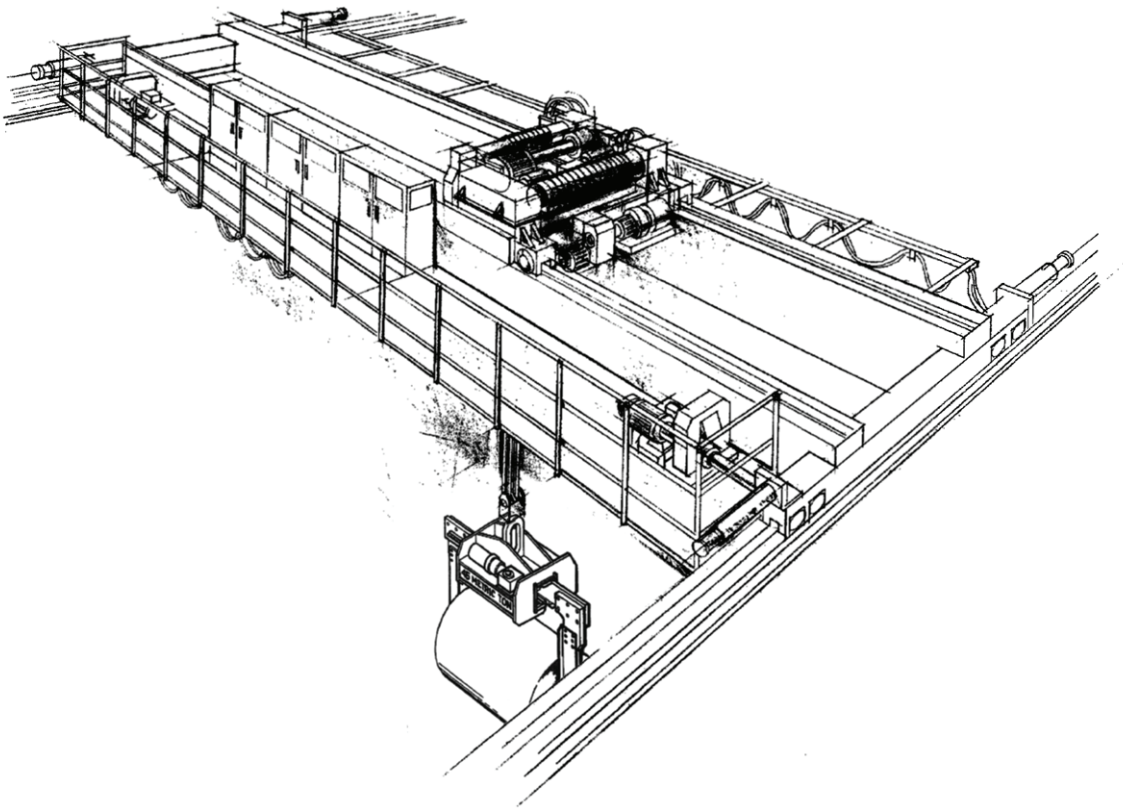

ST Electric Shoe Brakes

Magnetek ST Electric Shoe Brakes
Instruction Manual

MAGNETEK
MATERIAL HANDLING

Part Number: 452035 R01
October 2018

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Table of Contents

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Your New Electric Shoe Brakes

Thank you for your purchase of Magnetek's ST Electric Shoe Brakes. Magnetek has set a whole new standard in performance, dependability, and value with this unique new line of electric shoe brakes.

If your product ever needs modification or service, please contact one of our representatives at the following locations:

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Menomonee Falls, WI 53051

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Website: www.magnetek.com
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PREFACE AND SAFETY

Magnetek, Inc. (Magnetek) offers a broad range of radio remote control products, control products and adjustable frequency drives, and industrial braking systems for overhead material handling applications. This manual has been prepared by Magnetek to provide information and recommendations for the installation, use, operation and service of Magnetek's material handling products and systems (Magnetek Products). Anyone who uses, operates, maintains, services, installs or owns Magnetek Products should know, understand and follow the instructions and safety recommendations in this manual for Magnetek Products.

The recommendations in this manual do not take precedence over any of the following requirements relating to cranes, hoists and lifting devices:

- Instructions, manuals, and safety warnings of the manufacturers of the equipment where the radio system is used,
- Plant safety rules and procedures of the employers and the owners of facilities where the Magnetek Products are being used,
- Regulations issued by the Occupational Health and Safety Administration (OSHA),
- Applicable local, state or federal codes, ordinances, standards and requirements, or
- Safety standards and practices for the overhead material handling industry.

This manual does not include or address the specific instructions and safety warnings of these manufacturers or any of the other requirements listed above. It is the responsibility of the owners, users and operators of the Magnetek Products to know, understand and follow all of these requirements. It is the responsibility of the owner of the Magnetek Products to make its employees aware of all of the above listed requirements and to make certain that all operators are properly trained. **No one should use Magnetek Products prior to becoming familiar with and being trained in these requirements.**

Product Warranty Information

Magnetek, hereafter referred to as Company, assumes no responsibility for improper programming and/or installation of a device (such as a drive or radio) by untrained personnel. A device should only be programmed/installed by a trained technician who has read and understands the contents of the relevant manual(s). Improper programming/installation of a device can lead to unexpected, undesirable or unsafe operation or performance of the device. This may result in damage to equipment or personal injury. Company shall not be liable for economic loss, property damage, or other consequential damages or physical injury sustained by the purchaser or by any third party as a result of such programming. Company neither assumes nor authorizes any other person to assume for Company any other liability in connection with the sale or use of this product.

WARRANTY INFORMATION

FOR INFORMATION ON MAGNETEK'S PRODUCT WARRANTIES BY PRODUCT TYPE, PLEASE VISIT WWW.MAGNETEK.COM.

DANGER, WARNING, CAUTION and NOTE Statements

Read and understand this manual before installing, operating or servicing this product. Install the product according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

DANGERS, WARNINGS and CAUTIONS

Throughout this document DANGERS, WARNING and CAUTION statements have been deliberately placed to highlight items critical to the protection of personnel and equipment.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTE: *A NOTE statement is used to notify people of installation, operation, programming or maintenance information that is important, but not hazard-related.*

WARNINGS and CAUTIONS SHOULD NEVER BE DISREGARDED.

Registered Trademarks

Trademarks are the property of their respective owners.

1 General Description

Magnetek type ST and ST/E spring-applied electrohydraulic-actuated general-purpose pivoted twin external shoe brakes are designed for use on cranes and other severe braking applications involving heavy movable structures. Completely constructed from high-strength steel, they can be used with any drive type applied to hoisting or traveling motions.

There are two fundamental types of the ST brake. Type ST uses a non-adjustable torque spring contained inside the actuator to develop a fixed-magnitude braking torque. Type ST/E uses an adjustable torque spring that is external to the actuator to develop a magnitude of braking torque that is adjustable within a range. Braking action is always applied mechanically via the torque spring and brake release is always achieved via electric power supplied to the electrohydraulic actuator (thruster).

The ST brake can be arranged to deliver a percentage of the maximum torque by rearranging the brake pivot pins to provide a lower mechanical advantage of the brake linkage.

The ST/E brake has an external torque spring housed outside the thruster for quick adjustment and provides an infinitely adjustable range to set an exact braking torque. Once set, the brake will develop that single magnitude of torque while the brake is applied. The ST/E brake can operate between a maximum and minimum torque, as stated on its torque spring scale.

> ***NOTE:*** *Except when specifically engineered and used in conjunction with Magnetek Braketronic controllers, type ST/E brakes are more suited to crane bridge brakes.*

Operation of both types is similar and they are available for imperial brake wheel sizes between 6" to 19" and metric brake wheel sizes between 200 mm to 500 mm. Brakes for use with imperial wheel sizes are available in two standard designs. Type MST (and MST/E) brakes use a compact footprint and shaft height mounting arrangement designed by Magnetek Engineering, making them ideal for installation in tight spaces. Type AST (and AST/E) brakes follow the footprint, shaft height, and other specifications set forth by AISE (AIST) Technical Reports No. 11 and No. 6. Type IST (and IST/E) are for metric applications and follow the footprint, shaft height, and other specifications set forth by DIN 15435 and DIN 15434 standards.

Brakes can be supplied as “drop-ins” with identical mounting parameters to replace a wide range of competitors’ brakes, so there is no need to modify an end user’s existing brake supporting structure. Contact Magnetek’s sales team.

Magnetek is the only EMG-certified ELDRO® Electrohydraulic Thruster Repair Facility in North America. Contact Magnetek customer service for all refurbishment and spare parts needs on ELDRO® Electrohydraulic Thrusters.

> ***NOTE: FOR AN UNUSUAL APPLICATION, OR A RECOMMENDATION FOR A BRAKE SIZE AND TYPE, CONTACT MAGNETEK CUSTOMER SERVICE.***

1.1 ST

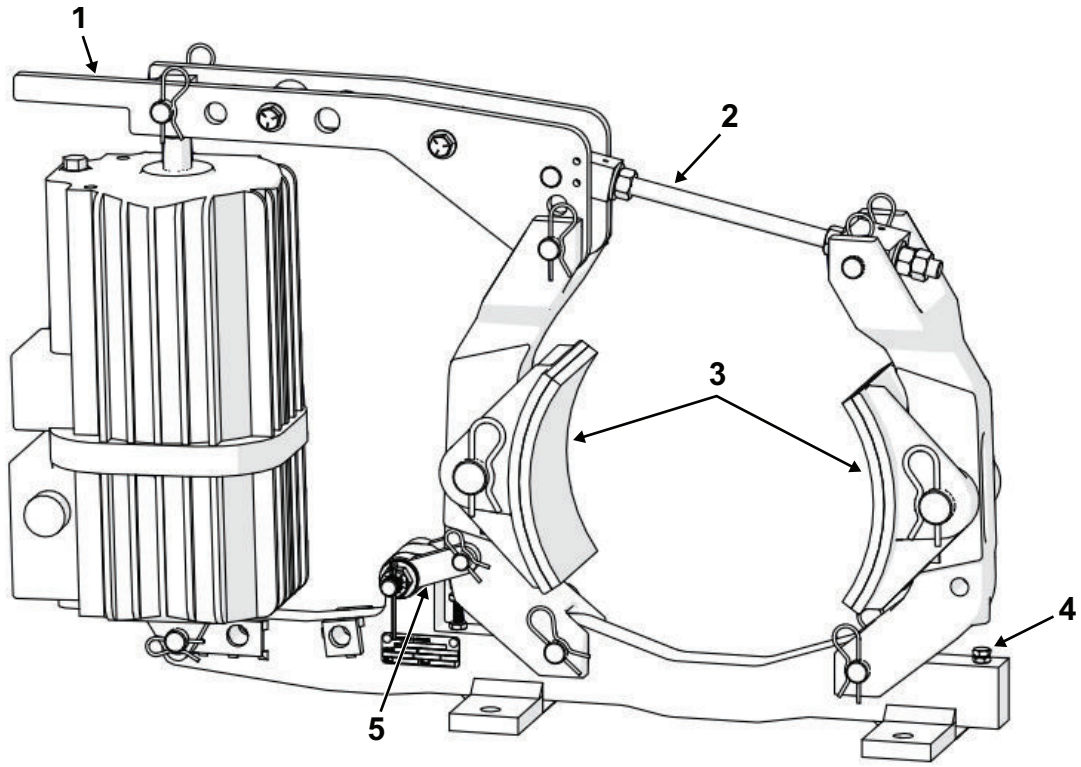


Fig. 1: ST

1. Brake Lever
2. Manual Adjustment Pushrod Assembly
3. Brake Shoes
4. Shipping Bolts
5. Automatic Equalization Assembly

1.2 ST/E

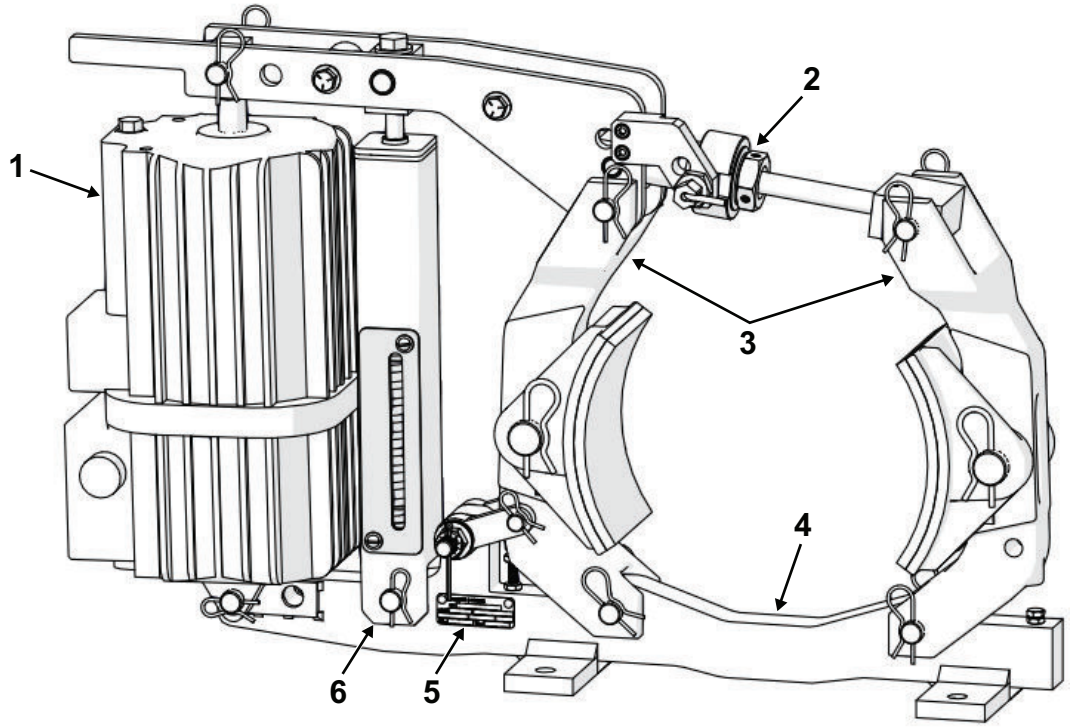


Fig. 2: ST/E

1. Thruster
2. Automatic Adjustment Pushrod Assembly
3. Brake Arms
4. Brake Base
5. Nameplate
6. External Torque Spring Assembly

2 Application

For a given wheel diameter the Association for Iron and Steel Technology (AIST) determines the recommended torque, when applied to 30- and 60-minute rated motors in steel mill applications. This is based upon experience and agreement within the industry, but it is ultimately determined by each end user whether to follow recommendations or not.

