*	BoltM12x25
8	*	Bolt M12x200/M12x190
	PBK001	Self-adjusting Brake Assembly, (For TPM2-10mm, TPM3-8mm, TPM4 N-brake)
	PBK002	Self-adjusting Brake Assembly, (For TPM2-8mm, TPM4 E-brake*2)

Optional Brake Parts

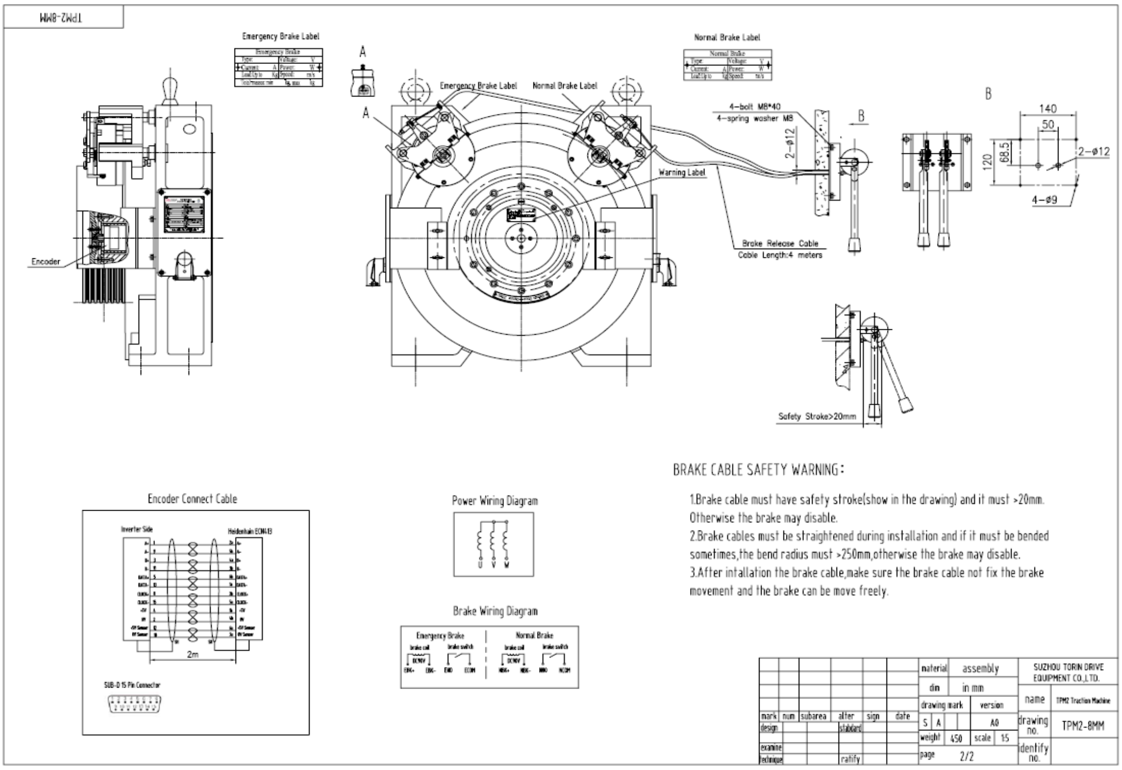
	Torin Drive Part No.	Description
	PBK028	TPM2 Flat Mount Brake Spring Assembly
	PBK029	TPM3 Flat Mount Brake Spring Assembly
	PBK030	TPM4 Flat Mount Brake Spring Assembly
	BMRA-TPM2-3	TPM2 and TPM3 Brake Manual Release Cable Assembly, Set of 2 including 5 meter cable and handle/baseplate
	BMRA-TPM4	TPM4 Brake Manual Release Cable Assembly, Set of 3 including 5 meter cable and handle/baseplate
	BRMA10-TPM2-3	TPM2 and TPM3 Brake Manual Release Cable Assembly, Set of 2 including 10 meter cable and handle/baseplate
	BMRA10-TPM4	TPM4 Brake Manual Release Cable Assembly, Set of 3 including 10 meter cable and handle/baseplate

