ISO 9001 CERTIFIED

502-MSB2-001-02

SERVICE MANUAL

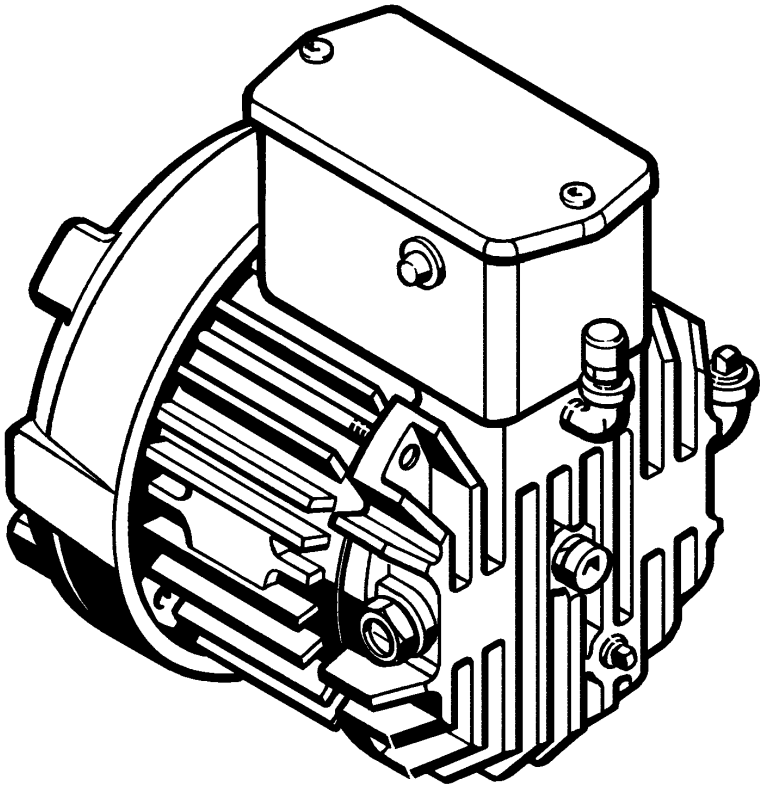
FOR

MSB2

Magna-Shear™

FULLY ELECTRIC

OIL SHEAR MOTOR BRAKE



WARNING - Read this manual before any installation, maintenance or operation.

FORCE CONTROL®

FORCE CONTROL INDUSTRIES, INC.

MANUFACTURERS OF MECHANICAL AND ELECTRICAL POWER TRANSMISSION EQUIPMENT

Limited Warranty

Upon written approval of the application by Force Control Industries, Inc. the standard warranty period will be extended to 24 months from date of shipment.

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A Return Goods Authorization (RGA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Force Control will pay the shipping costs of returning the owner parts that are covered by warranty.

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Section 1
DESCRIPTION and OPERATION

1-1 UNIT DESCRIPTION

The MSB2 MagnaShear **Fully Electric Motor Brake** with Oil Shear dependability is available with 4-1/2" FAK NEMA standard mounting flange. IEC Frames are also available. Spring set torque ratings range are 6 Lb. Ft. to 12 Lb. Ft.

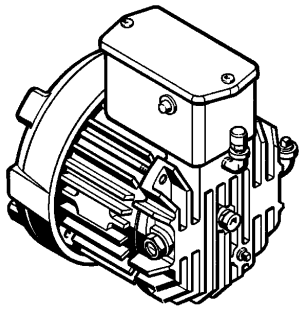
A spring set brake stack is released when 120 VAC power is supplied to the Brake Coil. Control logic is made simple by use of the motor starter auxiliary contactors. Back EMF effect from the motor windings is eliminated.

The units are ideal for a wide variety of applications including indexing tables, lifts, transfer conveyors, tap heads and other start/stop devices. Applications requiring the brake to be released on an average of more than 50% of the time or for long durations must be reviewed and approved by our engineering department.

1-2 The OIL SHEAR PRINCIPLE

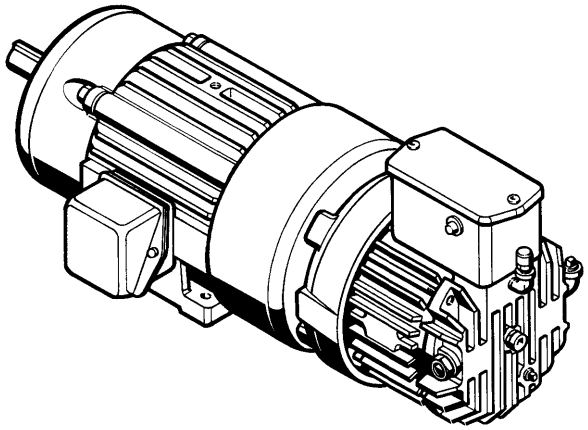
Conventional clutches and brakes depend on the friction between solid surfaces operating in air to transmit torque. Friction does the job but produces a great amount of heat and wear. The ***MSB2 MagnaShear*** **Motor Brake** is an *Oil Shear* Brake, with the friction surfaces operating in a constantly replenished film of oil. The oil molecules tend to cling to each other and to the friction surfaces. As moving and stationary elements are brought together, a thin but positive film of oil is maintained between them which is controlled by the clamping pressure and carefully designed grooves in the friction discs. Torque is transmitted from one element to the other through the viscous shear of the oil film. As long as there is relative motion between the elements, they are protected by the oil, thus greatly reducing wear. The replenished oil film also effectively transmits heat away from the friction elements.

MagnaShear **MSB2 Motor Brake**



4-1/2"Dia. AK Mounting Flange

MagnaShear **MSB2 Motor Brake furnished as an Assembled Brake Motor**



1/4 Horse Power, 56 Motor Frame up to 1 Horse Power, 145T or 184U Motor Frame Sizes

Figure 1.1 - MSB2 MagnaShear Motor Brakes

1-3 OPERATION

The cross section in *Figure 1.2* shows the ***MSB2 MagnaShear* Motor Brake** in the Stopped position with the brake stack engaged. The ***MSB2 MagnaShear* Motor Brake** will default to this position when all power is lost.

To run the Drive Motor the Brake Coil is energized, pulling the Armature Plate Assembly away from the Brake Stack which allows the splined hub and drive motor to rotate independently from the motor brake.

To stop the Drive Motor the Brake Coil is de-energized. This allows the brake springs to push the Armature Plate Assembly against the Brake Stack, clamping it and stopping the splined hub and drive motor.

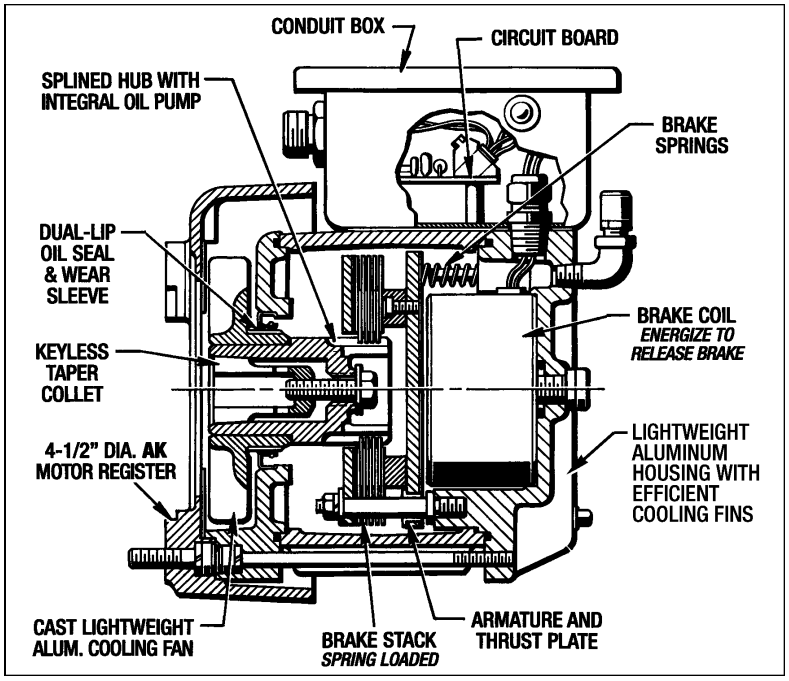


Figure 1.2 - MagnaShear MSB2 Motor Brake Cross Section

Section 2
SPECIFICATIONS

2-1 MSB2 *MagnaShear* Motor Brake Specifications

BRAKE SIZE	AVAILABLE		No. OF SPRINGS	STATIC TORQUE	DYNAMIC TORQUE	MAX. KE per ENGMT.	INERTIA	OIL CAP.	INPUT VOLTAGE	INRUSH CURRENT .4 Sec.	HOLDING CURRENT	MAX. DUTY CYCLE	COIL RESISTANCE @ 20° C
	PILOT DIA. *(Inches)*	COLLET BORE *(Inches)*		*(Lb. Ft.)*	*(Lb. Ft.)*	*(Ft. Lbs.)*	*(Lb. Ft.^{2})*	*(Ounces)*	*(VAC)*	*(Amps)*	*(Amps)*		*(Ohms)*
MSB2	4.50	.625 ..... .875	3	6	5	7,975	0.013	36	115 230	2.5 ..... 1.3	.3 2	100%	47 188
			4	8	7								
			6	12	11								

NOTES: Above ratings are based on 96° C maximum oil temperature and 1800 RPM motor.

% - Duty is percentage of time brake is released. *(Coil is Energized.)*

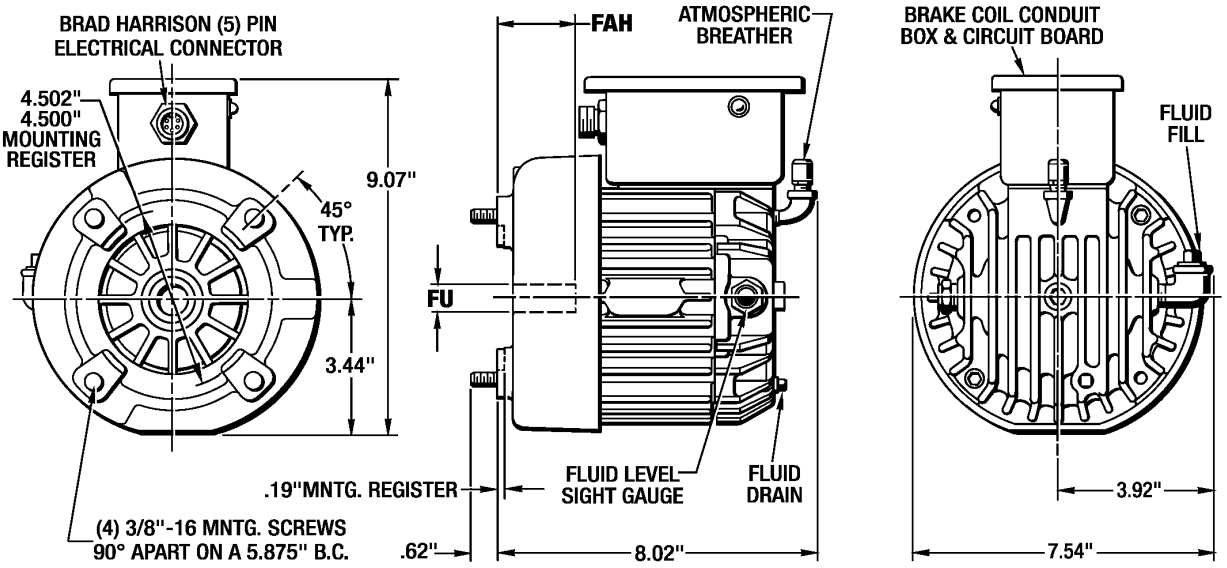
2-2 Thermal Horsepower Rating

% DUTY	CYCLE RATE *(Cpm)*	AMBIENT TEMPERATURE	
		25° C	40° C
25%	2	.45	.17
	5	.45	.17
	10	.44	.16
50%	2	.37	.16
	5	.36	.15
	10	.35	.14
75%	2	.28	.13
	5	.27	.13
	10	.26	.12