For a given wheel diameter and typical motor RPM the German Institute for Standardization (DIN) determines the suggested value of braking torque in general drive system applications. It is ultimately determined by each end user whether to follow recommendations or not.

When applied to four quadrant drives or other applications where wheel heating can be accurately predicted and the thermal load is relatively small, brakes can be provided with torque values in excess of recommendations.

When the thermal load and wheel heating are relatively large and the load cycle requires a larger than normal wheel size, as is frequently the case on crane bridge drives, brakes can be provided with torques lower than recommendations.

Issues resulting from severe applications where thermal expansion of the wheel is considerable or where excessive wheel runout is present can be resolved by using a series of thrusters with increased piston stroke length. The thruster releases the brake which ultimately makes a small clearance between the brake shoes and brake wheel, so increased stroke length maximizes the shoe clearance while the brake is in the released state.

For more demanding or corrosive environments, stainless steel hardware, **National Electrical Manufacturer's Association** (NEMA)-grade enclosures and paint and surface treatments are available. A wide range of brake wheels, OEM spare parts, special add-ons, and product options are available. Consult Magnetek product brochures, Magnetek.com, and/or Magnetek customer service for more information.

The standard thruster is weatherproof and dustproof. An electric motor inside the thruster develops hydraulic pressure to actuate and release the brake. The electric motor is a Totally Enclosed Non-Ventilated (TENV) construction, and the hydraulic section is fully sealed and self-contained. Electric motors for certain hazardous areas are available as options. Shunt-wound DC-powered thrusters are available as well.

Auxiliary heaters can be supplied with the thruster to improve performance in extremely cold environments. An optional breather unit can be installed within the thruster for environments that experience large temperature swings. The breather unit prevents pressure build-up within the thruster.

Brakes can operate between ambient temperatures of -40 to +158°F (-40 to +70°C) with the correct hydraulic fluid and seals. The cold temperature limit can be lowered even further with installation of an auxiliary heating unit.

Brakes can operate in environments of an altitude as great as 9,800 ft (3,000 m).

3 Description of Operation

3.1 General

Braking torque is applied via the torque spring. A heavy-duty compression spring pulls on the brake lever, transmitting force through the brake linkage, and forcing the shoes against the wheel. The default mode of the brake is to apply braking torque to stop and hold a load. This is referred to as “setting” the brake, or described as “the brake is set.”

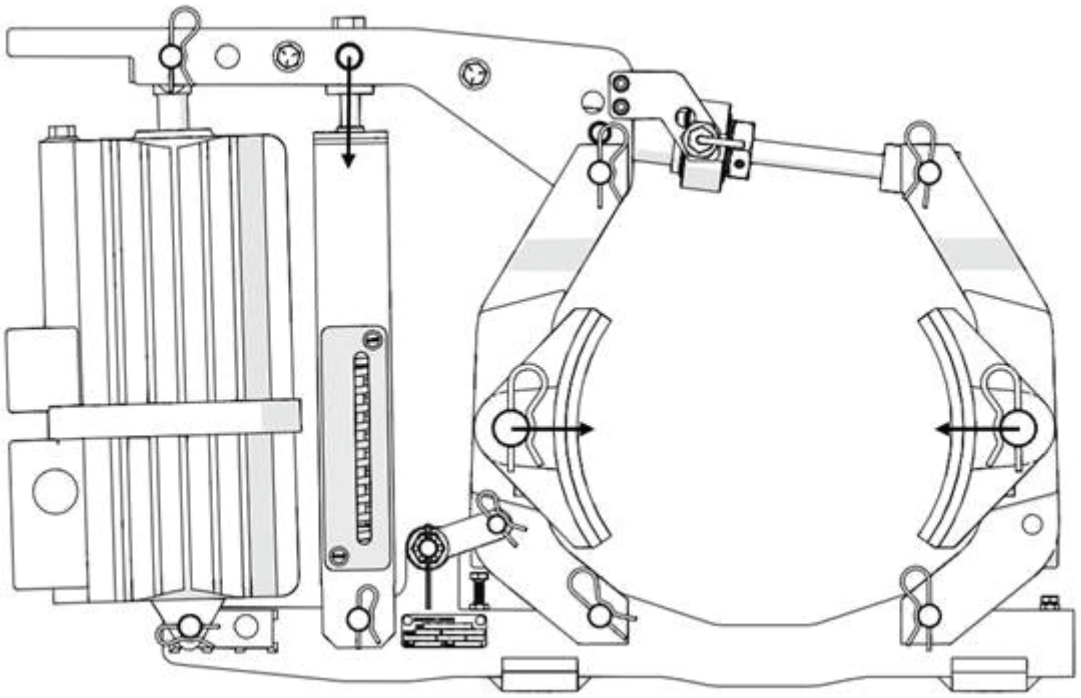


Fig. 3

Electric power to the thruster cancels the brake's ability to apply braking torque to the drive system. When electric power is applied, the thruster piston rod extends, pushes the brake lever, and the brake linkage moves the shoes completely off the wheel to develop a clearance. This is referred to the "releasing" the brake, or described as "the brake is released."

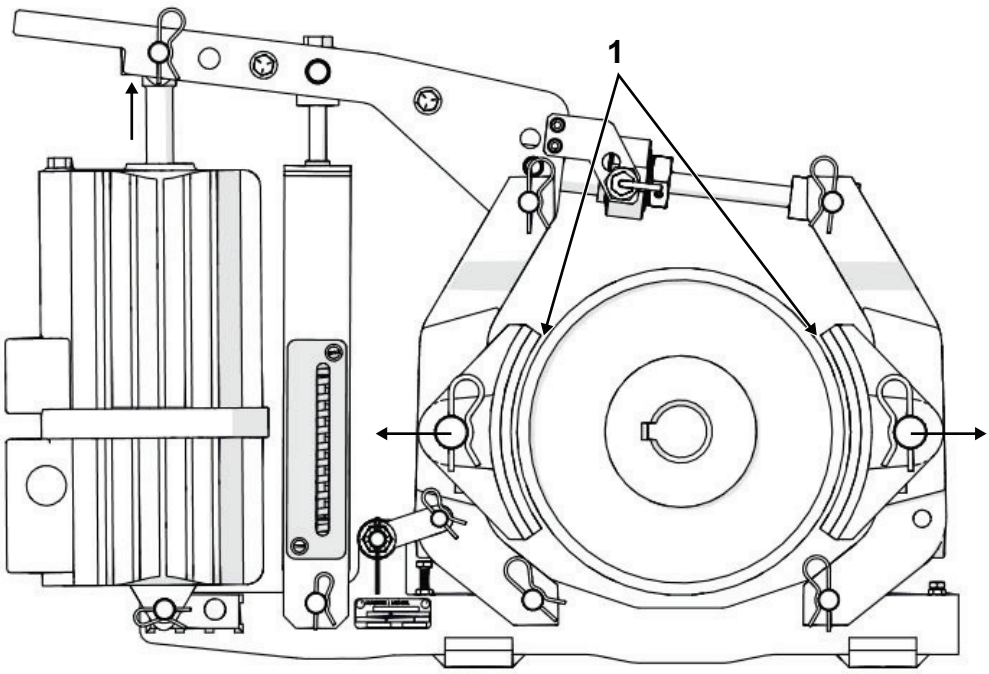


Fig. 4

1. Shoe Release Clearance

The ST brake has a fixed internal torque spring, but the braking torque can be reduced in fixed steps. This brake is generally used on hoist applications where the required torque is known precisely. ***See Table 1 on page 12*** and ***Fig. 5 on page 13***.

Table 1: ST Brake Mechanical Advantages

CONFIGURATION	
A + C	MAX TORQUE
B + C	LESS TORQUE
A + D	↓
B + D	LEAST TORQUE

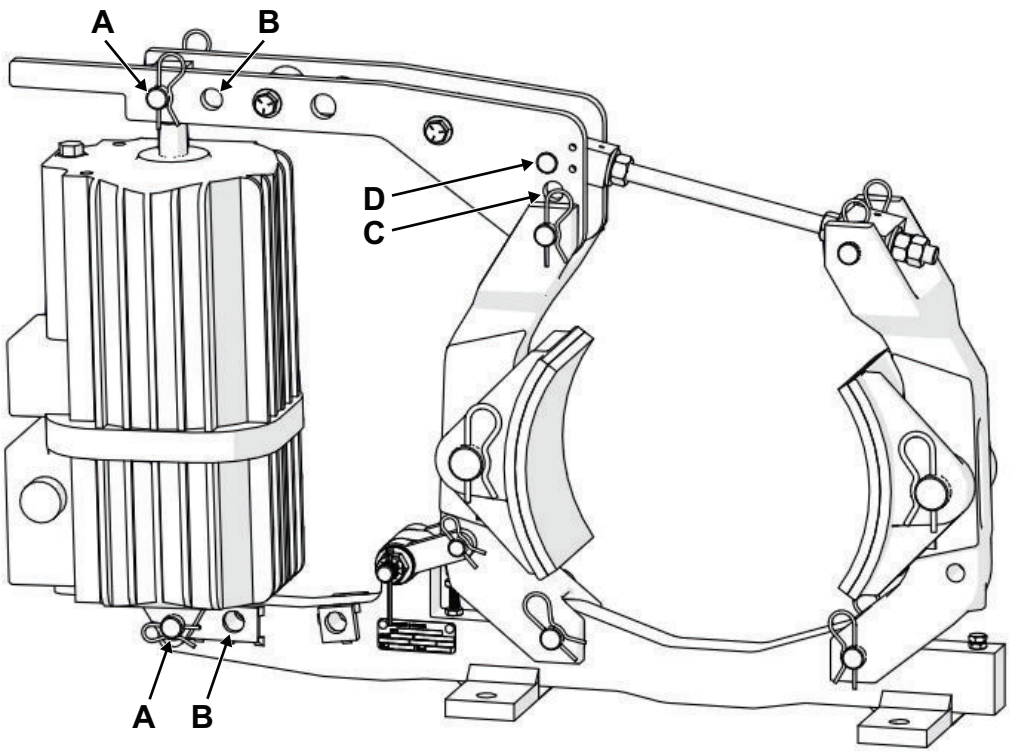


Fig. 5

The ST/E brake has an adjustable torque spring and is generally applied on installations where the required torque cannot be predetermined. The torque is increased by “tightening” the bolt into the housing as shown, and decreased by “loosening” the bolt the other direction. ***See Fig. 6 on page 13***.

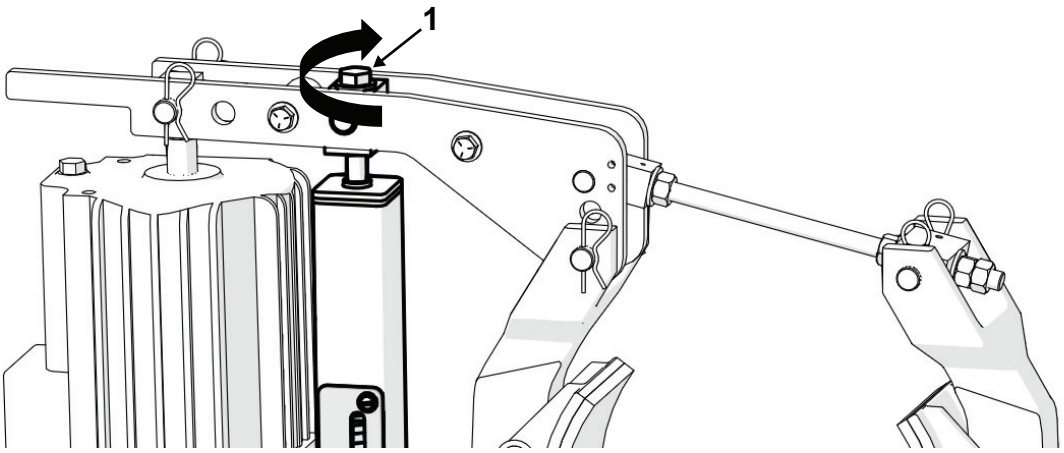


Fig. 6

1. Torque Spring Bolt

3.2 Thruster Reserve Stroke

Braking torque is applied via the torque spring and the operation of the brake is very dependent upon it. Torque springs are heavy-duty compression springs, so the force output of the spring is proportional to the amount of spring compression. More spring compression will make more braking torque.

The best method to determine the state of the torque spring and ensure proper operation, whether it be an external torque spring (ST/E) or an internal torque spring (ST), is by measuring the reserve stroke on the thruster. The reserve stroke is measured only when the brake is set. In this condition the reserve stroke must always be kept within the allowable limits. ***See Table 2 on page 15*** for specific reserve stroke settings.

