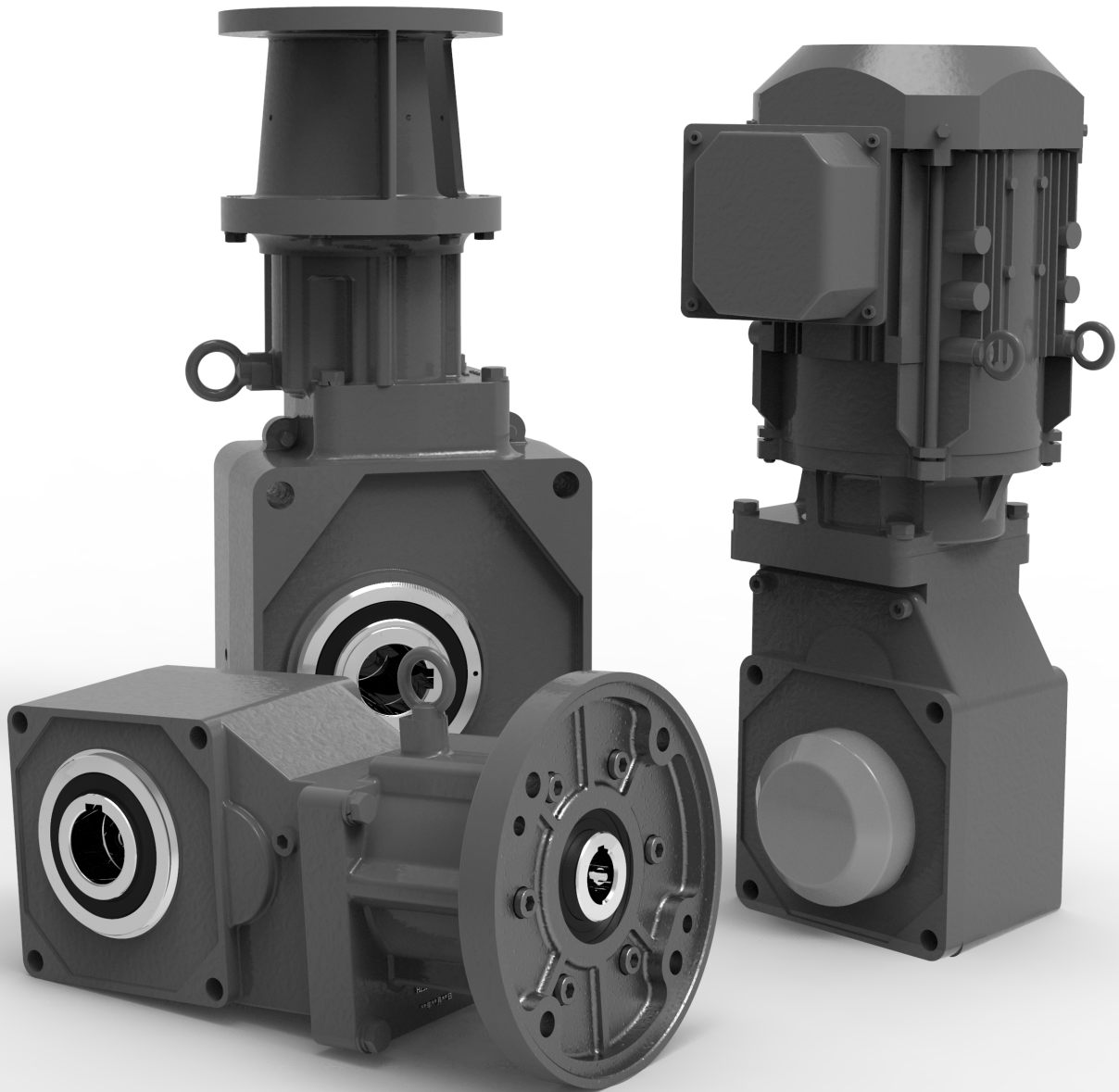


Operating and Maintenance Manual

BBB-H



Contents

Safety Precautions	1
Inspection Upon Delivery	2
Lubrication	2
Storage	3
Transportation.....	4
Installation	4
Standard Operating Conditions	4
Mounting Angle	4
Motor Mounting (Quill Shaft Type)	4
Direction of Rotation	5
Hollow Shaft Type	6
Keyed Hollow Bore	6
Shrink Disc	9
Torque Arm Installation	15
Wiring	17
Wiring Connections for Standard Motor Contactor	19
Wiring Connections for VFD (Inverter)	20
Operation	20
Daily Inspection and Maintenance	21
FB Brake Assembly – Inspection, Adjustment, and Maintenance	22
Brake Models FB-01A1, FB-02A1, and FB-05A1	22
Brake Models FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E and FB-3E.....	25
Brake Models FB-5E, FB-8E, FB-10E, and FB-15E	29
Troubleshooting	34

Safety Precautions

- Carefully read this maintenance manual and all accompanying documents before use (installation, operation, maintenance, inspection, etc.). Thoroughly understand the machine, information about safety, and all precautions for correct operation. Retain this manual for future reference.
- Pay close attention to the “**DANGER**” and “**CAUTION**” warnings regarding safety and proper use.



DANGER

Improper handling may result in physical damage, serious personal injury and/or death.



CAUTION

Improper handling may result in physical damage and/or personal injury.

Matters described in **CAUTION** may lead to serious danger depending on the situation.
Be sure to observe important matters described herein.



- Transport, installation, plumbing, wiring, operation, maintenance, and inspections should be performed by trained technicians; otherwise, electric shock, personal injury, fire, or damage to the equipment may result.
- In the case of disassembly, assembly or overhaul of this device, contact the nearest authorized service station.
- When using the equipment in conjunction with an **explosion proof motor**, a technician with electrical expertise should supervise the transport, installation, plumbing, wiring, operation, maintenance and inspection of the equipment; otherwise, explosion, ignition, electrical shock, personal injury, fire or damage to the equipment may result.
- When the unit is to be used in a system for human transport, a protecting device for human safety should be installed to prevent chances of accidents resulting in personal injury, death, or damage to the equipment due to running out of control or falling.
- When the unit is to be used for an elevator or lifter, install a safety protecting device on the elevator side to prevent it from falling; otherwise, personal injury, death, or damage to the equipment may result.

Inspection Upon Delivery



- Unpack the unit after verifying that it is positioned right side up; otherwise, injury may result.
- Verify that the unit received is in fact the one you ordered. Installing the wrong unit may result in personal injury or equipment damage.
- Do not remove the nameplate.

Verify the items listed below upon receiving the product. If a nonconformity or problem is found, please contact your nearest agent, distributor, or sales office.

1. Does the information on the nameplate conform to what you ordered?
2. Was any part broken during transport?
3. Are all bolts and nuts tightened firmly?
4. Were the ordered accessories received?

Lubrication

BBB-H units are grease-lubricated. They are filled prior to shipment and arrive ready for customer use. It is recommended to overhaul the gearbox after 20,000 hours.

Note: Over-hauling consists of disassembling the unit, replacing the seals and gaskets, cleaning the internal parts and then repacking the unit with designated grease.

Standard	Low Temperature	Food Grade
Nihon Koyu BA-11A	Nihon Koyu BH-17B	Fuchs Cassida SGG 000

Table 1. Grease Lubrication Levels.

Size	Ratio	oz. (g)
HZ522 HZ523 HZ524	5 - 20	31.7 (900)

Size	Ratio	oz. (g)
HA635	5 - 15	120oz (3400g)
	20	110oz (3100g)

Storage

If this product is not for immediate use, please note the following points when storing it.

Storage Location

Store the product indoors in a clean, dry location.



Do not store outdoors. Store in a location that is free of moisture, dust, extreme temperature changes, corrosive gases, etc.

Storage Time

- The storage time should be within one year.
- If the storage time exceeds one year, adherence to special rust prevention specifications is required. Please consult with us.
- If for export, adherence to export rust prevention specifications is required. Please consult with us.

Standard Rust Prevention Specifications

External Rust Prevention:

Rust prevention oil is applied when shipping from the factory. Check rust conditions every six months after shipment. Reapply the rust prevention process, if necessary.

Internal Rust Prevention:

Store in an ordinary factory or warehouse in an environment free of moisture, dust, extreme temperature changes, corrosive gases, etc.

Using After Storage

- Oil seals are affected by temperature, ultraviolet light, and other ambient conditions and can easily degrade. After long storage periods, inspect before operation, and replace any degraded seals with new seals.
- At startup, check that there are no unusual noises, vibrations, temperature rises, or other symptoms. For motor with brakes, check that brakes work properly. If any abnormalities are found, immediately contact the nearest authorized service station.

Transportation



Do not stand directly under a unit suspended by a crane or other lifting mechanism; otherwise, injury or death may result.



- Exercise ample care so as not to drop the unit.
When a lifting bolt/hole is provided, be sure to use it. After mounting a unit to a machine, do not hoist the entire machine using the lifting bolt/hole; otherwise, personal injury or damage to the equipment and/or lifting device may result.
- Before hoisting, refer to the rating plate, crate, outline drawing, catalog, etc. for the weight of the unit. Never hoist a unit that exceeds the rating of the crane or other mechanism being used to lift it; otherwise, personal injury or damage to the equipment and/or lifting device may result.
- Use an appropriate lifting bolt/hole, and make sure that the eye-bolt and/or nut is not loose before hoisting.

Installation

Standard Operating Conditions

Ambient temperature: 14°F to 104°F (-10°C to 40°C)

Humidity: 85% or less

Altitude: Lower than 3300 ft (1000 m) above sea level

Atmosphere: Free from corrosive gases, explosive gases or steam. It should also be free from dust and well ventilated.

Mounting Angle

There is no limit on a mounting angle.



Do not remove the motor's eye-bolt. In the rare case that it is removed, insert a bolt or other appropriate material into the screw hole to prevent water or other substances from entering the motor through the screw hole.

Motor Mounting (Quill Input Shaft)

Reducer Supplied with Motor (assembled):

Some units may come from the factory with the motor attached. In this case, no additional preparation is required.

Customer Supplied Motor or Motor Supplied Separately (disassembled):

- Inspect the input shaft hollow bore and the motor shaft for debris or other material that may prevent the insertion of the motor shaft into the hollow quill input shaft – carefully clean if necessary.
- To enable easy installation and removal of the motor, apply anti-seize paste to both the reducer hollow bore and the motor shaft.
- Hollow input shaft units for the **Food and Beverage Industry** have either an o-ring or gasket material (solid or liquid) for installation between the motor and reducer.
- Place the motor key into the motor shaft and carefully insert the motor into the quill high-speed shaft of the reducer. Do not force the assembly if the shafts are slanted or misaligned or if the key is only partially engaged.
- Ensure that the motor flange bolts are aligned with the through holes of the reducer flange, and also ensure that the motor is properly aligned with the reducer.

- Bolt the motor into place. Refer to the motor operating instructions for proper bolt tightening torque. **Important:** If the bolt is tightened when the fitting is not inserted, uneven tightening will result, causing damage to the internal bearing and other components.

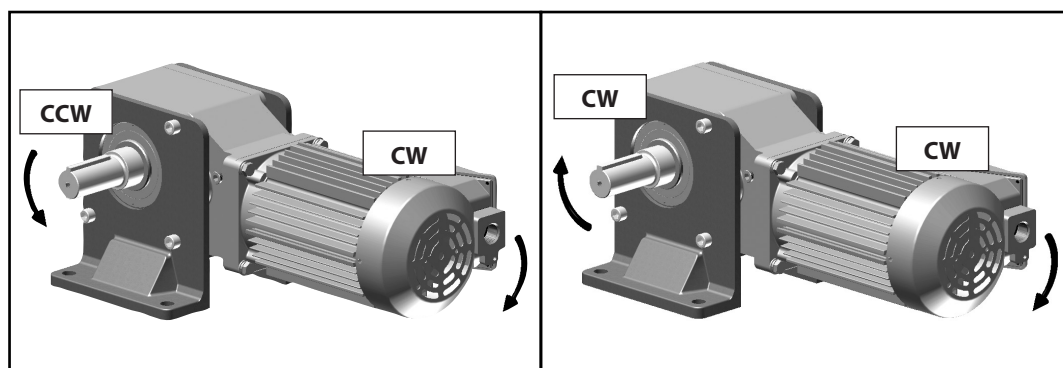
Direction of Rotation

- After wiring the motor as recommended in the Wiring section, the motor shaft rotates to the right as seen from the fan cover side. **Figure 1** shows the direction of rotation for the output shaft depending on the size and ratio combination.
- After corroborating direction of rotation, the gearmotor can be connected to the driven machine. It is recommended to do a test run with no load, and increase load gradually. Observe precautions listed in **Table 8** Trial Run Precautions in the Operation section during test run.

Fig. 1 Rotating Direction of the Output Shaft

Counter Clockwise Ratios¹

Clockwise Ratios¹



1. Solid output shaft only shown for demonstration purpose; it is not a standard option.

Model	Counter Clockwise Reduction Ratio (:1)	Clockwise Reduction Ratio (:1)
HZ522	5, 7, 10, 12, 15, 20	-
HZ523	5, 7, 10, 12, 15	-
HZ524	5, 7, 10.	-
HA635	5, 7, 10, 12, 15	20

Note: Swapping two of the three input power leads of a three-phase induction motor will cause the motor direction to reverse.

Hollow Shaft Type

Precautions for Mounting the Hollow Shaft Type

1) Driven Shaft Size

- If the driven shaft dimension is small and there is a space from the hollow shaft, abrasion from fretting tends to occur. The resulting abrasion powder may get pinched in the oil seal, causing the grease to leak.
- Furthermore, vibrations due to the space may damage the parts inside the drive.
- If the driven shaft length is short, excessive force is applied on the hollow shaft, possibly causing vibration or grease leak.
- If the effective length of driven shaft is short, the key and the keyway may be damaged.

2) Mounting on the Driven Shaft

- If the hollow shaft end face is hit with a metal hammer or the driven shaft was biting on the hollow shaft when assembled, the hollow shaft may become deformed and the oil seal contact may become uneven, causing the grease to leak.
- If the case or the oil seal is hit, the damaged or deformed case or oil seal may cause the grease to leak.