MECHANICAL DIMENSIONS

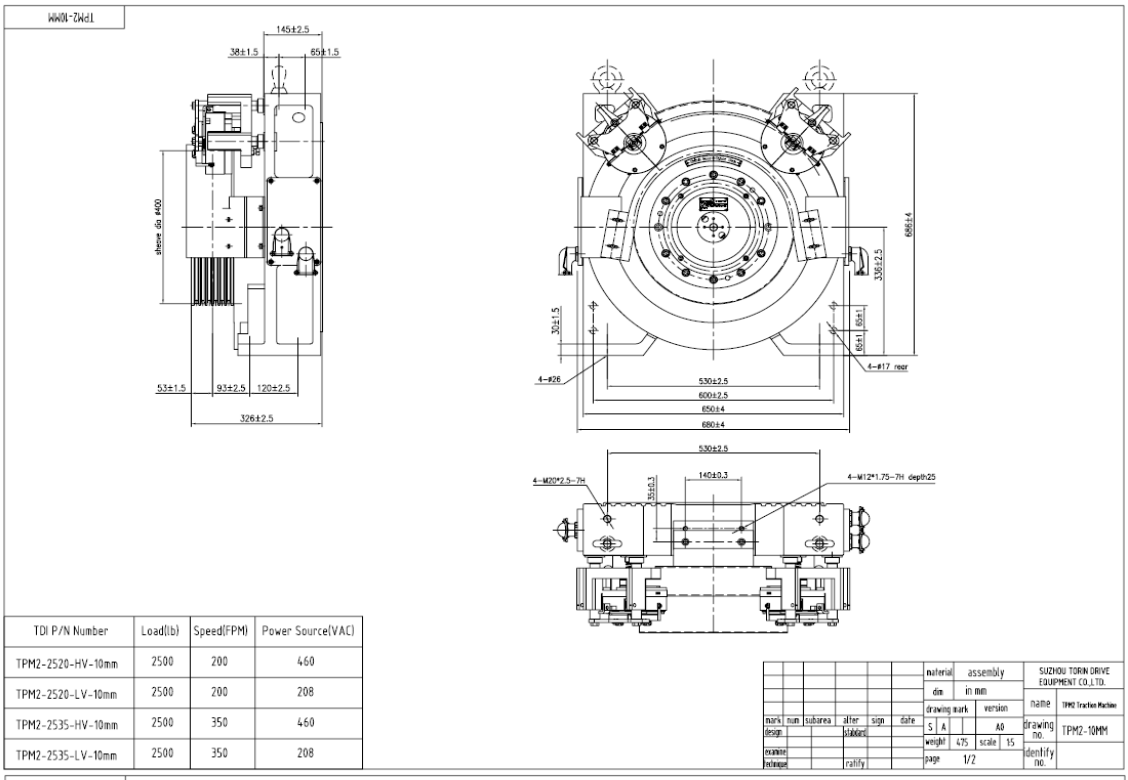
TPM2-8mm



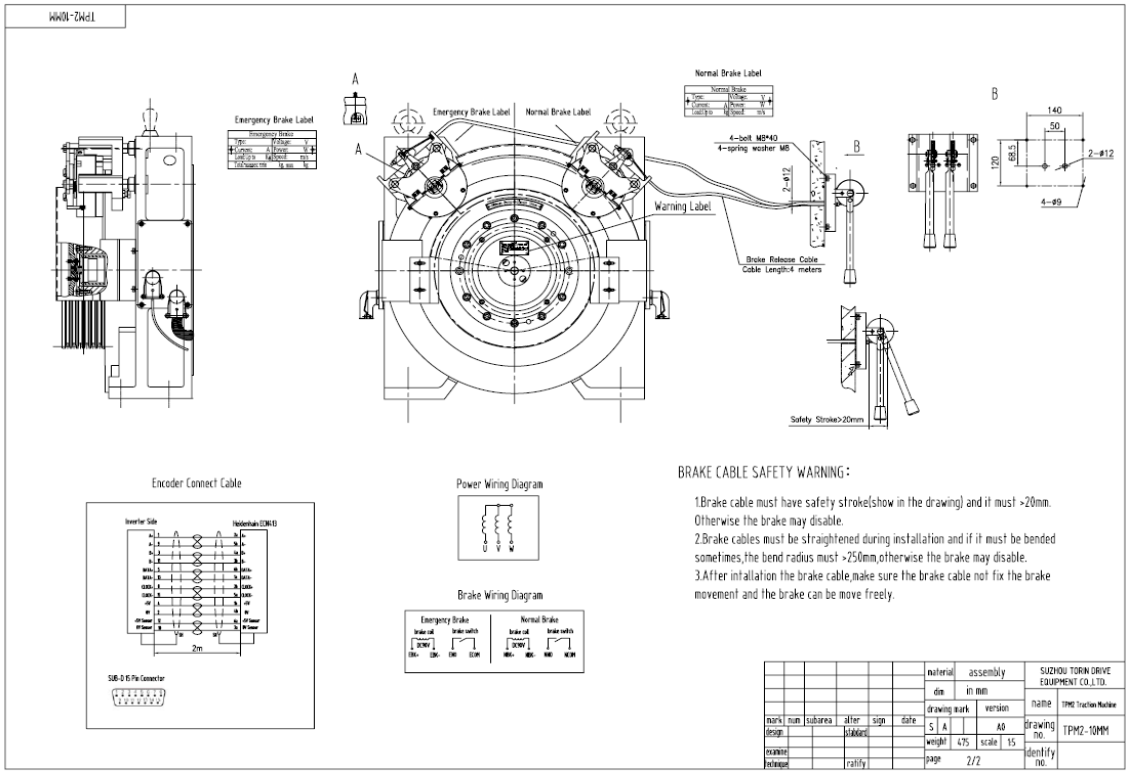
TDI P/N Number	Load(lb)	Speed(FPM)	Power Source(VAC)
TPM2-2520-HV-8mm	2500	200	460
TPM2-2520-LV-8mm	2500	200	208
TPM2-2535-HV-8mm	2500	350	460
TPM2-2535-LV-8mm	2500	350	208