The total stroke of the thruster is equal to the sum of the reserve stroke and active stroke. Reserve stroke is proportional to brake torque. Active stroke is proportional to shoe release clearance.

$$Total\ Stroke = Reserve\ Stroke + Active\ Stroke$$

$$Reserve\ Stroke \propto Brake\ Torque$$

$$Active\ Stroke \propto Shoe\ Release\ Clearance$$

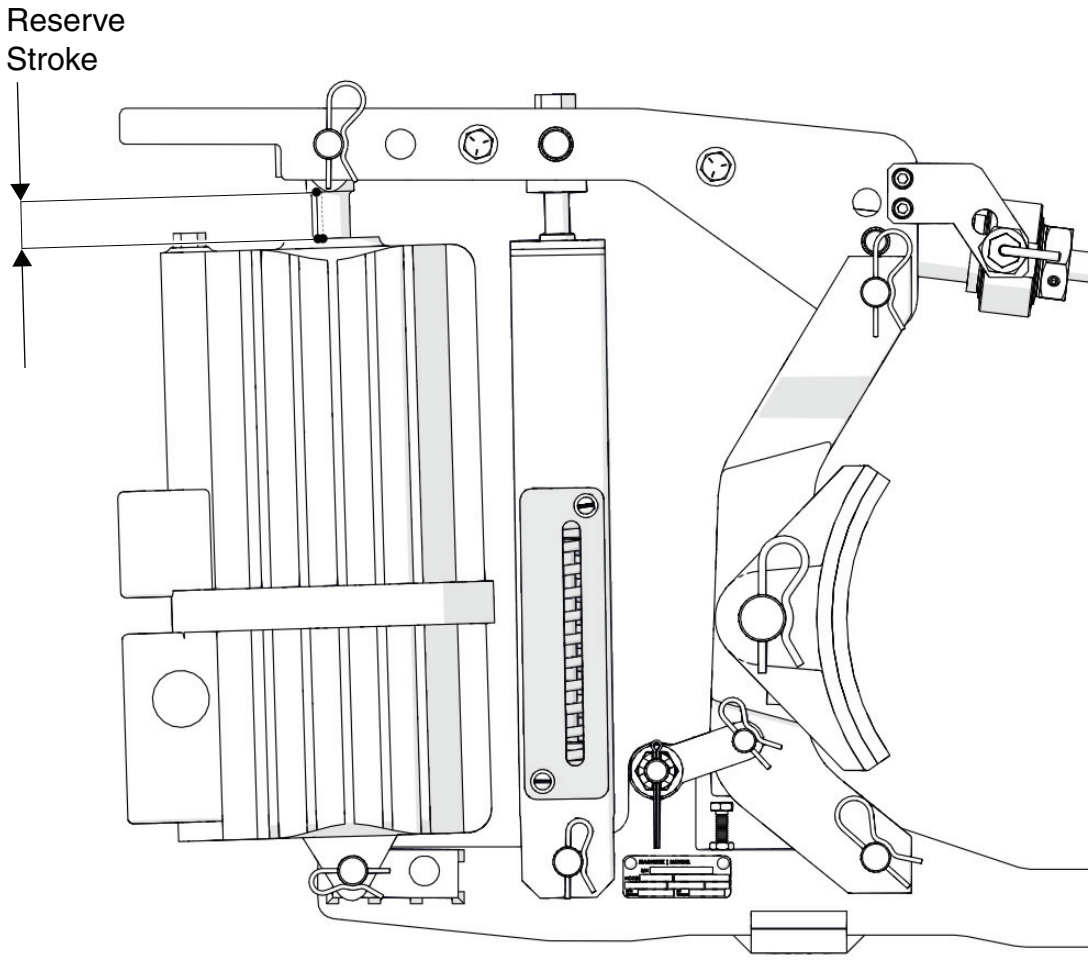


Fig. 7

Table 2: Allowable Range of Reserve Stroke

Thruster Size	Manual Adjustment Pushrod			Automatic Adjustment Pushrod	
	Minimum	Set X	Maximum	Minimum	Maximum
ED 23/5	0.60" (15 mm)	0.70" (17 mm)	0.89" (23 mm)	0.60" (15 mm)	0.89" (23 mm)
ED 30/5	0.60" (15 mm)	0.70" (17 mm)	0.89" (23 mm)	0.60" (15 mm)	0.89" (23 mm)
ED 50/6	0.70" (17 mm)	0.80" (20 mm)	0.99" (25 mm)	0.70" (17 mm)	0.99" (25 mm)
ED 80/6	0.70" (17 mm)	0.80" (20 mm)	0.99" (25 mm)	0.70" (17 mm)	0.99" (25 mm)
ED 121/6	0.70" (17 mm)	0.80" (20 mm)	0.99" (25 mm)	0.70" (17 mm)	0.99" (25 mm)
ED 201/6	0.70" (17 mm)	0.80" (20 mm)	0.99" (25 mm)	0.70" (17 mm)	0.99" (25 mm)
ED 301/6	0.70" (17 mm)	0.80" (20 mm)	0.99" (25 mm)	0.70" (17 mm)	0.99" (25 mm)

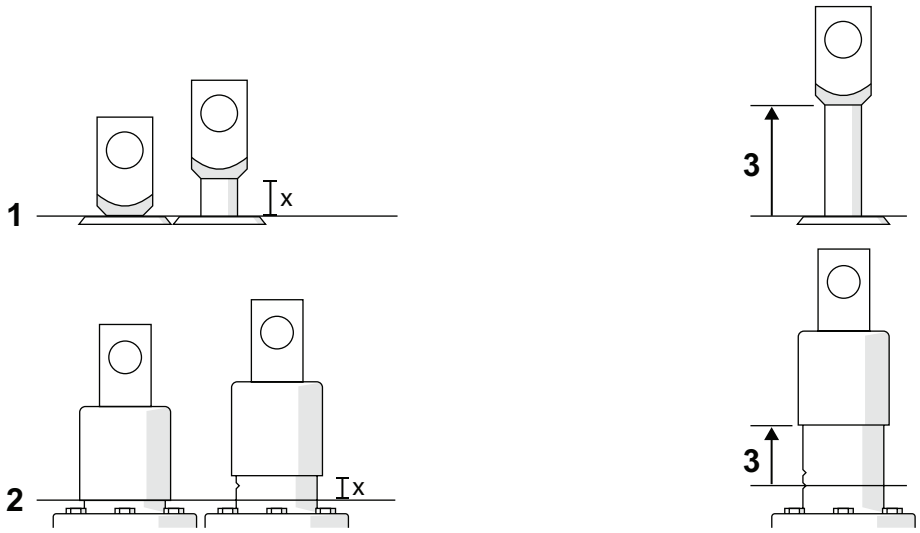


Fig. 8

1. ED23, ED30, ED50, ED80 Zero Reserve Stroke
2. ED121, ED201 Zero Reserve Stroke
3. Thruster On, Brake Released

If reserve stroke is below the minimum limit, this indicates that the torque spring is no longer compressed enough. The spring is outputting insufficient force so the brake is developing torque less than the intended magnitude. This is a hazardous condition of insufficient or potentially zero braking power available to a load.

When the thruster is powered to release the brake, the piston will travel to its maximum extended position. When reserve stroke is above its maximum limit, a hazardous condition arises because there is insufficient active stroke remaining for the thruster's piston rod to effectively release the brake shoes from the wheel. When the drive system moves a load in this condition, the brake shoes may drag upon the rotating brake wheel and/or continue to apply braking torque when the brake is supposed to be released. This will overheat the brake, which can cause damage to it and the drive system.

The reserve stroke will change naturally during brake operation. The wear of friction linings during normal use will decrease the reserve stroke. The thermal expansion of a brake wheel may increase the reserve stroke. A recent brake installation or adjustment may affect reserve stroke even after making proper adjustments. Reserve stroke is controlled via adjustments to the pushrod.

3.3 Pushrods

High-performance friction linings are bonded to the brake shoes and the thickness of the linings will naturally diminish over time as the brake is used. As the lining material diminishes, the brake linkage will naturally shift, causing the torque spring to decompress and the reserve stroke to diminish. Pushrod adjustments must be performed to compensate for this phenomenon.

Pushrods are described as having a "length." The pushrod length is the distance between the two pivot pins' axes as shown.

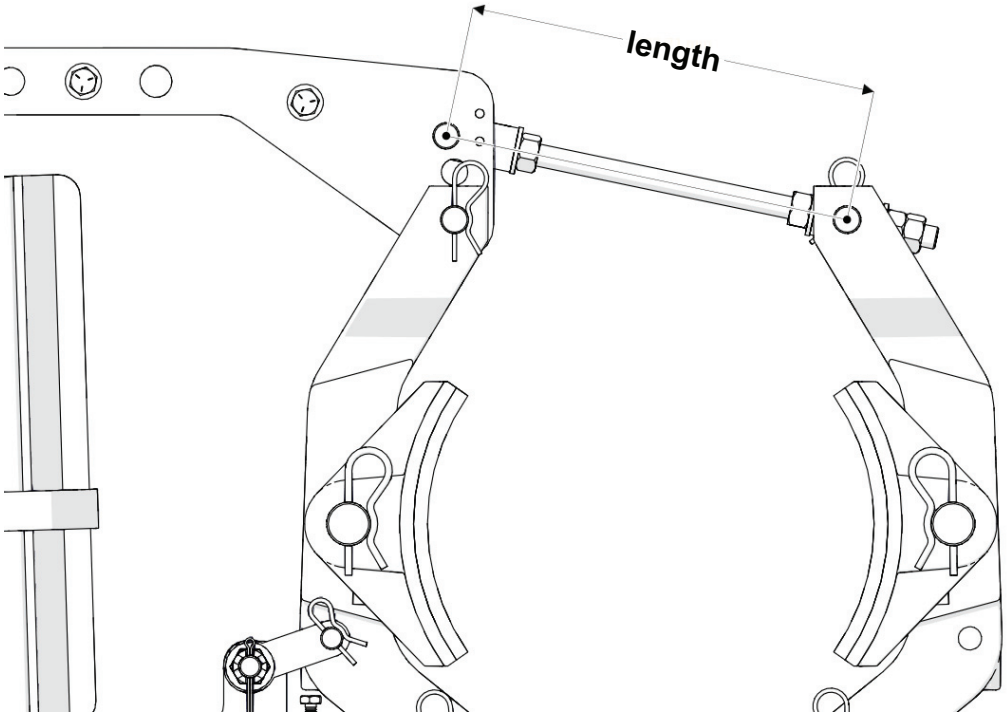


Fig. 9

The pushrod must decrease in length incrementally over the lifetime of a pair of friction linings to maintain correct reserve stroke and brake torque. When brake shoes are replaced, the pushrod must return to the approximate length it was set to upon initial installation of the brake. Brakes are supplied with either an automatic adjustment (AA) pushrod assembly or a manual adjustment (MA) pushrod assembly.

3.4 Automatic Adjustment Pushrod Assembly

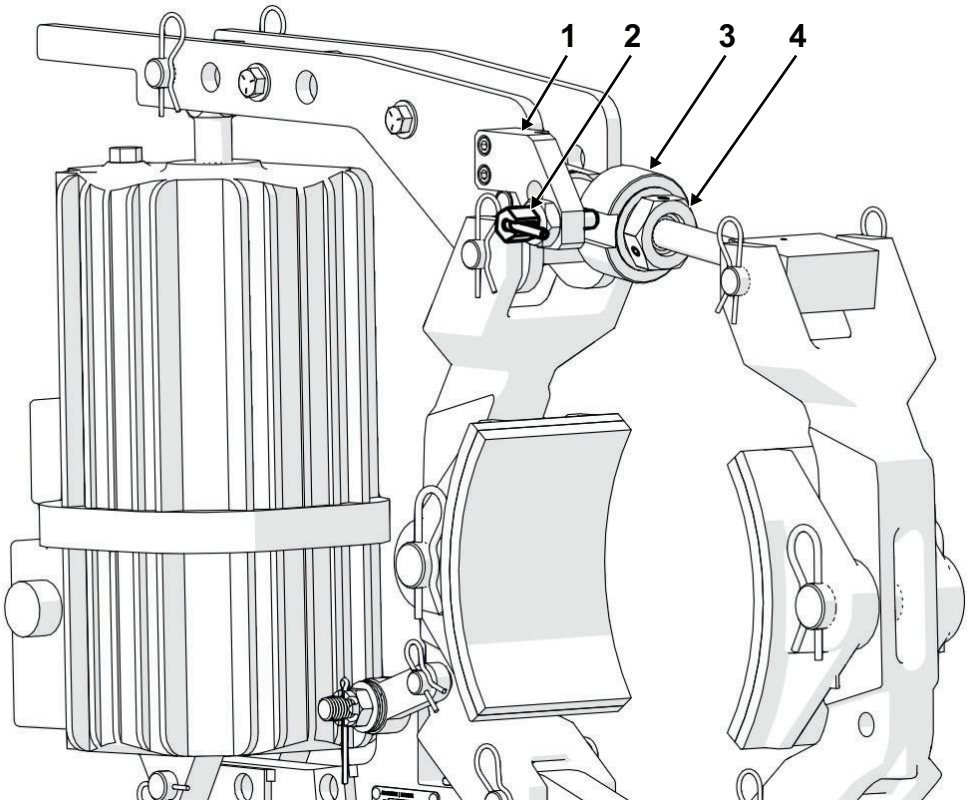


Fig. 10

1. AA Arm
2. Plunger
3. Ring Clutch
4. AA Hex Nut

The automatic adjustment (AA) pushrod is a link element of the total brake linkage. For brakes equipped with AA, the reserve stroke is maintained automatically by a one-way rotating clutch mechanism.

The retractable “plunger” mounted on the brake lever oscillates within a slot in the ring clutch. When the plunger is engaged, it is allowed to oscillate within the slot of the rotating clutch and the brake will maintain the correct reserve stroke because of this.

A ring clutch will have multiple slot features. Each slot is identified by a number of dots on the outer face of the ring, which indicate the amount of reserve stroke that will be developed. Slots with more dots develop more reserve stroke than slots with fewer dots. The plunger needs to engage with one slot for operation. Consult the brake engineering drawing for the correct slot to use. Different slots may be required for different configurations of the same brake. ***See Table 1 on page 12*** and ***Fig. 5 on page 13***.

> ***NOTE:*** *If the plunger is in the retracted position, the effect of the AA is lost and there is no automatic control of the reserve stroke, which will eventually cause a hazardous loss of torque.*

The plunger harnesses the motion of the thruster and will touch the faces of the slot, causing slight rotations of the ring clutch.

As the brake releases, the AA will infinitesimally rotate the clutch to decrease the pushrod length as necessary. This is the AA compensating for lining wear.

As the brake sets, the AA will infinitesimally rotate the clutch the other direction, although this will not change the pushrod length. This is the “freewheeling” direction of the clutch.

NOTE: *Only make pushrod length adjustments per the procedure in* ***Section 4 on page 24****.*

NOTE: *Never disassemble the AA mechanism. All refurbishment and calibration must be performed by Magnetek factory technicians. Only the removal and installation of complete AA assemblies is allowed to brakes in service.*

3.5 Manual Adjustment Pushrod Assembly

The manual adjustment (MA) pushrod is a link element of the total brake linkage. The MA pushrod controls the reserve stroke, but the reserve stroke must be maintained by human intervention.

Three hex nuts lock the adjustable trunnion block in position. The position of the adjustable trunnion block on the pushrod controls the reserve stroke. Never adjust the non-adjustable trunnion block.