3) Fixing on the Driven Shaft

- If the hollow shaft is not fixed, it may vibrate in the thrust direction due to the vibration from the operation or from the machine side, possibly causing the oil seal performance to become uneven and the grease to leak.
- The vibration may also damage the parts inside the drive.

4) Torque Arm Retainer

- Fixing the torque arm retainer may prevent the case from following the driven shaft movement, and as a result of excessive force being applied on the hollow shaft, the grease may leak through the oil seal.
- It may also damage the parts inside the drive.

When using the hollow shaft type, be sure to refer to the mounting procedure on **pages 8 to 14**.

Keyed Hollow Bore

1. Mount the gearmotor onto the driven shaft that has sufficient rigidity.
2. Ensure there is no restriction for the mounting angle.
3. Mounting Procedures:

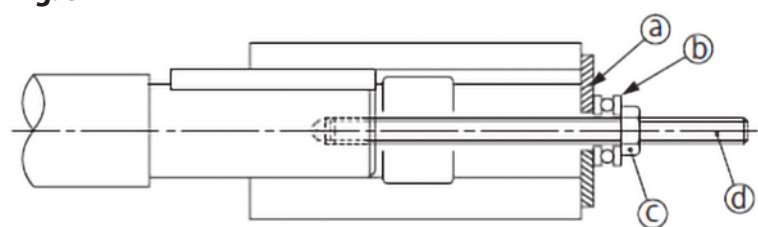
a. Connecting a Driven Shaft

Apply customer-supplied anti-seize grease to the surface of the driven shaft and the inner surface of the hollow shaft. Slide the BBB-H unit onto the driven shaft. To make the installation smoother if the fit is too tight, lightly tap the end of the hollow output shaft with a wooden hammer. **Avoid hitting the casing.** To ensure smooth installation of the drive, we recommend the use of a jig shown in **Figure. 5**.



Inappropriate installation will result in shaft fretting. Fretting will cause shaft wear, jamming, and misalignment between the gearmotor and driven shaft.

Fig. 5



- (a)Spacer (b)Thrust Bearing (c)Nut (d)Double end threaded bolt

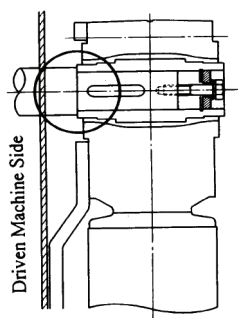
The hollow shaft is made according to ISO H8 tolerances. Following installation, ensure that the fitting between the hollow and the driven shaft is tightened correctly. We recommend ISO js6 or k6 as the tolerance for the driven shaft.

b. Mounting the BBB-H unit

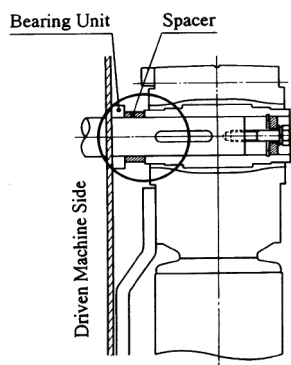
Be sure to fix the gearmotor onto the driven shaft. Fixing options are shown on **Figures 6 and 7**.

Fig. 6: Method of fixing in which the product does not move to the machine side.

Stepped Shaft Option



Spacer Option



Set Screw Option

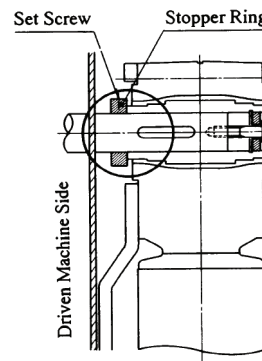
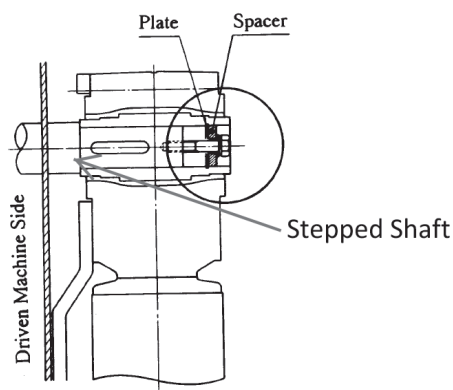
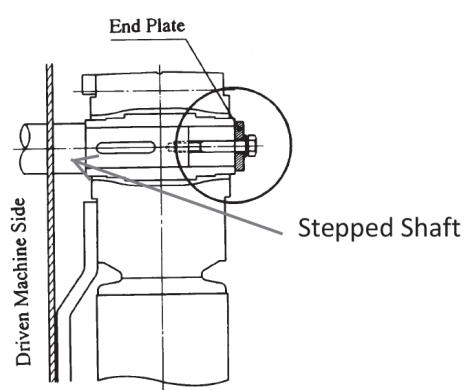


Fig. 7: Method of fixing in which the product does not move in the opposite direction of the machine.

Spacer and Plate Option



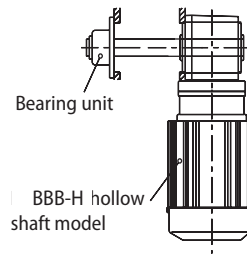
End Plate Option



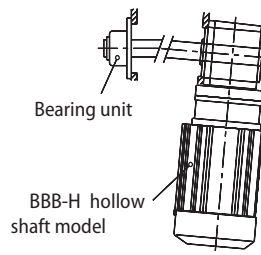


When installing the gearmotor when flange-mounted, ensure that the gearmotor and the shaft of the driven machine are properly aligned so that the gearmotor is free from excessive force (**Figure 8**).

Fig. 8

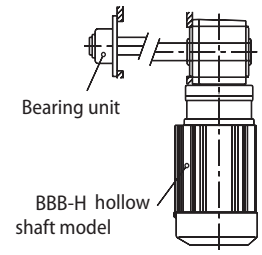


Correct



Incorrect

Poor perpendicularity of driven shaft center and mounting flange surface



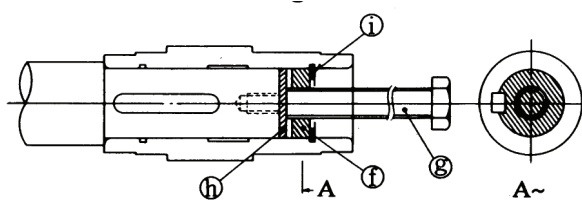
Incorrect

Poor concentricity of driven shaft and mounting flange

d. Removing the Shaft

Do not apply excessive force to the unit and shaft. Using a jig as shown in **Figure 9** will facilitate removal of the shaft.

Fig. 9



f - Spacer
h - Plate

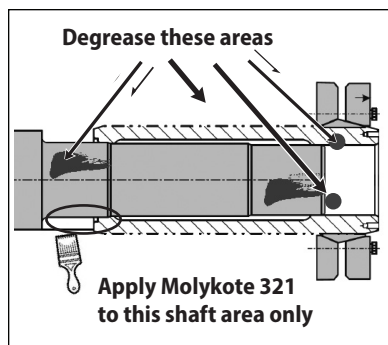
g - Bolt
i - Shaft retaining C-ring

Note: Customer should supply parts for setting, securing or removing the shaft.

Shrink Disc



Before placing unit onto driven shaft, **do not apply grease, oil, or anti-seize grease** to the entire driven shaft or to the bore of the shrink disc. Use of these friction-minimizing products will adversely affect the ability of the unit to transmit torque.



1

Clean and degrease contact surfaces; reducer shaft and bore, and the machine driven shaft.

Apply Molykote 321 or an equivalent dry film lubricant to the driven shaft projection opposite from the shrink disc.



For food grade application, use food grade dry film lubricant.



Do not apply any friction minimizing compound to the driven shaft at or near the shrink disc

2

Align the driven shaft with the reducer hollow bore and carefully slide unit onto the driven shaft.

If the fit is tight, strike on the reducer hollow bore with a mallet to assist in the assembly.



If using a soft non-metallic mallet during installation, strike **only** against the unit's steel hollow bore. **Do not** strike the reducer housing or oil seal. Damage to the bearings, the housing, and/or the seals may occur.

Note: If the fit is tight, use a jig such as the one shown in **Figure 5** to ease assembly. **Sumitomo does not supply a mounting jig. This information is provided for reference only.**



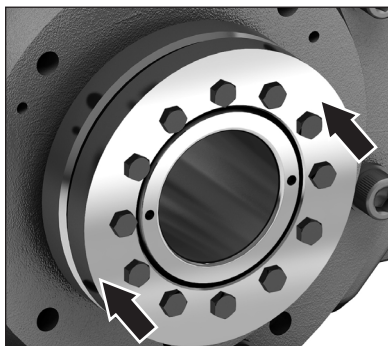
Never tighten locking screws before shaft installation. Inner ring may become permanently contracted even at low tightening torques.



Ensure that all power switches are locked out before installing or removing shrink disc. Wear safety glasses and protective clothing at all times

3

Remove any wooden spacers that may have been used during shipping. Lightly lubricate the hub outside diameter and shrink disc bore.

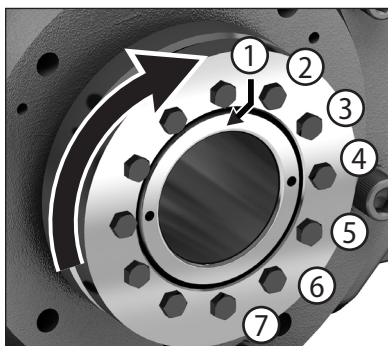


4

Set the (untightened) shrink disc on the reducer shaft.

5

After confirming the correct position of the hub and shrink discs, hand tighten three or four equally spaced locking screws and ensure the discs are parallel. Hand-tighten remaining locking screws.



6

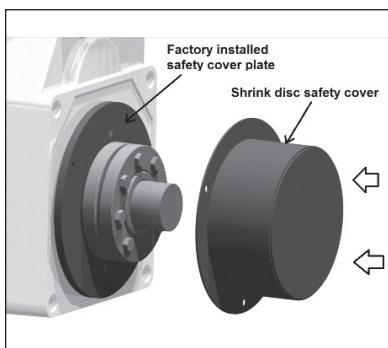
Using a torque wrench, tighten the screws according to the **initial torque** listed in **Table 3**. Tighten in either a clockwise or counter-clock wise sequence, using $\frac{1}{4}$ turns, until you can no longer complete a $\frac{1}{4}$ turn for any of the screws. This procedure keeps the discs parallel.

7

Continue to tighten the screws for two more passes. This compensates for system induced relaxing of the locking screws.

8

Set the torque wrench to the **final torque** and tighten all locking screws. At this point, no screw should turn; otherwise, set the torque wrench to the **initial torque** and repeat steps 6 and 7 above. It is **not** necessary to re-torque after equipment has been in operation.



9

For units with a safety cover, reinstall the guard over the **shrink disc**.



Do not operate unit until the torque arm has been attached. Refer to the **Torque Arm Installation** section in this guide for instructions.

Table 3. Shrink Disc Size and Tightening Torque

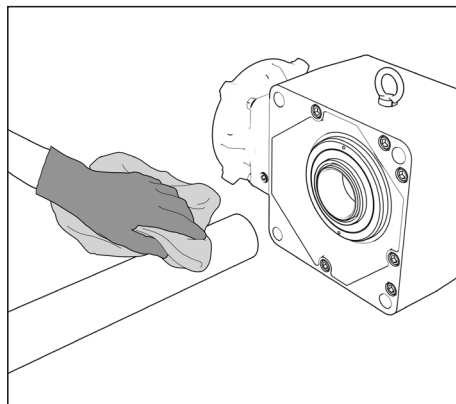
Screw Size	M5	M6	M8	M10	M12	M16
Initial Torque in-lb (Nm)	45 (5.1)	109 (12.3)	275 (31)	557 (63)	929 (105)	2327 (263)
Final Torque in-lb (Nm)	43 (4.9)	105 (11.8)	266 (30)	531 (60)	885 (100)	2221 (251)
Socket Size mm	8	10	13	17	19	24

Removal Instructions

Following either a clockwise or counterclockwise sequence, loosen all locking screws using approximately ½ turns, until you can remove the shrink disc from the hub. The shrink disc, hub, and shaft will return to their original clearance fits.

Note: Locking screws do not have to be removed completely from the shrink disc.

Easy Grip



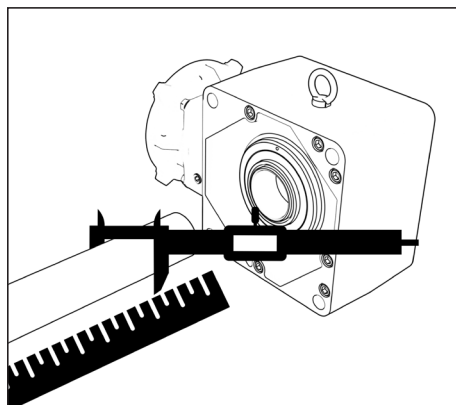
1



Use gloves as there may be burrs or sharp edge to a keyway, if present.

Hand dress any gouges or burrs with sandpaper. Use a degreaser and rags to wipe the gearbox hollow shaft OD and ID.

Clean the OD of the shaft to be installed. **Both the shaft and hollow shaft must be clean and dry—no grease or oil.**

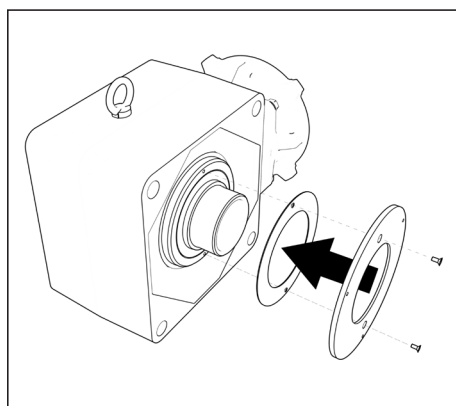


2

Check the surface finish of the shaft to be installed. The finish should be between 32 and 125 RMS.