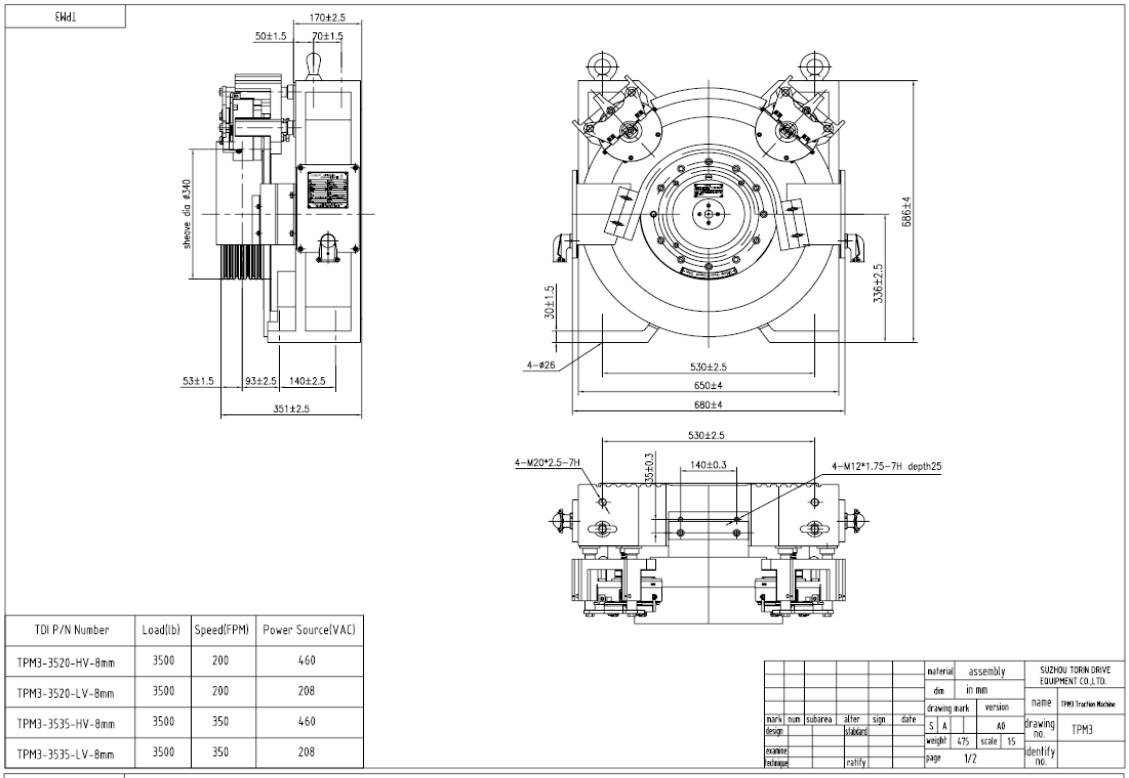
TPM2-10mm



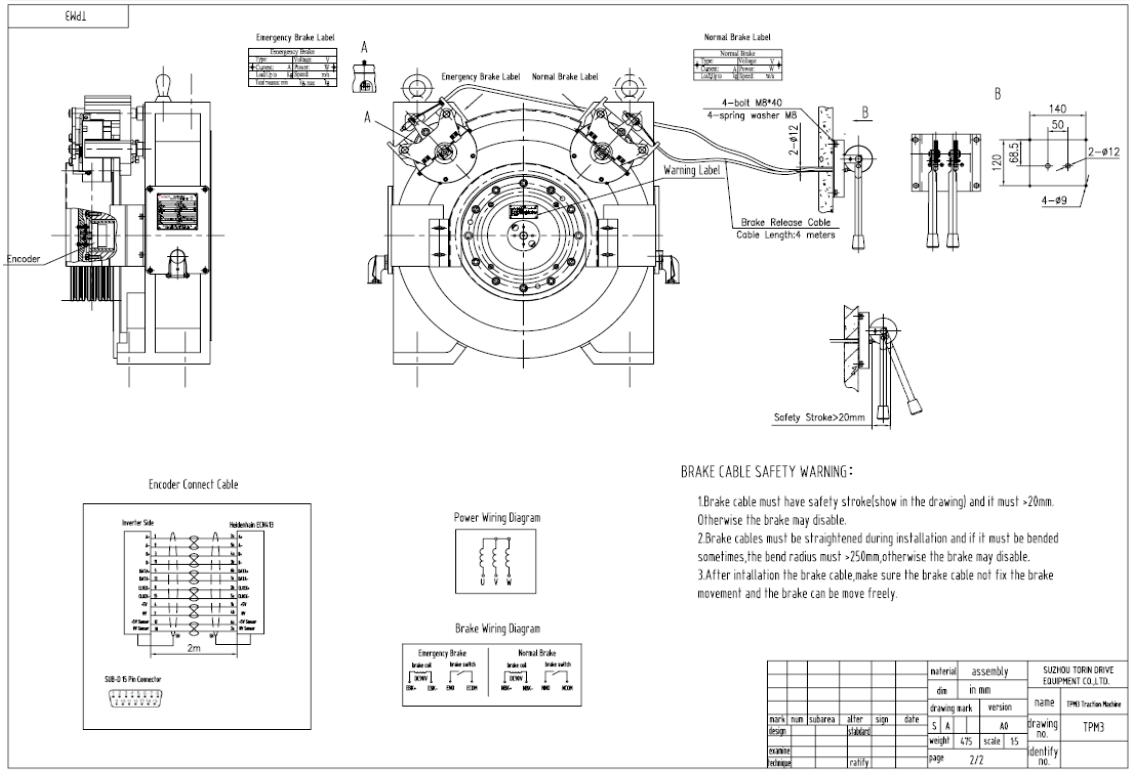
TDI P/N Number	Load(lb)	Speed(FPM)	Power Source(VAC)
TPM2-2520-HV-10mm	2500	200	460
TPM2-2520-LV-10mm	2500	200	208
TPM2-2535-HV-10mm	2500	350	460
TPM2-2535-LV-10mm	2500	350	208