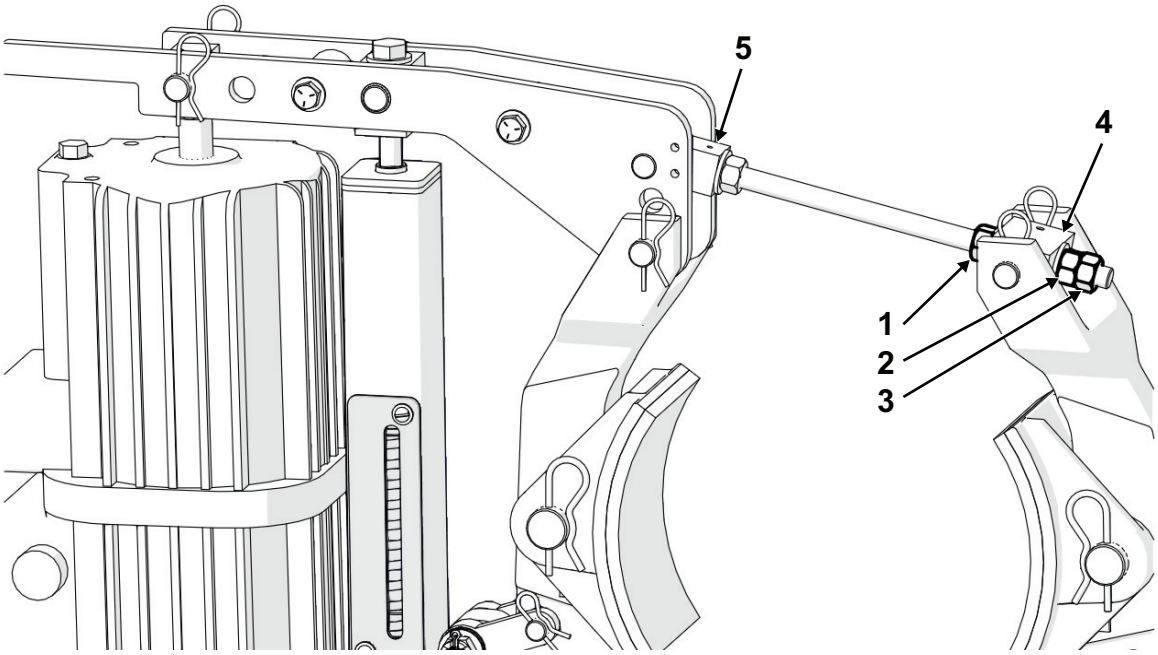


Fig. 11

1. Hex Nut #1
2. Hex Nut #2
3. Hex Nut #3
4. Adjustable Trunnion Block
5. Non-Adjustable Trunnion Block

NOTE: *For adjustment procedure of the MA mechanism, see* ***Section 4 on page 24****.*

3.6 Automatic Equalization Assembly

The automatic equalization (AE) assembly ensures adequate clearance for both shoes and the wheel when the brake is commanded to release. When the brake is released, the shoes are moved apart to provide clearance from the wheel. The thruster’s active stroke is proportional to the total clearance available to the two shoes.

As the thruster piston is raised, the shoe nearest to the thruster opens first.

Clearance given to the nearest shoe is limited by the AE assembly, and the remaining clearance that is available from the remaining active stroke is then spent to give clearance to the other shoe.

The AE friction bolt location determines the limit of clearance for the shoe nearest to the thruster. The location will automatically relocate as necessary to compensate for diminishing lining material thickness.

The alternative to the AE assembly is to use the shipping bolts to control the release position of each shoe individually. This would require continuous human intervention to make adjustments as the lining thickness diminishes with natural brake use. This is only necessary on some non-standard brake mounting orientations relative to gravity.

When shipping bolts are used to control shoe clearance, set the height of the bolt heads to create an equal clearance for both shoes, then lock the bolts in position via their respective jam nuts.

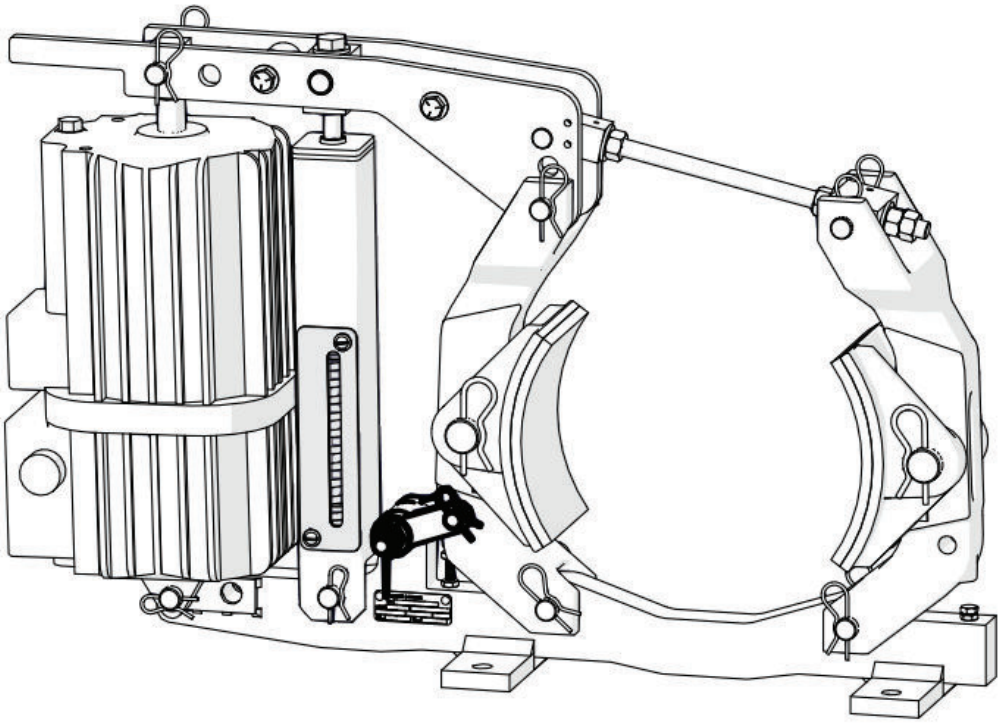


Fig. 12

3.7 External Torque Spring Assembly

There is no fundamental difference to the brake's operation whether an external torque spring (XTS) assembly is used or not.

The XTS simply relocates the torque spring to a housing that is external to the thruster. The torque spring compression is then controlled via the torque spring bolt, rather than being preset and nonadjustable.

The torque is read by viewing the bottom face of the torque spring (top face of the spring seat) through the torque spring housing window and reading its position on the torque scale label. Turning the bolt clockwise as shown below will compress the spring, increasing the braking torque. Turning the bolt counterclockwise will decrease the braking torque.

Always observe the torque scale label when adjusting the torque. Only read the torque when the brake is set. When the brake releases, the torque spring will compress more and a reading of torque is not valid.

Do not exceed the maximum torque nor set the torque below the minimum.

WARNING

Setting the torque outside the minimum and maximum bounds results in a hazardous condition that may lead to serious injury or death.

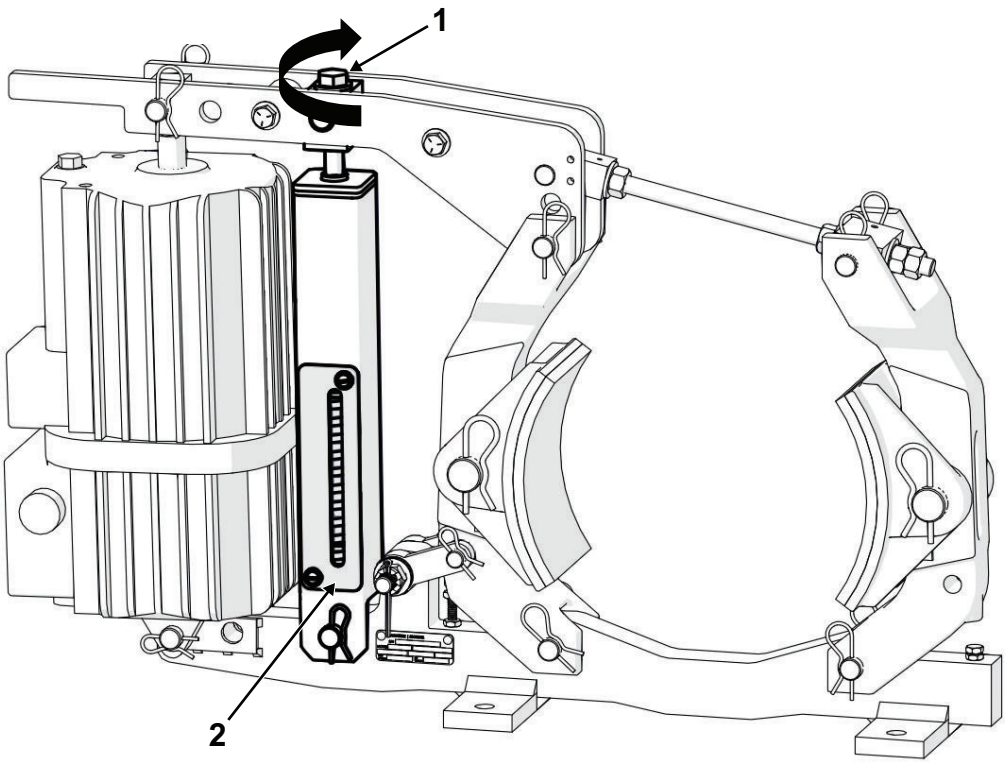


Fig. 13

1. Torque Spring Bolt
2. Torque Spring Housing Window

3.8 Hand-Release Mechanism

A hand-release mechanism is not required for brake operation but is a useful option to install for other purposes. A hand release allows for mechanical release of the brake, which is very useful for various maintenance procedures and other purposes, especially on larger brake sizes or brakes with larger thrusters.

Hand-release mechanisms connect the upper and lower pivot pins of the thruster to an auxiliary lifting mechanism. The hand release will overcome the torque spring and release the brake mechanically.

To use the hand release, rotate the handle to release the brake. When the hand release is not in use, the brake operates as it would normally if there were no hand release installed at all.

Hand release mechanisms are easily configured between “latching” and “non-latching” styles. Latching and non-latching styles are determined by the latching control bolt placement, which can be set in one of two positions.

When a hand release is configured to latching style, the hand release can release the brake and leave it locked in the released position since the hand-release handle is stalled at the “latching stop.”

When a hand release is configured to non-latching style, the hand release can release the brake but then must be held in that position to maintain the released position.

Hand-release mechanisms can be installed in one of four positions to make for a variety of clearances around the brake. In all cases, the handle will rest perpendicular to the thruster piston stroke and then be lifted parallel to the thruster piston stroke in order to release the brake.

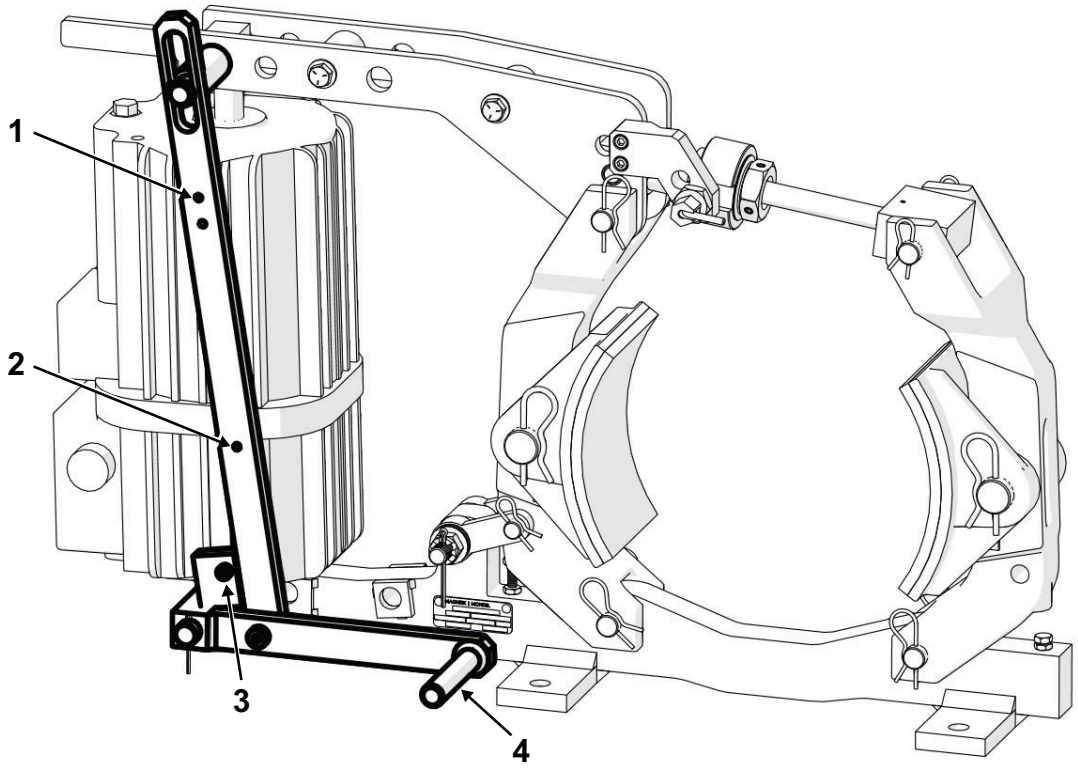


Fig. 14

1. Limit Switch Flag Connection
2. Non-Latching Stop
3. Latching Stop
4. Hand Release Handle

3.9 Limit Switches

Type ST and ST/E brakes can be used with limit switches to indicate any combination of brake set, brake release, or hand-release states. These indicators use a side rotary limit switch with a roller type operator. The limit switch provided by Magnetek offers a rugged enclosure meant to withstand harsh environments while being extremely reliable and requiring minimal maintenance.

Limit switches are attached to the thruster via an adaptor and triggered by limit switch flags. The brake must be set up with the appropriate reserve stroke before adjusting roller operator positions. The roller operator is adjusted using an Allen wrench and is set such that the roller operator rotates a minimum of five degrees when triggered by the limit switch flag.

For the “brake set” switch the roller operator is set beneath the flag and adjusted so that when the brake sets, the flag will trigger the roller operator. The roller operator signals that the thruster is not powered and torque is being applied to the brake wheel.

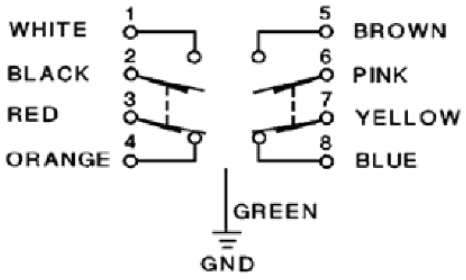
For the “brake release” switch the roller operator is set above the flag and adjusted so that when the brake releases, the flag will trigger the roller operator. The roller operator signals that the thruster is powered and torque is not being applied to the brake wheel.

For the “hand release” switch the roller operator is set above the flag and adjusted so that when the hand release is engaged the flag will trigger the roller operator. The roller operator signals that the hand release is engaged and torque is not being applied to the brake wheel.

Wiring is performed by removing the limit switch body and operating head from the wiring receptacle. Wires come through the conduit entrance and wire to the contactors per the wiring connection diagram provided. The pressure plate terminals accept AWG #22 through #12 wire (0.33 mm^2 through 3.31 mm^2) wire. A grounding screw (colored green) provides enclosure grounding.