The length of the shaft to be installed in the gearbox hollow shaft should be long enough to allow for full engagement of the clamp bushing, hollow shaft, and shrink disc. **The shaft length should not extend past ¼" of the outer edge of the clamping bushing** as it may contact the safety cover (see Figure 2).

The OD of the shaft tolerance should meet values provided in Table 1. Verify the shaft straightness is ≤ 0.0006 in/in (mm/mm).

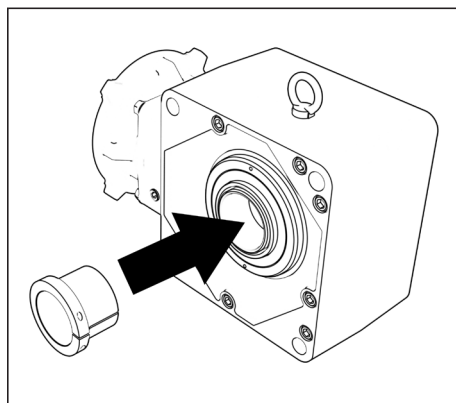


3

Install the Safety Cover Back Plate. **The back plate must be installed prior to installing the shrink disc.** Identify the side of the gearbox that the shrink disc will be installed on.

Install a gasket if applicable and then the back plate.

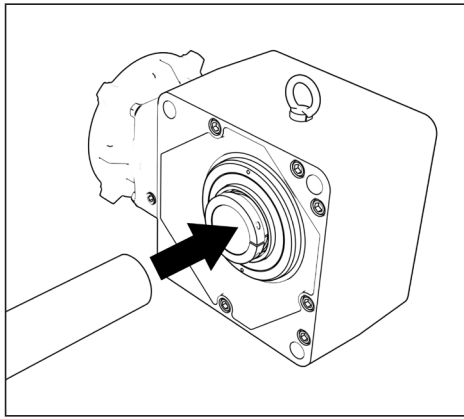
Install and tighten the two countersunk screws provided with the safety covers.



4

Insert the support bushing into the hollow shaft of the gearbox. Light oil may be added to the support bushing OD and ID only to assist with insertion into the hollow shaft and installation of the shaft.

Tap the support bushing until its lip is firmly against the edge of the hollow shaft.

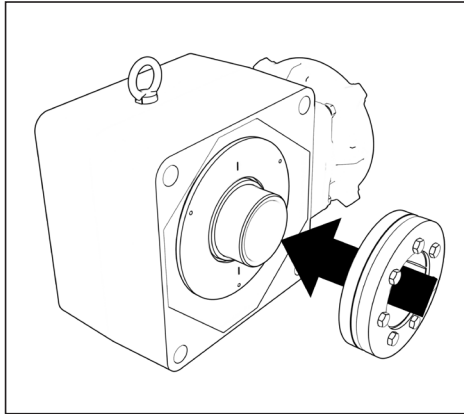


5

Align the hollow gearbox shaft with the support bushing installed to the equipment shaft in order to prevent the shaft binding and damage during installation. Push the gearbox onto the equipment shaft.



Verify that the shaft position will have **full length engagement** between the shaft, hollow shaft, clamp bushing and Shrink Disc or there may be permanent deformation of the hollow shaft.

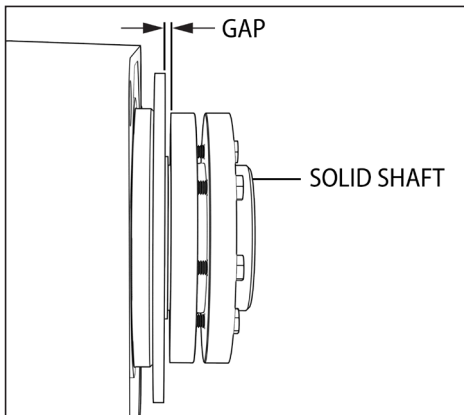


6

New Shrink Discs are properly lubricated. If you're reusing your Shrink Disc, first verify there is **Molykote G-Rapid Plus grease** is on the screws, under the screw heads and on the mating tapers (center inner tapered ring of shrink disc assembly).

Also verify the screw threads have not been stretched if previously installed.

Place the Shrink Disc onto the hollow shaft OD. You may need to loosen the Shrink Disc bolts first, but **DO NOT remove these bolts**.

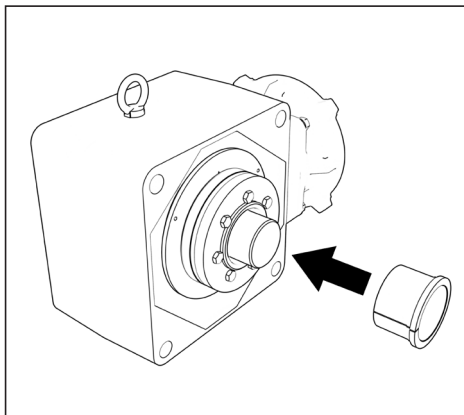


7

Position the shrink disc such that it will **not rub against the gearbox or safety cover back plate**.

The outer edge of the thrust ring should **not extend past the end of the gearbox hollow shaft**.

Hand tighten the shrink disc bolts.



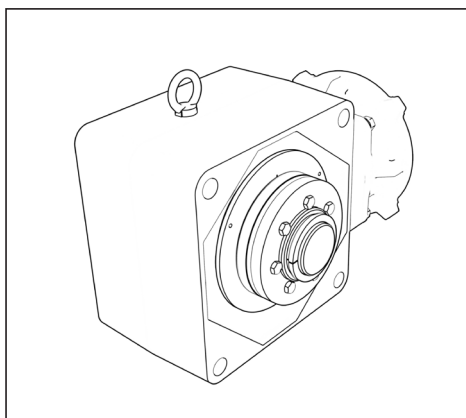
8

Do not apply rust preventive oils, anti-seize, or other lubricants to the clamp bushing. Insert the clamp bushing between the hollow shaft and the shaft. The clamp bushing should slide into position with minimal effort.

Push in the clamp bushing until its lip is firmly against the edge of the hollow shaft.

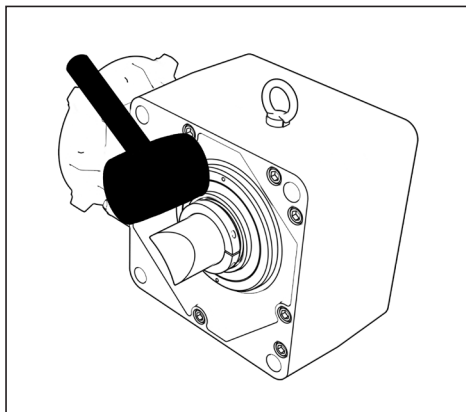


The clamp bushing is **NOT re-usable**.



9

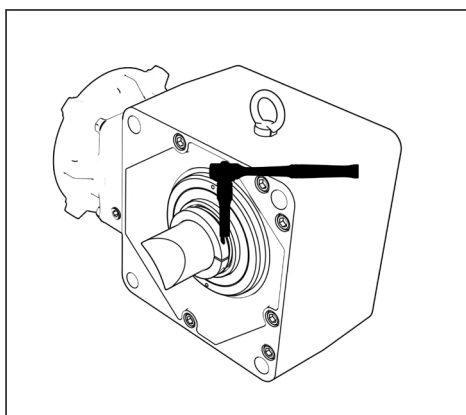
Clamp bushing shown in place.



10

Once the shaft is properly positioned, verify the support bushing lip remains seated against the edge of the hollow shaft.

Gently tap in place with a plastic or rubber hammer if necessary.



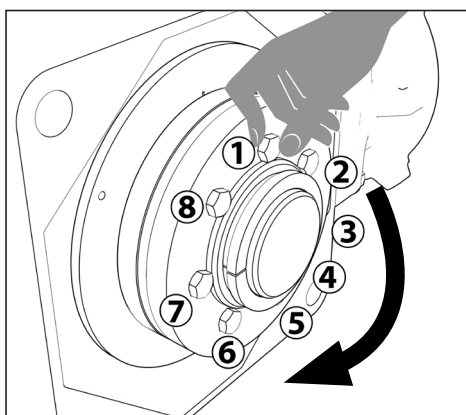
11



Use a calibrated torque wrench.

Tighten the support bushing cap screw to the recommended torque shown in **Table 2**.

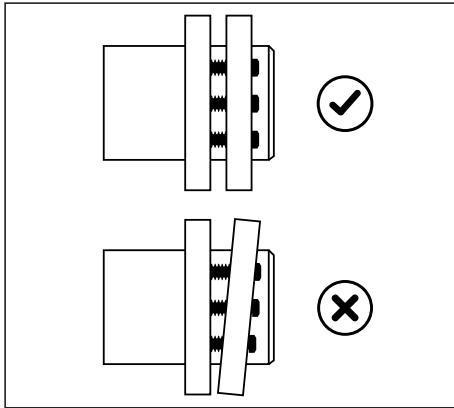
The support bushing is now fixed in place.



12

Position and align the shrink disc such that it is perpendicular and fully supported by the hollow shaft, shaft and clamp bushing.

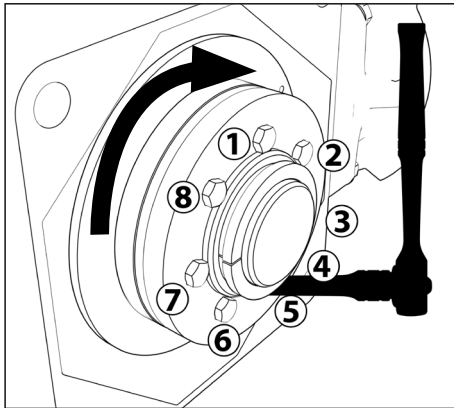
Hand-tighten the Shrink Disc bolts.



13



Measure the gap between the Shrink Disc outer rings to verify they are parallel.



14

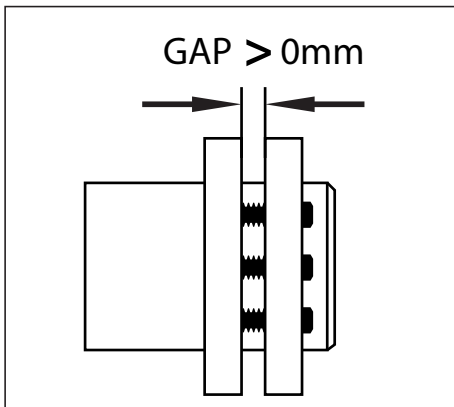
Set your torque wrench to **100 percent** of the recommended torque.

Tighten each Shrink Disc screw using the torque wrench. Use a **circular pattern** and work in **quarter turn increments** until the bolts reach 100 percent of the torque. See **Table 2** for torque values.



DO NOT tighten bolts in a star pattern.

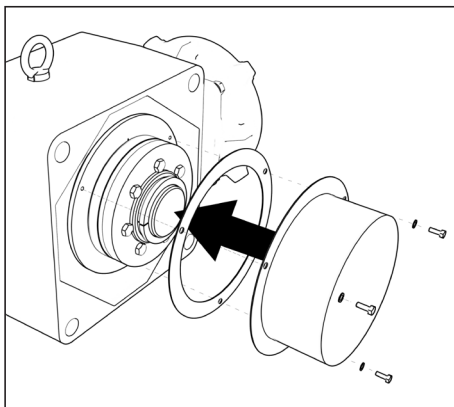
Only use a calibrated torque wrench for this step. **DO NOT** use impact tools or hand tools.



15

Use feeler gauge to verify that there is a gap (**gap > 0mm**) between outer rings of the shrink disc.

Verify the Shrink Disc outer rings are parallel within **0.005 inches (0.127mm)**.



16

Install the safety cover and gasket if applicable to the back plate using the three hex bolts and washers provided.

Torque Arm Installation

Standard Face Mount Torque Arm

Mount the torque arm on the driven machine side of the drive casing. Use hexagon socket head bolts for mounting. (See **Table 4** for bolt sizes.)

Table 4. Torque Arm Bolt Sizes.

Model	Bolt
HZ522	M20
HZ523	
HZ524	
HA635	

The torque arm should be mounted to ensure that the contact surface between the drive and shaft are free from excessive forces (**Figure 10**). **Do not attach the torque arm using anti-rotation bolts.** For applications that require frequent starts and stops or frequent reversing, insert a rubber bushing (or spacer) between the torque arm and securing bolt in order to dampen impact load as shown in (**Figure 11**).

Fig. 10

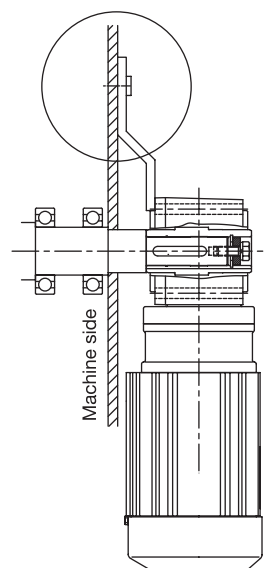
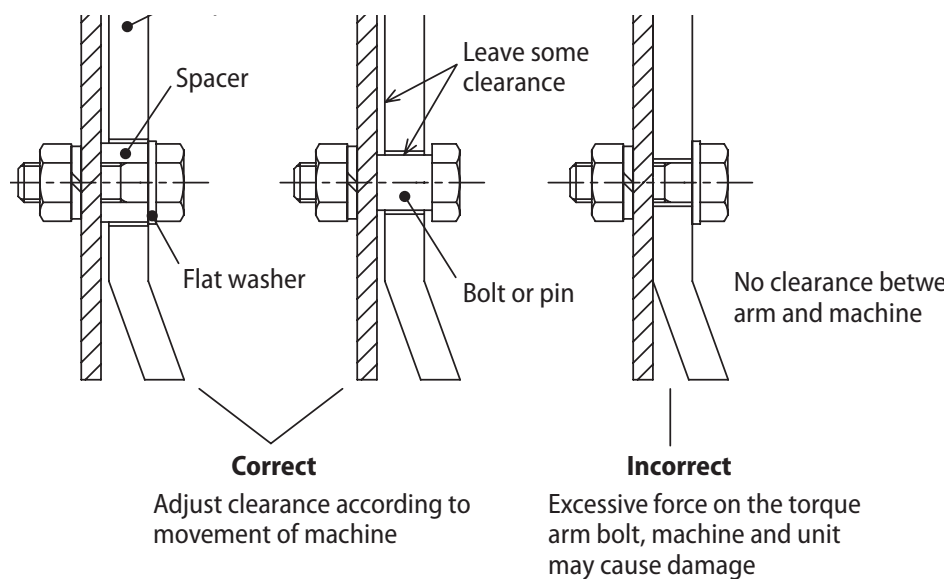


Fig. 11



T-Type Torque Arm

The BBB-H T-type torque arm design allows for reversing rotation and can be mounted to accept loads in tension or compression. Any of the mounting positions shown in **Figure 12** are permissible. **Table 5** shown below, mentions the necessary components for a proper operation of the T-type torque arm.