2-3 MSB2 *MagnaShear* ABM Specifications (Assembled Brake Motor)

Motor HP	Motor RPM	Frame Size			Brake Size	Available Torques *(Lb. Ft.)*
		T	U	IEC		
1/4	1800	56	56	------	MSB2	6, 8 and 12
1/4	1700	------	------	DT71K4	MSB2	6, 8 and 12
1/4	1200	56	56	------	MSB2	6, 8 and 12
1/3	1800	56	56	------	MSB2	6, 8 and 12
1/3	1700	------	------	DT71C4	MSB2	6, 8 and 12
1/3	1200	56	56	------	MSB2	6, 8 and 12
1/2	1800	56	56	------	MSB2	6, 8 and 12
1/2	1700	------	------	DT71D4	MSB2	6, 8 and 12
1/2	1200	56	56	------	MSB2	6, 8 and 12
3/4	1800	56	56	------	MSB2	6, 8 and 12
3/4	1700	------	------	DT80K4	MSB2	6, 8 and 12
3/4	1200	56	56	------	MSB2	6, 8 and 12
1	1800	------	184U	------	MSB2	6, 8 and 12
1	1800	143T	184U	------	MSB2	6, 8 and 12
1	1700	------	------	DT80N4	MSB2	6, 8 and 12
1	1200	------	184U	------	MSB2	6, 8 and 12
1	1200	143T	184U	------	MSB2	6, 8 and 12
1	1200	145T	184U	------	MSB2	6, 8 and 12
1-1/2	1800	------	184U	------	MSB2	6, 8 and 12
1-1/2	1800	145T	184U	------	MSB2	6, 8 and 12
1-1/2	1700	------	------	DT90S4	MSB2	6, 8 and 12
1-1/2	1200	182T	------	------	MSB2	6, 8 and 12
1-1/2	1200	------	184U	------	MSB2	6, 8 and 12
2	1800	------	184U	------	MSB2	6, 8 and 12
2	1800	145T	184U	------	MSB2	6, 8 and 12
2	1720	------	------	DT90L4	MSB2	6, 8 and 12

2-4 MSB2 *MagnaShear* Motor Brake Dimensions



Std. Motor Shaft Tolerances:
.625" Dia & .875"Dia.
(+.0000" -.0005")

Std. Motor Register Tolerances:
4.500"Dia.
(+.000" -.003")

FA	FAH	
	Min.	Max.
.625"	1.30"	2.00"
.875"	1.37"	2.42"

Section 3
INSTALLATION

IMPORTANT SAFETY PRECAUTIONS

The *MagnaShear* Motor Brake units described in this manual must not be installed in any manner except as specified and must not be operated at speeds, horsepower loads or temperatures other than those specified in this manual.

Failure to limit the operation of the drive to the conditions specified could damage the unit or damage interconnected equipment and void the Warranty.

WARNING

BEFORE INSTALLATION OR ATTEMPTING ANY REPAIRS TO THE MOTOR BRAKE,OPEN THE DISCONNECTS TO THE DRIVE MOTOR. LOCK IT OUT TO AVOID THE POSSIBILITY OF PERSONAL INJURY.

3-1 RECEIVING THE *MagnaShear* MOTOR BRAKE

Check the brake for shortage or damage immediately after arrival. Prompt reporting to the carrier's agent, with notations made on the freight bill, will expedite satisfactory adjustment by the carrier.

A. Assembled Electric Brake Motor (EBM)

If your ***MagnaShear* Motor Brake** is shipped preassembled to a drive motor, it is filled with oil and ready to run except for installing the Air Breather (#45) and electrical wiring. *(See Figure 3.2 and 3.3 for Electrical Wiring Diagram.)*

NOTE:

Before shipment, the Air Breather (#45) is removed and a pipe plug put in its place. This is done to prevent oil spillage during shipment. In most cases this will be a red plastic plug. This plug must be removed and the Breather (#45) installed to prevent damage to the brake. The breather is taped to the motor shaft for shipment. Always check the oil level though, to see if the oil level is in the center of the Sight Gauge (#46). **(See Section 4 - LUBRICATION.)**

B. MagnaShear Motor Brake

The standard ***MSB2 MagnaShear* Motor Brake** has been partially assembled at the factory for ease of shipment and installation. The motor brake is completely assembled except for the Fan Shroud (#7), Fan and Hub Sub-Assembly (#900), Collet (#110) and the Motor Mounting Screws (#149) and Studs (#155).

During Installation refer to Section 8 - Repair Parts for a visual reference to all parts.

Figure 8.1 - Fan Shroud, Fan, Hub and Collet.

Figure 8.2 - MSB2 MagnaShear Brake Assembly

Figure 8.3 - Electric Box and Circuit Board.

Figure 8.4 - Vertical Installation.

3-2 VERIFYING MOTOR SPECIFICATIONS

The **Motor Manufacturer's Specifications** must be verified first to ensure the Motor Brake Oil Seal Reliability. (1) **Motor Shaft Runout**, (2) **Mounting Face Runout** and (3) **Motor Shaft to Pilot Diameter Eccentricity** need to be checked with a Dial Indicator as shown in *Figure 3.1*.

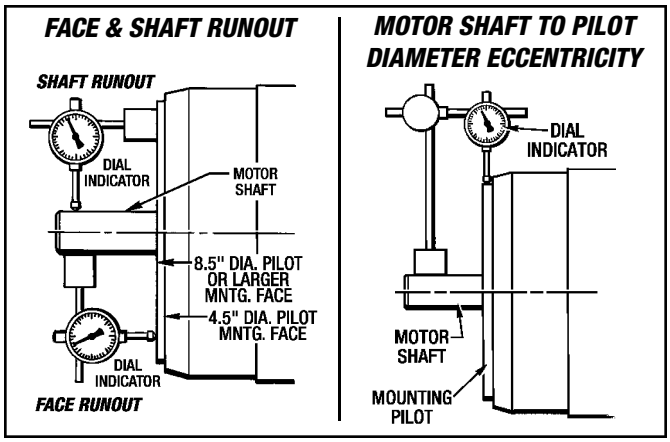


Figure 3.1 - Verifying Motor Specifications

MAXIMUM ALLOWABLE T.I.R. (Inches)
(As Per NEMA MG 1 Standard)

Pilot Dia. Dimensions	Tolerance On Pilot Dia.		Maximum Allowable Shaft Runout	Maximum Allowable Face Runout	Maximum Allowable Eccentricity
	Plus	Minus			
Less than 12"	.000	.003	.002	.004	.004
12"& Larger	.000	.005	.003	.007	.007

CAUTION - T.I.R. in excess of this maximum will result in a potential leak condition.

3-3 CHECKING BRAKE STACK ALIGNMENT

It will first be necessary to check the brake stack to make sure that the friction disc splines are all aligned with each other.

Use the following procedure:

1. Place the brake on the work bench in a vertical position with the Input Housing (#15) pointing upwards.
2. With a flashlight visually check the brake stack to see if the spline teeth are all aligned with each other.

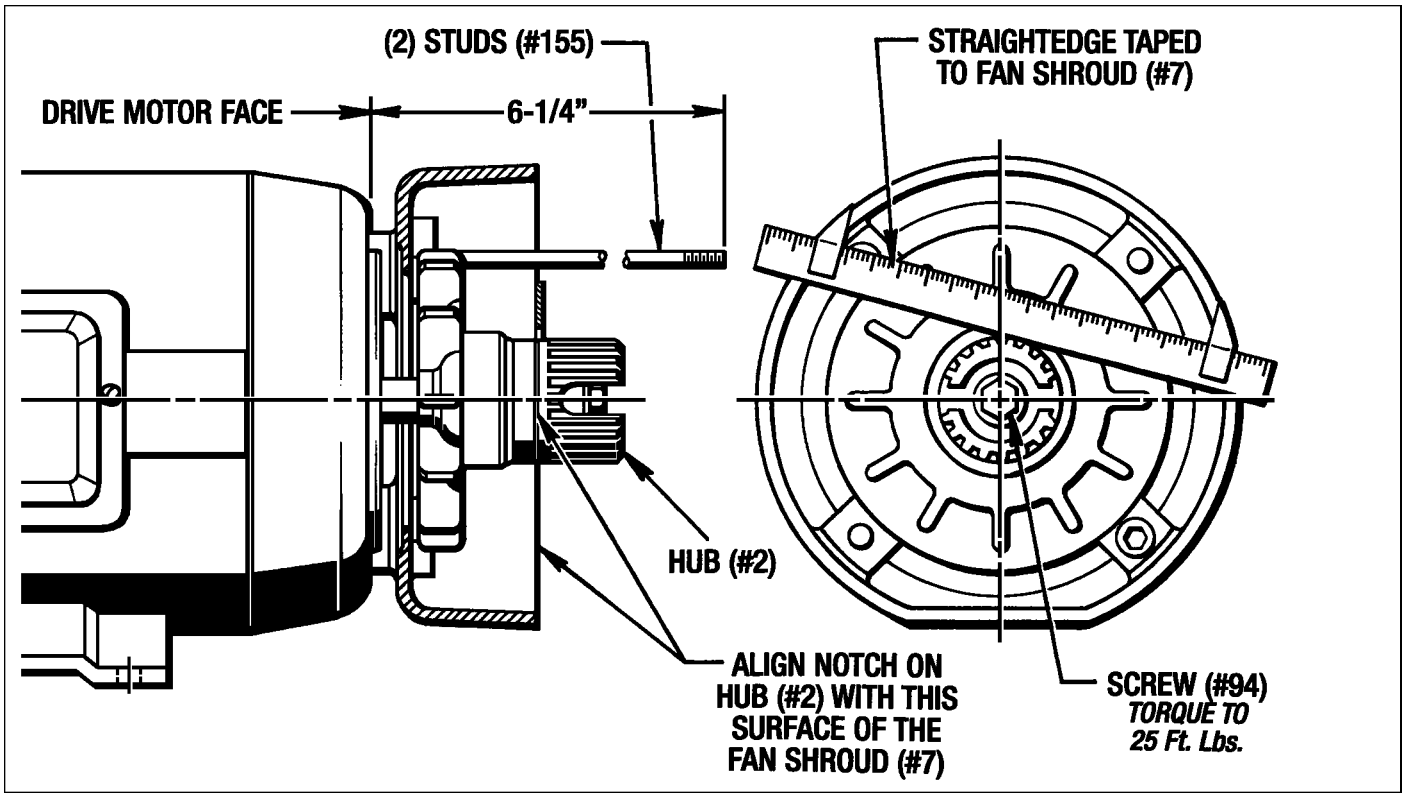


Figure 3.2 - Hub Alignment

If they are not aligned with each other, then 120 VAC will have to be applied to the brake coil to release the brake stack.

3. Remove the cover from the Electric Box (#405) and with a similar Test Set-up which is shown in *Figure 5.1*, apply 120 VAC to the Terminal Strip J1 on the Circuit Board (#400). This will release the brake stack.
4. Lubricate the lip of the Oil Seal (#31) located in the Input Housing (#15) with a little vaseline or white grease.
5. With a screw driver or appropriate tool align the teeth as best as you can with each other.
6. Carefully insert the splined end of the Hub and Fan Sub-Assembly (#900) into the brake stack spline as far as it will go. This will align the teeth perfectly.

   CAUTION - Be very careful not to damage the lip of the Oil Seal (#31) when inserting the hub.
7. Turn the 120 VAC off and then pull the Hub and Fan (#900) back out of the brake very carefully. Replace the cover on the electric box.