Table 3: Limit Switch Specifications

EATON Cutler-Hammer	E50 Double Throw, Double Pole (2 N.O. – 2 N.C.)
Switch Body Receptacle Operating Head Operator	E50SB E50RB E50DR19 E50KL579
Environmental Ratings	NEMA 1, 3, 3S, 4, 4X, 6, 6P, 13, IP67
Conduit Entrance	1/2" NPT or 20 mm threading
Mechanical Life	13,000,000 operations minimum
Electrical Life	100,000 operations typical at full load
Ambient Temperature Range	-40°F to 175°F (-40°C to 79°C)
Wire Size	Will accept AWG #22 through #12 (0.33 mm^2 through 3.31 mm^2), single or stranded wire

Rating	Voltage	Make Current	Break Current	Make Volt-amperes	Break Volt-amperes	
NEMA A600	120VAC 240VAC 480VAC 600VAC	60A 30A 15A 12A	6A 3A 1.5A 1.2A	7200	720	
NEMA R300	120VDC 240VDC	0.25A 0.13A	0.25A 0.13A	-	-	

3.10 Other

Magnetek Engineering will supply any custom design that is required. Various special features such as hydraulic and pneumatic overrides, lining wear measuring devices, double thruster brakes, special enclosures, stainless steel components, special lockout/tagout devices, etc. can be made available upon request. If any custom features are installed, consult the brake's engineering drawing for supplementary instructions.

4 Adjustment

DANGER

A thruster reserve stroke of zero will result in total loss of braking torque. Under no circumstances should the brake be allowed to function with zero reserve stroke. Such operation results in the loss of load control, which can result in injury or death.

DANGER

A physical obstruction between the brake lever and thruster or the brake lever and external torque spring housing will result of total loss of brake torque. Ensure the brake lever is never obstructed. Ensure the brake lever is always free to rotate during operation.

Adjustments to the quality of the brake wheel and limits for brake wheel runout are given below.

Table 4: Allowable Brake Wheel Properties

BRAKE WHEEL SIZE	MINIMUM BRAKE WHEEL DIAMETER AFTER RESURFACING[1]	MAXIMUM FULL-SPEED BRAKE WHEEL RUNOUT[2]
6"	-	0.006"
8"	7.94"	0.008"
10"	9.92"	0.010"”
13"	12.90"	0.013"
16"	15.87"	0.016"
19"	18.87"	0.019"
200 mm	198.5 mm	0.20 mm
250 mm	248.0 mm	0.25 mm
315 mm	312.5 mm	0.32 mm
400 mm	397.0 mm	0.40 mm
500 mm	496.0 mm	0.50 mm

Notes:

[1] Per the recommendations of AISE Technical Report No. 11, which only apply for imperial series of brake wheels.

[2] Evaluate brake wheel runout at full speed.

4.1 Manual Operation

To safely perform a brake installation, shoe replacement, thruster replacement, and other work requires that the brake be released and reapplied without energizing the thruster. When a hand release is installed, it can be used quickly and easily, otherwise manual release of the brake will be necessary by lifting the brake lever handle.

4.2 Automatic Adjustment Pushrod

WARNING

The automatic adjustment mechanism uses a one-way rotating clutch to adjust pushrod length. Never disassemble this clutch. Incorrect reassembly will render the auto-adjust feature inoperative. This can lead to loss of load control and result in damage, injury or death.

CAUTION

The two setscrews used to lock the hex nut to the clutch drive shaft are factory set. Do not loosen these setscrews or change the position of the hex nut relative to the clutch ring. Failure to observe this warning can cause the automatic adjustment feature to become inoperative. This can lead to loss of load control and result in damage, injury or death.

It is necessary to occasionally adjust the AA manually to perform an operation, such as replacing brake shoes or brake installation/removal.

Only make pushrod length adjustments per the procedure below. Never disassemble the AA mechanism. All refurbishment and calibration must be performed by Magnetek factory technicians. Only the removal and installation of complete AA assemblies is allowed to brakes in service.

> ***NOTE:*** *Any time a brake that uses an AA is adjusted manually, first place the plunger in the retracted position.*

DANGER

Disconnect, lock out and tag out the disconnect switch which feeds this equipment to prevent power from being applied while service is being performed.

WARNING

Always safely secure loads from gravity, wind and any external energy source that may inadvertently move the drive system. Follow facility safety procedures to prevent drive system movement when performing pushrod adjustments manually.

WARNING

Releasing the brake electrically (via the thruster) creates a threat from an unexpected power outage while work is being performed. The stored mechanical energy in the torque spring will instantly move the brake linkage and create hazardous pinch points for technicians performing work on the brake. It is always recommended to release the brake manually to perform work.

To increase or decrease the pushrod length manually:

1. Note whether the small or large slot in the ring clutch is engaged with the plunger.
2. Retract the plunger.
3. Release the brake manually by lifting the brake lever or using a hand release.
4. Change the pushrod length by:
    a. Turning the AA hex nut to increase the pushrod length.
    b. Rotating the clutch by hand to decrease the pushrod length.
        i. The direction by which to turn the hex nut or clutch depends on the specific brake. First determine the “freewheeling” direction of the clutch.
5. Set the brake.
6. When returning the brake to an operational state, ensure the correct slot in the ring clutch is used, then engage the AA plunger.

Releasing the brake (step 3) will relieve the mechanical forces on the pushrod while adjustments are made and prevent damage to the threads in the assembly.

Often the goal of a pushrod adjustment is to increase the pushrod length enough to completely eliminate the thruster reserve stroke so that other maintenance can be performed. To return the pushrod to an operational state, decrease the pushrod length enough to develop a small reserve stroke, then cycle the thruster on and off to allow the AA to set the correct reserve stroke automatically.

4.3 Manual Adjustment (MA) Pushrod

WARNING

If the brake uses a manual adjustment pushrod assembly, the thruster reserve stroke must be monitored and adjusted by human intervention. Always keep the reserve stroke within the stated range while the brake is applied, see ***Table 2*** in ***Section 3.2 on page 15***.

DANGER

Disconnect, lock out and tag out the disconnect switch which feeds this equipment to prevent power from being applied while service is being performed.

It is necessary to adjust the MA pushrod to perform various maintenance procedures and also during normal brake use in order to compensate for diminishing lining material thickness.

WARNING

Always safely secure loads from gravity, wind and any external energy source that may inadvertently move the drive system. Follow facility safety procedures to prevent drive system movement when performing adjustments on a manual adjustment pushrod.

WARNING

Releasing the brake electrically (via the thruster) creates a threat from an unexpected power outage while work is being performed. The stored mechanical energy in the torque spring will instantly move the brake linkage and create hazardous pinch points for technicians performing work on the brake. It is always recommended to release the brake manually to perform work.

As friction material wears away, the brake linkage will naturally shift to move the shoes increasingly closer to the brake wheel, and a corresponding reduction of reserve stroke will occur. To compensate, when the reserve stroke nears the lower limit, the pushrod length must be reduced in order to increase the reserve stroke.

To adjust the MA pushrod:

1. Measure reserve stroke before adjustment.
2. Release the brake manually by lifting the brake lever or using a hand release.
3. Loosen hex nut #3 and hex nut #1 off the adjustable trunnion block.
4. Turn hex nut #2 to move the trunnion block.
    a. Advancing hex nut #2 toward the thruster will increase reserve stroke.
    b. Moving the hex nut #2 away from the thruster will decrease reserve stroke.
5. Tighten hex nut #1 and hex nut #2 hand tight on the trunnion block.
6. Set the brake.
7. Power the thruster on and off to fully open and close the brake several times.
8. Allow the thruster to settle, then measure the new reserve stroke.
9. Confirm reserve stroke is within the correct limit to proceed, or return to step 2.
10. Tighten the hex nuts against the adjustable trunnion block (torque to hardware manufacturer recommendations) to fix its new position.
    a. Hex nut #1 full torque against the block
    b. Hex nut #2 half torque against the block
    c. Hex nut #3 full torque against hex nut #2

Releasing the brake (step 2) will relieve the forces on the pushrod while adjustments are made and prevent damage to the pushrod and hex nut threads.

Often the goal of a pushrod adjustment is to increase the pushrod length enough to completely eliminate the thruster reserve stroke so that other maintenance can be performed. If this is the case, then perform the work after step 4.

The frequency with which an MA pushrod must be adjusted to compensate for lining material wear is completely dependent upon the application. Frequently used “stopping brakes” with high rates of friction material wear may not be preferable applications for MA pushrods.

> ***NOTE:*** *It is the responsibility of the end user to determine proper inspection and maintenance schedules to inspect reserve stroke frequently enough and always maintain it within safe limits.*

4.4 Torque Adjustment

> ***NOTE:*** *The National Electrical Manufacturer’s Association (NEMA) states: “The torque ratings apply at a worn lining condition defined as the point where re-adjustment is required as recommended by the manufacturer.”*

The rated torque, as shown on the nameplate, will be developed when the following conditions are met:

- The brake is applied and aligned properly.
- The brake wheel is aligned and in good condition.
- The thruster reserve stroke is within the allowable range.
- Magnetek-supplied friction linings are installed.
- A Magnetek-supplied brake wheel is installed.
- The linings and wheel are in good condition.
- Burnishing has been completed.

Type ST/E brake torque can be infinitely adjusted within the minimum and maximum values as shown on the external torque spring scale. An ST/E brake may also have the option to change the connection point of the pushrod and lever to change the mechanical advantage of the brake.

The ST brake torque can be decreased to a percentage of maximum by rearranging the connection points to change the brake linkage's mechanical advantage. ***See Table 1 on page 12*** and ***Fig. 5 on page 13***. Consult the brake engineering drawing for specific information about rearrangement of brake pivot pins for changes to the mechanical advantage. After rearranging brake pivot pins and before operating the brake, replace all retaining pins, cotter pins and washers.

4.5 Automatic Equalization (AE) Assembly

> ***NOTE:*** *Anytime a brake that uses an AA pushrod needs the brake linkage moved manually, first place the plunger in the retracted position.*

It is sometimes necessary to move the AE position or move it in order to prepare the AE for other work, such as a shoe replacement.

To move the AE:

1. Increase the pushrod length (see ***Section 4.2 on page 25***) to drive reserve stroke to zero and then increase it further to develop as much shoe clearance as necessary.
2. Push the brake arms in any convenient way or use a soft-faced mallet to force the “thruster side” brake arm away from the wheel. Do so enough so that the shoe on the thruster side has the maximum available clearance.

If it is necessary to remove the “thruster side” brake arm to perform work, first remove the retaining pins and the AE control pin that goes through the brake arm. When finished with the work, reinstall the brake arm and AE control pin.

When ready to the return the AE to operation, setting the correct reserve stroke and cycling the brake to release and set will allow the AE friction bolt to relocate automatically.

The friction bolt assembly is pre-tensioned at the factory.

> ***NOTE:*** *Only adjust the friction bolt and castle nut as a last resort if the linkage cannot be moved by the methods described earlier.*

> ***NOTE:*** *The individual orientations of the stack of Belleville washers is critical to the operation of the AE assembly. See the following diagram for the orientations.*

If the friction bolt assembly is disturbed, re-tension the assembly according to the following:

1. Install the bolt, Belleville washers and castle nut through the AE arms and brake base. See ***Figure 15 on page 30***.
2. Tighten the castle nut until all Belleville washers are flat.
3. Loosen the castle nut no more than 1/6 of a turn, to align the nearest cotter pin slot and hole.
4. Install the cotter pin.

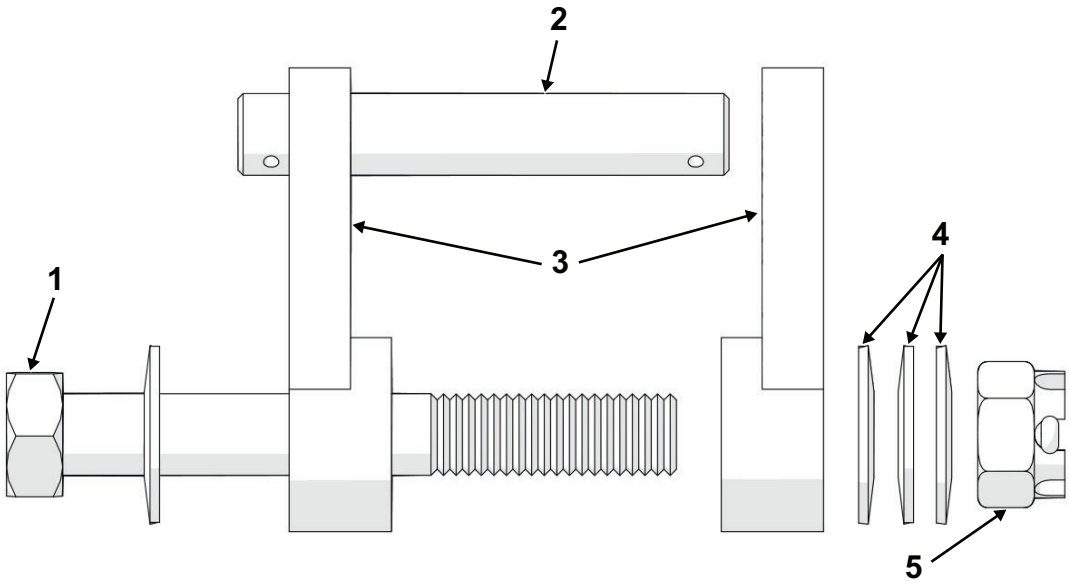


Fig. 15

1. Friction Bolt
2. Control Pin
3. AE Arms
4. Orientation of Belleville Washers
5. Castle Nut

4.6 Anti-Drag Feature

The brake shoes have a degree of freedom that allows them to pivot around their pin connection to the brake arm. This is necessary to ensure proper contact of the friction linings and brake wheel at all points in time, as the lining thickness diminishes naturally during operation.

When the brake releases, this also means that gravity works to pivot the shoes via their self-weight. This creates the undesirable effect of the shoes dragging upon the brake wheel when the brake releases. For this reason every brake includes the anti-drag feature.

The anti-drag feature uses bending plate springs to hold the position of the shoes relative to the brake arms. The self-weight of the shoes is not enough to move them against the force of the plate springs. However, the force of the torque spring transferred to the shoes will easily overcome the force from the plate springs and pivot the shoes as necessary.