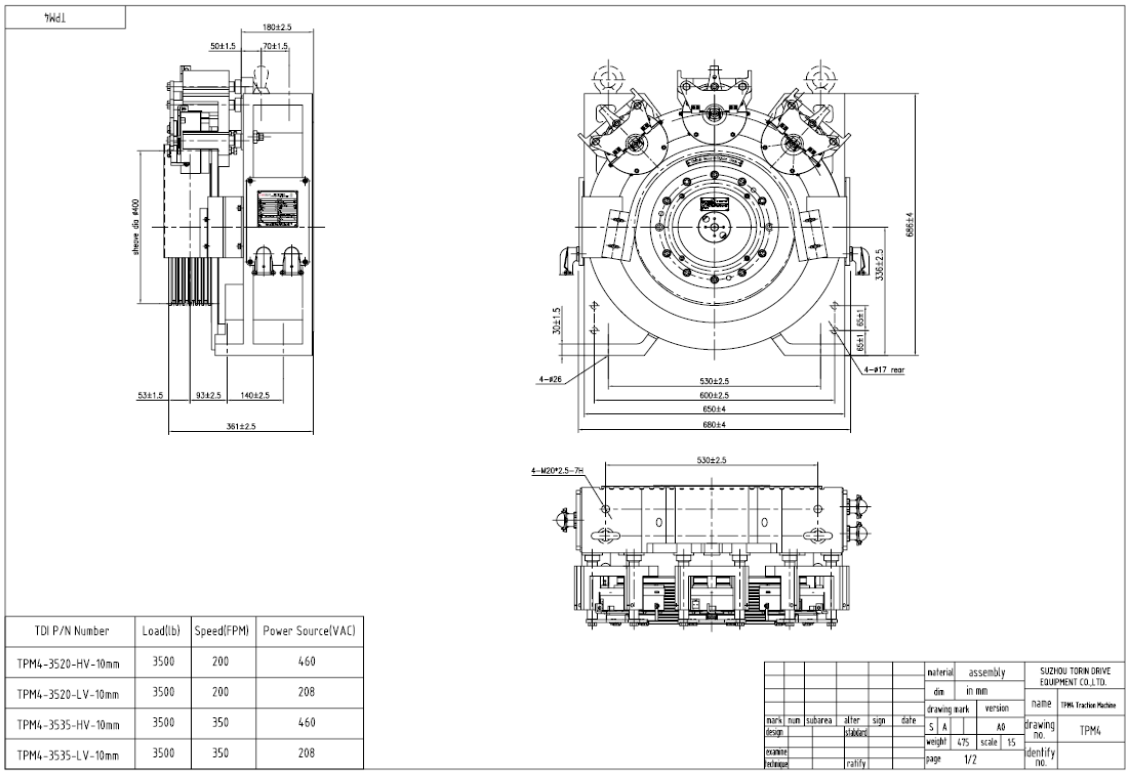
TPM3-8mm



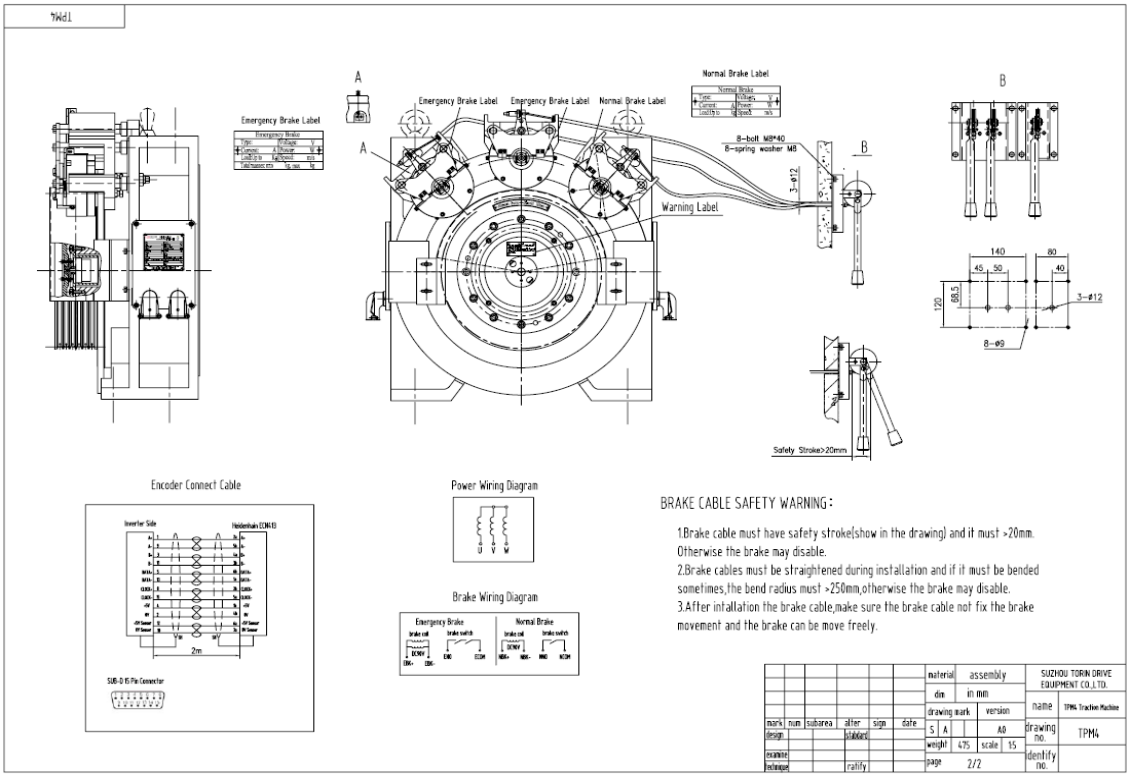
TDI P/N Number	Load(lb)	Speed(FPM)	Power Source(VAC)
TPM3-3520-HV-8mm	3500	200	460
TPM3-3520-LV-8mm	3500	200	208
TPM3-3535-HV-8mm	3500	350	460
TPM3-3535-LV-8mm	3500	350	208



TPM4-10mm



TDI P/N Number	Load(lb)	Speed(FPM)	Power Source(VAC)
TPM4-3520-HV-10mm	3500	200	460
TPM4-3520-LV-10mm	3500	200	208
TPM4-3535-HV-10mm	3500	350	460
TPM4-3535-LV-10mm	3500	350	208



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