During the operation, the BBB-H unit will rotate in the direction opposite to that of the driven shaft.



Tighten both pairs of nuts against the mounting tab so that there is zero clearance between the rubber bushings and the tab, but you can still rotate the rubber bushings by hand. Do not overtighten, but ensure that the nuts in each pair are tightened securely against each other so vibration will not cause them to loosen. Be sure that the bottom of the mounting angle bracket is secured to a rigid surface.

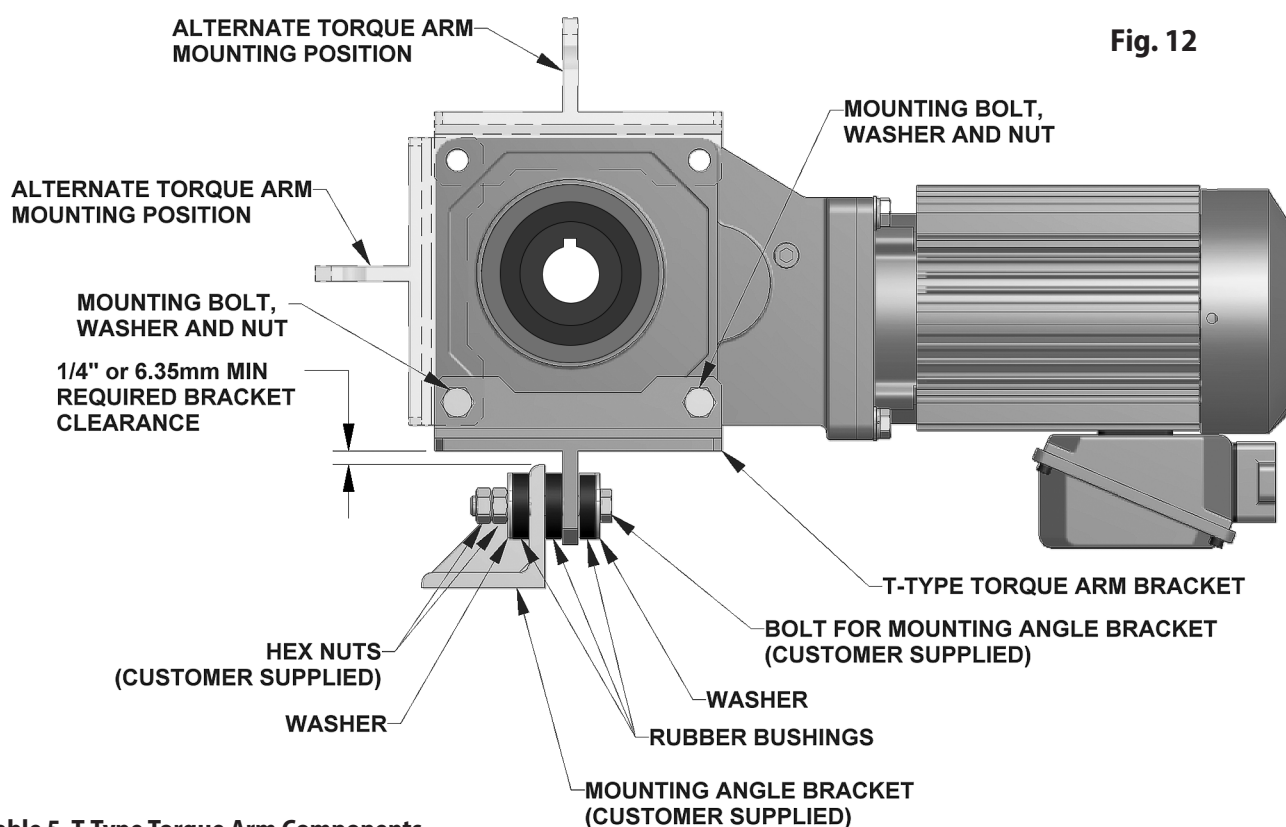


Table 5. T-Type Torque Arm Components

Item	Quantity
Torque Arm	1
Bolt, Hex Head	2
Washer, Lock	2
Nut, Hex, Coarse	2
Bushing, Rubber	3
Washer, T-Type	2

Wiring

1. Prior to wiring, refer to the name plate mounted to the motor portion of the BBB-H unit. Check the power supply, interconnects, relays, protective starting devices (i.e, Star (Wye) delta - if reduced voltage starting is required), space heaters, thermal sensors and other accessories.
2. Be aware that long wiring may cause voltage drops.

Wiring Connections for Standard Motor Contactor

Models FB-01A1 through FB-15E, 230/460V, 60Hz or 575V, 60Hz

Fig. 13-a Normal Brake Action, 230V or 575V Brake

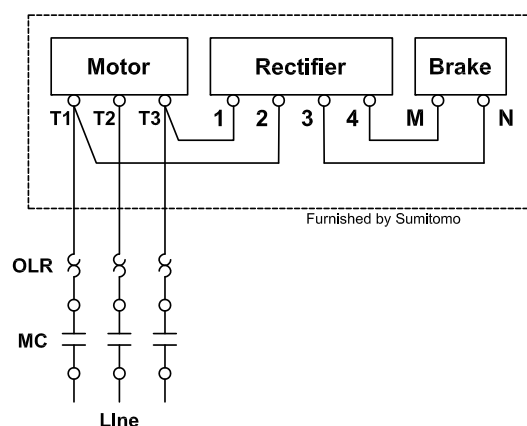


Fig. 13-b Fast Brake Action, 230V Brake

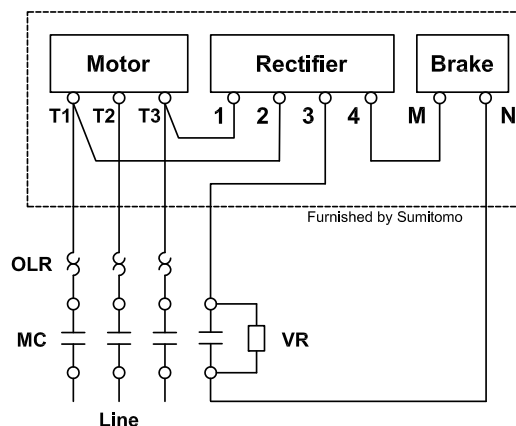


Fig. 13-c Normal Brake Action, 460V Brake

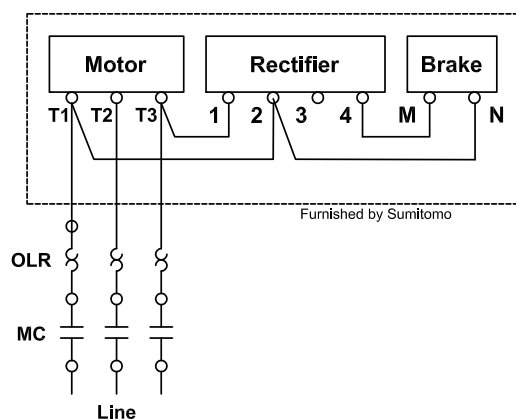
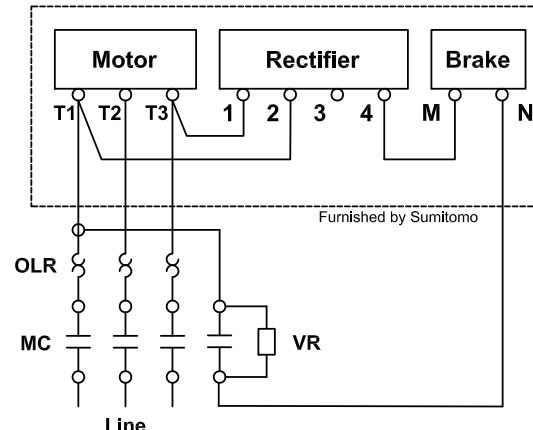


Fig. 13-d Fast Brake Action, 460V or 575V Brake



Key:

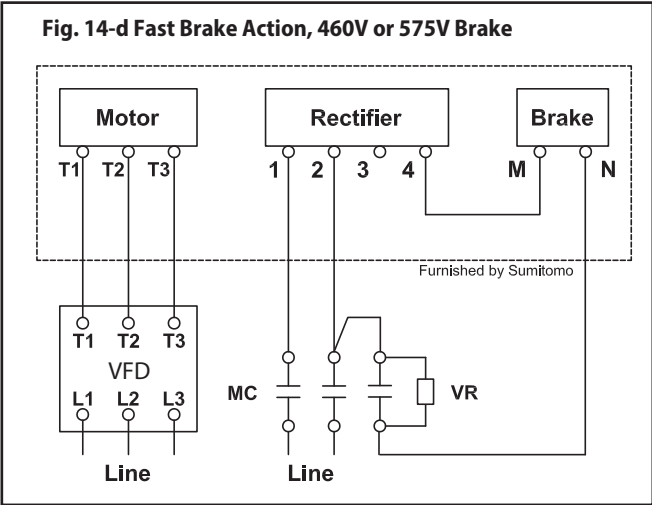
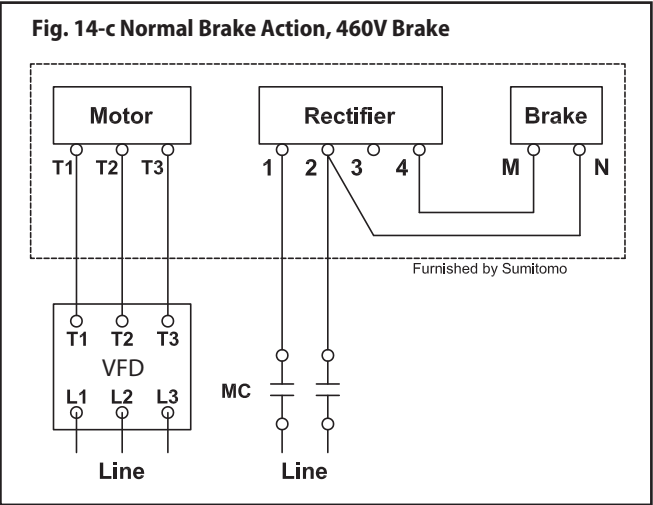
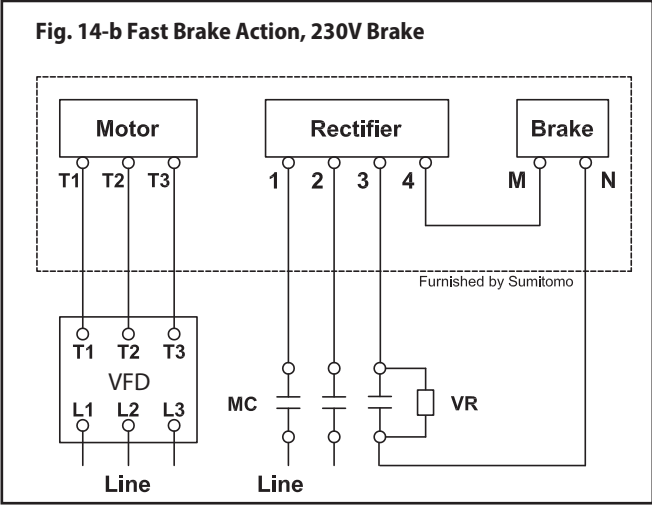
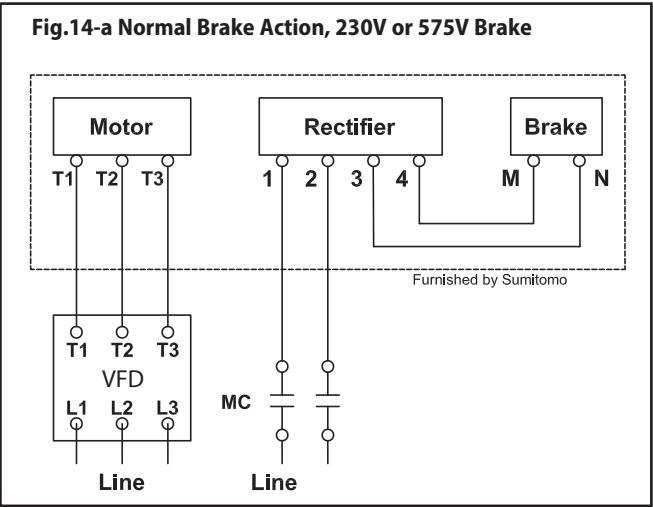
MC: Motor Contactor

OLR: Overload or Thermal Relay

VR: Varistor (protective device, refer to Varistor Specification **Table 6**)

Wiring Connections for VFD (Inverter)

Models FB-01A1 through FB-15E, 230/460V, 60Hz or 575V, 60Hz



Key:
VR: Varistor (protective device, refer to Varistor Specification **Table 6**)

Table 6. Varistor Specification Table

Operating Voltage		190-230V	380-460V	575V
Varistor Rated Voltage		AC260-300V	AC510V	AC604V
Varistor Voltage		430-470V	820V	1000V
Rated Watt	FB-01A1, 02A1, 05A1	Over 0.4W	Over 0.4W	Over 0.4W
	FB-1E, 1D	Over 0.6W	Over 0.6W	Over 0.4W
	FB-1HE, 2E, 2D, 3E	Over 1.5W	Over 1.5W	Over 0.6W
	FB-5E, 8E, 10E, 15E	Over 1.5W	Over 1.5W	Over 1.5W

Motor Operating Precautions

a. Always ground the motor terminal box or frame.

b. Insulation Resistance

Follow instructions supplied with the motor insulation tester. The insulation resistance value will vary depending on the temperature, humidity, extent of contamination, the servicing period, test running time, as well as the motor output, voltage and type of insulation. Therefore, the insulation resistance (r) cannot be expressed uniformly; however, it should be equal to or greater than the value listed in **Table 7**.