To adjust the shoe position manually, simply push the shoe by hand or use a soft-faced mallet to tap the upper edge of the shoes as necessary.

4.7 Time Delay Adjustment

The thruster nameplate will indicate when optional time delay valves are installed.

Letter “**S**” indicates an adjustable piston retraction (brake set) time delay.

Letter “**H**” indicates an adjustable piston extension (brake release) time delay.

If both adjustments are present, then the thruster is equipped with adjustable time delay valves independently controlling both the piston extension and retraction times.

When time delay valves are not fitted, the thruster response time to extend or retract, is between 0.4 and 0.8 seconds depending on thruster size.

With time delay valve(s) installed, extension and/or retraction times are adjustable between approximately 0.5 and 10 seconds depending on thruster size.

Remove the delay valve protective cap to expose the adjustment screw.

Turn the screw clockwise to increase the delay, and counterclockwise to decrease the delay.

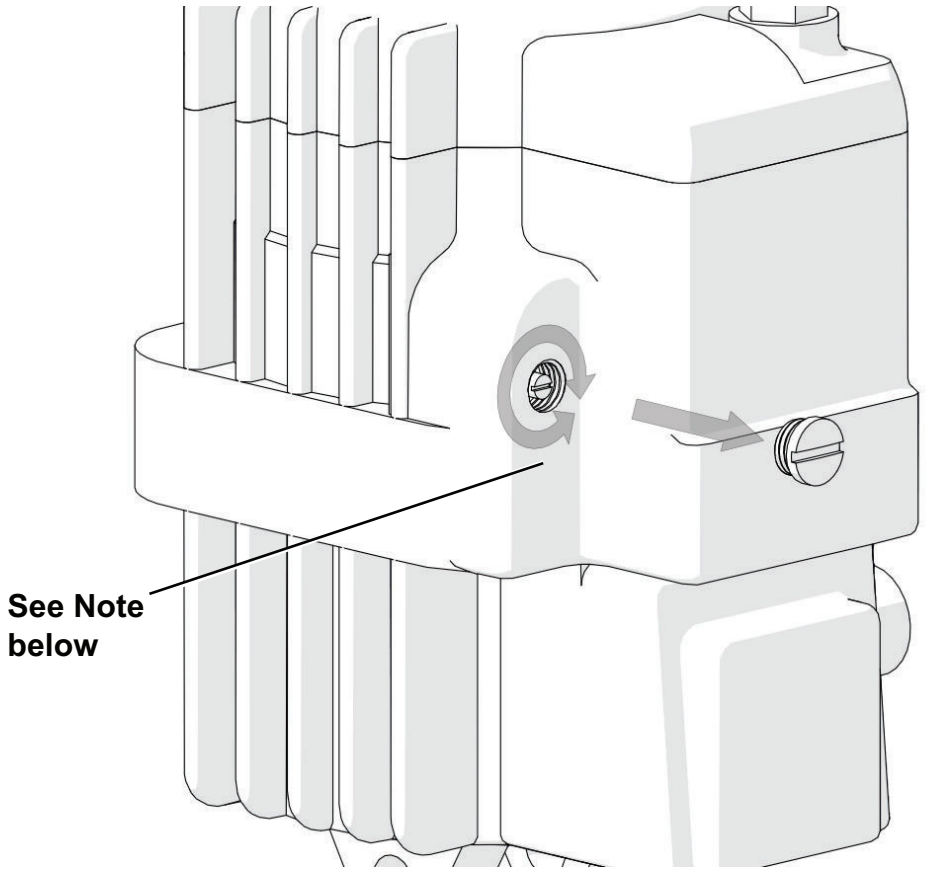


Fig. 16

For minimum delay, set the head of the adjustment screw even with the exterior face of the housing.

> ***NOTE:*** *Do not position the screw head beyond the exterior face of the housing. This may lead to failure of the adjustment system and/or leakage of the thruster.*
>
> ***NOTE:*** *The standard thruster has the shortest response time. A thruster fitted with delay(s) provides longer response times, even when the delay(s) are adjusted for minimum effect.*

5 Electrical Detail

CAUTION

The thruster must be connected to its electrical supply through a flexible cable or sealed flexible conduit. The thruster pivots relative to the brake base during operation. This is also required to ensure that contaminants will not enter the motor through the wiring and junction box.

CAUTION

Avoid contact with “live” terminals and prevent contaminant entry. Install the thruster terminal box cover as soon as connections are complete.

Always check that the utility line voltage and frequency match the information on the thruster nameplate before making a connection.

> ***NOTE:*** *Use flexible type SO- or HAR-approved cable suitable for the rated temperature to connect the thruster to the voltage supply. The thruster must be allowed to pivot relative to the base.*

Connect the ground before connecting the thruster to the supply voltage.

Ensure that the terminal box cable gland is attached properly in accordance with the IP type of protection specified on the thruster nameplate. Always keep the terminal box clean, secure the cover tightly and maintain the seal.

Use IP65 enclosure fittings if the brake is outside. The threaded inlet cable gland is M25 x 1.5 for cable diameters Ø12-18 mm.

Optional heating units, breather units and more can be supplied and are necessary for some extreme environments.

Operation of the thruster is not dependent of the direction of motor rotation. The cable leads can be connected to the terminals in any phase sequence.

The motor leaves the factory already arranged for the customer-specified voltage, which is also shown on the nameplate.

Thrusters have either a 9-pole terminal board or a 6-pole terminal board inside the terminal box. Both use a multi-voltage ratio (1:2) that can be rearranged to work with one of two voltage supplies.

Connection of 9-pole Terminal Board

Connections of 9-pole terminal boards can be rearranged to work with one of two voltage supplies as shown. For example, the 460V/60Hz arrangement is easily changed to the 230V/60Hz arrangement.

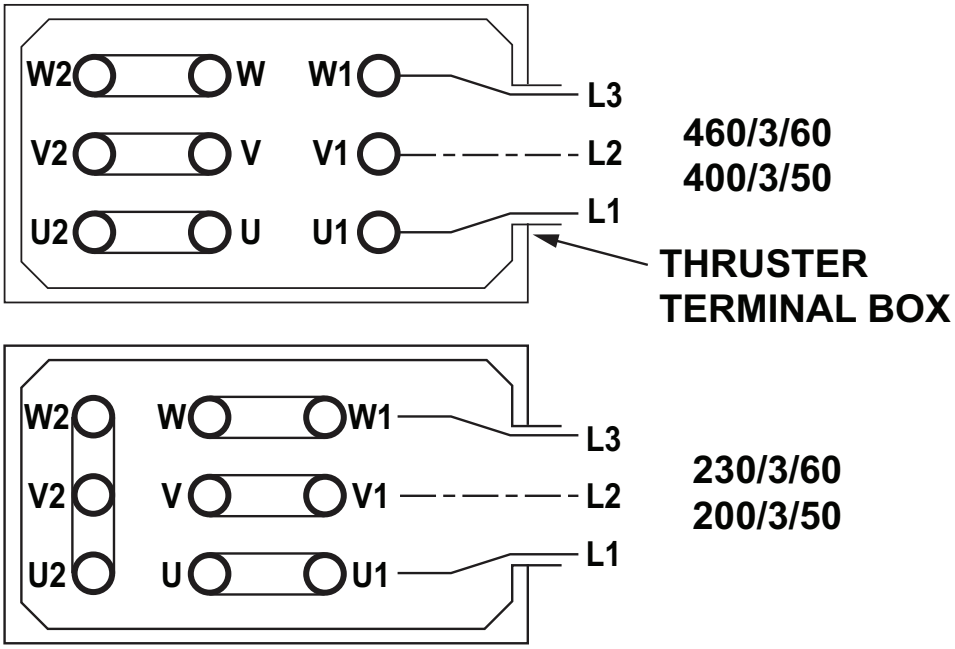


Fig. 17: Connection of 9-pole Terminal Board

Connection of 6-pole Terminal Board

Connection of 6-pole terminal boards is achieved via “Y” or “Δ” configuration.

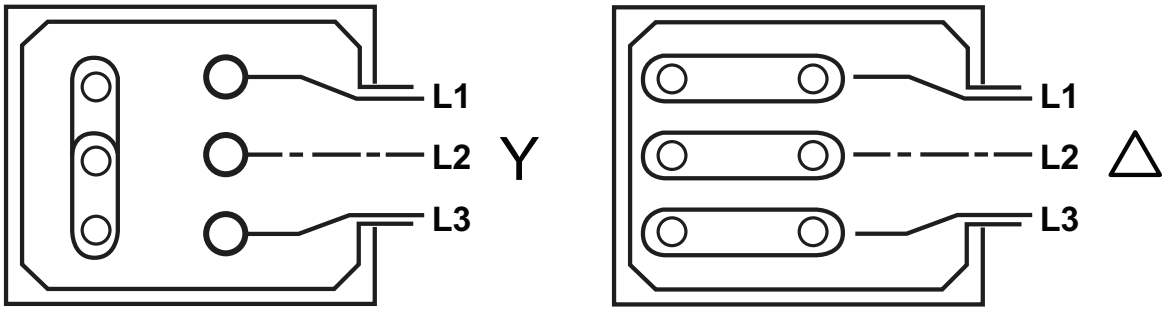


Fig. 18: Connection of 6-pole Terminal Board

A variety of thrusters are available to work with many voltages to conform to the supply of the end user’s facility. Three-phase, 60 Hz, 230/460VAC are standard units for applications in North America. Three-phase, 50 Hz, 230/400VAC, 290/500VAC, and 400/690VAC are standard units for applications outside of North America. Generally, thrusters can be supplied with voltages in the range of 110-690V for either 50 or 60 Hz frequencies.

A wiring diagram showing the possible terminal link arrangements is fastened inside the thruster terminal box cover.

Thrusters for use with VDC supply are available upon request.

6 Installation

WARNING

Anyone involved in the installation or service of this brake must have:

- Received specific training.
- Had experience on similar equipment.
- Knowledge of the equipment on which the brake is installed.
- The ability to understand the terminology.
- The ability to understand the diagrams.

Do not proceed unless technically qualified for the work involved.

DANGER

Read and understand the engineering drawing of the brake dimensions and brake linkage movement during operation. Low overhead obstructions may interfere with the brake lever in a traveling overhead crane application or otherwise.

CAUTION

The integrity of the brake may be compromised or a replacement part may not fit if alterations are made to the brake to achieve required alignment or otherwise.

CAUTION

If the alterations to the brake supporting structure are required, they must be done under the direction of a competent authority.

DANGER

All electrical power to this equipment must be disconnected by competent personnel. Consult specific wiring diagrams to identify and isolate all live power inputs to the equipment.

DANGER

Unexpected movement or hazardous voltage can cause injury or death. Disconnect, lock out and tag out the power source that feeds this device to prevent power from being applied while inspection and repairs are being performed. Before beginning repairs, try the operational controls to verify that the intended power source is disconnected.

Before installing the brake:

1. After unpacking, visually inspect the brake assembly to ensure that damage has not occurred during shipment and that there are no loose or missing parts.
2. Remove and discard any wedges used to secure the brake against vibration during transportation.
3. Unlock the jam nuts and move the shipping bolts down so they do not touch the brake arms, unless a non-standard mounting set-up is required.
4. Prepare the brake supporting structure and ensure the brake wheel rim is at least 1/4” (5mm) wider (total width) than the brake shoes.

To install the brake:

1. Allow adequate clearance between the brake and adjacent obstructions to allow access for adjustment and maintenance. Consult the brake engineering drawing for pertinent dimensions.

NOTE: *Brake shoe replacement requires space for complete withdrawal of the link arm pivot pins.*

2. Whether mounting a brake in a new or existing installation, the base mounting bolts need a reasonable clearance in the base mounting holes to allow the brake to be aligned to the brake wheel. The brake engineering drawing or customer approval drawing shows the recommended bolt size for brake mounting and the size and depth of the associated thru-hole in the brake base.
3. Circumstances of the end user’s machinery layout may determine the best order of installation for the brake and the wheel. This may be due to the available space or handling facilities on site. Generally the wheel is installed first on a horizontal table surface with brake mounting features already built into the structure, and that is what the following procedure assumes.
4. Type ST and ST/E brakes cannot be partially disassembled and inserted perpendicular to the wheel axis. The brake must be inserted from in front of the wheel and moved parallel to the wheel axis.

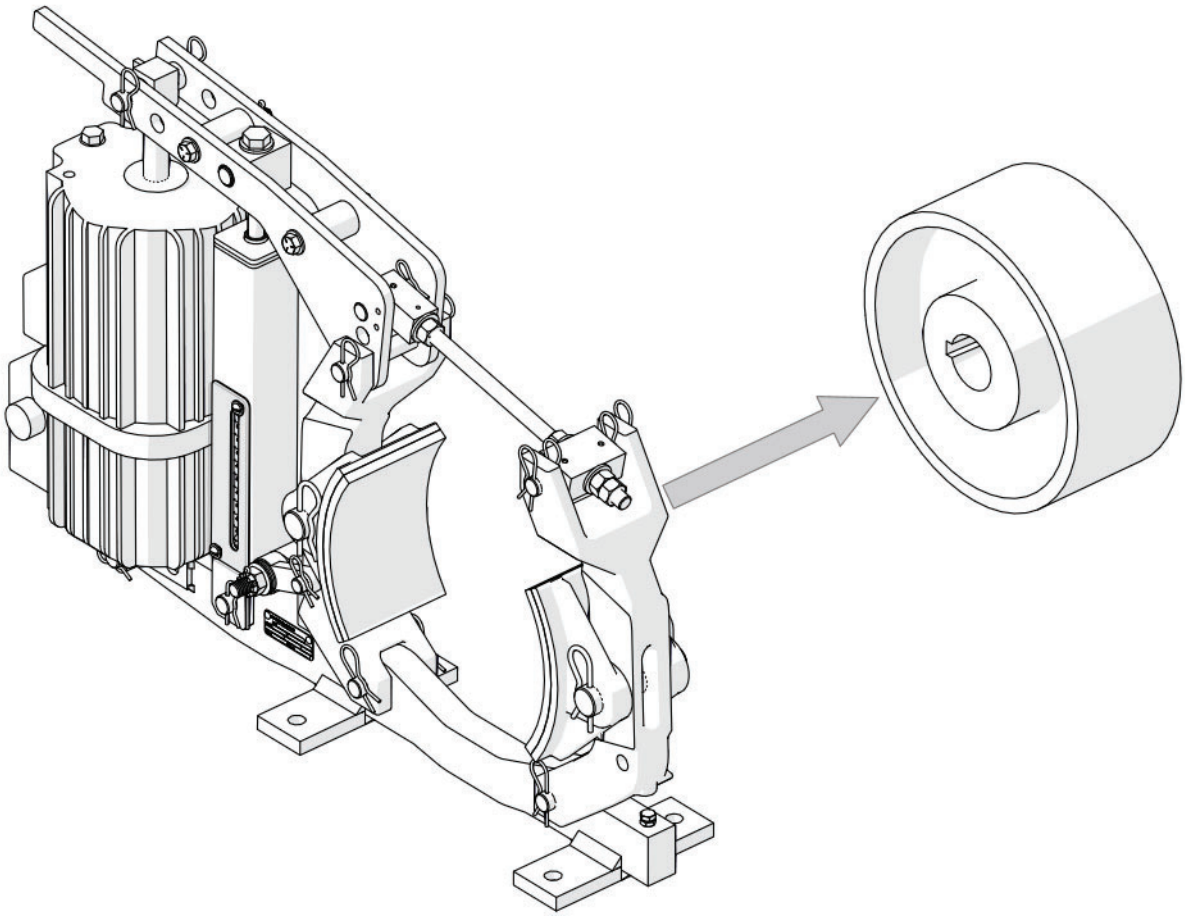


Fig. 19

5. The brake supporting structure surface should be flat and parallel to the motor and brake wheel axis. It is acceptable to place shims under the brake base for vertical placement.