3-4 MOUNTING THE BRAKE TO THE MOTOR

(See Figures 3.2 and 8.1)

First check the motor shaft, pilot diameter and mounting face for any nicks, scratches or burrs. Clean-up and de-burr if necessary.

1. Apply a little ***Blue Loctite #242*** to the (2) Studs (#155) and screw them into the drive motor leaving 6-1/4" exposed from the motor face. The (2) holes are indicated with a grey tone in *Figure 3.2* above. Let the Loctite set for approx. 5 minutes before proceeding any further.
2. Slide the Fan Shroud (#7) over the (2) extended Studs (#155) and attach to the motor face with (2) Lockwashers (#127) and (2) Screws (#149). **Torque to 25 Ft. Lbs.**
3. Remove the Screw (#94) and Washer (#81) from the Hub (#2). Coat the threads with ***Blue Loctite #242*** or equivalent and re-install them back into the hub. Do not tighten the screw at this time. The Collet (#110) must be loose in the hub bore.
4. Slide the Hub and Fan Sub-Assembly (#900) with the Collet (#110) in place over the motor shaft.

   IMPORTANT - Do not lubricate the motor shaft or collet bore.
5. Tape a steel straightedge to the face of the Fan Shroud (#7) as shown in *Figure 3.2* above.
6. Tap the Hub and Fan Sub-Assembly (#900) lightly to position it on the motor shaft. The Hub (#2) has a notch machined in it for positioning. Align this notch

with the back edge of the straightedge as shown in *Figure 3.2*. This alignment should be ± 1/64".

NOTE - The hub and collet will move approx. 1/32" further onto the shaft when the Screw (#94) is tightened. **Take this into account when positioning the hub on the shaft.**

7. Tighten Screw (#94) after the hub and collet have been properly positioned. **Torque to 25 Ft. Lbs.**
8. Re-check alignment. If it is within the ±1/64" tolerance, remove the straightedge. If it isn't, loosen and remove the Screw (#94). Re-apply the ***Blue Loctite #242*** to the screw threads and repeat Steps 3 thru 8.
9. Lubricate the Wear Sleeve (#32), located on the Fan (#120), with a little vaseline or white grease.

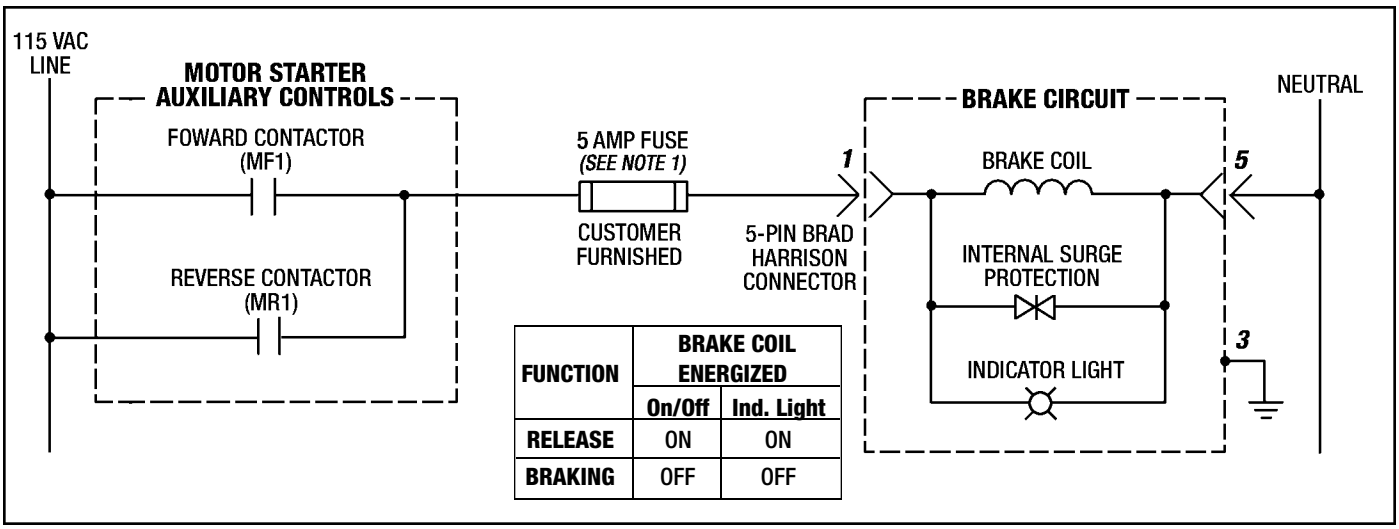
   Also re-coat the lip of the Oil Seal (#31) with a little vaseline or white grease.
10. Slide the Brake Sub-Assembly over the (2) extended Studs (#155) as far as it will go. **Be very careful not to damage the Oil Seal (#31).**

    NOTE: You will probably have to rotate the motor shaft by hand to align the spline on the Hub (#2) with the spline teeth on the brake stack.

    IMPORTANT - Be sure that all of the Friction Disc splines are engaged on the Hub spline before installing the Allen Nuts (#136). Also look inside the Fan Shroud to be sure that the Brake is fully seated in the Fan Shroud.
11. Attach with (2) Lockwashers (#127) and (2) Allen Nuts (#136). **Torque to 25 Ft. Lbs.**
12. Install the Air Breather (#45) and fill with oil as described in **Section 4 - Lubrication.**

3-5 WIRING SPECIFICATIONS

(See Figures 3.3 and 3.4)



FUNCTION	BRAKE COIL ENERGIZED	
	On/Off	Ind. Light
RELEASE	ON	ON
BRAKING	OFF	OFF

Figure 3.3 - Electrical Schematic

NOTE 1:
1. Circuit Breaker Requirements - 120VAC, Type #10 AC, High Inrush Current (Motor Starter), 5 amp.

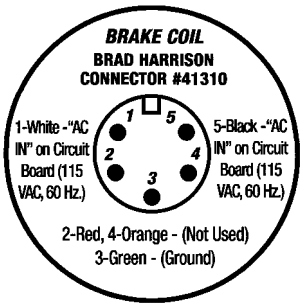


Figure 3.4 - Electrical Connector

3-6 START-UP

Verify that the Brake Coil is connected correctly. Check to see if the Drive Motor is wired correctly, fuses are in place and the motor disconnect is turned on. Set-up preliminary settings on positioning switches to insure the brake will stop.

"Bump" the Drive Motor to check for correct rotation. If the rotation is incorrect change two of the phase wires and recheck rotation. Verify that the Brake Coil Indicator Light on the Conduit Box is **ON** while the drive motor is running.

Next, complete a cycle to insure that there are no interference problems within the system.

Set-up Position Switches as required

Section 4
LUBRICATION

4-1 CHECKING THE OIL LEVEL

When the brake is installed and weekly thereafter, or until experience dictates otherwise, check the oil level. Always check the oil level with the brake at room temperature and while it is not running.

The ***MSB2 MagnaShear*** **Motor Brake** has an Oil Sight Gauge (#46) to visually check the fluid level. *See Figure 4.1 below for the location of this sight gauge.*

It is located on the side of the End Housing (#9) for horizontal brakes and on the side of the Main Housing (#8) for vertical brakes.

The oil level is to be at the center of this Sight Gauge (#46) for all models **with the drive motor turned off.**

4-2 OPERATING TEMPERATURES

A. Ambient Temperature

The standard oil used in the ***MSB2 MagnaShear*** **Motor Brake** was designed to operate in ambient temperatures up to 125° F. If the ambient temperature will fall outside of this range please contact Force Control Industries, Inc. for specific recommendations on proper lubricant and oil seals.

B. Oil Sump Temperature

The maximum recommended oil sump temperature is 200° F.

4-3 CHANGING THE OIL *(See Figure 4.1 below)*

IMPORTANT

Always open the disconnects to the drive motor and lock them out before changing the oil.

Every three months completely drain the oil from the brake by removing the Drain Plug (#64) or the Pipe Cap (#67). The Sight Gauge (#46) and Air Breather (#45) should also be removed and cleaned at this time.

The oil should be changed more frequently when used in harsh environments or high cyclic applications.

A. Horizontal and Vertical-Brake Down

1. Remove Pipe Plug (#64) and drain out all of the oil into a suitable container. Save or discard as condition warrants. Replace the drain pipe plug when finished.
2. Remove the Pipe Plug (#62) and fill with fresh oil to the center of the Sight Gauge (#46). Replace the fill pipe plug when finished.

B. Vertical-Brake Up

1. Remove Pipe Cap (#67) and drain out all of the oil into a suitable container. Save or discard as condition warrants. Replace the pipe cap when finished.
2. Remove the Pipe Plug (#62) and fill with fresh oil to the center of the Sight Gauge (#46). Replace the fill pipe plug when finished.

CAUTION

Do not overfill the brake unit. Excess oil will cause the brake to over heat.

4-4 TYPE OF OIL

Use only Mobil Automatic Transmission Fluid ATF-210 (Type “F”) or Mobil Multi-Purpose Automatic Transmission Fluid for most drives.

Other fluids may be specified for special applications.

Always use the type of oil specified on the Name Plate.

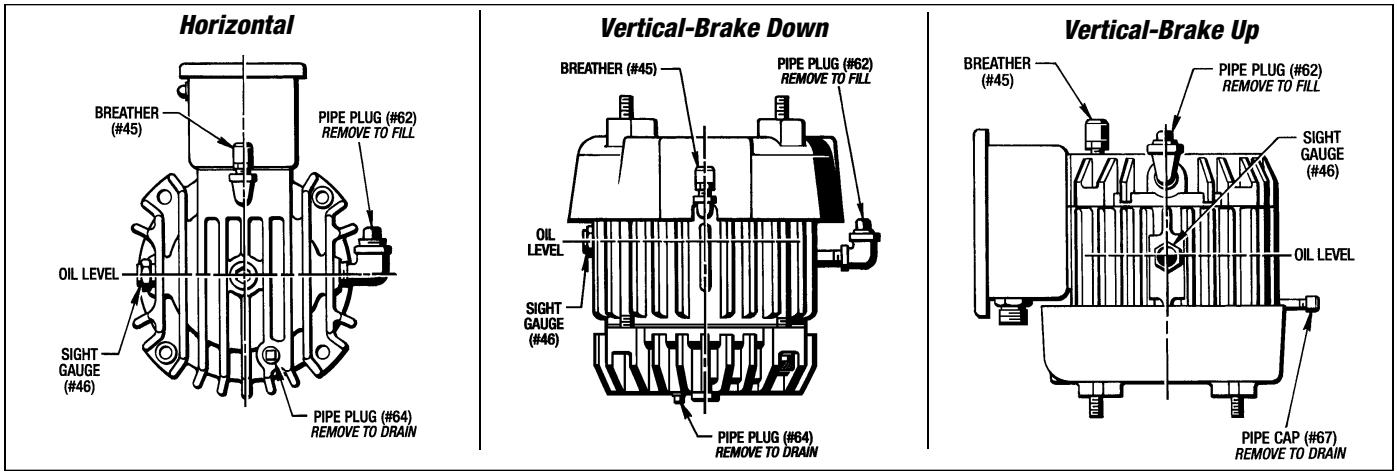


Figure 4.1 - Lubrication

Section 5
OPERATIONAL CHECKS

Make these Operational Checks with the ***MagnaShear*** **Motor Brake** shut down and completely assembled with the drive motor attached.

Provisions for manual operation checks must be made if the drive unit has been removed for service and repair. 120 VAC, 60 Hz. electrical service is required to energize the coils. *(See Figure 5.1 below for the Test Set-Up)*

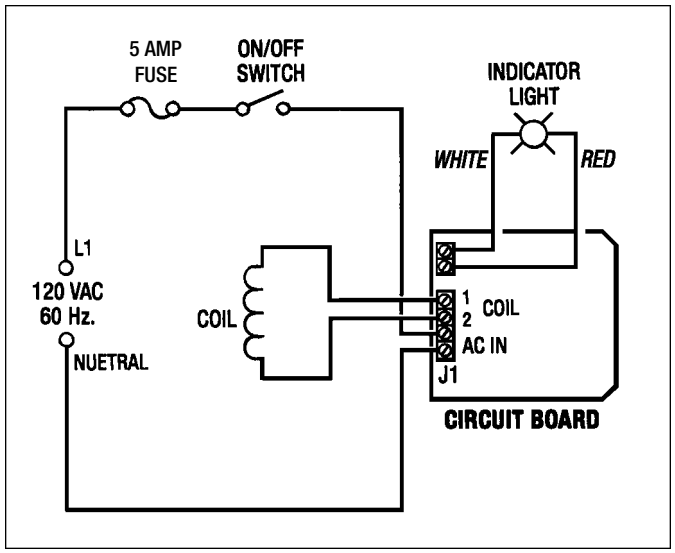


Figure 5.1 - Test Set-Up Electrical Schematic

5-1 CHECKING THE BRAKE OPERATION

To check the Brake Operation electrical power is not required to energize the coil since the ***MagnaShear*** **Motor Brake** has a normally spring loaded brake when the coil is de-energized.

Disconnect the load to the motor. Install a torque wrench on the motor shaft and apply torque. The brake should slip at approximately the static torque of the brake. *(Refer to page 3 for torque ratings.)*

5-2 CHECKING THE BRAKE COIL OPERATION

1. Remove the cover from the Conduit Box (#405).
2. Disconnect the black and white power leads from the Brad-Harrison Cable Connector (# 416) to “AC In” on Terminal Strip J1.located on the Circuit Board (#400).
3. Connect the test power leads to “AC In” on J1. Turn the On/Off Switch to ON. The Power Indicator Light should come on.
4. Manually turn the Drive Motor Output Shaft. If the shaft turns then the Brake Coil and Control Circuit is operating properly.

   If it is not able to be turned, then the Brake Coil or Circuit Board is not functioning properly. (See Section 6 - Trouble Shooting.)

CAUTION

Physical damage or mal-function in the motor or brake stack can also prohibit shaft rotation.

Section 6
TROUBLESHOOTING

6-1 TROUBLESHOOTING CHART

PROBLEM	POSSIBLE CAUSE	REMEDY
1. Brake fails to engage properly.	Electrical control circuit.	Check control circuit.
	Faulty *MagnaShear* circuit board.	Replace circuit board.
	Worn friction surfaces.	Check disc stack for wear and replace if necessary.
2. Brake fails to release properly.	Electrical control circuit.	Check control circuit.
	Faulty *MagnaShear* circuit board.	Replace circuit board.
	Faulty coil.	Replace coil.
	Low voltage at coil.	Check wire size and voltage.
3. Brake torque too high.	Excessive spring force.	Contact Force Control.
	Low oil level.	Check oil level and add oil.
4. Brake torque too low	Inadequate spring force.	Contact Force Control.
5. Noise and vibration	Motor mounted on poor foundation.	Improve installation. Tighten mounting bolts
6. Drive overheats (200° F max.)	Brake fails to engage or disengage properly.	See #1 and #2 above.
	Improper oil level.	Check oil level. Add/Drain as req'd.
7. Oil leakage.	Bad oil seal	Disassemble and replace.
	Gaskets.	Tighten all external screws.
	Poor ventilation.	Remove breather and clean.
8. Brake does not repeat.	Electrical control circuit.	Check control circuit.
	Faulty *MagnaShear* circuit board.	Replace circuit board.
	* Oil temperature change.	Check temperature.
	Machine resistance changed.	Lubricate bearings.

* For installations requiring precise starting and stopping, operating temperatures are important. Operating temperatures between 115° F and 165° F are recommended.

6-2 TROUBLESHOOTING COILS

A. Coil Resistance Test

Remove the cover from the Junction Box (#405) and disconnect the (2) Coil Leads from both terminals on the Terminal Strip J1 located on the Circuit Board (#400).

Hook-Up a Meg-Ohmmeter to both coil leads as shown in *Figure 6.1*. Set the Meg-Ohmmeter to "Ohm" range and test Resistance at 500 VDC.

The Resistance should read as follows:

MSB2 Coil Resistance.....47 Ohms ± 10%

A reading outside of this range would indicate that the Coil is bad and needs to be replaced. See Section 7 for Coil Replacement.

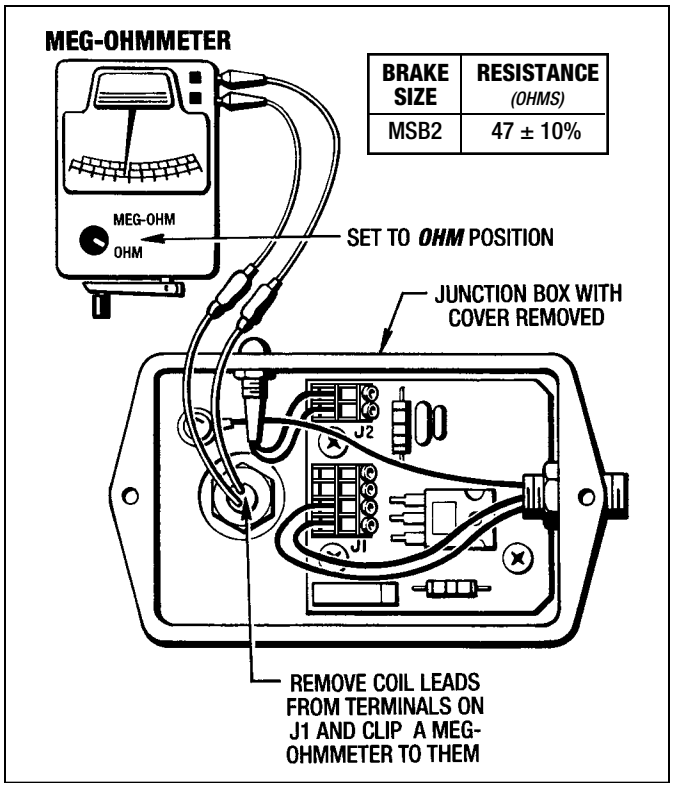


Figure 6.1 - Coil Resistance Testing

NOTE:
A Hi-Pot Tester can be used for this test but do not exceed 1250 VDC.

B. Coil Current Leakage Test

Remove the cover from the Junction Box (#405) and disconnect the (2) Coil Leads from both terminals on the Terminal Strip J1 located on the Circuit Board (#400).

Connect (1) alligator clip to both Coil Leads and the other one to Chassis Ground Screw (#426). *(See Figure 6.2)*

A reading of **10 Meg-Ohms or greater** indicates that the Coil is fine and does not need to be replaced. Anything much less would indicate that there is a short to ground and the Coil would need to be replaced. See Section 7 for Coil Replacement.

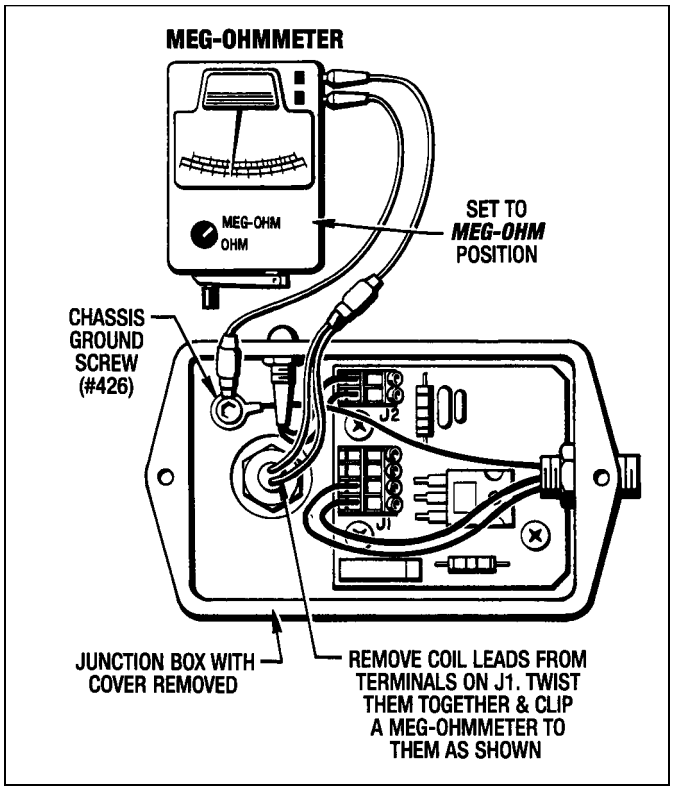


Figure 6.2- Coil Current Leakage Testing

NOTE:
A Hi-Pot Tester can be used for this test but do not exceed 1250 VDC.

Section 7
REPAIR and REPLACEMENT

WARNING
SHUT-OFF AND LOCK-OUT ALL ELECTRICAL POWER BEFORE ATTEMPTING TO MAKE ANY REPAIRS TO THE BRAKE UNIT.

7-1 GENERAL INFORMATION

Unless the Motor Brake is to be completely overhauled, it should be disassembled only to the extent necessary to gain access to the worn or damaged parts.

During disassembly and reassembly procedure refer to the exploded view drawings in Section 8 for a visual reference to all parts. They are as follows:

1. *Figure 8.1* - Fan Shroud, Fan, Collet and Hub
2. *Figure 8.2* - MSB2 *MagnaShear* Motor Brake
3. *Figure 8.3* - Electric Box and Circuit Board
4. *Figure 8.4* - Vertical Installation

7-2 CLEANING AND INSPECTION

Clean metal parts in a suitable solvent and dry with low pressure compressed air. The Drive Plates (#12) can be cleaned in a solvent but ***DO NOT*** clean the Friction Discs (#13) in solvent. Use only a clean, dry and lint-free rag to clean them. (Solvent will damage the friction material used on them.) Always keep the Friction Discs (#13) and Drive Plates (#12) in the same order as they were removed.

After cleaning inspect parts for cracks, distortion, scoring, nicks, burrs or any other damage that would affect the operation of the brake.

Pay particular attention to the Wear Sleeve (#32) located on the Fan and Hub (#900) and the Oil Seal (#31) located in the Input Housing (#15). Check for nicks, scratches or any damage that would cause leakage.

7-3 REPAIR OR REPLACEMENT

A fine stone or crocus cloth may be used to remove minor surface defects from parts if the operation or sealing action of the part is not affected. The use of coarser abrasives or other machining methods should not be attempted and damaged parts should be replaced.

Replacement is recommended for the following parts when needed:

1. Replace all Gaskets, O-Rings, Oil Seals and Wear Sleeves removed at disassembly.

   NOTE - The Wear Sleeve (#32) located on the Fan and Hub (#900) cannot be replaced as an individual part. If it is damaged and needs replaced, the whole Fan and Hub (#900) will have to be replaced.

2. Replace Brake Stack as a complete Assembly.
3. The Circuit Board (#400) and Holding Coil (#284) are also common replacement parts.

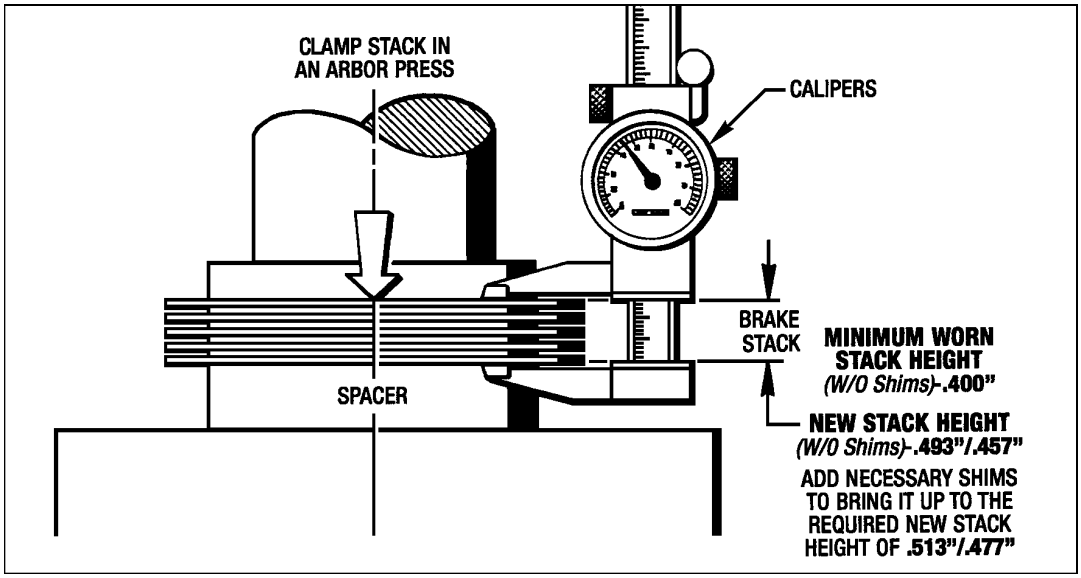


Figure 7.1 - Measuring Stack Height

7-4 MEASURING STACK HEIGHT

The Stack Height must be measured to determine whether or not the Brake Stack needs to be replaced. If it measures under the Minimum Worn Stack Height then the Brake Stack needs to be replaced. Also, if you are installing a new brake stack, it needs to be measured to determine the amount of shims required *(See Figure 7.1)*

7-5 REPLACING BRAKE STACK

(See Figures 7.2, 8.2 and 8.3)

A. Disassembly

1. First drain all the oil from the unit into a suitable container. **See Section - 4 LUBRICATION** for location of drain plugs. Save or discard as condition warrants.
2. Also disconnect the 5-Pin Brad Harrison Cable from the Electric Box (#405).
3. Remove the (2) Allen Nuts (#136) and (2) Lockwashers (#127) from the End Housing (#9) and pull the Brake Assembly straight back out of the Fan Housing (#7).

   CAUTION - Be very careful not to damage the lip of the Oil Seal (#31) when removing the Brake Assembly.
4. Remove the (2) Screws (#72) and (2) Lockwashers (#129) from the Input Housing (#15) and lift it and the Main Housing (#8) off the End Housing (#9). *(See Figure 7.2)*
5. Remove the (2) O-Rings (#104) and discard them.
6. Take the (3) Hex Nuts (#165), (3) Lockwashers (#128) and (3) Flat Washers (#193) off the (3) Driver Pins (#195) in an **even manner to release the spring pressure safely.**
7. Lift the Thrust Plate (#5) off the Brake Stack.
8. The Brake Stack can now be removed from the (3) Driver Pins (#195). *(See Figure 7.2)*
9. Take the (12) Separator Springs (#17) out of the Brake Stack. If there are any shims in the stack, leave them there to measure the **Stack Height**.
10. Place the Brake Stack in an arbor press and measure the **Stack Height** to determine whether or not the Brake Stack needs to be replaced. *(See Figure 7.1)*

If the Brake Stack needs replaced then use the fol - lowing procedure:

11. Measure the new stack with the same procedure as shown in *Figure 7.1* to determine the amount of shims required. The normal shim requirement is .020".

B. Reassembly

1. Install a Drive Plate (#12) then (3) Separator Springs (#17) over the (3) Driver Pins (#195).
2. Next place a Friction Disc (#13) on the installed Drive Plate (#12).
3. Continue with this process until (5) Drive Plates (#12), (4) Friction Discs (#13) and (12) Separator Springs (#17) are installed. You will end up with a Drive Plate (#12) on top.
4. Place any shims that are required for the correct stack height on last.

It will now be necessary to energize the brake coil to get the (3) Hex Nuts (#165), (3) Lockwashers (#128) and (3) Flat Washers (#193) on the (3) Driver Pins (#195).

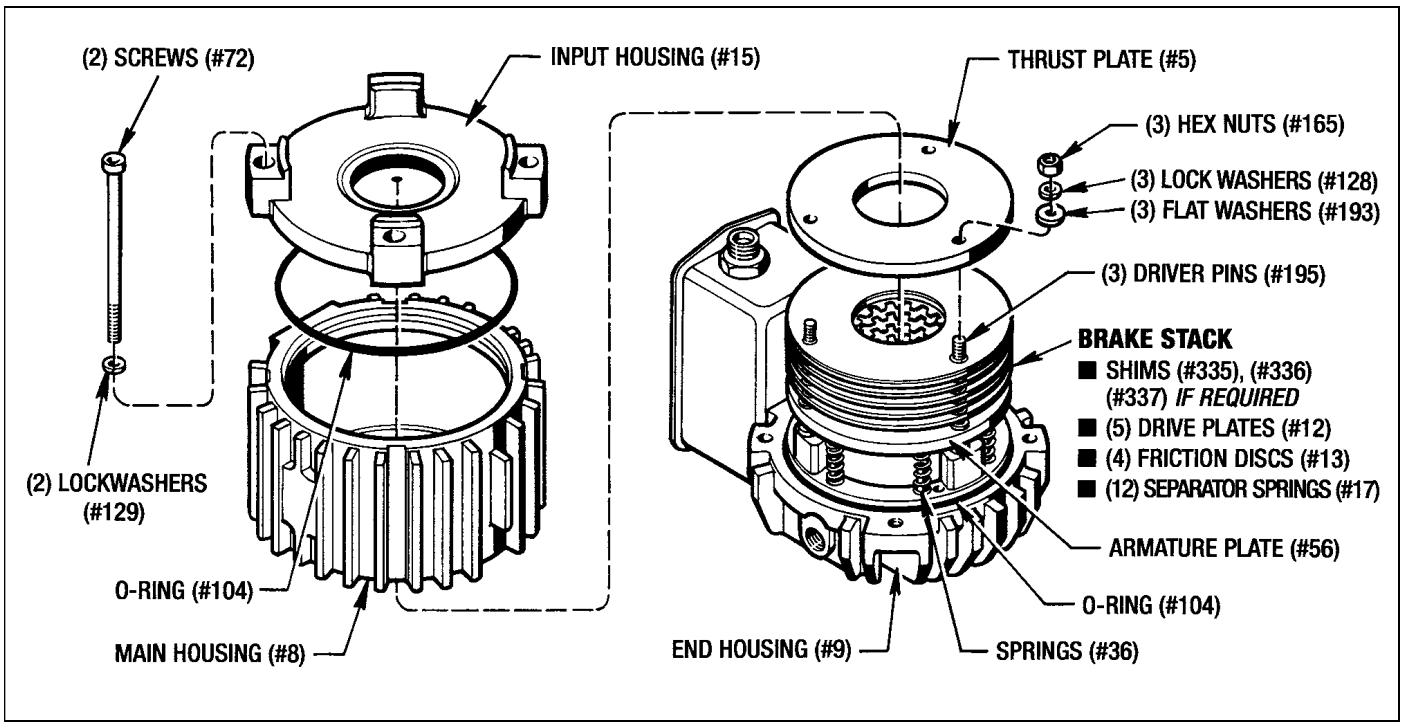


Figure 7.2 - Replacing the Brake Stack

5. Remove the cover from the Electric Box (#405) an with a similar Test Set-Up, as shown in Figure 5.1, apply 120 VAC to the (2) **"AC In"** terminals on the Terminal Strip J1. This will allow the brake stack to drop down.
6. Place the Thrust Plate (#5) on the Brake Stack.
7. Install the (3) Flat Washers (#193), (3) Lockwashers (#128) and (3) Hex Nuts (#165) back on the Driver Pins (#195). **Torque to 7 Ft. Lbs.**

   IMPORTANT - Make sure that the spline teeth in the Friction Discs (#13) are all aligned with each other and the Friction Discs (#13) are also centered in the stack.
8. Disconnect the 120 VAC from the brake coil and replace the cover on the Electrical Box. (#405).
9. Lubricate a new O-Ring (#104) with Vaseline, or equivalent, and install it on the End Housing (#9).
10. Set the Main Housing (#8) in place.
11. Lubricate the other new O-Ring (#104) with Vaseline, or equivalent, and install it into the o-ring groove of the Input Housing (#15).
12. Set the Input Housing (#15) in place on the Main Housing (#8).
13. Attach with (2) Screws (#72) and (2) Lockwashers (#129). **Torque to 14 Ft. Lbs.**

If the Brake Stack is the only repair to be made, then re-attach the Brake Assembly to the Fan Shroud (#7) and the motor face.

14. First lubricate the lip of the Oil Seal (#31) with Vaseline, or equivalent. Carefully slide the Brake Assembly over the (2) extended Studs (#155). **Be very careful not to damage the oil seal lip.**

    NOTE - You will probably have to rotate the motor shaft by hand to align the spline on the Hub (#2) with the spline teeth in the brake stack.
15. Attach with (2) Lockwashers (#127) and (2) Allen Nuts (#136). **Torque to 25 Ft. Lbs.**
16. Replace the drain plugs and/or any other fittings removed and fill with fresh oil as specified in **Section 4 - LUBRICATION.**

7-6 REPLACING CIRCUIT BOARD (#400)

(See Figure 7.3)

1. Take the cover off the Electric Box (#405).
2. Disconnect all the wires from the (2) Terminal Strips J1 and J2 on the Circuit Board (#400).
3. Remove the (3) Screws (#428) and (3) Nylon Washers (#431).
4. Take the old Circuit Board (#400) off and replace it with a new one.
5. Re-attach with (3) Screws (#428) and (3) Nylon Washers (#431). Re-connect the wires to J1 and J2 Terminal Strips.
6. Replace the electric box cover.

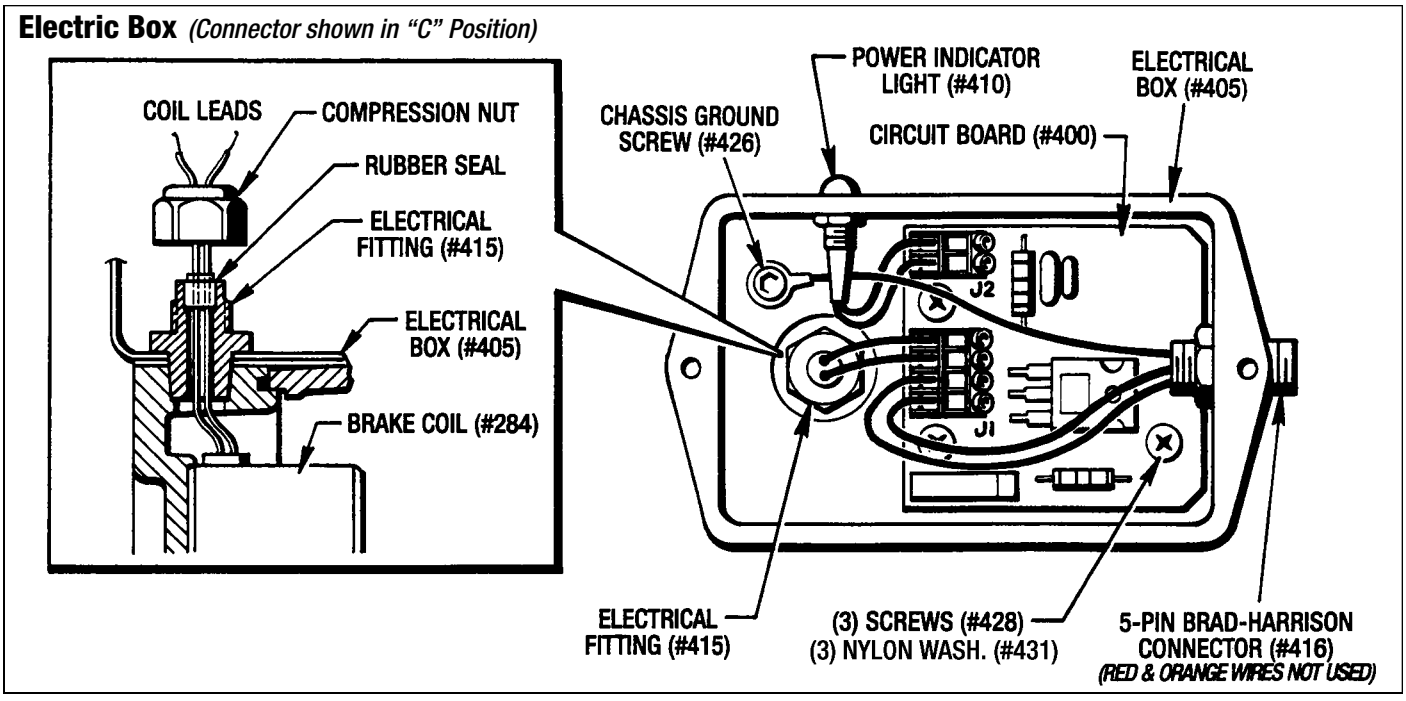


Figure 7.3 - Electric Box with Cover Removed

7-7 REPLACING HOLDING COIL (#284)

(See Figures 7.3, 8.2 and 8.3)

A. Disassembly

See **7-5 REPLACING THE BRAKE STACK** and repeat **Steps 1 thru 8** to remove the brake from the motor and to disassemble the brake down to the brake stack.

9. Pull the Armature Plate (#56) and Armature Ring (#58) up off the (3) Driver Pins (#195).

   NOTE - If for some reason you want to replace the (3) Bushings (#116) in your existing Armature Plate (#56), see **7-8 - REPLACING ARMATURE PLATE BUSHINGS.**

10. Remove the (6) or (8) Springs (#36) from the brake.

    NOTE - A free-hand sketch of the spring locations may help you at reassembly.

11. Dis-connect the coil leads from J1 terminal strip located on the Circuit Board (#400). Also remove the compression nut from the Electrical Fitting (#415) and pry the rubber seal out of the fitting and off of the coil leads. *(See Figure 7.3.)*

12. Remove Screw (#153) and Lockwasher (#275).

13. Lift the Holding Coil (#284) out of the end housing.

14. Remove and discard O-Ring (#103).

B. Reassembly

1. Lubricate a new O-Ring (#103) with vaseline, or equivalent and install it into the End Housing (#9) counterbore.
2. Place a new Holding Coil (#284) into the End Housing (#9), pushing the coil leads up through the Electrical Fitting (#415).
3. Attach the Coil (#284) with (1) Lockwasher (#275) and (1) Screw (#153).Make sur that the coil wires are at the top of the brake. **Torque to 60 Ft. Lbs.**
4. Place the rubber seal on the coil leads and pull the wires through, taking up all the slack in the wires. Seat the rubber seal into the threaded part of the Electrical Fitting (#415). Tighten down the compression nut. (See Figure 7.3)
5. Attach the coil leads to the Terminal Strip J1 on the Circuit Board (#400) and replace the cover on the Electrical Box (#405).
6. Set the End Housing (#9) so the Coil (#284) is facing upright. According to the sketch made at disassembly place the correct number of Springs (#36) into the End Housing.
7. Set the Armature Plate (#56) and Armature Ring (#58) over the (3) Driver Pins (#195) and in position on the springs.

Continue the Reassembly with the same procedure described in **7-5 - REPLACING THE BRAKE STACK, *B. Reassembly, Steps 1 thru 15.***

7-8 REPLACING ARMATURE PLATE BUSHINGS

A new Armature Plate (#56) will come with the (3) Bronze Bushings (#116) already pre-reamed and installed. If you want to keep your existing Armature Plate (#56) and only replace the (3) Bronze Bushings (#116) - ***Use the following procedure:***

1. Remove the (4) Screws (#152) and take the Armature Ring (#58) off the Armature Plate (#56).
2. Remove the (3) existing bushings with an arbor press. Make sure that the holes in the Armature Plate (#56) are clean and free of any nicks, burrs or foreign material.
3. Carefully press the (3) new Bronze Bushings (#116) into the Armature Plate (#56) with an arbor press.
4. Re-attach the Armature Ring (#58) to the Armature Plate (#56) with the (4) Screws (#152). **Torque to 7 Ft. Lbs.**

7-9 REPLACING OIL SEAL (#31)

1. First drain all the oil from the unit into a suitable container. **See Section 4 - LUBRICATION** for location of drain plugs. Save or discard as condition warrants.
2. Also disconnect the 5-Pin Brad Harrison Cable from the Electric Box (#405).
3. Remove the (2) Allen Nuts (#136) and (2) Lockwashers (#127) from the End Housing (#9) and pull the Brake Assembly straight back out of the Fan Housing (#7).

   CAUTION - Be very careful not to damage the lip of the Oil Seal (#31) when removing the Brake Assembly.

4. Remove the (2) Screws (#72) and (2) Lockwashers (#129) from the Input Housing (#15) and lift it off the Main Housing (#8)
5. Remove the O-Ring (#104) and discard it.
6. Press the Oil Seal (#31) out of the Input Housing (#15).
7. Clean out the oil seal bore and lightly coat the bore with **Permatex #3D Sealant**. Press the new Oil Seal (#31) into the bore with an arbor press.
8. Lubricate a new O-Ring (#104) and place it in the o-ring groove in the Input Housing (#15).
9. Attach the Input Housing (#15) with the (2) Screws (#72) and (2) Lockwashers (#129). Torque to 14 Ft. Lbs.

10. Lubricate the lip of the Oil Seal (#31) and the Wear Sleeve (#32) with a little vaseline, or equivalent.
11. Slide the Brake Assembly over the (2) Studs (#155) and onto the hub spline as far as it will go. You will probably have to rotate the motor shaft to align the spline teeth with the brake stack.

    CAUTION - Be very careful not to damage the lip of the Oil Seal (#31)

    IMPORTANT - Be sure that all of the Friction Disc splines are engaged on the Hub spline before installing the Allen Nuts (#136). Also look inside the Fan Shroud to be sure that the Brake is fully seated in the Fan Shroud.
12. Install the (2) Lockwashers (#127) and (2) Allen Nuts (#136) to the extended Studs (#155). **Torque to 25 Ft. Lbs.**
13. Make sure that all the fittings, pipe plugs, Sight Gauge (#46) and Air Breather (#45) are installed correctly.

    Fill with oil as described in **Section 4 - LUBRICATION.**

7-10 REPLACING HUB AND FAN SUB-ASSEMBLY (#900)

1. First drain all the oil from the unit into a suitable container. See **Section 4 - LUBRICATION** for location of drain plugs. Save or discard as condition warrants.
2. Also disconnect the 5-Pin Brad Harrison Cable from the Electric Box (#405).
3. Remove the (2) Allen Nuts (#136) and (2) Lockwashers (#127) from the End Housing (#9) and pull the Brake Assembly straight back out of the Fan Housing (#7).

   CAUTION - Be very careful not to damage the lip of the Oil Seal (#31) when removing the Brake Assembly.
4. Insert a large screw driver into the Hub (#2) pump opening to keep the hub from turning. Remove the Screw (#94) and Brass Washer (#81) with a socket head wrench from the Hub (#2). *(The screw size is 3/8"-16)* Discard the Washer (#81).
5. Thread a 3/8"-16 x 1/2" Lg. Set Screw into the Collet (#110) as shown in *Figure 7.4.* Make sure this set screw extends approx. 1/8" beyond the end of the Collet (#110).

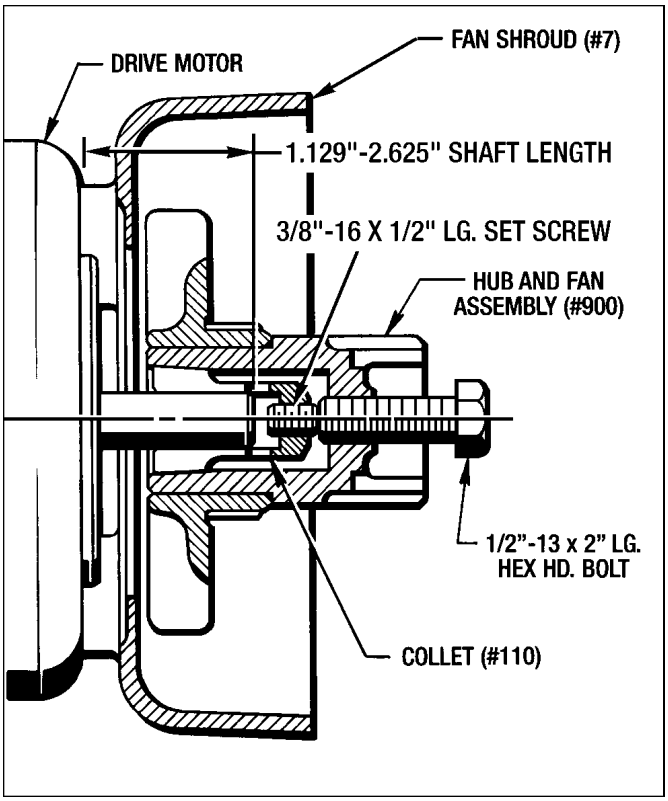


Figure 7.4 - Removing Hub (#2) and Collet (#110)

6. Thread a 1/2"-13 Hex Hd. Bolt into the Hub (#2) until it contacts the 3/8"-16 x 1/2" Lg. set screw. Holding the Hub (#2) with the screw driver, continue turning the bolt until the Hub (#2) is forced off the Collet (#110). *(See Figure 7.4)* Remove both the 3/8"-16 Set Screw and the 1/2"-13 Hex Hd. Bolt.
7. Mount the Collet (#110), Hub and Fan Sub-Assembly (#900) and the Motor Brake Assembly back on the motor as described in **Section 3-4 MOUNTING THE BRAKE TO THE MOTOR.**
8. Make an Operational Check to make sure that everything in properly re-assembled. **See Section 5 - OPERATIONAL CHECKS.**

Section 8
ILLUSTRATED PARTS LIST

8-1 GENERAL INFORMATION

This section illustrates, lists and describes all parts for the ***MSB2 MagnaShear*** **Motor Brake**. Parts are identified on the exploded views with Part Reference Numbers. These Numbers correspond to the Part Reference Number given in the Parts Lists.The Part Name and Quantity Used is also given in the Parts List. This Part Reference Number, Part Name and Quantity should be used when ordering Replacement Parts.

8-2 DRIVE MOTORS

The Drive Motors used with these ***MagnaShear*** **Motor Brakes** are standard motors and may be repaired or replaced by any qualified Motor Re-build Facility or Supplier.

8-3 FACTORY REBUILD SERVICE

Reconditioning Service is offered by Force Control Industries, Inc. at the factory. A complete factory rebuild will be 50% the cost of a new unit if the housings are reusable. If Housings need to be replaced , there will be an additional cost.

Contact Force Control Industries, Inc. for authorization and shipping instruction before returning a drive unit for this service. Force Control cannot be responsible for units returned to the factory without prior notice and authorization.

Care must be given to the packing of returned drives. Always protect mounting feet by attaching to a skid. Shipment-damaged drives always delays repairs. It is usually impossible to recover damage costs from the carrier. When possible, describe the problem experienced on your shipping papers.

Return to: **Force Control Industries, Inc.**
3660 Dixie Highway
Fairfield, Ohio 45014

Phone: (513) 868-0900
Fax: (513) 868-2105
E-Mail: info@forcecontrol.com

8-4 ORDERING REPLACEMENT PARTS

When ordering replacement parts, please specify all of the following information:

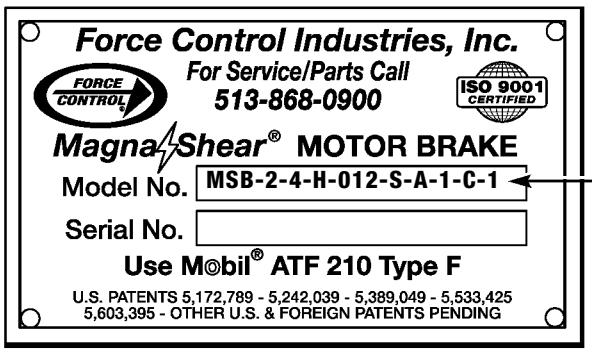
1. Brake Model Number (On the Name Plate.)
2. Brake Serial Number (On the Name Plate.)
3. Part Reference Number (From the parts list or exploded view drawing.)
4. Part Name (From the parts list.)
5. Quantity (From the parts list.)
6. Complete Shipping Information.

Failure to include information for items 1 through 6 will only delay your parts order. Unless another method is specified for item 6, parts weighing less than 150 Lbs. will be shipped United Parcel Service. Parts weighing more than 150 Lbs. will be shipped Motor Freight. Air freight and other transportation services are available but only if specified on your order.

8-5 NAME PLATE AND MODEL NUMBER

The Name Plate shown is located on the Adapter Fan Shroud.

The Example shown is a size MSB2, 4-1/2" Pilot Dia., Horizontal Mounting, 12 Lb. Ft. Torque, No Manual Release, 5/8" Collet Bore Dia., 115 VAC, Connector located on front side of Conduit Box. and with an Engineering Revision of 1.



MSB – 2 – 4 – H – 012 – S – A – 1 – C – 1

1 2 3 4 5 6 7 8 9 10 11

Size (1)

2 = MSB2

Pilot Diameter (FAK) (2)

4 = 4.500"

Mounting Position (3)

H = Horizontal
U = Brake Up
D = Brake Down

Torque (4, 5, 6)

0 0 6 = 6 Lb. Ft.
0 0 8 = 8 Lb. Ft.
0 1 2 = 12 Lb. Ft.

Manual Release (7)

S = Not Available

Collet Bore (8)
(Motor Shaft Dia.)

A = .625"
0 = .875"

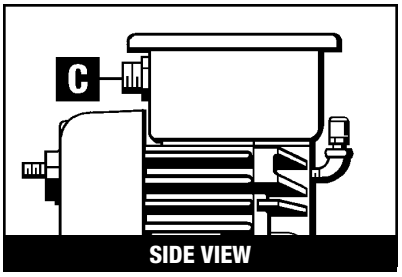
Voltage (9)

1 = 115 VAC

Connector Location (10)

C = Front (Std.)

Revision (11)
(By Force Control)



REPAIR PARTS LIST *(Figure 8.1)*
MSB2 MagnaShear MOTOR BRAKE Fan Shroud, Fan, Collet and Hub

Ref. No.	Part Name	Qty.	Ref. No.	Part Name	Qty.
Δ 2	Brake Hub	1	Δ 120	Fan	1
7	Adapter, Fan Shroud	1	127	Lockwasher, 3/8”	4
Δ 32	Wear Sleeve	1	136	Allen Nut, 3/8”-16	2
81	Brass Washer	1	149	Low Hd. Screw, 3/8”-16 x 1-1/4” Lg.	2
94	Hex Hd. Screw, 3/8”-16 x 1-1/4” Lg.	1	155	Stud, 3/8”-16 x 7” Lg.	2
Δ 105	O-Ring	1	900	Hub and Fan Sub-Assembly	1
110	Collet				
	5/8” Dia. Bore	1			
	7/8” Dia. Bore	1			

Δ - These parts cannot be ordered as individual parts.
They are a part of the Hub and Fan Sub-Assembly (#900).

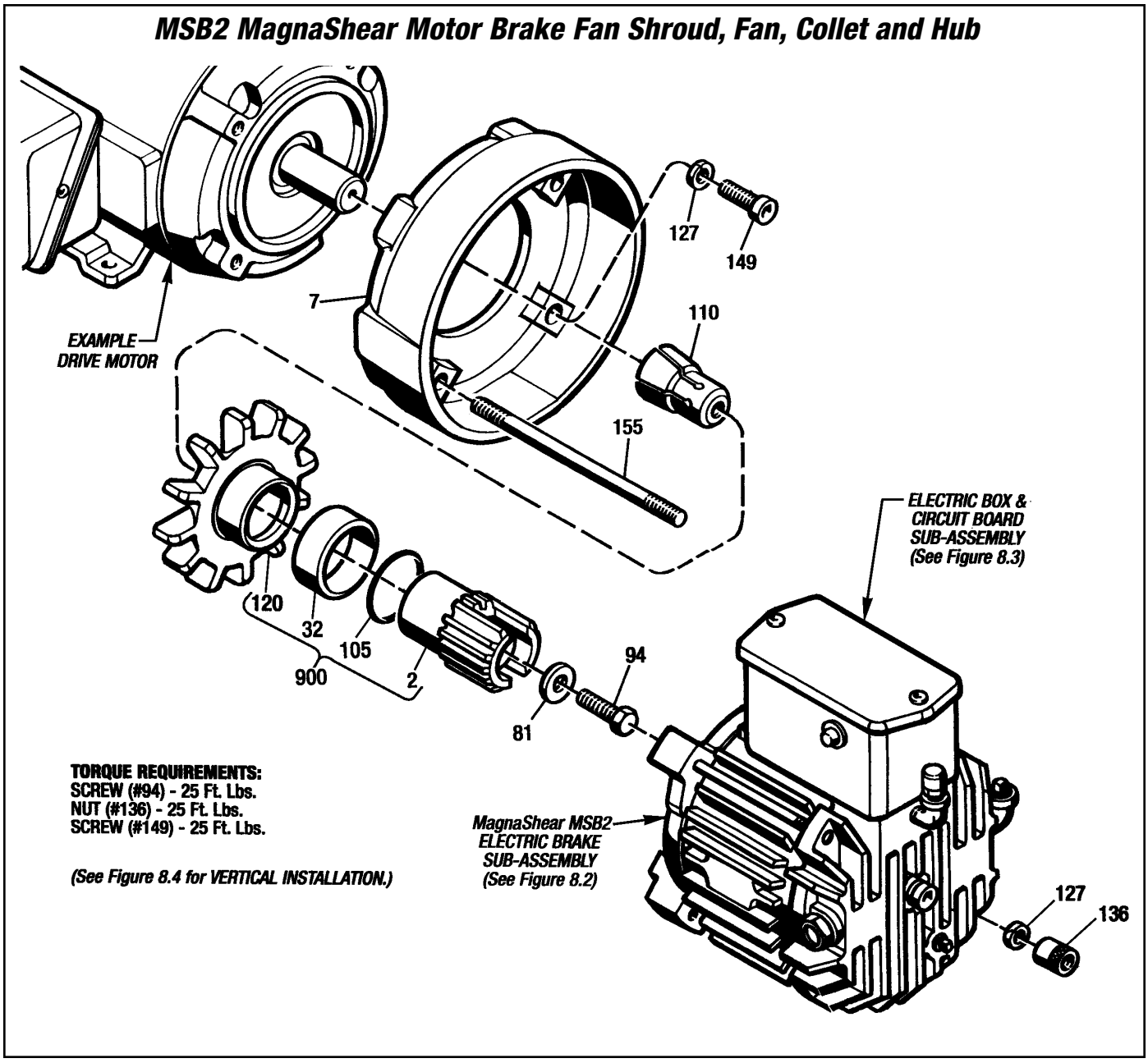


Figure 8.1 - MSB2 MagnaShear Motor Brake - Fan Shroud, Fan, Collet and Hub

REPAIR PARTS LIST

MSB2 MagnaShear Motor Brake Sub-Assembly

(Figure 8.2)

Ref. No.	Part Name	Qty.	Ref. No.	Part Name	Qty.
*5	Thrust Plate	1	64	Pipe Plug, 1/8” NPT	1
8	Main Housing	1	72	Soc. Hd. Screw, 5/16”-18 x 4-3/4” Lg.	2
9	End Housing	1	*103	O-Ring	1
*12	Drive Plate	5	*104	O-Ring	2
*13	Friction Disc	4	116	Bronze Bushing	3
15	Input Housing	1	119	Roll Pin	
*17	Separator Springs	12		8 Ft. Lbs. Torque	4
*31	Oil Seal	1		12 Ft. Lbs. Torque	6
*36	Spring		128	Lockwasher, 1/4”	3
	8 Ft. Lbs. Torque	4	129	Lockwasher, 5/16”	2
	12 Ft. Lbs. Torque	6	152	Low. Hd. Cap Screw, 1/4”-20 x 1/2”.	4
*45	Air Breather	1	153	Low. Hd. Cap Screw, 1/2”-13 x 1-1/4”	1
*46	Sight Gauge	1	165	Hex Nut, 1/4”-20	3
52	Threaded Insert	2	192	But. Hd. Screw, #10-24 x 1/4”	2
53	Threaded Insert	3	193	Flat Washer	3
55	Shim	1	195	Driver Pin	3
56	Armature Plate	1	275	Lockwasher, 1/2”	1
58	Armature Ring	1	284	Holding Coil	1
61	90° Street Elbow, 3/8” NPT	1	*335	Shim .005” Blue	AR
62	Pipe Plug, 3/8” NPT	1	*336	Shim .010” Brown	AR
63	90° Fitting	1	*337	Shim .020” Yellow	AR

NOTES:

* - Indicates parts in Overhaul Kit.

AR - As Required.

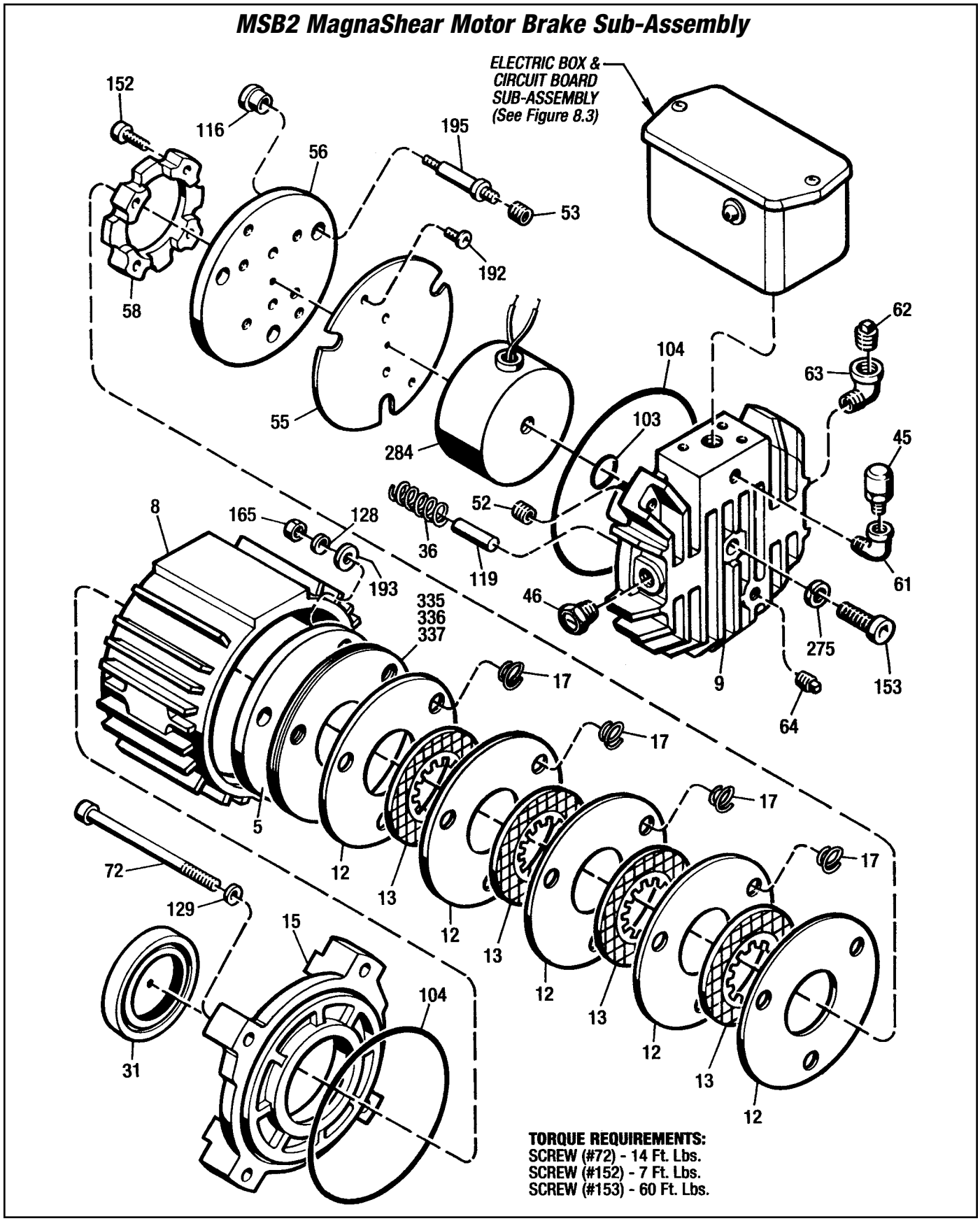


Figure 8.2 Repair Parts - MSB2 MagnaShear Motor Brake

REPAIR PARTS LIST

MSB2 MagnaShear Motor Brake Electric Box and Circuit Board

(Figure 8.3)

Ref. No.	Part Name	Qty.	Ref. No.	Part Name	Qty.
400	Circuit Board	1	426	Button Hd. Screw, #10-24 x 1/4”	1
405	Junction Box	1	428	Pan Hd. Screw, #8-32 x 1/2”	3
410	Indicator Lamp	1	429	Button Hd. Cap Screw, 1/4”-20 x 1/2”	2
415	Electrical Fitting	1	431	Nylon Washer	3
416	Receptacle 5-Pin	1	432	Lock Washer, 1/4”	2
417	Receptacle Nut	1	435	Stand-Off	3
*425	Gasket	1			

NOTES:

* - Indicates parts in Overhaul Kit.

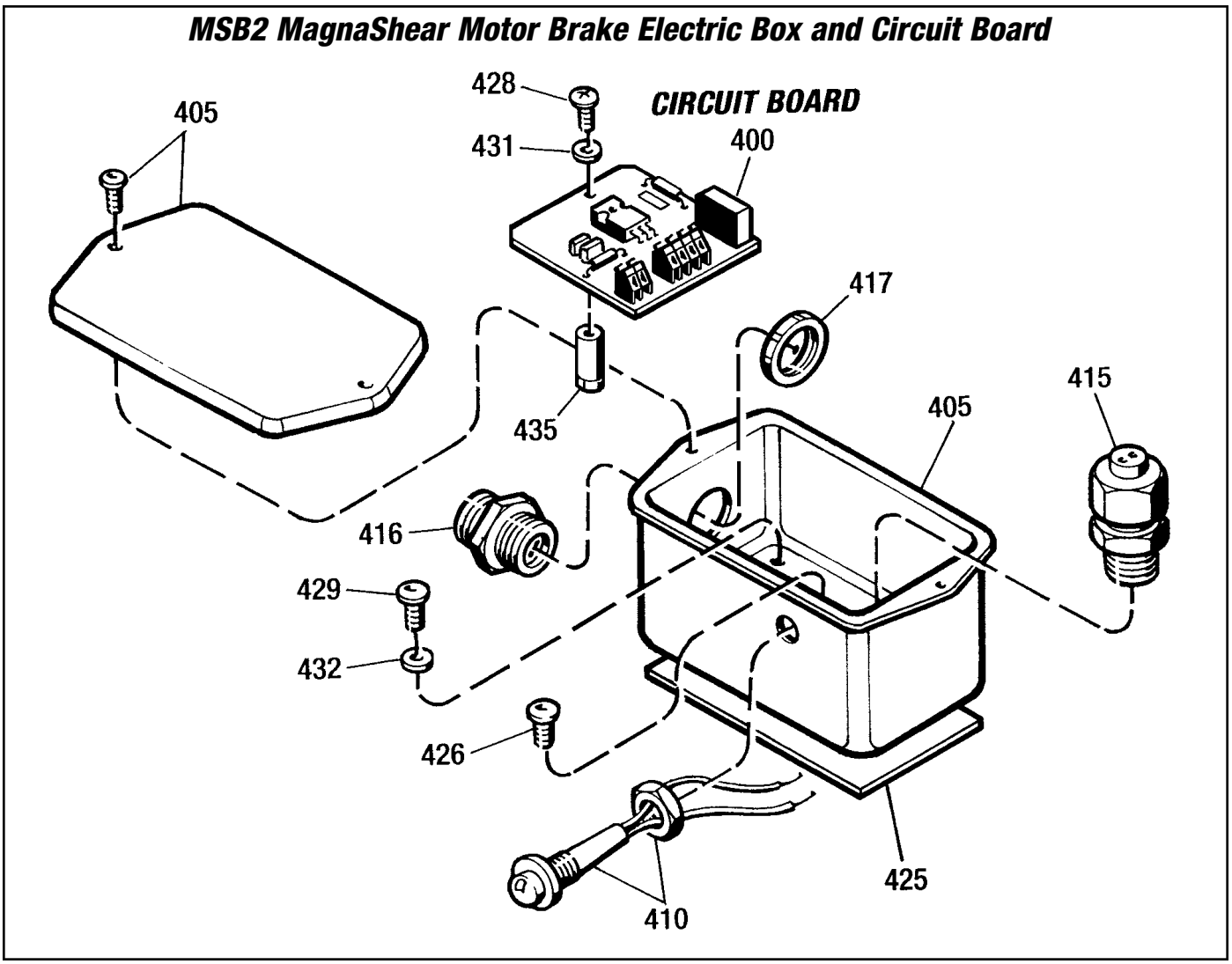


Figure 8.3 - MSB2 MagnaShear Motor Brake - Electric Box and Circuit Board

REPAIR PARTS LIST

MSB2 MagnaShear Motor Brake - Vertical Installation

(Figure 8.4)

Ref. No.	Part Name	Qty.	Ref. No.	Part Name	Qty.
*45	Air Breather	1	69	1/8” x 1-1/2” Lg. Pipe Nipple	1
*46	Sight Gauge	1	71	3/8” x 1-3/4” Lg. Nipple *(Vert. Down Only)*	1
62	3/8” NPT Pipe Plug, Sq. Hd.	1	75	3/8” NPT Pipe Plug	
63	3/8” NPT Street Elbow *(Vert. Up Only)*	1		*Vertical Up*	1
64	1/8” NPT Pipe Plug *(Vert. Down Only)*	1		*Vertical Down*	2
66	1/8” NPT Elbow *(Vert. Down Only)*	1	140	3/8” NPT Elbow *(Vert. Down Only)*	1
67	1/8” NPT Pipe Cap *(Vert. Up Only)*	1			

NOTES:

* - Indicates parts in Overhaul Kit.

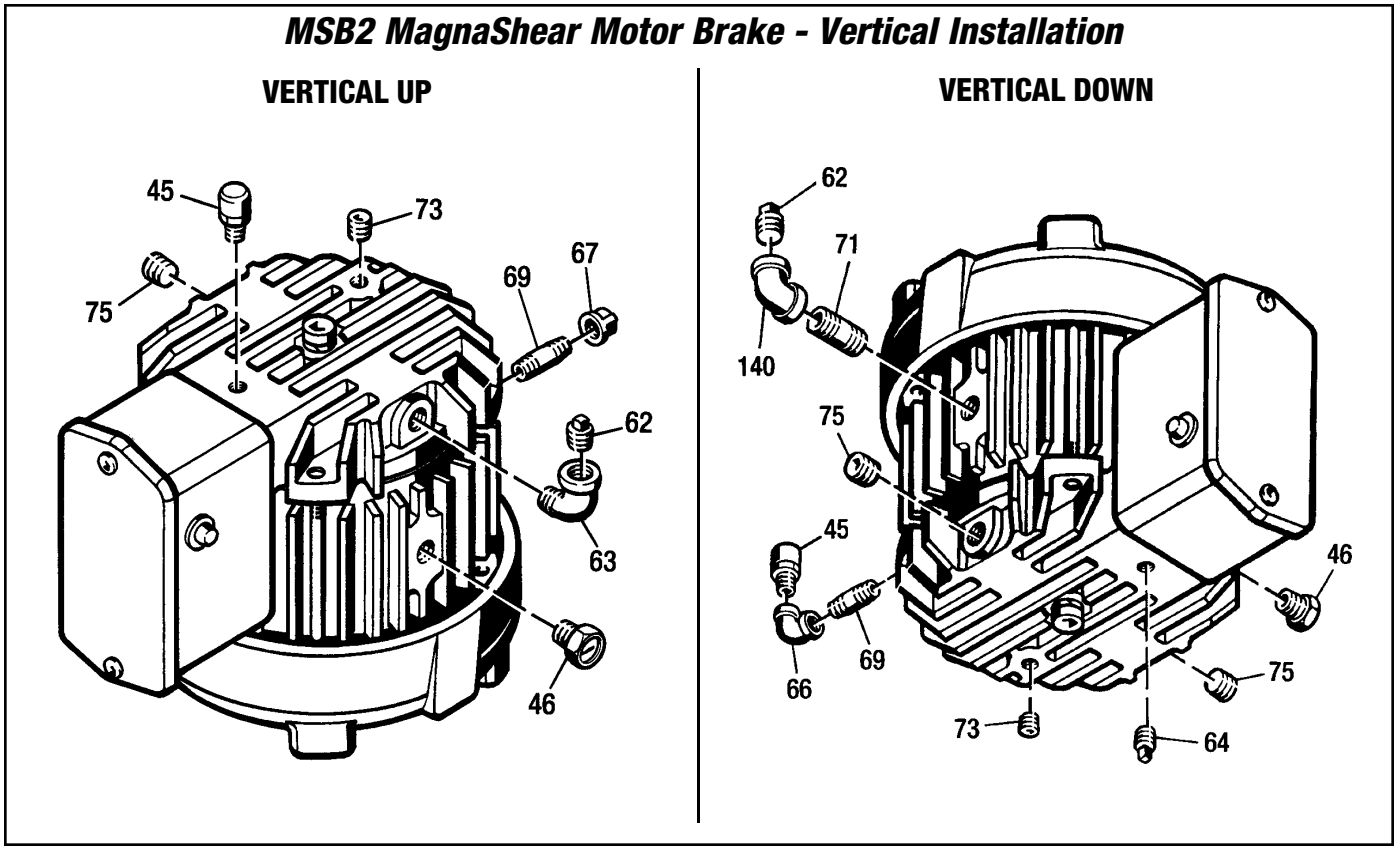


Figure 8.4 - MSB2 MagnaShear Motor Brake - Vertical Installation

Manual Revision & Printing History

MSB2 MagnaShear Motor Brake

REVISION NUMBER	REVISION DATE *(Mo./Yr.)*	PRINTING DATE *(Mo./Yr.)*	REVISION/ACTION DESCRIPTION	REVISION INITIATED BY: *(Name)*	REVISION MADE BY: (Name)
502-MSB2-001-02	-------	4/03	Printed	--------	--------
	1/04	-------	Optimized digital size of document. Made new PDF document. Converted to Windows platform. Added Revision History.	Brooks	Brooks
	-------		Printed	-------	--------

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