Table 7. Insulation Resistance

Motor Voltage	Megger Voltage	Insulation Resistance (r)
Low voltage motor ($\leq 600V$)	500V	Higher than 1 M Ω

Operation

Once the BBB-H unit is installed, ensure that the wiring is correct and secure prior to operation. Observe the precautions listed in **Table 8** during the trial run. Stop running the gearmotor if any abnormalities are detected and contact your nearest sales office or distributor.

Table 8. Trial Run Precautions

Observation	Possible Cause
Any abnormal noises or vibrations	1.The casing is distorted due to an uneven mounting surface. 2.The gearmotor is resonant due to insufficient rigidity of the mounting surface. 3.The shaft of the BBB-H and the driven machine are not aligned. 4.Vibrations of the driven machine are conveyed to the gearmotor. 5.Rigidity of the driven machine and its shaft is insufficient (hollow shaft type). 6.Excessive force is exerted on the baffle sections of the torque arm (hollow shaft type). 7.After the BBB-H unit is flange or foot mounted, undue force is exerted between the gearmotor and its shaft.
Abnormally high temperature of the gear casing or motor frame surface.	1.Motor electric current is exceeding the rated value specified on the nameplate. 2.Is voltage applied between THREE motor connections equal to the motor nameplate voltage rating $\pm 10\%$? 3.The ambient temperature around the unit is too high.

Daily Inspection and Maintenance

1. Inspect the gearmotor daily for each of the items listed in **Table 9**.
2. If any abnormalities are found during daily inspections, follow the procedures outlined in the Troubleshooting Guide, **Table 18 on page 32**. If the abnormality is not listed or the recommended procedure does not solve the problem, contact your nearest sales office or distributor.
3. The BBB-H unit does not require grease replenishment, but overhauling after 20,000 hours of operation, or 3 - 5 years will extend its life.

Table 9. Daily Inspection Items

Items	Details
Electric Current	Is the electric current higher than the value specified on the nameplate?
Noise	Is the gearmotor making any unusual sounds?
Vibration	Are there any unusual vibrations of the gear or motor frame?
Surface Temperature	Is the surface temperature of the gear case, or motor frame too high or rising suddenly? (The temperature rise during operation varies depending on the type of motor. There may be a problem, if the temperature frequently rises approximately 40°C (104°F) above the ambient temperature.)
Grease Leakage	Is there any grease leaking from the gear assembly?
Mounting Bolts/Torque Arm	Are there any loose mounting bolts?
Chains and V-belts	Are there any loose chains or V-belts?
Brake	Is the brake lining worn out? Is the air gap within specification?

FB Brake Assembly - Inspection, Adjustment & Maintenance

FB series brakemotors are designed to be mechanically rugged in design, electrically reliable and efficient in operation. To maintain this reliable performance, the brake assembly must be inspected and adjusted periodically.

This section of the manual pertains specifically to the brake portion of the BBB-H unit and provides all the necessary information to insure long and trouble-free service.

Brake Models FB-01A1, FB-02A1, and FB-05A1

1. Standard Brakemotor Specifications

Table 10 lists the standard specifications for Models FB-01A1, FB-02A1, and FB-05A1.

Table 10. FB-01A1, FB-02A1, and FB-05A1 Standard Specifications

Brake Model	Motor Capacity		Standard Braking Torque ft - lbs (<i>N - m</i>)	Braking Delay Time (sec)			Brake Work Capacity		
				Normal Braking Action		Fast Braking Action	Allowable E ₀ (J/min)	Gap Adjust (x 10 ⁷ J)	Total E ₁ (x 10 ⁷ J)
	Standard Wiring	Inverter Wiring ^[1]							
FB-01A1	1/8	0.1	0.7 (1.0)	0.15 ~ 0.2	0.08 ~ 0.12	0.015 ~ 0.02	1080	2.6	6.7
FB-02A1	1/8 ~ 1/3	0.1 ~ 0.25	1.4 (2.0)						
FB-05A1	1/4 ~ 1/2	0.2 ~ 0.4	2.9 (4.0)	0.1 ~ 0.15	0.03 ~ 0.07	0.01 ~ 0.015			

Notes: Above table applies to standard brake specification under standard brake torque. Special brakes may perform differently from those shown. Initial brake torque may be lower than specified brake torque. If this is the case, under light load start and stop the motor to wear-in the braking surface. To improve performance for positioning accuracy or lifting applications, consider using fast braking action circuit. If the brake is operated at a rate greater than the Allowable Brake Work Capacity, E_0 , the brake performance may degrade or become inoperable.

[1] Also applies to wiring where brake is powered separately from the motor leads.

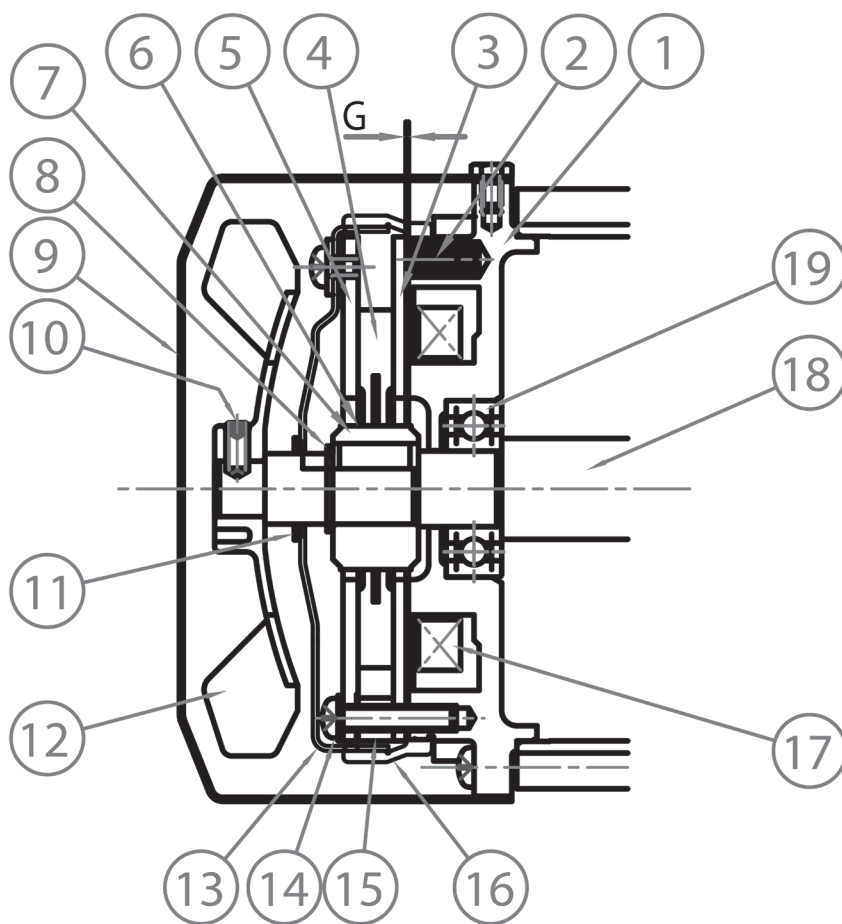
2. Construction and Operating Principles

a) Construction

Figure 15 illustrates the construction of the brake. The restraining screw (14) fastens the brake shoe (5) and spacer (15) onto the stationary core (1). The armature plate (3) is kept from rotation by the restraining screw (14) but moves axially by electromagnetic attraction and the tension of the pressure spring (2). The brake lining (4) is fitted to the hub (7) which is secured to the motor shaft with a key. The solenoid coil (17) is energized via a rectifier provided within the conduit box.

Fig. 15 FB-01A1, FB-02A1, FB-05A1 Models

No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Armature Plate*
4	Brake Lining*
5	Brake Shoe*
6	Leaf Spring*
7	Hub*
8	C-type Retaining Ring
9	Cover
10	Set Screw (TEFC model only)
11	V-Ring
12	Fan (TEFC model only)
13	Waterproof Cover
14	Restraining Screw*
15	Spacer*
16	Waterproof Seal
17	Solenoid Coil*
18	Motor Shaft
19	Fan Side Bearing



* These parts are included in a complete brake kit.

b) Operating Principles

The brake is a (fail safe type) spring actuated type brake, which will release the brake mechanism when the solenoid coil is energized and which will engage when the coil is de-energized.

When power is applied to the unit, the solenoid coil and the electric motor will energize, and the energized coil attracts the armature plate (3) against the tension of the pressure spring (2). As a result, the brake lining (4) will disengage, and the motor begins to run.

When the power is disconnected, the solenoid coil and the electric motor is de-energized. This causes the pressure spring (2) to actuate the armature plate (3) which in turn presses the brake lining (4) against the brake shoe (5) and brings the motor to a quick stop.

3. Inspection

- a) At regular intervals, check that:
- the unit is operating normally.
 - the brake lining is not excessively worn (or gap G is normal).
 - all the mounting screws are securely tightened.

b) Manual brake release procedure

FB-01A1, FB-02A1, and FB-05A1 brakemotors are equipped with a one touch release mechanism. To manually release the brake with power to the unit turned off, pull the brake release lever up and out from its holder and push it forward towards the reducer. Releasing the lever will re-engage the brake.

4. Gap Inspection

The brake lining will wear after the unit has been used for a long period of time. Regularly check that gap G (**Figure 15**) is at an acceptable value. If the gap G become too large, the solenoid coil may fail to pull in the armature plate and hence cannot release the brake, resulting in the unit remaining in a continuously braked condition. Follow these steps to inspect the brake gap:

- Remove cover (9).
- Remove fan (12) by loosening set screw (10) (models FB-02A1 and FB-05A1).
- Remove waterproof seal (16).
- Insert a gap gage into the space between stationary core (1) and armature plate (3). Measure the gap size at three appropriate circumferential points.
- The gap needs to be adjusted if the values are close to the allowable limit listed in **Table 11**.

Table 11. Brake Gap Size

Brake Type	Gap value G, in. (mm)	
	Spec. value	Allowable limit
FB-01A1	0.008 - 0.014 (0.20 - 0.35)	0.02 (0.5)
FB-02A1		
FB-05A1		

5. Gap Adjustment

If the brake lining is so heavily worn that gap adjustment is required, follow these steps:

- Remove cover (9).
- Remove fan (12) by loosening set screw (10) (models FB-02A1 and FB-05A1).
- Remove waterproof seal (16).
- Loosen restraining bolts (14), rotate the brake shoe completely counterclockwise, and re-tighten the restraining bolts (14). After tightening the restraining bolts, measure the gap G to verify that it falls within the specification value and the allowable limit shown in Table 10. (This procedure reduces the gap approximately 0.012 inch (0.30 mm).)
- Check for brake performance by turning system power on and off a few times.
- Reinstall waterproof seal (16) and fan(12).
- Replace cover (9).

Brake Models FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, and FB-3E

1. Standard Brakemotor Specifications

Table 12 lists the standard specifications for Models FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, FB-3E.

Table 12. Models FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, FB-3E Standard Specifications

Brake Model	Motor Capacity		Standard Braking Torque ft - lbs (<i>N - m</i>)	Braking Delay Time (sec)			Brake Work Capacity		
				Normal Braking Action		Fast Braking Action	Allowable E ₀ (J/min)	Gap Adjust (x 10 ⁷ J)	Total E ₁ (x 10 ⁷ J)
	Standard Wiring	Inverter Wiring ^[1]							
FB-1D	1/2 ~ 3/4	0.4 ~ 0.55	5.8 (7.5)	0.2 ~ 0.3	0.1 ~ 0.15	0.01 ~ 0.02	1620	7.0	33.1
FB-2D	3/4	0.55	11 (15)				2580	6.8	29.5
FB-1E	1	0.75	5.5 (7.5)	0.25 ~ 0.45	0.15 ~ 0.25	0.01 ~ 0.03	2580	11.6	38.7
FB-1HE	1.5	1.1	8.0 (11)	0.45 ~ 0.65	0.25 ~ 0.35		3360	20.8	46.3
FB-2E	2	1.5	11 (15)	0.35 ~ 0.55	0.15 ~ 0.25				
FB-3E	3	2.2	16 (22)	0.75 ~ 0.95	0.4 ~ 0.5	0.02 ~ 0.04	5720	26.3	105.3

Notes: Above table applies to standard brake specification under standard brake torque. Special brakes may perform differently from those shown. Initial brake torque may be lower than specified brake torque. If this is the case, under light load start and stop the motor to wear-in the braking surface. To improve performance for positioning accuracy or lifting applications, consider using fast braking action circuit. If the brake is operated at a rate greater than the Allowable Brake Work Capacity, E₀, the brake performance may degrade or become inoperable.

[1] Also applies to wiring where brake is powered separately from the motor leads.

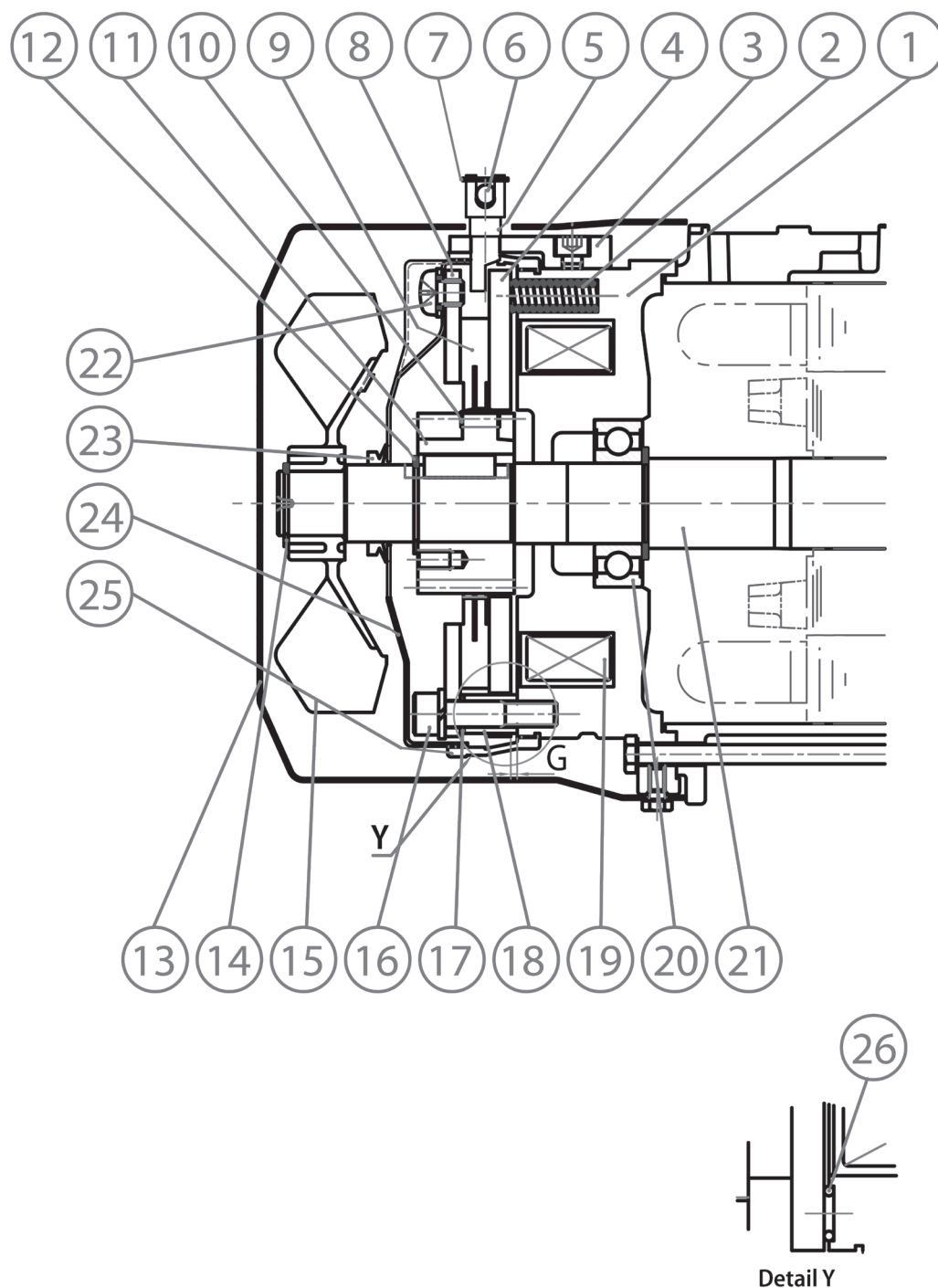
2. Construction and Operating Principles

a) Construction

Figure 16 illustrates the construction of the brake. The restraining bolt (16) fastens the brake shoe (8), gap adjusting shims (17) and spacer (18) onto the stationary core (1). The armature plate (4) is kept from rotation by the restraining bolt (16) but moves axially by electromagnetic attraction and the tension of the pressure spring (2). The brake lining (9) is fitted to the hub (11) which is secured to the motor shaft with a key. The solenoid coil (19) is energized via a rectifier provided within the terminal box.

Fig. 16 FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, and FB-3E Models (E-Series Shown)

No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Brake Release Support
4	Armature*
5	Shifting Pin
6	Brake Release Lever
7	Retaining Clip
8	Brake Shoe*
9	Brake Lining*
10	Leaf Spring*
11	Hub*
12	C-type Retaining Ring
13	Cover
14	Retaining Ring
15	Fan
16	Restraining Bolt*
17	Gap Adjusting Shims*
18	Spacer*
19	Solenoid Coil*
20	Fan Side Bearing
21	Motor Shaft
22	Attachment Screw
23	V-Ring
24	Waterproof Cover
25	Waterproof Seal
26	Shock Absorber*



* These parts are included in a complete brake kit.

b) Operating Principles

The brake is a (fail safe type) spring actuated type brake, which will release the brake mechanism when the solenoid coil is energized and engages when the coil is de-energized.

When power is applied to the unit, the solenoid coil and electric motor will become energized, and the energized coil attracts the armature plate (4) against the tension of the pressure spring (2). As a result, the brake lining (9) disengages, and the motor starts to run.

When the power is disconnected, the solenoid coil and the electric motor are not energized. This causes the pressure spring (2) to actuate the armature plate (4) which in turn presses the brake lining (9) against the brake shoe (8) and brings the motor to a quick stop.

3. Inspection

a) At regular intervals, check that:

- the unit is operating normally.
- the brake lining is not excessively worn (or gap G is normal).
- all the mounting screws are securely tightened.

b) Manual brake release procedure

FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E and FB-3E brakemotors are equipped with a one touch release mechanism. To manually release the brake with power to the unit turned off, pull the brake release lever up and out from its holder and push it forward towards the reducer. Releasing the lever will re-engage the brake.

4. Gap Inspection

The brake lining will wear after the unit has been used for a long period of time. Regularly check that gap G from time to time (**Figure 16**) is at an acceptable value. If gap G become too large, the solenoid coil may fail to pull in the armature plate and hence cannot release the brake, resulting in the unit remaining in a continuously braked condition. Follow these steps to inspect the brake gap:

- Remove shifting pin (5) and brake release lever (6).
- Remove cover (13).
- Remove fan (15) by removing retaining ring (14).
- Remove waterproof seal (25).
- Insert a gap gage into the space between the stationary core (1) and armature plate (4). Measure the gap size at three appropriate circumferential points.
- Check for brake performance by turning system power on and off a few times.
- The gap needs to be adjusted if the values are close to the allowable limit listed in **Table 13**.

Table 13. Brake Gap Size

Brake Type	Gap value G, in. (mm)		
	Spec. value	Allowable limit	Gap Adjustment Shim Thickness
FB-1D, FB-2D	0.012 - 0.016 (0.3 - 0.4)	0.024 (0.6)	0.008 - 0.01 (0.2 - 0.25)
FB-1E	0.01 - 0.014 (0.25 - 0.35)	0.024 (0.6)	0.008 - 0.01 (0.2 - 0.25)
FB-1HE, FB-2E	0.01 - 0.014 (0.25 - 0.35)	0.029 (0.75)	0.014 - 0.018 (0.35 - 0.45)
FB-3E	0.01 - 0.014 (0.25 - 0.35)	0.033 (0.85)	0.018 - 0.022 (0.45 - 0.55)

5. Gap Adjustment

If the brake lining is so heavily worn that gap adjustment is required, follow these steps:

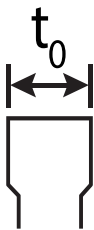
- Remove shifting pins (5) and brake release lever (6).
- Remove the cover (13). Remove fan (15) by removing retaining ring (14). Remove V-Ring (23) waterproof seal (25) and waterproof cover (24).
- Measure the gap size to confirm the deviation from the specification value. The minimum adjustable setting is no less than the thickness of the Gap Adjusting Shim shown in **Table 13**.
- Loosen the restraining bolt (16) and remove parts (16), (8), (17), and (18) as a set. Be careful not to remove only the bolt (16) and lose the shims (17).
- Decrease the number of shims in use according to the degree of wear (**Note:** Retain the removed shims for use during the brake lining replacement procedure). Reassemble parts (16), (8), (17) and (18) as a set.
- Once reassembled, check gap G. If the gap size is still too large, adjust the number of shims again.
- After completing the gap adjustment, turn the system power on and off a few times to check the brake performance.
- Replace waterproof cover (24), waterproof seal (25), V-Ring (23), fan (15), retaining ring (14), cover (13), shifting pins (5), and brake release lever (6).

6. Brake Lining Replacement

Follow these steps to replace the brake lining when its thickness has reached the allowable limit shown in **Table 14**, or when sleeve adjustment is no longer an effective means of gap adjustment:

- Remove shifting pins (5) and brake release lever (6).
- Remove the cover (13). Remove fan (15) by retaining ring (14). Remove V-Ring (23) waterproof seal (25) and waterproof cover (24).
- Loosen the restraining bolt (16) and remove parts (16), (17), (18) and (8) as a set.
- Remove the brake lining (9), taking care to prevent the leaf spring (10) from coming off.
- Install the new brake lining, taking care not to damage or remove the leaf spring (10). Ensure that the lining moves smoothly along the hub (11).
- Replace any gap adjusting shims removed and retained from previous gap adjustments. Then reinstall parts (16), (17), (18) and (8) as a set.
- Measure gap G. Readjust if the gap is not within the specification value range.
- Turn the system power on and off a few times to check the brake performance. If no abnormalities are detected, replace waterproof cover (24), waterproof seal (25), V-Ring (23), fan (15), retaining ring (14), cover (13), shifting pins (5) and brake release lever (6).

Table 14. Brake Lining Size

Brake Type	Brake lining dimension	Initial Thickness t_0 , in. (mm)	Allowable Thickness t_0 , in. (mm)
FB-1D		0.276 (7.0)	0.236 (6.0)
FB-2D, FB-1E		0.347 (8.8)	0.307 (7.8)
FB-1HE, FB-2E, FB-3D		0.354 (9.0)	0.315 (8.0)
FB-3E		0.398 (10.4)	0.331 (8.4)

Brake Models FB-5E, FB-8E, FB-10E, and FB-15E

1. Standard Brakemotor Specifications

Table 15 lists the standard specifications for Models FB-5E, FB-8E, FB-10E, and FB-15E.

Table 15. Models FB-5E, FB-8E, FB-10E, and FB-15E Standard Specifications

Brake Model	Motor Capacity		Standard Braking Torque ft - lbs (<i>N - m</i>)	Braking Delay Time (sec)		Fast Braking Action	Brake Work Capacity		
				Normal Braking Action			Allowable E ₀ (J/min)	Gap Adjust (x 10 ⁷ J)	Total E ₁ (x 10 ⁷ J)
	HP x 4P	kW x 4P		Standard Wiring	Inverter Wiring ^[1]				
FB-5E	5	3.7	30 (40)	1.1 ~ 1.3	0.4 ~ 0.5	0.02 ~ 0.04	6900	57.4	382.8
FB-8E	7.5	5.5	40 (55)	1.0 ~ 1.2	0.3 ~ 0.4				
FB-10E	10	7.5	59 (80)	1.8 ~ 2.0	0.6 ~ 0.7		10800	110.2	551.1
FB-15E	15	11	80 (110)	1.6 ~ 1.8	0.5 ~ 0.6				

Notes: Above table applies to standard brake specification under standard brake torque. Special brakes may perform differently from those shown. Initial brake torque may be lower than specified brake torque. If this is the case, under light load start and stop the motor to wear-in the braking surface. To improve performance for positioning accuracy or lifting applications, consider using fast braking action circuit. If the brake is operated at a rate greater than the Allowable Brake Work Capacity, E₀, the brake performance may degrade or become inoperable.

[1] Also applies to wiring where brake is powered separately from the motor leads.

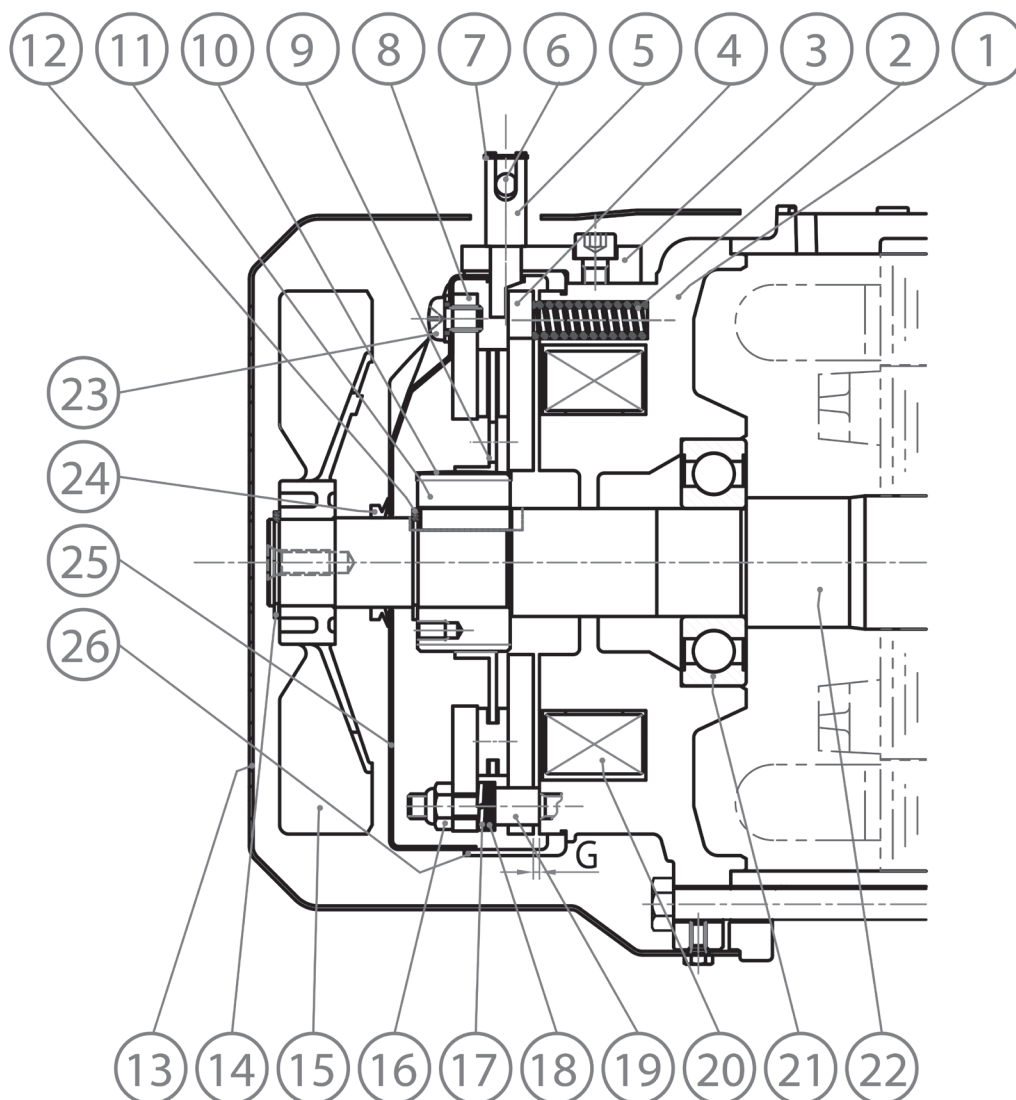
2. Construction and Operating Principles

a) Construction

Figures 17-a and 17-b illustrate the construction of the brake. Among the brake parts, the stationary core (1), solenoid coil (20), and stud bolt (19) constitute an integral subassembly unit. The stud bolt (19) keeps the armature plate (4) from rotating, but the plate moves axially by electromagnetic attraction and the tension of the pressure spring (2). The adjusting washer (18) and spring washer (17) hold the brake shoe (8) against the nut (16) at all times. The brake lining (9) is fit to the hub (11), which is secured to the motor shaft with a key.

Fig. 17-a FB-5E and 8E Models

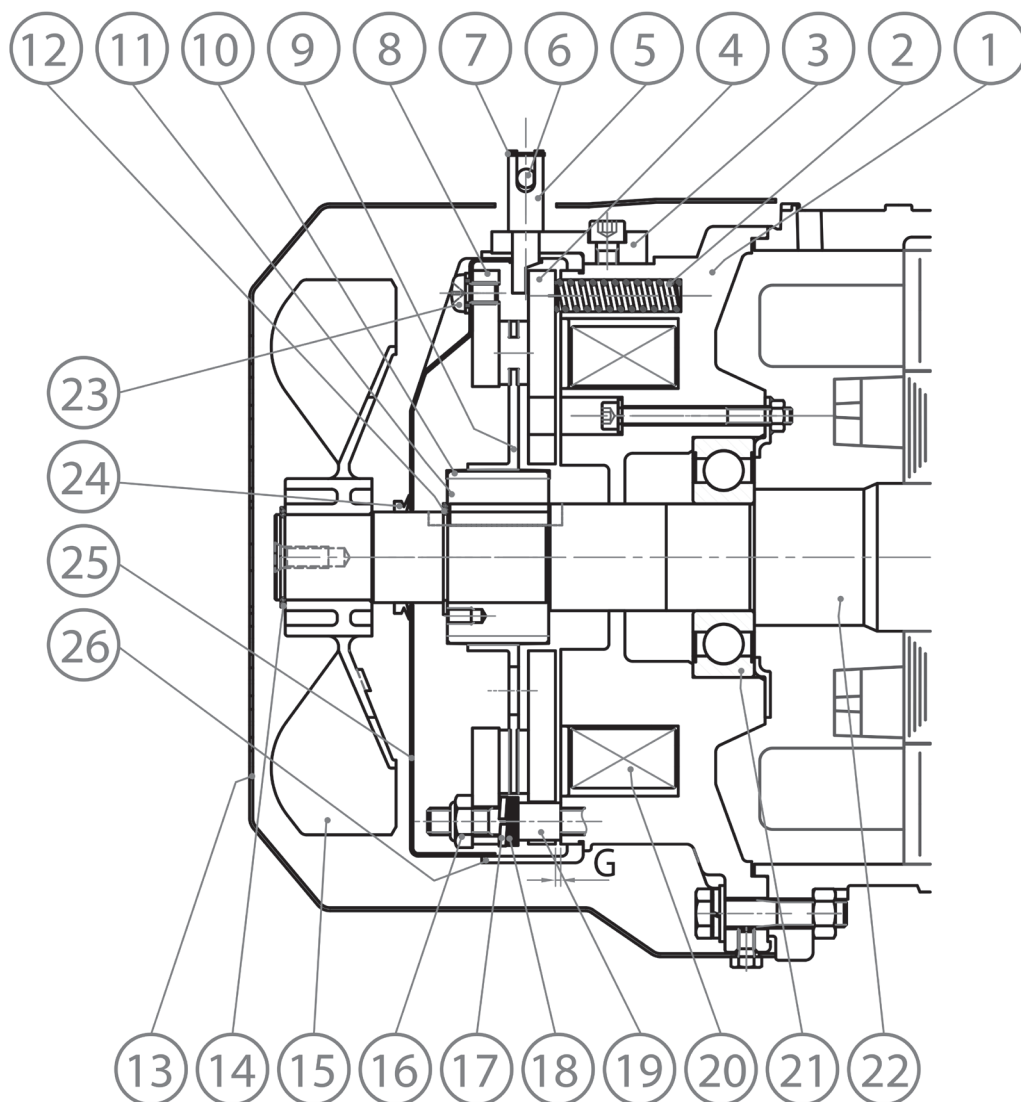
No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Brake Release Support
4	Armature*
5	Shifting Pin
6	Brake Release Lever
7	Retaining Clip
8	Brake Shoe*
9	Brake Lining*
10	Leaf Spring*
11	Hub*
12	C-type Retaining Ring
13	Cover
14	C-type Retaining Ring
15	Fan
16	Gap Adjusting Nut*
17	Spring Washer
18	Adjusting Washer*
19	Stud Bolt*
20	Solenoid Coil*
21	Fan Side Bearing
22	Motor Shaft
23	Attachment Screw
24	V-Ring
25	Waterproof Cover
26	Waterproof Seal



* These parts are included in a complete brake kit.

Fig. 17-b FB-10E and 15E Models

No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Brake Release Support
4	Armature*
5	Shifting Pin
6	Brake Release Lever
7	Retaining Clip
8	Brake Shoe*
9	Brake Lining*
10	Leaf Spring*
11	Hub*
12	C-type Retaining Ring
13	Cover
14	C-type Retaining Ring
15	Fan
16	Gap Adjusting Nut*
17	Spring Washer
18	Adjusting Washer*
19	Stud Bolt*
20	Solenoid Coil*
21	Fan Side Bearing
22	Motor Shaft
23	Attachment Screw
24	V-Ring
25	Waterproof Cover
26	Waterproof Seal



* These parts are included in a complete brake kit.

b) Operating Principles

The brake is a (fail-safe type) spring actuated type brake that releases the brake mechanism when the solenoid coil is energized and engages when the solenoid coil is not energized.

When power is applied to the unit, the solenoid coil and electric motor become energized and the energized coil attracts the armature plate (4) against the tension of the pressure spring (2). As a result, the brake lining (9) disengages and the motor starts to run.

When the power is disconnected, the solenoid coil and electric motor are not energized. This causes the pressure spring (2) to actuate the armature plate (4), which in turn presses the brake lining (9) against the brake shoe (8) and brings the motor to a quick stop.

3. Inspection

a) At regular intervals, check that:

- the unit is operating normally.
- the brake lining is not excessively worn (or gap G is normal).
- all the mounting screws are securely tightened.

b) Manual brake release procedure

FB-5E, FB-8E, FB-10E, and FB-15E brakemotors are equipped with a one-touch release mechanism. To manually release the brake with power to the unit turned off, pull the brake release lever out from its holder and push it forward toward the reducer. Releasing the lever will re-engage the brake.

4. Gap Inspection

The brake lining will wear after the unit has been used for a long period of time. Regularly check that gap G (**Figures 17-a and 17-b**) is at an acceptable value. If gap G becomes too large, the solenoid coil may fail to pull in the armature plate, and hence cannot release the brake, resulting in the unit remaining in a continuously braked condition. Follow these steps to inspect the brake gap:

- Remove shifting pin (5) and brake release lever (6).
- Remove cover (13).
- Remove fan (15) by removing retaining ring (14).
- Remove waterproof seal (26).
- Insert a gap gage into the space between the stationary core (1) and armature plate (4). Measure the gap size at three appropriate circumferential points.
- Check for brake performance by turning system power on and off a few times.
- The gap needs to be adjusted if the values are close to the allowable limit listed in **Table 16**.

Table 16. Brake Gap Size

Brake Type	Gap value G, in. (mm)	
	Spec. value	Allowable limit
FB-5E, FB-8E	0.014 - 0.017 (0.35 - 0.45)	0.040 (1.0)
FB-10E, FB-15E		0.047 (1.2)

5. Gap Adjustment

If the brake lining is so heavily worn that gap adjustment is required, follow these steps:

- Remove shifting pins (5) and brake release lever (6).
- Remove the cover (13). Remove fan (15) by removing retaining ring (14). Remove V-Ring (24) waterproof seal (26) and waterproof cover (25).
- Insert a gap gage into the space between the stationary core (1) and armature plate (4) and rotate the nut (16) at the tip of the stud bolt (19) clockwise until the gap measures an appropriate size. If the gap is too large to adjust by this procedure, decrease the number of adjusting washers (18) in use. Evenly adjust the three nuts (16) until the gaps at the three circumferential points are equal and fall within the specification range shown in **Table 16**.
- After completing the gap adjustment, turn the system power on and off a few times to check the brake performance.
- Replace waterproof cover (25), waterproof seal (26), V-Ring (23), fan (15), retaining ring (14), cover (13), shifting pins (5), and brake release lever (6).

6. Brake Lining Replacement

Follow these steps to replace the brake lining when its thickness has reached the allowable limit shown in **Table 17**, or when sleeve adjustment is no longer an effective means of gap adjustment:

- Remove shifting pins (5) and brake release lever (6).
- Remove the cover (13). Remove fan (15) by retaining ring (14). Remove V-Ring (24) waterproof seal (26) and waterproof cover (25).
- Remove all three nuts (16)
- Remove the brake shoe (8) and take out the brake lining (9).
- Fix the leaf spring (10) as shown in **Figure 18**.
- Apply a small amount of grease along the spline of the new brake lining (9), taking care not to apply any to the wear surface.
- Fit the new brake lining (9) onto the hub (11) and check that it moves smoothly. Remove any excess grease.
- After reassembling the brake, measure gap G. If the gap is out of the specification range, adjust by rotating the gap adjusting nut (16).
- Turn the system power on and off a few times to check the brake performance. If no abnormalities are detected, replace the fan (15), retaining ring (14) and cover (13).
- Measure gap G. Readjust if the gap is not within the specification value range.
- Turn the system power on and off a few times to check the brake performance. If no abnormalities are detected, replace waterproof cover (25), waterproof seal (26), V-Ring (24), fan (15), retaining ring (14), cover (13), shifting pins (5) and brake release lever (6).

Table 17. Brake Lining Size

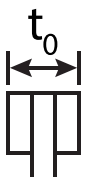
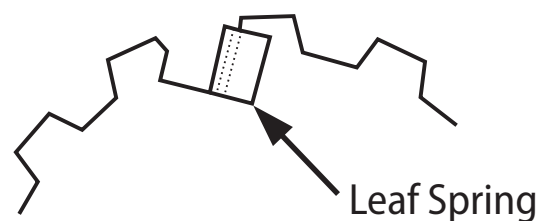
Brake Type	Brake lining dimension	Initial Thickness t_0 , in. (mm)	Allowable Thickness t_0 , in. (mm)
FB-5E, FB-8E		0.394 (10.0)	0.236 (6.0)
FB-10E, FB-15E		0.433 (11.0)	0.276 (7.0)

Fig. 18 Leaf Spring



Troubleshooting

The BBB-H unit is running normally when it meets the following criteria:

- 1) The motor begins to run immediately after the start switch is moved to the ON position.
- 2) The unit does not make any abnormal sounds during operation.
- 3) The motor stops running within about 0.5 seconds after power to the unit is switched off.

Table 18. Quick Troubleshooting Guide

Problem			Possible Cause	Corrective Action
BBB-H	Runs Hot	Overloading	Load exceeds the capacity of the BBB-H	Check rated capacity of the BBB-H; replace with unit of sufficient capacity or reduce load.
		Improper lubrication	Wrong lubricant	Flush out and refill with correct lubricant as recommended.
	Vibration or noise	Loose Foundation bolts / Torque Arm	Weak mounting structure	Inspect mounting of BBB-H. Tighten loose bolts and/or reinforce mounting structure.
			Loose bolts	Tighten bolts.
		Failure of bearings	May be due to lack of lubricant	Replace unit.
			Overload	Check rated capacity of BBB-H, replace with unit of sufficient capacity or reduce load.
	Output shaft does not turn	Motor shaft broken	Overloading of reducer can cause damage	Replace broken shaft. Check rated capacity of BBB-H.
			Key missing or sheared off on input shaft	Replace key.
		Motor doesn't turn	Motor	Refer to Motor section of Troubleshooting Guide.
MOTOR	Load is disconnected but motor doesn't rotate	Makes a groaning sound	Faulty switch contact	Replace contact.
			Blown fuse	Replace.
			One phase wire of the power supply open	Replace.
			Stator coil open	Repair by rewinding or replacing stator assembly.
			Stator and rotor touching due to bearing housing wear	Replace the bearing and bracket.

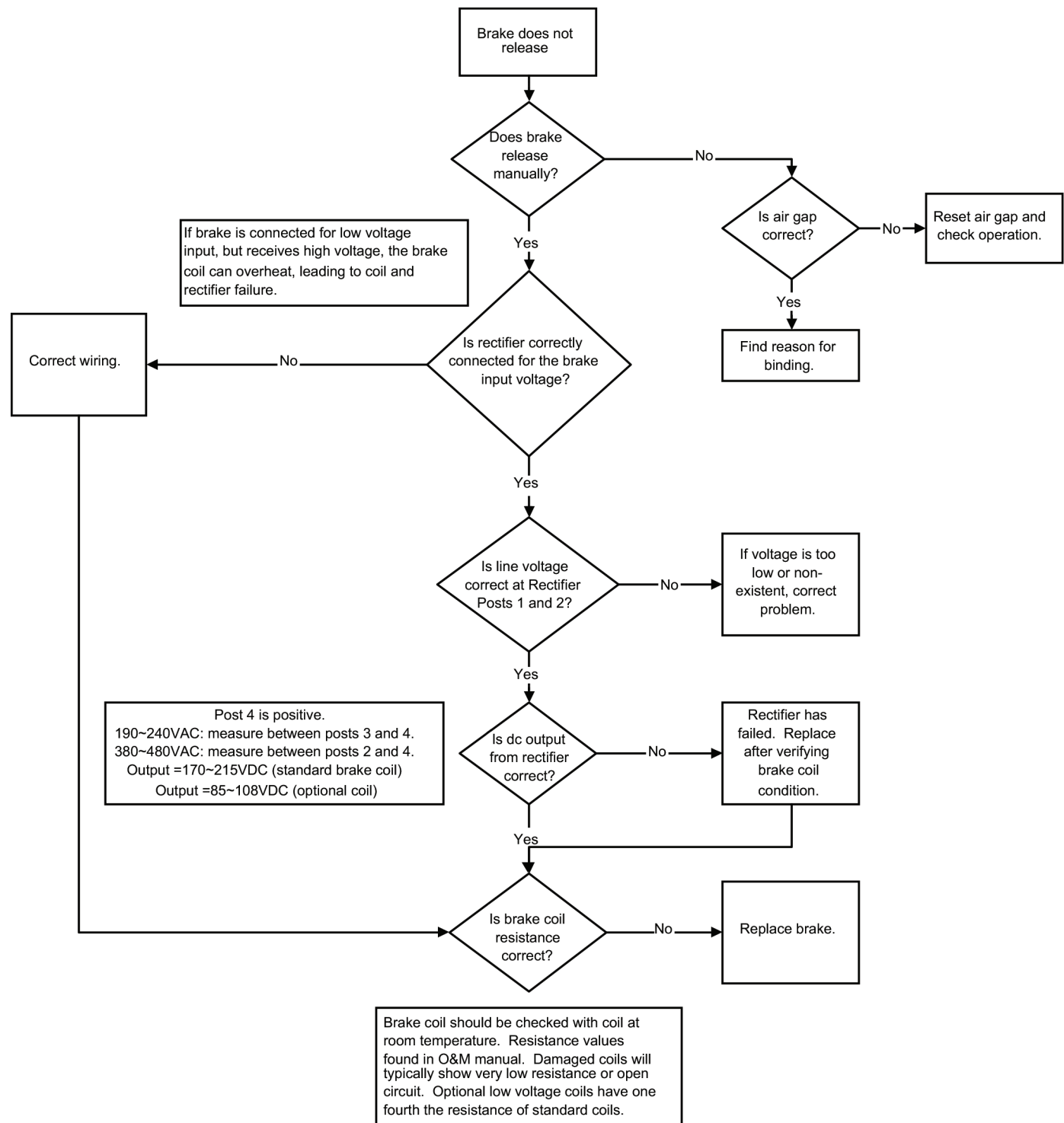
Table 18. Quick Troubleshooting Guide (cont.)

Problem			Possible Cause		Corrective Action
MOTOR (cont.)	Load is disconnected but motor doesn't rotate (cont.)	Starts in either direction when turned by hand	Three phase is operating as single-phase		Check the power source with a voltmeter.
		Doesn't make any noise	Stator coil open		Repair by rewinding or replacing stator assembly.
			Outside the motor	Power failure	Contact the power company.
				Open connection wire	Check the source wiring.
				Faulty starter contact	Replace contact.
	Rotates with the load disconnected, but:	Rotates in the wrong direction	Connection error		Change any two of the three-phase source.
		Fuse blows	Shorted lead wire		Replace.
		Speed doesn't increase	Faulty starter contact		Replace contact.
		Groans	Overcurrent Overheating	Rotor and stator touching	Repair by winding or replacing stator assembly.
			Overcurrent	One phase of stator coil shorted	Replace the stator winding.
		Makes a high pitched metallic noise	Faulty bearing		Replace the bearing.
	Rotates when the load is disconnected but when the load is connected:	Switch overheats	Insufficient switch capacity		Replace with one having the rated capacity.
			Overload		Drop to the rated load.
		Fuse blows	Insufficient fuse capacity		Replace with one having the rated capacity.
		Overheats	Overload		Drop to the rated load.
			Voltage drop		Consult with the power company.
		Speed suddenly drops	Voltage drop		Consult with the power company.
			Overload		Drop to the rated load.
	Stops	Bearing damaged by overheat		Replace the bearing.	

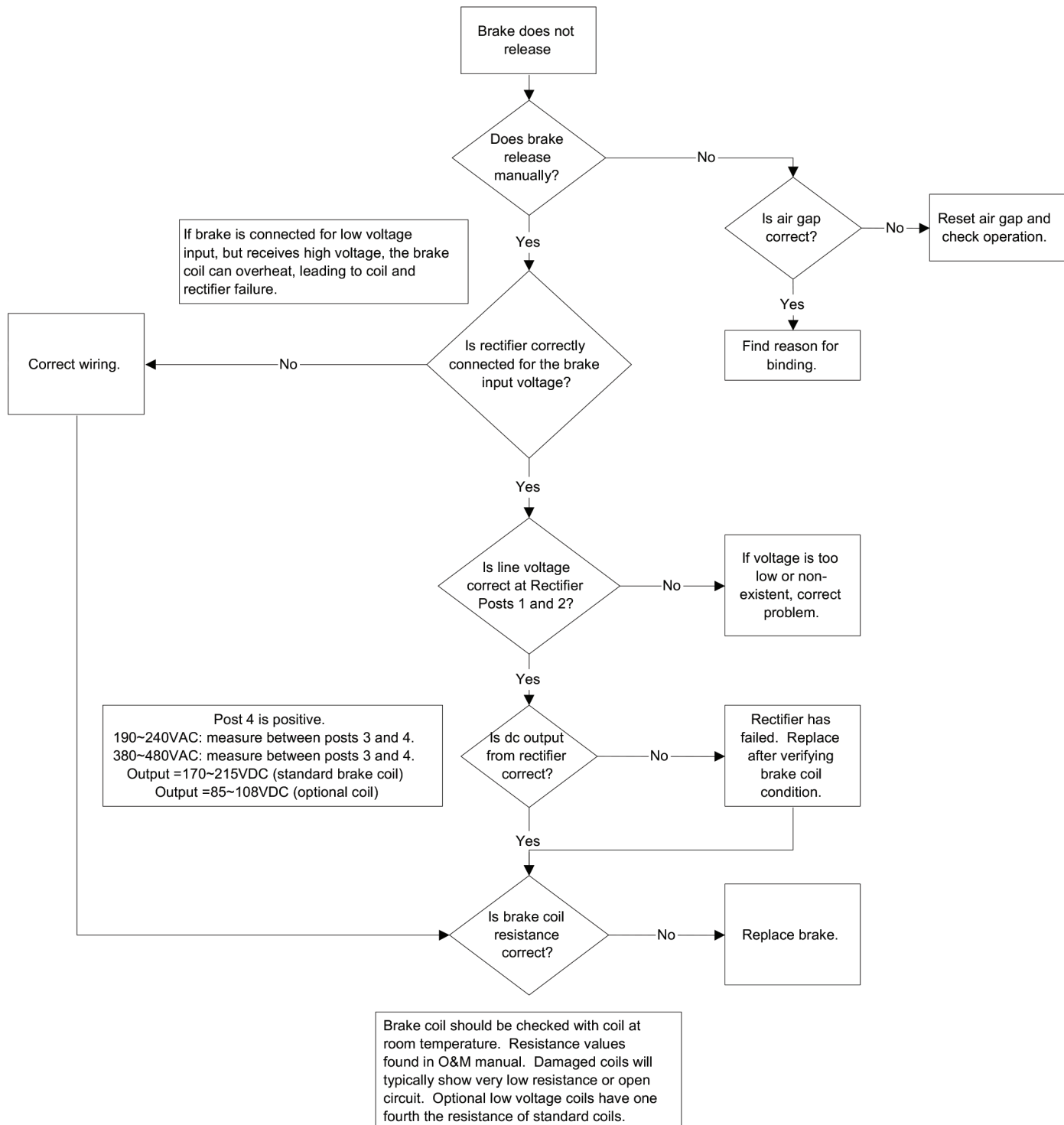
Table 18. Quick Troubleshooting Guide (cont.)

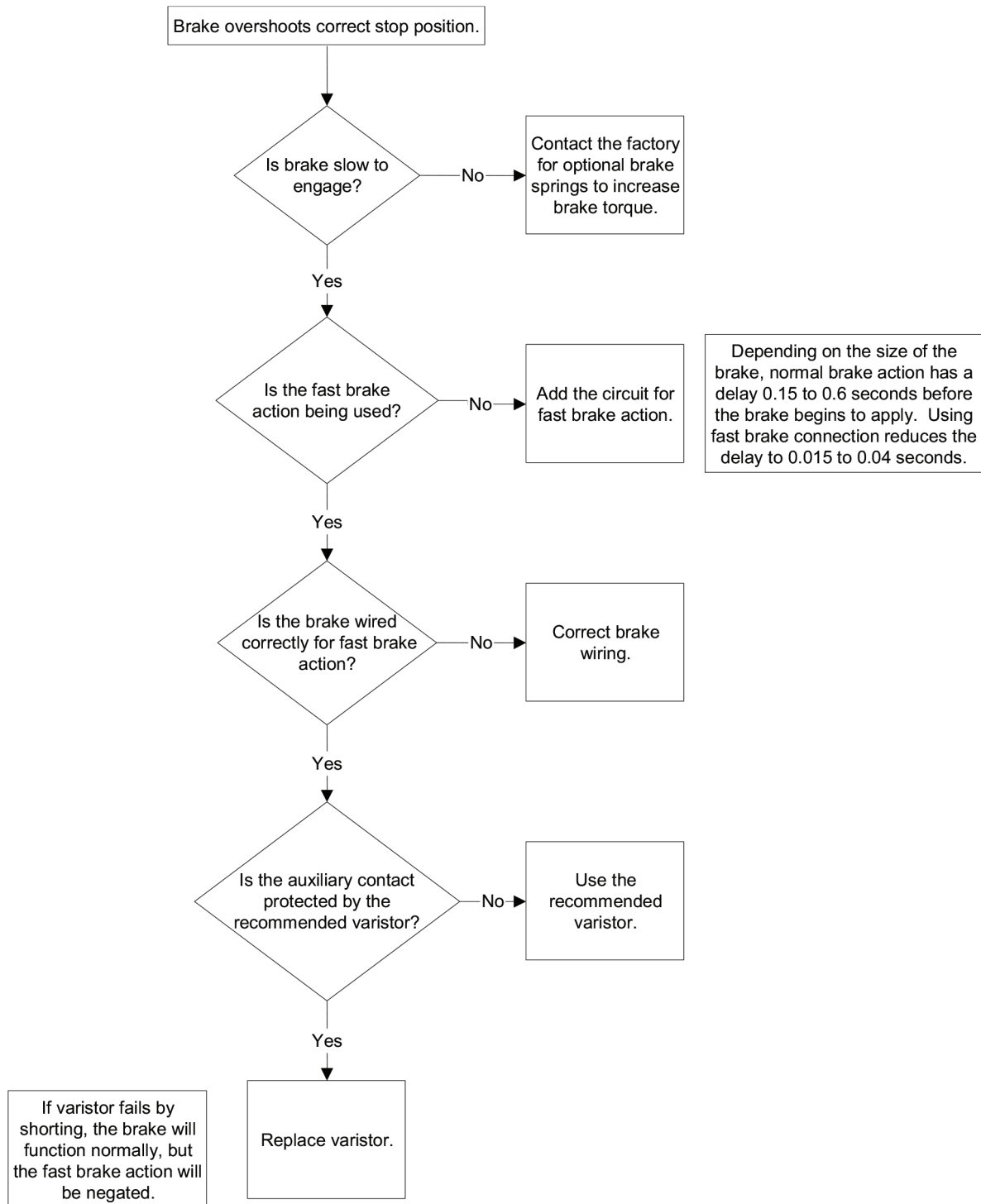
Problem		Possible Cause	Corrective Action
BRAKE	Brake fails to operate	Improper adjustment after reassembly	Adjust again.
	Brake slips (Braking time is too long)	Not wired for fast action	Wire for fast action.
		Foreign matter entrapped in brake lining. Oil on lining surface	Remove foreign matter and take preventive action. Wipe lining surface with a dry cloth.
		Worn brake lining	Adjust brake gap or replace lining.
		Uneven brake gap	Adjust evenly.
		Excessive load	Decrease load or use larger brake.
	Rotor fails to turn	Faulty electric circuit	Check circuit.
		Blow fuse	Replace fuse.
		Only single phase available from three phase power supply	Measure power supply voltage and check for defective circuit.
		Protective device has tripped	Eliminate cause and reset.
		Damaged or burned motor winding	Repair or replace.
		Rust on brake friction surface	Clean brake (lining).
		Gap needs adjustment	Readjust gap.
		Burned bearing	Replace.
		Overload	Replace. Check and troubleshoot load and safety device.
	Abnormal noise	Foreign material inside the brakemotor.	Examine inside brakemotor and remove foreign material.
		Damaged bearing	Replace.
		Worn brake lining	Adjust brake gap or replace lining.
		Hub leaf spring is off or damaged	Replace.
		Burned solenoid coil	Replace.
		Damaged rectifier	Replace.
	Trouble under loaded condition	Voltage drop	Raise voltage to rated level.
		Overload	Reduce the load or oversize the brakemotor.
		Improper protective device setting	Adjust protective device.

PROBLEM: BRAKE DOES NOT RELEASE
RECTIFIER: 25FW-4FB



PROBLEM: BRAKE DOES NOT RELEASE
RECTIFIER: OTHER THAN 25FW-4FB





Notes

Notes

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