WARNING

Never lift the brake assembly by the pushrod. The weight of the brake can irreversibly damage the rod, leading to fracture and total loss of braking effect. Lift the brake by the brake lever and trunnion block.

6. Observe the following correct lift points and place the brake upon the brake supporting structure.

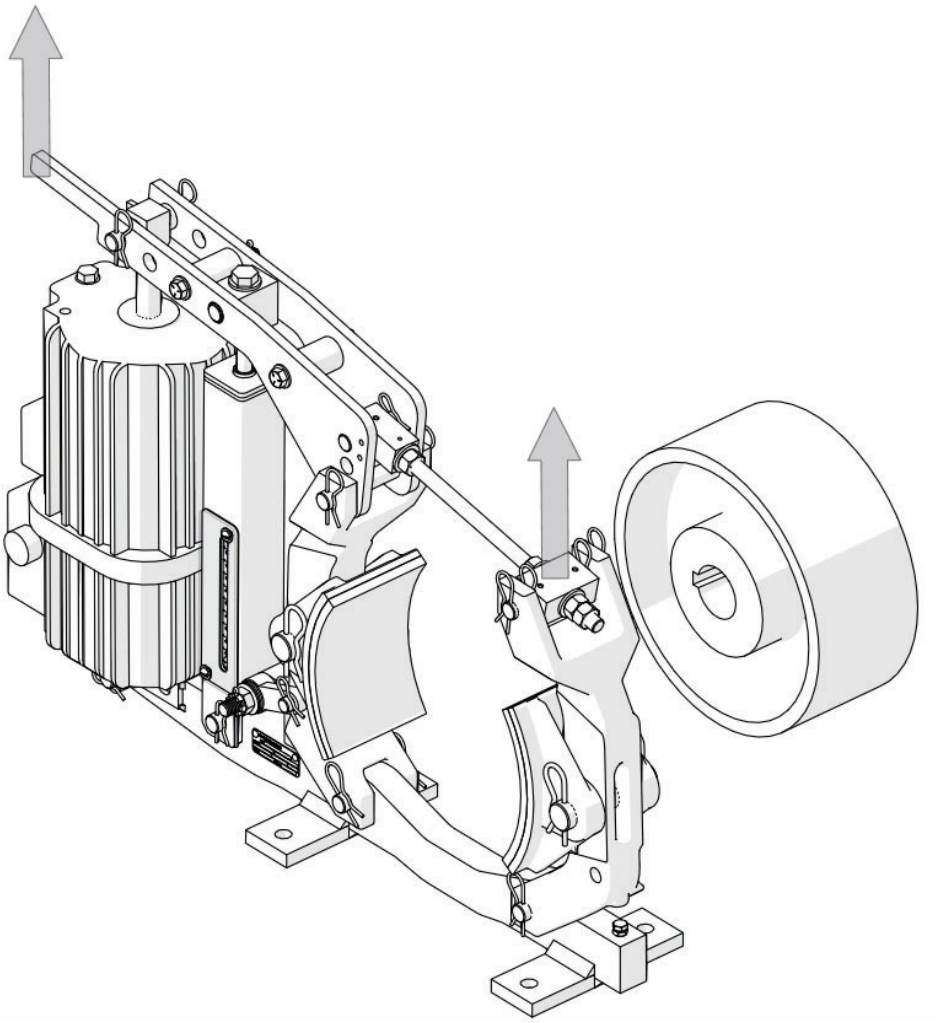


Fig. 20

7. Release the brake and/or increase the pushrod length as necessary and slide the brake to center the brake shoes across the width of the brake wheel. Centering the brake shoes avoids ridge formation on the brake linings, which otherwise becomes a dangerous situation as the linings wear.
8. After placing the brake and installing the wheel, insert the mounting hardware and tighten less than hand tight.
9. Connect the thruster to the electrical supply using a flexible, sealed conductor suitable for the rated temperature. Use type SO- or HAR-approved cable suitable for the rated temperature. The thruster must be allowed a few degrees of movement without the risk of dirt or moisture entering the terminal box. ***Section 5 on page 32*** provides all necessary electrical details.
10. Decrease the pushrod length to establish the reserve stroke per ***Table 2*** in ***Section 3.2 on page 15***. Establishing the reserve stroke will apply the brake, causing the brake to align itself to the wheel and maximize the shoe contact area.
11. Verify approximately equal clearance in all four of the base mounting holes for the mounting bolts. If necessary, increase the pushrod length to unclamp the brake, center the brake to the mounting holes, and then re-establish the reserve stroke.

NOTE: *Magnetek does not recommend "dowelling" or "keeper plates" to maintain alignment. The correct mounting bolts with correct bolt torque will secure the brake properly and allow for minor adjustment to the alignment in the future when replacement shoes are installed.*

12. Power the thruster on and off several times, ensuring that the reserve stroke rests at the correct setting. This will use the strength of the torque spring to best align the brake to the wheel and mounting hardware.
13. Tighten the mounting hardware to full torque per the hardware manufacturer recommendations for the specific bolt size.
14. Ensure again that the reserve stroke rests at the designed value.

Type ST and ST/E brakes are typically installed with the base horizontal and the brake wheel shaft horizontal, as shown in ***Figure 21***.

Type ST and ST/E brakes can also be wall mounted, with the brake wheel shaft horizontal. For proper thruster operation in this mounting arrangement, the thruster terminal box/nameplate must face up. This ensures the reservoir of hydraulic fluid maintains proper internal flow. The thruster has allowable operating positions in range -15° to 90° as shown.

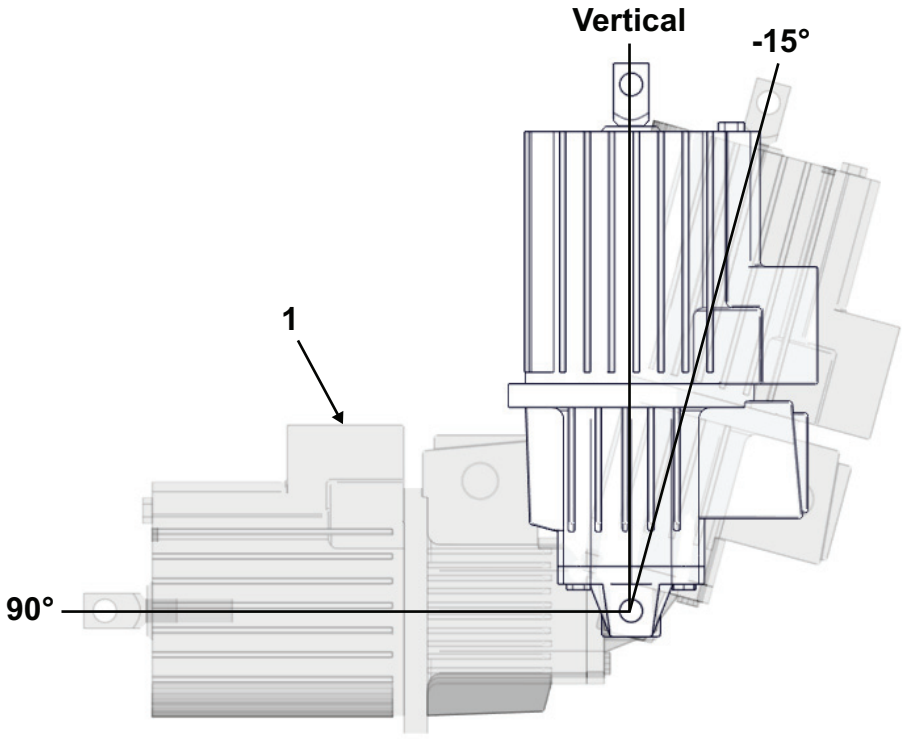


Fig. 21

1. Nameplate

In this position, the equalizing bolt opposite the thruster will be most effective in ensuring equal shoe clearance.

Type ST and ST/E brakes can also be wall mounted with the brake wheel shaft vertical. Again this requires the thruster nameplate to face up, which requires a special thruster employing a rotated mounting pin axis 90° from the standard configuration. For this mounting arrangement both shipping bolts may be required to ensure equal shoe clearance.

For non-standard mounting arrangements consult the factory.

The brake assembly must always be parallel and aligned to the brake wheel within a maximum of 1/32 inch (±0.8 mm), in three axes (horizontal, vertical and longitudinal).

WARNING

Failure to install the brake wheel correctly may result in total loss of braking. Do not operate the brake unless the wheel is secured to the shaft. Failure to properly center the brake and obtain uniform lining contact results in localized heating and, ultimately, reduced torque, which can cause injury or death.

7 Burnishing

> ***NOTE:*** *The National Electrical Manufacturer's Association (NEMA) states: "The torque ratings apply at a worn lining condition defined as the point where re-adjustment is required as recommended by the manufacturer."*

Once the brake is correctly mounted upon the brake supporting structure and all adjustments are properly set, the brake will still not achieve the rated torque. This is because the friction linings are not yet burnished. They have not established an operational interface with the brake wheel.

For any friction braking application, burnishing once the system is initially installed is critical to long-term performance. Burnishing is a method to:

- Prepare the compounds of the friction linings for thermal load
- Form the working surface flat by eliminating localized high spots
- Deposit friction material onto the brake wheel, to improve the coefficient of friction

Burnishing is always required to make the rated torque. Burnishing should always be performed upon an initial brake installation, brake realignment, brake shoe replacement or brake wheel replacement. For shoe and wheel replacement, realigning the brake by loosening the mounting hardware, cycling the brake open and closed, then retightening the mounting hardware may reduce the amount of time spent burnishing.

The key to burnishing is to apply successive braking stops with small inertial loads and to limit the overall temperature rise in the brake wheel.

On hoists, well-spaced, short bursts of energy, such as an e-stop at high speed with no load, are best to achieve initial "burnishing."

On traveling motions, well-spaced motions without other loads at medium speed are best to achieve burnishing.

Burnishing may involve between 100-200 cycles of this nature.

CAUTION

A minimum of 60% contact on both friction linings, or a torque measuring method to prove the brake is achieving rated torque, is required before subjecting the brake to full service capacity. Failure to do so means the brake may not produce rated torque. The percentage of the working surface that has been burnished is visually apparent on the friction linings.

Modern linings, although hard wearing, cannot support the heat transferred to the brake without burnishing. "Glazing" is a condition where the lining has been heated beyond its working temperature range and is no longer capable of its designed coefficient of friction. "Glazing" will seldom be removed by further braking operations or burnishing attempts. Serious glazing damage may only be resolved by brake shoe replacement.

"Glazing" is prevented by ensuring a minimum of 60% contact area, or a torque measuring method to prove the brake is achieving rated torque, before placing the brake in service.

As an alternative to the burnishing methods above, a distinct advantage of type ST and ST/E brakes is that the thruster can be easily overridden while the drive is operating, without damage to the thruster. When circumstances permit, force can be applied to the brake lever to cause the brake to set while the thruster is

powering to release the brake. This will force the brake shoes onto the wheel during drive system movement.

Do not exceed a maximum of 300°F (150°C) of the brake wheel during burnishing.

Wear will be more rapid when the linings are new. The localized high spots wear down during the burnishing process. Adjustment may be required soon after the brake has been put into service.

Always use genuine Magnetek lined brake shoes. This will maintain brake performance and ensure that the braking torque is neither more nor less than the specified rating.

Refurbished or re-lined brake shoes using friction materials and adhesives other than genuine Magnetek parts are not tested for performance, wear or reliability.

Do no use re-lined shoes where the castings are damaged, worn or distorted.

8 Operational Test

CAUTION

Always perform an operational test of the brake after any installation, realignment, brake, replacement, shoe replacement, wheel replacement or repair. Read and understand the intent of the warnings published in this document.

WARNING

Before conducting an operational test, remove all tools, chocks and other equipment, which may create a hazard when drive machinery is operated.

WARNING

Following any repair or adjustment, and before conducting an operational test, verify that all brake adjustments are complete in accordance with ***Section 4 on page 24***.

Follow all installation, adjustment and burnishing procedures previously described. Ensure the reserve stroke is correct.

Check brake wheel runout. Verify the radial runout does not exceed 0.001" (.025 mm) per inch (25 mm) of brake wheel diameter an all drive speeds. See ***Table 4*** in ***Section 4 on page 24***.

Iteratively proceed through the next steps. If the brake succeeds at each step then proceed. If the brake fails, then perform more burnishing before returning to the operational test.

1. Begin the operational test with no load and slow speed conditions. Ensure the brake can stop and hold an empty hook, or stop a traveling motion within an acceptable distance and time.
2. Increase load and speed to medium settings. Ensure a hoist load can be stopped and held and there is no creep or drift of the load. Ensure a traveling motion is stopped within an acceptable distance and time.
3. Increase the load and speed to maximum operational settings. Ensure a hoist load can be stopped and held and there is no creep or drift of the load. Ensure a traveling motion is stopped within an acceptable distance and time.

If burnishing or correct measurement of torque has been achieved and all of these tests are acceptable, then the brake is ready for full service.

Consult AIST and/or the Crane Manufacturers Association of America (CMAA) standards for recommendations for suggested stopping distances and times.

9 Maintenance and Repair

WARNING

When replacing a brake wheel or associated drive line components on an existing installation, verify that the brake is centered with uniform lining contact as described in ***Section 6 on page 34***. Incorrect repair or replacement can result in death or injury to personnel.

WARNING

During operation, the temperature of the thruster and fluid temperature and pressure will increase. This is normal but presents a risk of burns and scalds while the thruster is hot. Switch off power to the thruster and allow it to cool to ambient temperature before performing any work.

9.1 Replacing the Brake Shoes

NOTE: *NEMA Standard ICS 9-1993, Part 1 recommends that brakes be fitted with new or re-lined shoes before the lining material is worn excessively. Refer to* ***Table 7*** *in* ***Section 10.1 on page 50*** *for minimum thickness.*

WARNING

Always safely secure loads from gravity, wind and any external energy source that may inadvertently move the drive system. Follow facility safety procedures to prevent drive system movement when replacing brake shoes.

WARNING

Releasing the brake electrically (via the thruster) creates a threat from an unexpected power outage while work is being performed. The stored mechanical energy in the torque spring will instantly move the brake linkage and create hazardous pinch points for technicians performing work on the brake. It is always recommended to release the brake manually to perform work.

NOTE: *Use caution when removing retaining pins and pivot pins to prevent brake parts from dropping uncontrollably.*

To replace the brake shoes:

1. Increase the pushrod length as much as necessary per ***Section 4 on page 24***.
2. If using an ST/E brake, remove the torque spring bolt.
3. Move the AE assembly as far away from the wheel as possible per ***Section 4 on page 24***.
4. Remove retaining pins as necessary and remove:
    a. Lever/thruster pivot pin
    b. Brake arm/lever pivot pin
    c. Brake arm/pushrod pivot pin(s)
5. The brake lever and pushrod are now disconnected from the brake; set them aside.
6. Remove retaining pins and remove both brake arm/base pivot pins.
7. Lift out both brake arm/shoe assemblies.
8. Remove retaining pins and withdraw the shoe pivot pins.
9. Separate the shoes from the arms.

Other methods, such as removing the brake wheel or pivoting the brake arm far enough away from the wheel, may allow for shoe removal.

NOTE: *Always replace shoes as a pair.*

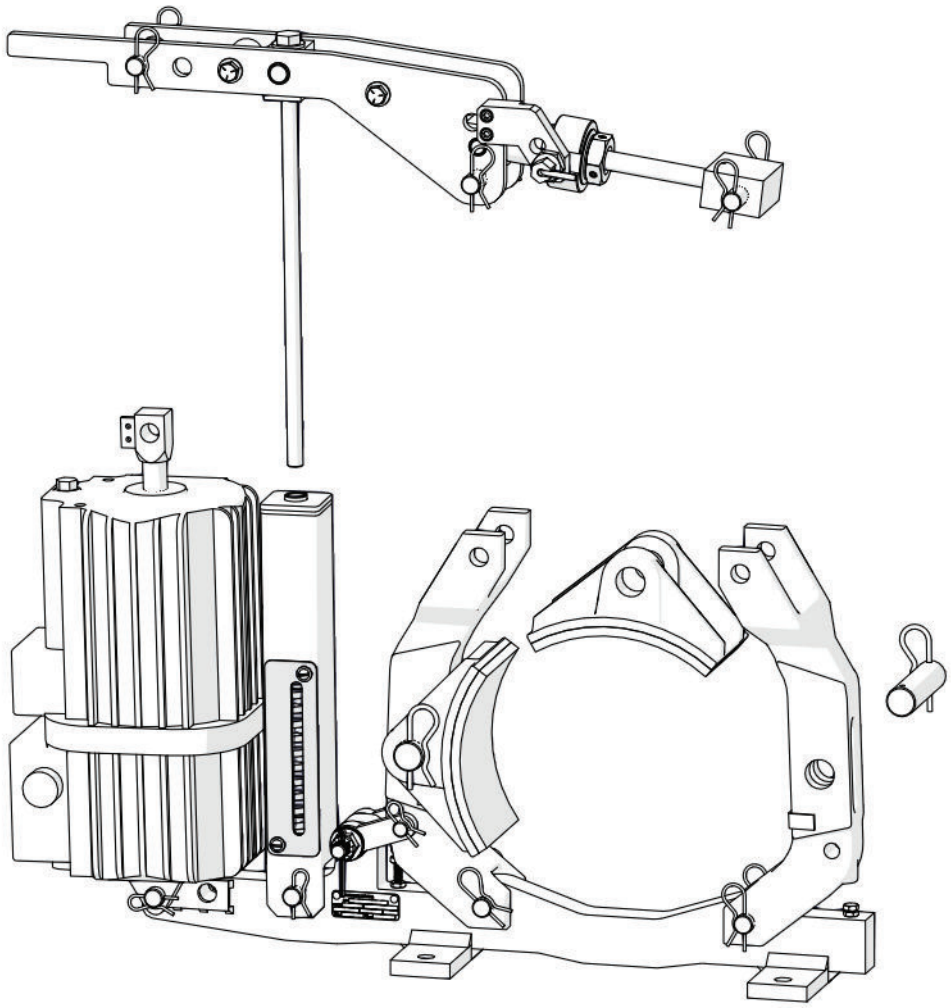


Fig. 22

Before starting shoe installation, check that the brake surface of the wheel is clean and free from oil and grease.

Check that all anti-drag plate springs fastened to the brake arms are secured by their screws and that no screws are loose.

Install the replacement shoe assemblies in the reverse order of the steps previously described (steps 9 to 3). Add a minimum amount of lubricant such as Anti-Seize or grease for ease of assembly, applying it to all pivot pins that were removed.

Ensure all retaining and cotter pins have been reinstalled.

Make pushrod adjustments per ***Section 4 on page 24*** and re-establish the correct reserve stroke.

Burnish the new shoe linings per ***Section 7 on page 40***.

Perform an operational test per ***Section 8 on page 42***.

> ***NOTE:*** *It is not recommended that shoes be re-lined with friction materials other than genuine Magnetek parts. New bonded shoe assemblies can be ordered as repair parts. Factory rebuilt shoes are also available from Magnetek. Under this program, credit will be allowed for old brake shoes in usable condition.*

9.2 Pushrods

The AA assembly must be removed and replaced as a complete unit. Follow steps 1 through 5 of the shoe replacement procedure above, and then disassemble the two lever spacer bolts to isolate the AA pushrod assembly from the levers. Reinstallation is achieved in the reverse order.

Components in the MA assembly are accessed in the same way, but the lever does not need to be disassembled.

9.3 Bushings for AA and XTS Assemblies

There are cylindrical bushings pressed into the lever pivot points for the AA pushrod and external torque spring assemblies. Using an arbor press, remove the used bushings and reinstall the replacement bushings when replacing an AA pushrod assembly or replacing worn bushings generally.

9.4 Other

Removing and re-installing other components on the brake can be done in a similar way as a shoe replacement procedure.

Increasing the pushrod length and driving the reserve stroke to zero, according to instructions in the pushrod sections of ***Section 4 on page 24***, will relieve the torque spring of its stored mechanical energy. Once this is achieved further components may be disassembled.

Major brake components are all pinned together and some components involve threaded hardware. Disassembling the brake involves removing retaining hardware, pivot pins and threaded hardware.

A small amount of thread-locking adhesive (such as Loctite 277) is used on the screws holding the anti-drag springs, the hand release pivot bolt and the screws holding the automatic adjustment arm for the plunger. A small amount of lubricant such as Anti-Seize or grease is applied to all brake pivot pins for ease of assembly.

Maintenance and inspection periods depend on operating conditions. High-duty cycle applications obviously require more frequent inspections than brakes operating in low-duty cycle applications. In either case, Magnetek recommends a general inspection every 100 operating hours or once every month at a minimum.

Pivot pins may experience surface wear and a corresponding loss of pin diameter will occur. Monitor pivot pins, replace as necessary, or at least:

Replace all stainless steel pivot pins every 500,000 braking cycles.

Replace all aluminum bronze pivot pins every 150,000 braking cycles.

Pushrods may fail from fatigue stress without obvious signs of wear.

Replace pushrods (or the entire AA assembly) no later than every 750,000 braking cycles.

> ***NOTE:*** *Always use genuine Magnetek replacement parts. This will ensure correct geometry, tolerancing and material strength to prolong the service life of a brake.*

9.5 Inspection

Electrical connections and mechanical fasteners should be checked for tightness. Inspect the brake mounting bolts for tightness.

Inspect the brake wheel to ensure its connection to the motor shaft or drive system is in good standing. Check for unusual scoring, signs of over-heating, cracking or wear. Replace any damaged, cracked or excessively worn brake wheels.

Check for signs of wear and/or deformation on the following components, and replace if necessary:

Various pivot pins and all cotter pins should be in good condition.

Various hardware should be in good condition, including thrust washers and threads on bolts and nuts.

Replace brake pushrod assemblies if there are signs of deformation, if excessive rust has built up or for any other reason that would lead to strength degradation.

A full rebuild of the brake every three years or 1,500,000 cycles (whichever comes first) is suggested.

9.6 Lubrication

Periodic lubrication is not required. A minimum amount of lubricant such as Anti-Seize or grease applied to pivot pins is recommended for assembly.

9.7 Thruster Working Fluid

The thruster leaves the factory correctly filled with the fluid and seals for the specified operating temperature range.

The fluid will not deteriorate in service. If there are no obvious signs of leakage or inadequate performance, no additional fluid will be required.

If adding fluid is necessary for any reason, use only the fluid identified on the nameplate to ensure compatibility with the installed seals and the specified operating temperature range. Fill the thruster while in the vertical position. **DO NOT OVERFILL.**

Table 5: Hydraulic Fluid Volume

THRUSTER	Liters (L) fluid
ED23/5	1.6
ED30/5	1.9
ED50/6	4.2
ED80/6	4.2
ED121/6	9.4
ED201/6	9.4
ED301/6	9.2
ED121/12	9.4
ED201/12	9.4
ED301/12	9.2

Table 6: Recommended Hydraulic Fluids

Ambient Temperature			Hydraulic Fluid
Lower Limit	Upper Limit	Use with Seals	
-13°F (-25°C)	122°F (+50°C)	NBR	C-10
41°F (+5°C)	158°F (+70°C)	Viton	C-46*
14°F (-10°C)	158°F (+70°C)	Viton	M-20*
-31°F (-35°C)	122°F (+50°C)	NBR	M-20

* Thrusters with this fluid and seal combination must use breather cap to operate above ambient temperature of 60°C.

All hydraulic fluids are obtainable directly from Magnetek.

Optional heating units may be installed in order to lower the operating temperature limit in extremely cold environments.

Optional breather units may be installed in order to compensate for large temperature swings in the environment and prevent hydraulic pressure buildup.

10 Replacement Parts

10.1 Brake Lining Replacement

As a general guide, Magnetek recommends that brake linings be replaced when the linings wear down to 1/16” (1.5mm) minimum thickness at any point on the lining. ***Table 7***, taken from standard ICS 9-1993, Part 1: Electromagnetic Brakes, shows NEMA’s recommended range of minimum lining thickness for bonded and riveted linings on brake wheels from 8" to 19" diameter.

Table 7: Minimum Allowable Lining Thickness

Wheel Diameter (Inches)	Maximum RPM	Lining Thickness (1)	
		Riveted (2)	Bonded
8" (~200 mm)	5,000	0.010" (.25 mm)	0.016" (.41 mm)
10" (~250 mm)	4,000	0.010" (.25 mm)	0.020" (.51 mm)
13" (~315 mm)	3,300	0.010" (.25 mm)	0.026" (.66 mm)
16" (~400 mm)	2,600	0.015" (.38 mm)	0.032" (.81 mm)
19" (~500 mm)	2,300	0.015" (.38 mm)	0.038" (.97 mm)
(1) Minimum permissible prior to replacement. (2) Above rivet head at maximum wear point.			

For parts replacement, part number identification, or complete disassembly and rebuild, refer to the brake engineering drawing.

Magnetek can supply a variety of replacement part “kits” and individual parts. Quick turnaround brake refurbishment and recertification at Magnetek’s factory is also available to Magnetek brake owners.

Always quote the Magnetek serial number when ordering parts.

For optimum brake life and performance use only genuine Magnetek parts.

11 Long-Term Storage

If a brake assembly will not be installed immediately, it can be stored indoors in a dry location indefinitely or outdoors for a reasonable time if adequately protected from moisture and corrosive atmosphere. The brake assembly must always be protected from direct exposure to the elements unless specifically treated at the factory for use in that environment. Covering with plastic sheeting is not acceptable unless provision is made to prevent condensation under the plastic.

During storage, rust may form on the surface of the brake wheel. This is not usually a problem with ductile iron wheels, nor is it necessary to clean the wheel before placing the wheel in service. The first few brake applications will polish the wheel.

Steel wheels may form scale when corroded, and the braking surface may have to be re-machined to remove the scale. See ***Table 4*** in ***Section 4 on page 24*** for machining limits. Dynamic balance may be affected by machining.

Before painting a brake, protect all pivot points, pushrod threads, thruster piston, brake wheel and linings.

Data plates and labels must not be removed or painted over.

MAGNETEK MATERIAL HANDLING | MONDEL CE EC

Declaration of Incorporation of Partially Completed Machinery

Applicable Safety Directive: Machinery Directive 2006/42/EU

Responsible Party:
(manufacturer)

Magnetek Inc.
Material Handling Group
N49 W13650 Campbell Dr.
Menomonee Falls, WI 53051
United States of America

We hereby declare that on the date of the declaration the following incomplete machine complied with all basic safety and health regulations found in the directive 2006/42/EC of the European Parliament and of the Council on machinery. The declaration is rendered invalid if modifications are made to the product.

Product Designation: MST/AST/IST Electric Shoe Brake

The incomplete machine may not be put into operation until conformity of the machine into which the incomplete machine is to be installed with the provisions of the Machinery Directive (2006/42/EC) is confirmed.

Applicable Harmonized Standards:

- EN 60204-1: 2006 - Electrical Equipment of Machines – Part 1, General Requirements.
- Machinery Directive 2006/42/EC, Annex 1.
- EN ISO 12100:2011-03 - Safety of machinery - General principles for design - Risk assessment and risk reduction.

The manufacturer agrees to forward on demand the special technical documents for the incomplete machine to state offices.

Person authorized to place the product on the EU market:

Name: Edward G. Butte

Position: Director, Global Strategic Marketing

Date: 8/13/2018

Address: N49 W13650 Campbell Dr. Menomonee Falls, WI 53051 United States of America

Signature: