SM-CYCLO® BRAKEMOTOR

Operating and Maintenance Manual
4000 Series
FB and CMB Type

BRAKEMOTOR

SUMITOMO
MACHINERY CORPORATION OF AMERICA

Manual
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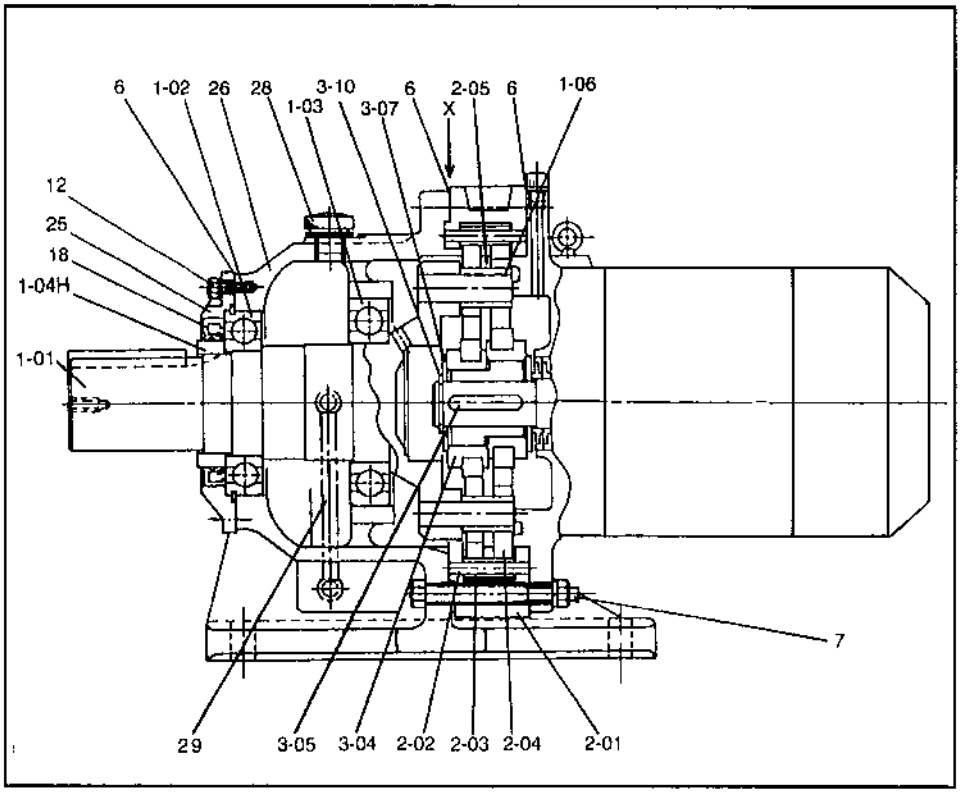

Fig. 2 Single Reduction (Vertical Base Mount)

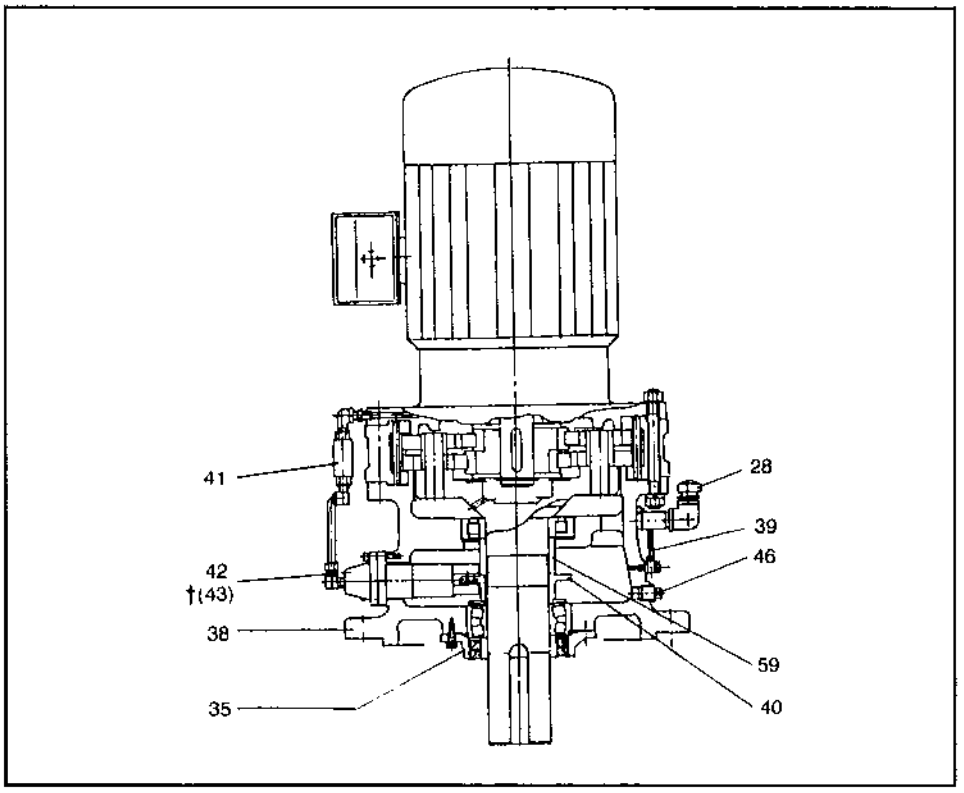

Table 1. Main Parts

Part No.	Part Name
1-01	Slow Speed Shaft w/Pins
1-02	Bearing A
1-03	Bearing B
1-04H	Oil Seal Collar—Horizontal
1-06	Slow Speed Shaft Rollers
2-01	Ring Gear Housing
2-02	Ring Gear Pins
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2-04	Cyclo Disc
2-05	Spacer Ring
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7	Casing Nuts & Bolts
12	Bolts for SS Oil Seal Housing
15	Grease Nipple
18	Slow Speed Output Oil Seal
25	Horizontal Oil Seal Housing
26	Horizontal Case
28	Oil Fill Plug
29	Oil Gauge—Horizontal Unit
35	Vertical Oil Seal Housing
38	Vertical Case (Integral V Type)
39	Oil Gauge—Vertical Unit
40	Cam
41	Piping Set & Oil Signal
42	Plunger Pump
43	Positive Displacement Pump
46	Drain Plug
55	Intermediate Cover
57	Eye Bolt
*59	Spacer

*Pt. No. 59 — frame sizes 4205-4275 only.

MODELS FB-01A, -02A, AND -05A

1. Introduction

SM-CYCLO FB series brakemotors were developed to be mechanically rugged in design, electrically reliable and efficient in operation. This manual has been written to provide all the necessary information to insure long and trouble-free service.

Please note that the information in this manual specifically pertains to the brake portion of the gearmotor. For information on the basic gearmotor, please refer to the SM-CYCLO 4000 Series Gearmotor Operating and Maintenance Manual.

2. Standard Brakemotor Specifications

Table 2.

Brake Type	Motor HP	Brake Torque ft-lb	Inertia WK^2 lb-ft^2	Brake Coil	Brake Current (A)		Coil Resis ohms	Brake Delay Time (seconds)	
					230V	460V		Normal	Fast
FB-01A	1/8	0.7	0.0083	DC Energized	0.1	0.06	2700	0.15 ~ 0.2	0.015 ~ 0.02
FB-02A	1/4 1/3	1.4 1.4	0.0131	Type, Built-in Rectifier within	0.1	0.06	1791	0.15 ~ 0.2	0.015 ~ 0.02
FB-05A	1/2	2.9	0.016	Conduit Box	0.1	0.06	1791	0.1 ~ 0.15	0.01 ~ 0.015

Notes: 1) Continuous time rating for both the brake and motor.
2) Indoor types can be installed in any orientation for use.

3-1 Construction and Operating Principles

a) Construction

Fig. 3 illustrates the construction of the brake. The restraining bolt (4) fastens the brake shoe (10) and spacer (2) onto the stationary core (1). The armature plate (11) is kept from rotation by the restraining bolt (4), but moves axially by electromagnetic attraction and the tension of the pressure spring (12). The brake lining (3) is fitted to the hub (5), which is secured to the motor shaft with a key. The solenoid coil (13) is energized via a rectifier provided within the conduit box.

Table 3. FB-01A, -02A, -05A Parts

No.	Part Name
1	Stationary Core*
2	Spacer*
3	Brake Lining*
4	Restraining Bolt*
5	Hub*
6	C-type Retaining Ring
7	Cover
8	Fan (TEFC model only)

No.	Part Name
9	Leaf Spring*
10	Brake Shoe*
11	Armature*
12	Pressure Spring*
13	Solenoid Coil*
14	Ball Bearing
15	Motor Shaft

*These parts are included in a complete brake kit.

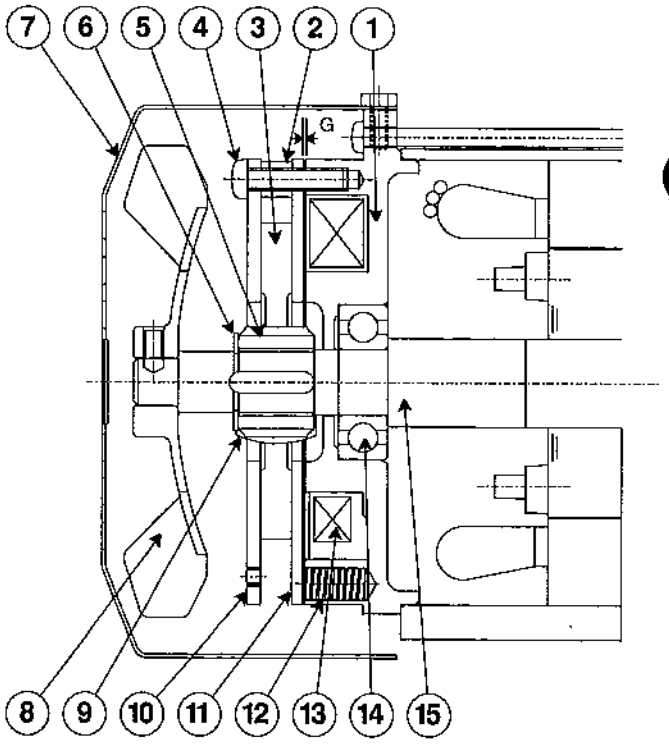


Fig. 3 FB-01A, FB-02A, FB-05A Models

b) Operating Principles

The brake is a (fail safe type) spring actuated type brake that will release the brake mechanism when the solenoid coil is energized and 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 (11) against the tension of the pressure spring (12). As a result, the brake lining (3) 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 (12) to actuate the armature plate (11), which in turn presses the brake lining (3) against the brake shoe (10) and brings the motor to a quick stop.

3-2 Inspection, Adjustment and Maintenance
a) Inspection
Check the following points at regular intervals:

a) The unit is operating normally.
b) The brake lining is not worn excessively (or gap G is normal).
c) All the mounting screws are securely tightened.

b) Gap inspection and adjustment
The brake lining will wear after the unit has been used for a long period of time. It is necessary to check the brake for gap G from time to time (Fig. 3). Should 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.

Gap inspection procedure

a) Remove cover (7).
b) Insert a gap gage into the gap between stationary core (1) and armature plate (11), and measure the size of the gap. Adjustment is needed if the measured value is close to the allowable limit shown in Table 4. Gap measurement should be made at three appropriate circumferential points.

Table 4. Brake Gap Size

Brake Type	Gap value G (In)	
	Spec. value	Allowable limit
FB-01A	0.006 ~ 0.010	0.020
FB-02A		
FB-05A		

Gap adjustment procedure
If the brake lining is so heavily worn that gap adjustment is required, proceed as follows:

a) Remove cover (7).
b) Loosen restraining bolt (4), rotate the brake shoe completely counterclockwise, and re-tighten the restraining bolt (4). After tightening the restraining bolt, measure the gap G to verify that it falls within the specification value and the allowable limit shown in Table 4. (This procedure will reduce the gap by about 0.012 inch.)
c) Check for brake performance by turning system power on and off a few times.
d) Replace cover (7).

MODELS FB-01A, -02A, AND -05A

Table 5. Brake Lining Size

Brake Type	Brake lining dimension	Initial thickness t_o (in)
FB-01A FB-02A FB-05A		0.276

3-3 Standard Wiring Connection, Dual Voltage

Fig. 4-a Normal Brake Action, High Voltage

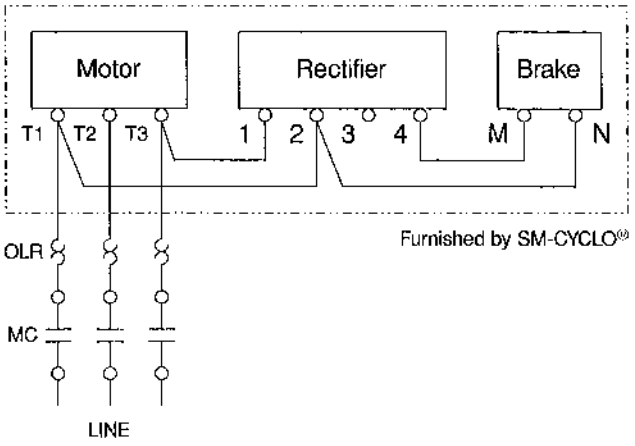


Fig. 4-b Fast Brake Action, High Voltage

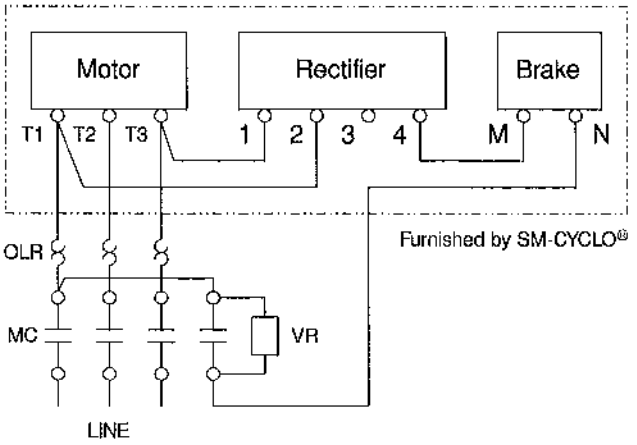


Fig. 4-c Normal Brake Action, Low Voltage

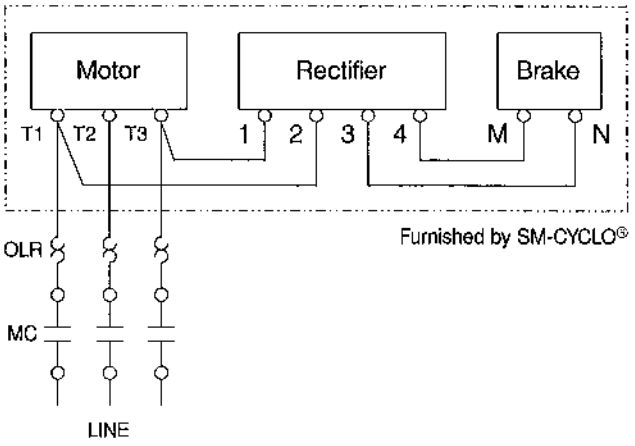
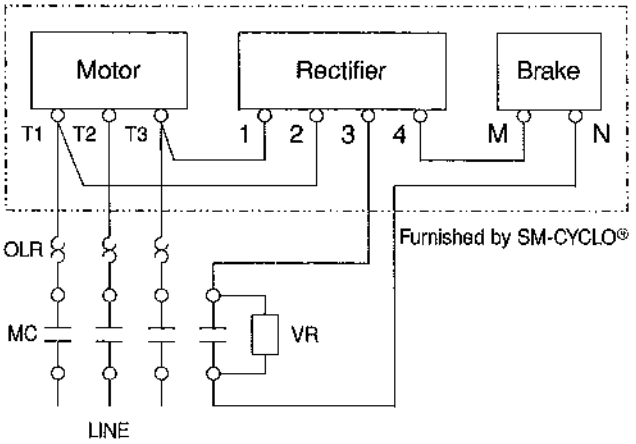


Fig. 4-d Fast Brake Action, Low Voltage



3-4 Inverter Wiring Connection, Dual Voltage

Fig. 5-a Normal Brake Action, High Voltage

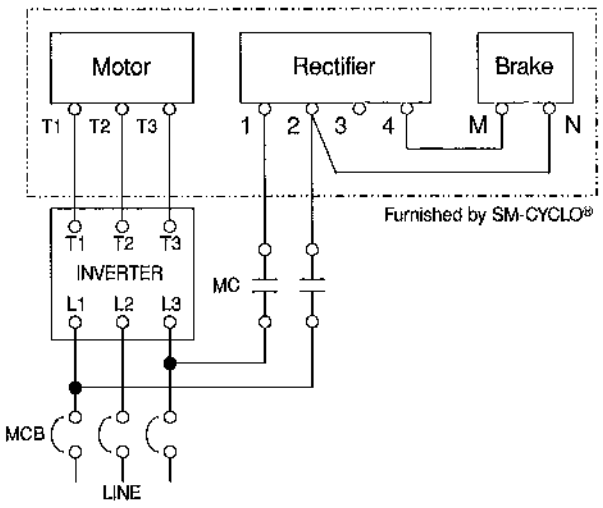


Fig. 5-b Fast Brake Action, High Voltage

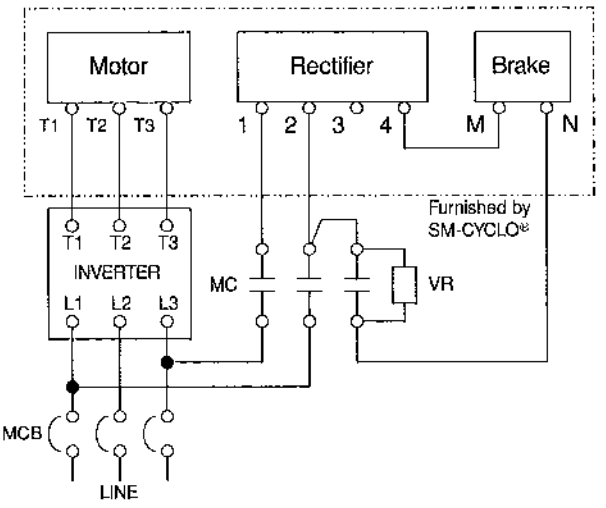


Fig. 5-c Normal Brake Action, Low Voltage

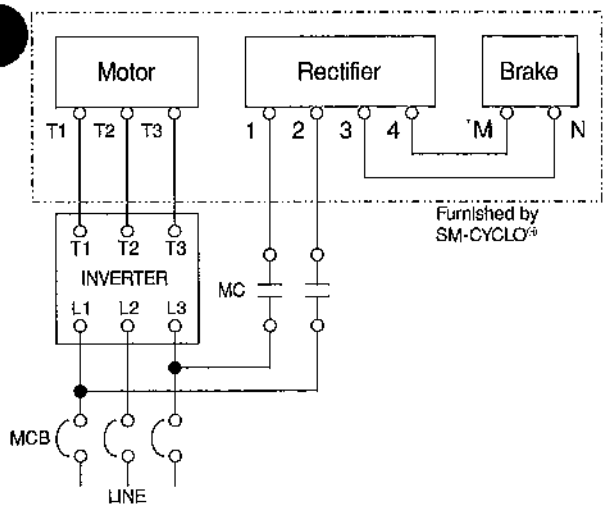
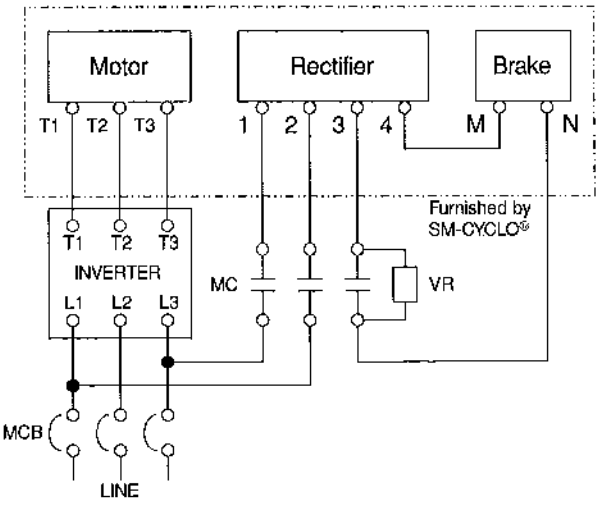


Fig. 5-d Fast Brake Action, Low Voltage



MC: Electromagnetic contactor
MCB: Magnetic Circuit Breaker
OLR: Overload or thermal relay
VR: Varistor (protective device)

Recommended brake contactor size for fast acting circuit is greater than 5 times rated current shown in Table 2 on page 2.

Table 6. Varistor Specifications

Operating Voltage		200-230V	380-460V
Var. Rated Voltage		AC260~300V	AC510V
Varistor Voltage		430~470V	820V
Rated Watt	FB-01A, 02A	Over 0.2W	Over 0.4W
	FB-05A	Over 0.2W	Over 0.4W

3-5 Troubleshooting

The brake is normal when it meets the following criteria:

a) The motor begins to run immediately after the start switch is pressed to ON.
b) No abnormal sounds are heard from the unit during operation.
c) The motor stops running within about 0.5 second after power to the unit is switched off.

Should you find any abnormality, refer to Table 7 below and take the appropriate corrective action as soon as possible.

Table 7. Quick Troubleshooting Guide

Problem	Possible Cause	Corrective Action
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 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
	Blown 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	Check and troubleshoot load and safety device
Abnormal noise	Foreign material inside the brakemotor	Check inside and remove
	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

2. Standard Brakemotor Specifications

Table 8.

Brake Type	Motor HP	Brake Torque ft-lb	Inertia WK^2 lb-ft^2	Brake Coil	Brake Current (A)		Coil Resis ohms	Brake Delay Time (seconds)	
					230V	460V		Normal	Fast
FB-1B	3/4	5.8	0.0267	DC Energized Type, Built-in Rectifier within Conduit Box	0.1	0.1	1470	0.2 ~ 0.3	0.01 ~ 0.02
	1	5.8	0.0308						
FB-2B	1.5	11	0.0504		0.3	0.2	589	0.2 ~ 0.3	0.01 ~ 0.02
	2	11	0.0558						
FB-3B	3	16	0.0884		0.3	0.2	589	0.3 ~ 0.40	0.01 ~ 0.02

Notes: 1) Continuous time rating for both the brake and motor.
2) Indoor types can be installed in any orientation for use.

3-1 Construction and Operating Principles

a) Construction

Fig. 6 illustrates the construction of the brake. The restraining bolt (7) fastens the brake shoe (15), gap adjusting sleeves (5) and spacer (4) onto the stationary core (1). The armature plate (16) is kept from rotation by the restraining bolt (7), but moves axially by electromagnetic attraction and the tension of the pressure spring (17). The brake lining (8) is fitted to the hub (10), which is secured to the motor shaft with a key. The solenoid coil (18) is energized via a rectifier provided within the terminal box.

Table 9. FB-1B, -2B, -3B Parts

No.	Part Name
1	Stationary Core*
2	Brake Release Support
3	Shifting Pin
4	Spacer*
5	GAP Adjusting Sleeve*
6	Brake Release Lever
7	Restraining Bolt*
8	Brake Lining*
9	Leaf Spring*
10	Hub*

No.	Part Name
11	Retaining Ring
12	Fan Cover
13	Fan Set Pin
14	Fan
15	Brake Shoe*
16	Armature*
17	Pressure Spring*
18	Solenoid Coil*
19	Fan Side Bearing
20	Motor Shaft

*These parts are included in a complete brake kit.

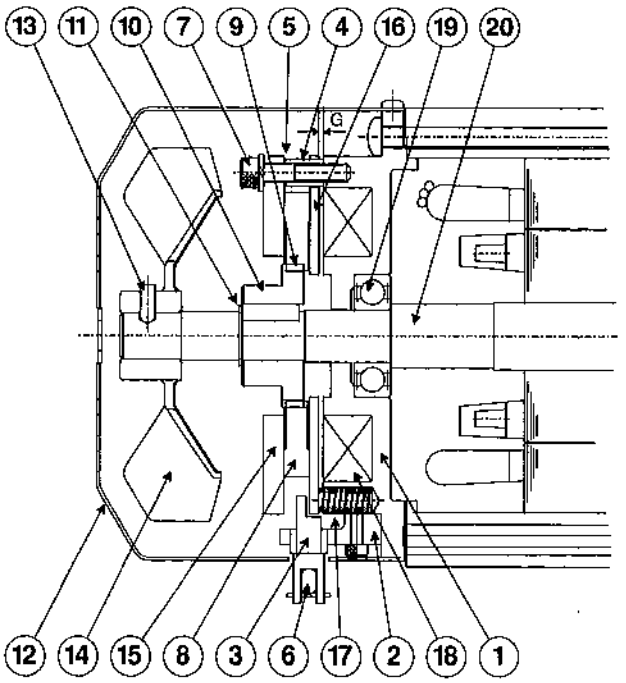


Fig. 6 FB-1B, -2B, -3B Mode

b) Operating Principles

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

MODELS FB-1B, -2B AND -3B

When power is applied to the unit, the solenoid coil and the electric motor will energize, and the energized coil attracts the armature plate (16) against the tension of the pressure spring (17). As a result, the brake lining (8) 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 (17) to actuate the armature plate (16), which in turn presses the brake lining (8) against the brake shoe (15) and brings the motor to a quick stop.

3-2 Inspection, Adjustment and Maintenance

a) Inspection

Check the following points at regular intervals:

a) The unit is operating normally.
b) The brake lining is not worn excessively (or gap G is normal).
c) No screws in the unit are loose.

b) Manual brake release procedure

To manually release the brake with power to the unit off, use the brake release mechanism as follows:

FB-1B, -2B, and -3B brakemotors are equipped with a one-touch release mechanism. To disengage brake, pull out the brake release lever from its holder and push it forward toward the reducer. Releasing the lever will re-engage the brake.

c) Gap inspection and adjustment

The brake lining will wear after the unit has been used for a long period of time. It is necessary to check the brake for gap G from time to time (Fig. 6). Should 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.

Gap Inspection procedure

a) Remove fan cover (12).
b) Insert a gap gage into the gap between stationary core (1) and armature plate (16), and measure the size of the gap. Adjustment is needed if the measured value is close to the allowable limit shown in Table 10. Gap measurement should be made at three appropriate circumferential points.

Table 10. Brake Gap Size

Brake Type	Gap value G (in)	
	Spec. value	Allowable limit
FB-1B	0.008 ~ 0.012	0.020
FB-2B	0.008 ~ 0.012	0.020
FB-3B	0.008 ~ 0.012	0.028

Gap adjustment procedure
If the brake lining is so heavily worn that gap adjustment is necessary, proceed as follows:

a) Remove fan cover (12). Measure the gap size to confirm the deviation from the specified value. The minimum adjustable setting is no less than the thickness of the GAP adjusting sleeve, 0.008 in.
b) Loosen set pin (13) and remove fan (14).
c) Slightly loosen restraining bolt (7), remove parts (4), (5), (7), and (15) as a set. Be careful not to remove only bolt (7) and lose sleeves (5).
d) The thickness of one gap adjusting sleeve (5) is 0.008 in. Decrease the number of the sleeves in use according to the degree of the wear. Reassemble parts (4), (5), (7), and (15) as a set.
e) After reassembly, check gap G. If the gap size is still too large, adjust the number of the sleeves again.
f) After completion of gap adjustment, check for brake performance by turning system power on and off a few times.
g) Replace fan (14), set pin (13) and cover (12).

d) Brake lining replacement

When the brake lining has been worn to such a degree that its thickness has reached the allowable limit shown in Table 11, or when sleeve adjustment is no longer an effective means of gap adjustment, replace the brake lining with a new one as follows:

a) Remove fan cover (12), measure gap G. Remove set pin (13) and fan (14).
b) Slightly loosen restraining bolt (7), then remove parts (4), (5), (7), and (15) as a set.

c) Take out brake lining (8) and measure its thickness. During removal of the lining, take care to prevent leaf spring (9) from coming off.

d) Install the new brake lining. Then, check to ensure that the lining moves along the hub (10) smoothly. Take care to ensure that the leaf spring (9) is not damaged or removed during the installation of the lining.

e) Replace the gap adjusting sleeves removed during gap adjustment. Then, reinstall parts (4), (5), (7), (15) as a set.

f) Measure gap G. Readjust if gap is out of the specification value.

g) Check for brake performance by turning system power on and off a few times. If no abnormalities are detected, replace fan (14), set pin (13) and cover (12).

Table 11. Brake Lining Size

Brake Type	Brake lining dimension	Initial thickness t_o (in)	Allowable thickness limit t_o (in)
FB-1B	t_o	0.276	0.236
FB-2B		0.322	0.283
FB-3B		0.354	0.315

3-3 Standard Wiring Connection, Dual Voltage

Fig. 7-a Normal Brake Action, High Voltage

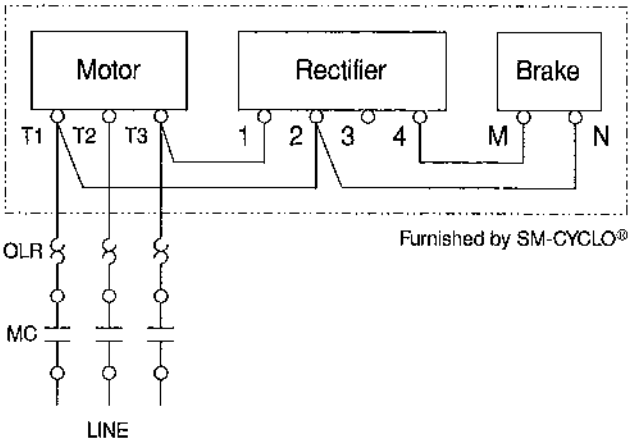


Fig. 7-b Fast Brake Action, High Voltage

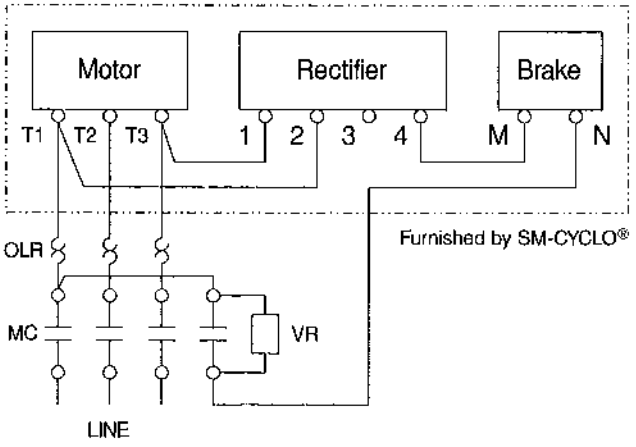


Fig. 7-c Normal Brake Action, Low Voltage

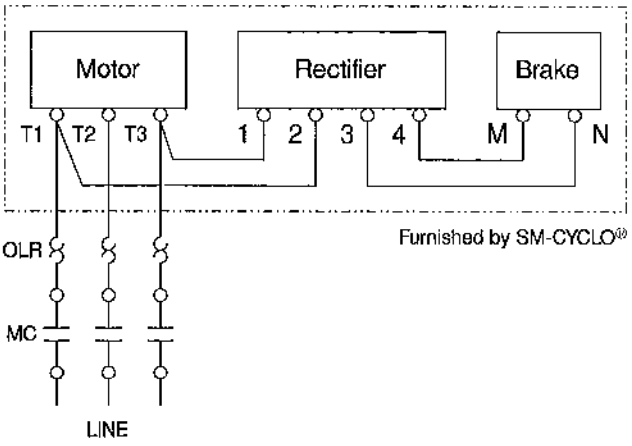
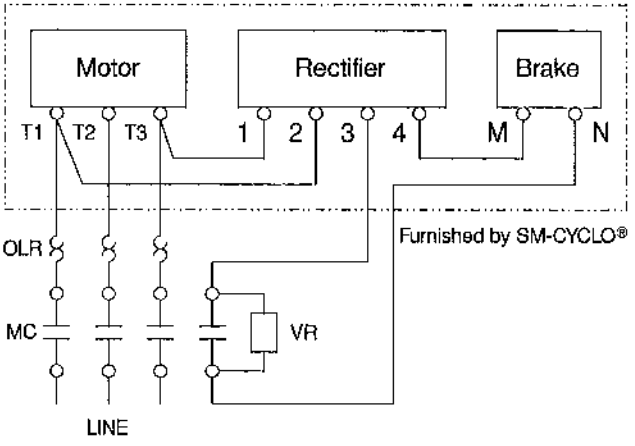


Fig. 7-d Fast Brake Action, Low Voltage



3-4 Inverter Wiring Connection, Dual Voltage

Fig. 8-a Normal Brake Action, High Voltage

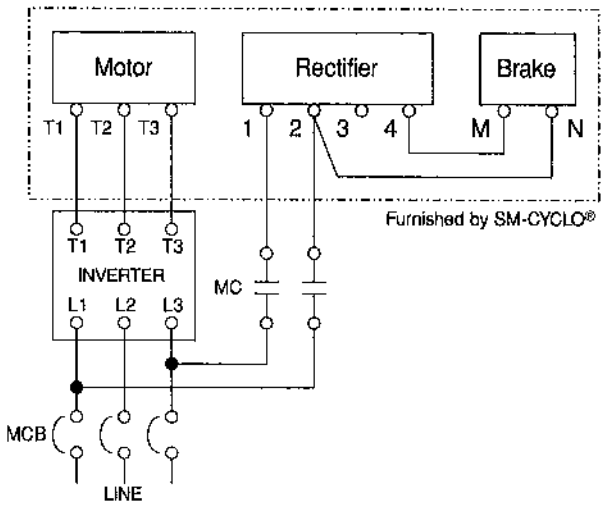


Fig. 8-b Fast Brake Action, High Voltage

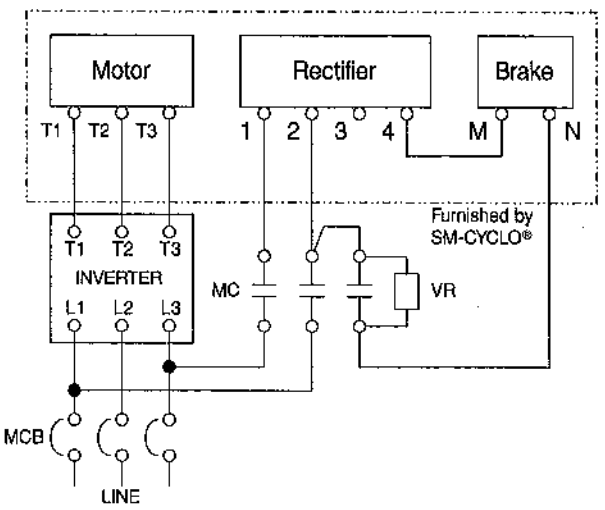


Fig. 8-c Normal Brake Action, Low Voltage

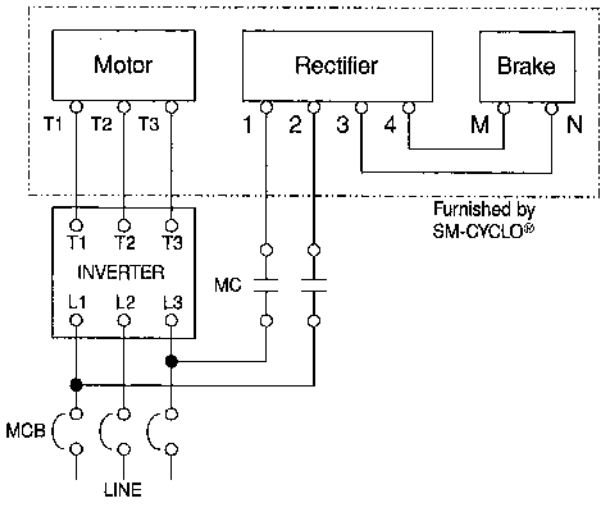
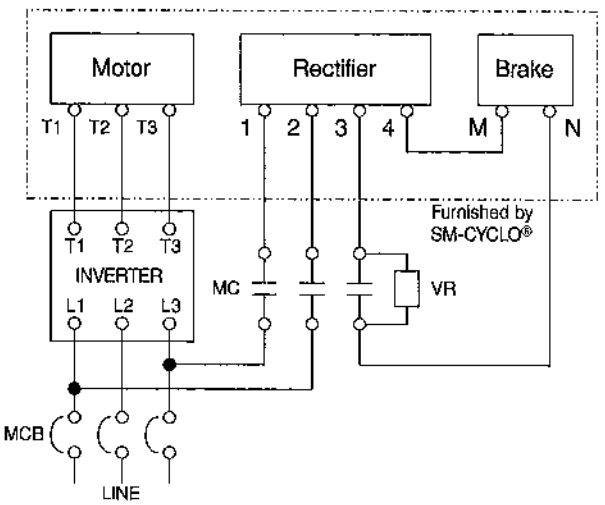


Fig. 8-d Fast Brake Action, Low Voltage



MC: Electromagnetic contactor
MCB: Magnetic Circuit Breaker
OLR: Overload or thermal relay
VR: Varistor (protective device)

Recommended brake contactor size for fast acting circuit is greater than 5 times rated current shown in Table 8 on page 7.

Table 12. Varistor Specifications

Operating Voltage		200-230V	380-460V
Var. Rated Voltage		AC260~300V	AC510V
Varistor Voltage		430~470V	820V
Rated Watt	FB-1B	Over 0.4W	Over 0.6W
	FB-2B, 3B	Over 0.6W	Over 1.5W

3-5 Troubleshooting

The brake is normal when it meets the following criteria:

a) The motor begins to run immediately after the start switch is pressed to ON.
b) No abnormal sounds are heard from the unit during operation.
c) The motor stops running within about 0.5 second after power to the unit is switched off.

Should you find any abnormality, refer to Table 13 below and take the appropriate corrective action as soon as possible.

Table 13. Quick Troubleshooting Guide

Problem	Possible Cause	Corrective Action
Brake fails to operate	Release lever still engaged	Disengage and lock lever in holder
	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 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
	Blown 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	Check and troubleshoot load and safety device
Abnormal noise	Foreign material inside the brakemotor	Check inside and remove
	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

MODELS FB-5B, -8B, -10B, AND -15B

2. Standard Brakemotor Specifications
Table 14.

Brake Type	Motor HP	Brake Torque ft-lb	Inertia WK^2 lb-ft^2	Brake Coil	Brake Current (A)		Coil Resis ohms	Brake Delay Time (seconds)	
					230V	460V		Normal	Fast
FB-5B	5	27	0.227	DC Energized	0.7	0.3	308	0.4 ~ 0.5	0.01 ~ 0.02
FB-8B	7.5	40	0.297	Type, Built-In	0.7	0.3	308	0.3 ~ 0.4	0.01 ~ 0.02
FB-10B	10	54	0.718	Rectifier within	0.9	0.5	207	0.7 ~ 0.8	0.03 ~ 0.04
FB-15B	15	80	0.973	Conduit Box	0.9	0.5	207	0.5 ~ 0.6	0.03 ~ 0.04

Notes: 1) Continuous time rating for both the brake and motor.
2) Indoor types can be installed in any orientation for use.

3-1 Construction and Operating Principles

a) Construction

Fig. 9 and Fig. 10 illustrate the construction of the brake. Among the brake parts, stationary core (1), solenoid coil (18), and stud bolt (3) constitute an integral sub-assembly unit. The armature plate (16) is kept from rotating by the stud bolt (3), but moves axially by electromagnetic attraction and the tension of the pressure spring (17). The adjusting washer (4) and spring washer (7) hold the brake shoe (15) against the nut (8) at all times. The brake lining (9) is fit to the hub (10), which is secured to the motor shaft with a key. The solenoid coil is energized via a rectifier provided within the terminal box.

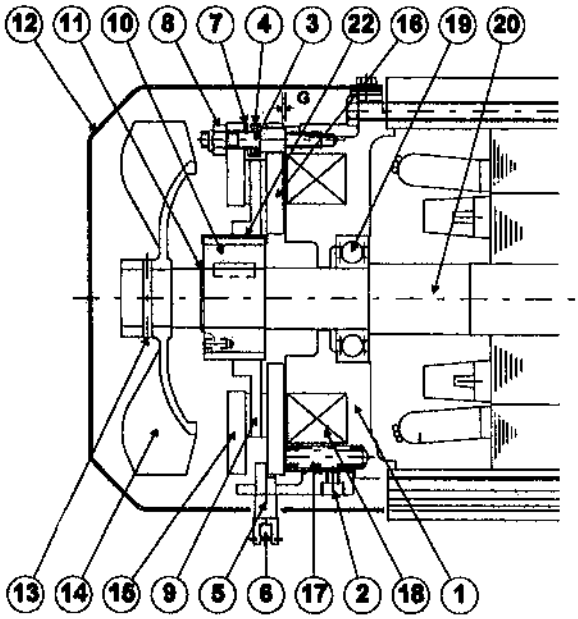


Fig. 9 FB-5B, FB-8B Models

Table 15. FB-5B, -8B, -10B, -15B Parts

No.	Part Name
1	Stationary Core*
2	Brake Release Support
3	Stud Bolt*
4	GAP Adjusting Washer*
5	Shifting Pin
6	Brake Release Lever
7	Spring Washer*
8	Nut*
9	Brake Lining*
10	Hub*
11	Retaining Ring

No.	Part Name
12	Fan Cover
13	Fan Set Screw or Pin
14	Fan
15	Brake Shoe*
16	Armature Plate*
17	Pressure Spring*
18	Solenoid Coil*
19	Fan Side Bearing
20	Motor Shaft
21	Bearing Cover
22	Leaf Spring*

*These parts are included in a complete brake kit.

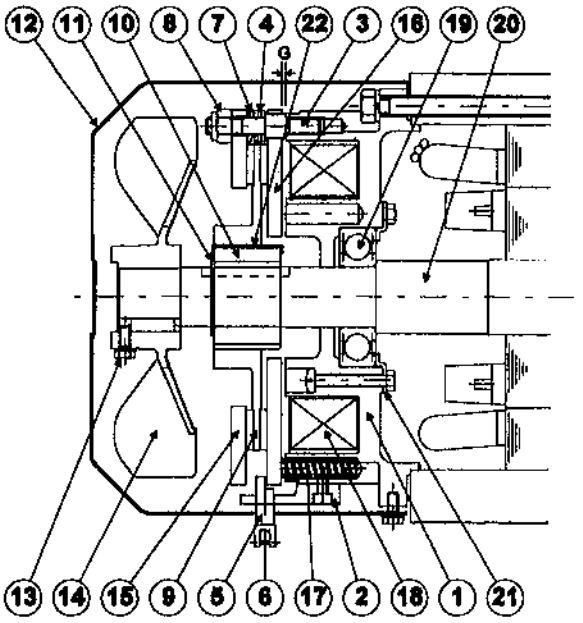


Fig. 10 FB-10B, FB-15B Models

b) Operating Principles
The brake is a (fail safe type) spring actuated type brake that will release the brake mechanism when the solenoid coil is energized and 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 (16) against the tension of the pressure spring (17). As a result, the brake lining (9) 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 (17) to actuate the armature plate (16), which in turn presses the brake lining (9) against the brake shoe (15) and brings the motor to a quick stop.

3-2 Inspection, Adjustment and Maintenance
a) Inspection
Check the following points at regular intervals:
a) The unit is operating normally.
b) The brake lining is not worn excessively (or gap G is normal).
c) All the mounting screws are securely tightened.

b) Manual brake release procedure
To manually release the brake with power to the unit off, use the brake release mechanism as follows:
FB-5B, -8B, -10B, and -15B brakemotors are equipped with a one-touch release mechanism. To disengage brake, pull out the brake release lever from its holder and push it forward toward the reducer. Releasing the lever will re-engage the brake.

c) Gap inspection and adjustment
The brake lining will wear after the unit has been used for a long period of time. It is necessary to check the brake for gap G from time to time (Figs. 9 and 10). Should 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.

Gap inspection procedure
a) Remove fan cover (12).
b) Insert a gap gage into the gap between stationary core (1) and armature plate (16), and measure the size of the gap. Adjustment is needed if the measured value is close to the allowable limit shown in Table 16. Gap measurement should be made at three appropriate circumferential points.

Table 16. Brake Gap Size

Brake Type	Gap value G (in)	
	Spec. value	Allowable limit
FB-5B	0.016 ~ 0.020	0.039
FB-8B	0.016 ~ 0.020	0.039
FB-10B	0.016 ~ 0.020	0.047
FB-15B	0.016 ~ 0.020	0.047

Gap adjustment procedure
If the brake lining is so heavily worn that gap adjustment is required, proceed as follows:
a) Remove fan cover (12).
b) Insert a gap gage into the gap between stationary core (1) and armature plate (16), and rotate the nut (8) at the tip of the stud bolt (3) clockwise until appropriate size is reached. Should gap be too large for this adjustment, decrease the number of adjusting washers in use. The three nuts (8) should be evenly adjusted by turns until the gaps at the three circumferential points are equal in width and fall within specification range shown in Table 16.

c) Check for brake performance by turning system power on and off a few times.
d) Replace fan (14), set pin or screw (13) and cover (12).

d) Brake lining replacement
When the brake lining has been worn to such a degree that its thickness has reached the allowable limit shown in Table 17, replace the brake lining with a new one as follows:

a) Remove fan cover (12).
b) For models FB-5B and -8B remove set pin (13) and fan (14). For models FB-10B and -15B remove set screw (13) and fan (14).
c) Remove all three nuts (8).
d) Remove brake shoe (15) and take out brake lining (9).
e) Fix leaf spring (22) as shown in Fig. 11.
f) Apply a small amount of grease along the spline of the lining. Be careful not to apply grease to the wear surface.
g) Fit a new brake lining (9) onto hub (10); check to ensure that the lining moves smoothly. Remove excess grease.
h) After completion of brake assembly, measure gap G. If the gap is out of specification range, adjust by rotating gap adjusting nut (8).
i) Check for brake performance by turning system power on and off a few times. If no abnormalities are detected, replace fan (14), set pin or screw (13) and cover (12).

Table 17. Brake Lining Size

Brake Type	Brake lining dimension	Initial thickness t_o (in)	Allowable thickness limit t_o (in)
FB-5B	t_0	0.394	0.237
FB-8B		0.394	0.237
FB-10B		0.433	0.276
FB-15B		0.433	0.276

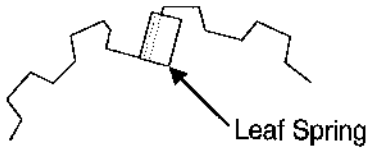


Fig. 11

3-3 Standard Wiring Connection, Dual Voltage

Fig. 12-a Normal Brake Action, High Voltage

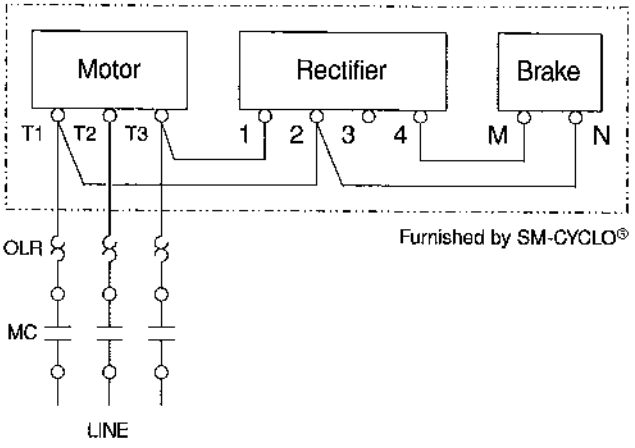


Fig. 12-b Fast Brake Action, High Voltage

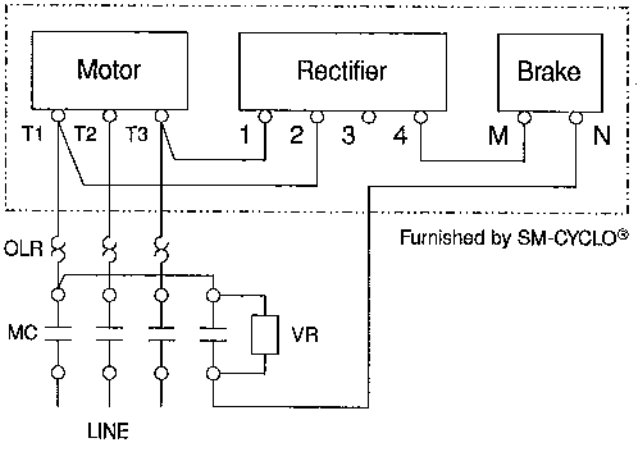


Fig. 12-c Normal Brake Action, Low Voltage

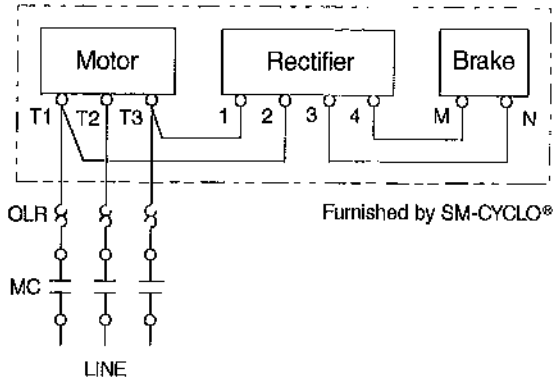
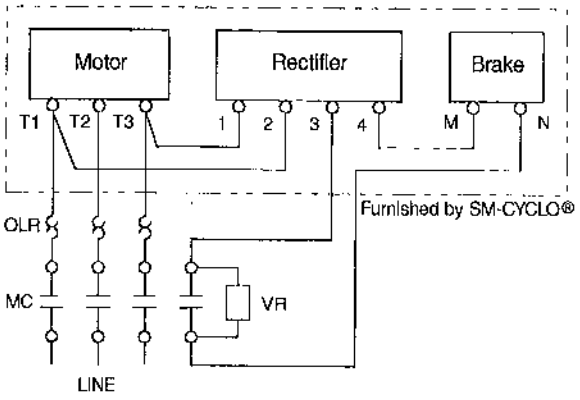


Fig. 12-d Fast Brake Action, Low Voltage



3-4 Inverter Wiring Connection, Dual Voltage

Fig. 13-a Normal Brake Action, High Voltage

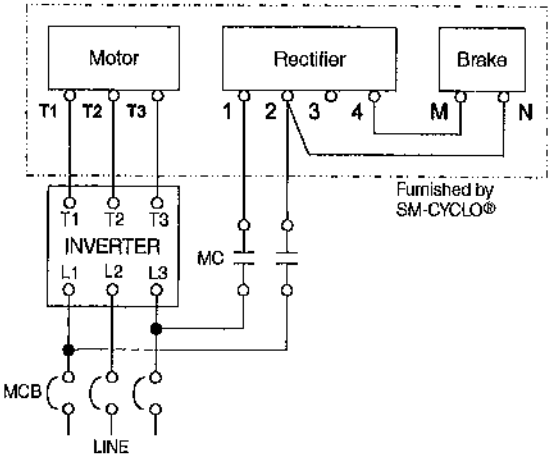


Fig. 13-b Fast Brake Action, High Voltage

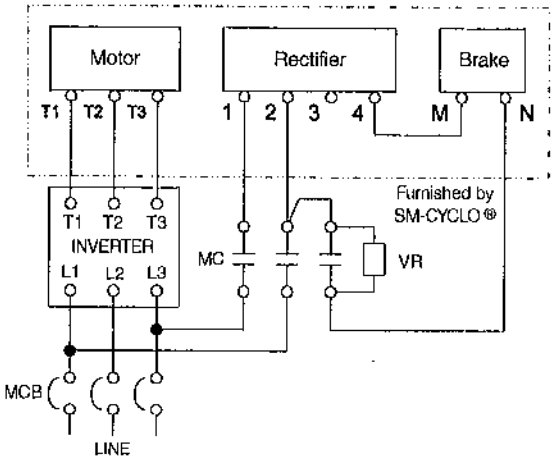


Fig. 13-c Normal Brake Action, Low Voltage

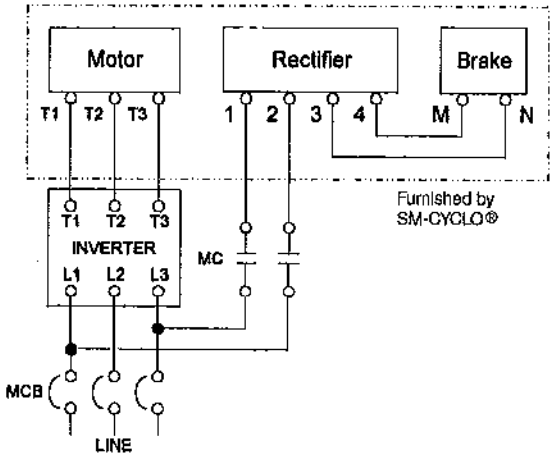
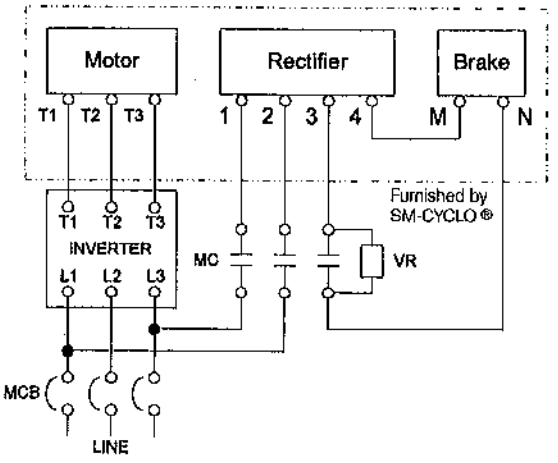


Fig. 13-d Fast Brake Action, Low Voltage



MC: Electromagnetic contactor
MCB: Magnetic Circuit Breaker
OLR: Overload or thermal relay
VR: Varistor (protective device)

Recommended brake contactor size for fast acting circuit is greater than 5 times rated current shown in Table 14.

Table 18. Varistor Specifications

Operating Voltage		200-230V	380-460V
Var. Rated Voltage		AC260~300V	AC510V
Varistor Voltage		430~470V	820V
Rated Watt	FB-5B, 8B	Over 0.6W	Over 1.5W
	FB-10B, 15B	Over 1.0W	Over 1.5W

3-5 Troubleshooting

The brake is normal when it meets the following criteria:

a) The motor begins to run immediately after the start switch is pressed to ON.
b) No abnormal sounds are heard from the unit in operation.
c) The motor stops running within about 0.5 second after power to the unit is switched off.

Should you find any abnormality, refer to Table 19 below and take the appropriate corrective action as soon as possible.

Table 19. Quick Troubleshooting Guide

Problem	Possible Cause	Corrective Action
Gap cannot be set to spec. value	Brake lining wear is too great	Reduce the number of gap adjusting washers
Brake fails to operate	Release lever still engaged	Disengage and lock lever in holder
	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 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
	Blown 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	Check and troubleshoot load and safety device
Abnormal noise	Foreign material inside the brakemotor	Check inside and remove
	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

3-1 Construction and Operating Principles

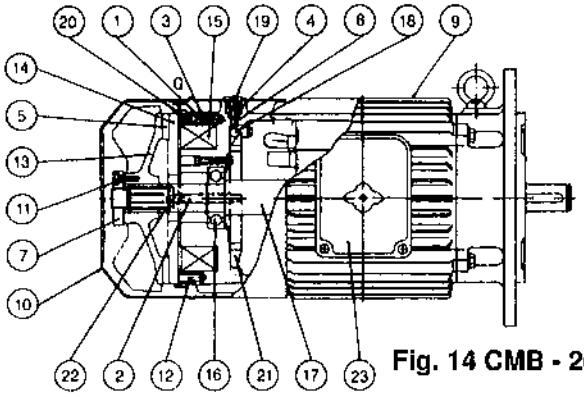


Fig. 14 CMB - 20 Model

Table 20. CMB-20 Parts

No.	Part Name
1	Stationary Core*
2	Restraining Bolt*
3	Pressure Spring*
4	Auxillary Spring
5	Brake Lining*
7	Restraining Nut*
8	Adjusting Bolt (Not Supplied
9	Motor
10	Fan Cover
11	Bolt*
12	Pin*

No.	Part Name
13	Brake Wheel*
14	Armature Plate*
15	Solenoid Coil*
16	Bearing
17	Motor Shaft
18	Roller*
19	Plug*
20	Dust Proof Seal*
21	Shifting Plate*
22	Nut*
23	Condult Box

*These parts are included in a complete brake kit.

a) Construction

Each brake consists of a solenoid coil (15), armature plate (14), and brake lining (5). The armature plate (14) is free to move axially along the motor shaft (17), but is restrained from rotation by a pin (12). A pressure spring (3) forces the armature plate (14) against the brake wheel (13), which is fixed to the motor shaft (17). The restraining nut (7) restrains the brake wheel against axial motion when braking.

A threaded stud passes through the armature plate (14) and stationary core (1), threading into the shifting plate (21). A nut (22) is installed on one end of the stud.

The brake includes an air gap adjustment mechanism that consists of a roller (18), adjusting bolt (8), auxiliary spring (4), and shifting plate (21).

b) Operating Principles

When power is applied, the current flows through the solenoid coil, an electromagnetic force attracts the armature plate — overcomes spring forces — the brake disengages and the motor shaft begins to rotate.

When the power is removed, the current flow through the solenoid coil stops and the electromagnetic force decays. The spring (3) force now moves the armature plate (14) toward the brake wheel (13) pressing the brake lining (5) against the brake wheel and the motor shaft quickly comes to a stop.

3-2 Wiring Connection

NOTE: For single voltage brakemotor 208V, 230V, 460V, 575V, or other special voltages, please refer to the motor mounted connection diagram or refer to the factory.

Normal Brake Action

Fig. 15-a Low Voltage 200 ~ 230V

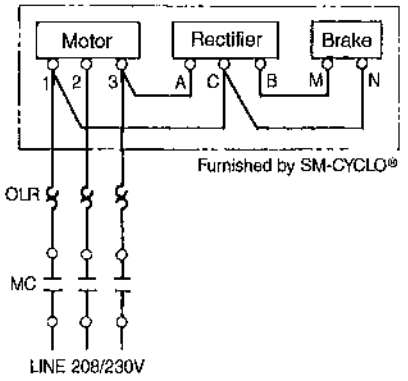
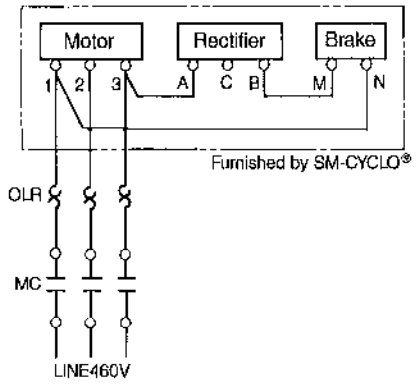
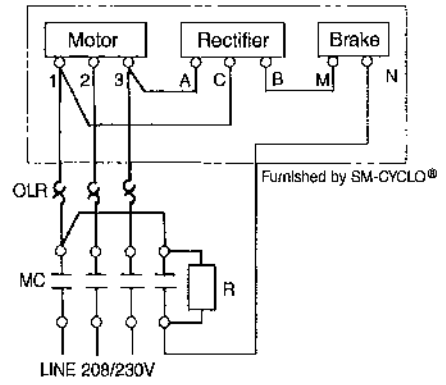


Fig. 15-b High Voltage 400 ~ 460V



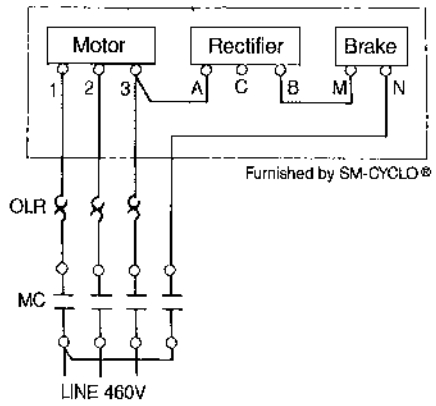
Fast Brake Action

Fig. 15-c Low Voltage 200 ~ 230V



OLR: Overload or thermal relay
MC: Electromagnetic contactor
R: Resistor (2 watt, 200~300Ω)

Fig. 15-d High Voltage 400 ~ 460



3-3 Adjustment and Maintenance

a) Brake Lining Inspection
If the brake has been in operation for a long period of time and then starts to operate improperly, check the brake lining for wear. Under normal use the lining will wear after approximately 200,000 engagements.

b) Inspection of Air Gap "G"
The air gap "G" will increase as the brake lining wears. It must not exceed .050 inch, or difficulty may be experienced. To check the air gap, proceed as follows:
a) remove the plug (19), cover (10) and the dust proof seal (20).
b) insert a feeler gage between the stationary core and the armature plate. If air gap exceeds .050 inch, adjust the gap as follows:

c) Adjustment of Air Gap "G"
a) remove the two bolts (2) using a socket head wrench.
b) install an M8 thread by 30mm long brake adjusting bolt at position #8 figure 9.
c) turn the brake adjusting bolt (8) clockwise until the brake is completely released.
d) tighten the restraining nut (7) until the lining (5) nearly contacts the brake wheel.
e) remove the brake adjusting bolts installed in step d above. Air Gap "G" should now measure 0.030 inch or less.

DANGER — Failure to remove the brake adjusting bolt will result in an inoperative brake.

f) install bolts (2) and tighten.
g) install dust proof seal (20), cover (10), and plug (19).
h) test brakemotor a few times to insure proper operation.

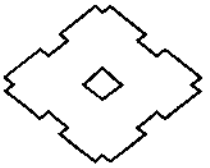
3-4 Troubleshooting

The brake is normal when it meets the following criteria:
a) The motor begins to run immediately after the start switch is pressed to ON.
b) No abnormal sounds are heard from the unit in operation.
c) The motor stops running within approx. 1.5 seconds after the power to the unit is switched off. Should you find any abnormality, refer to Table 21 below and take the appropriate corrective action as soon as possible.

Table 21. Quick Troubleshooting Guide (For Model CMB-20)

Problem	Possible Cause	Corrective Action
Brake inoperative	Brake lining excessively worn	Inspect according to par. 3-3-b
	Improperly serviced after assembly	Reservice
Motor does not rotate when power is applied	Air gap G excessively increased	Adjust gap G according to par. 3-3-c
	Electromagnetic coil opened	Repair it at service shop
	Rectifier damaged	Replace it
	Wiring failure	Wire correctly
	Voltage drop	Contact SUMITOMO
	Retaining nut overtightened in serving	Readjust
	Spring overtensioned	Pressure spring correctly
Long braking time	Fast action circuit not used	Change to fast action (refer to par. 3-2)
	Air gap G excessive; friction disc comes in contact with nut	Adjust gap G according to par. 3-3-c
	Insufficient brake torque	Adjust spring compression
Brake cannot operate continuously due to reset mechanism	Restraining nut overtightened	Readjust according to par. 3-3-c
	Motor protection device imporperly adjusted	Reset bolt

FORMULA AND CONVERSION REFERENCE TABLES



TORQUE

$$T = \frac{63025 \times HP}{rpm}$$

T = Torque inch lbs.
HP = Horsepower transmitted
rpm = Revolutions per minute

HORSEPOWER

$$HP = \frac{T \times rpm}{63025}$$

VELOCITY

a.) ANGULAR

$$\omega = 2\pi \times r \times rpm$$

b.) LINEAR

$$v = 2\pi \times r \times rpm$$

V = Linear velocity (ft./min.)
R = Radius (feet)
rpm = Revolutions per minute
ω = Angular velocity (radians per minute)

ANGULAR ACCELERATION

$$\Theta = \frac{2\pi \times N}{60t}$$

Θ = Angular Acceleration (radians/sec/sec)
N = Angular velocity (rpm)
t = Time in sec. required to accelerate from rest
J = Moment of inertia (lb. ft./ft. of system) Motor and load

ACCELERATION TIME

$$tacc = \frac{J}{308} \times \frac{N_M}{T_M - T_L}$$

N_M = Motor speed (rpm)
T_M = Motor torque (lb. ft.)
T_L = Load torque (lb. ft.)

CONVERSION IN UNIT SYSTEMS

a) Length

	ft (foot)	in (inch)	m (meter)	mm (millimeter)
1 ft. =	1	12	0.3048	304.8
1 in. =	0.0833	1	0.0254	25.40
1m =	3.281	39.370	1	1,000
1mm =	0.0033	0.0394	0.001	1

b) Weight

	lb (pound)	oz (ounce)	kg (kilogram)	g (gram)
1 lb =	1	16	0.4536	453.6
1 oz =	0.0625	1	0.0284	28.35
1 kg =	2.205	35.27	1	1,000
1 g =	0.0022	0.0353	0.001	1

c) Torque

	ft-lb (foot pound)	in-lb (inch pound)	kgm (kilogram meter)
1 ft. lb.=	1	12	0.1383
1 in. lb=	0.0833	1	0.0115
1 kgm =	7.233	86.8	1

d) Power

	HP (British horsepower)	PS (horsepower) Metric)	KW (kilowatt)	kgm/s
1 HP =	1	1.014	0.7455	76.04
1 PS =	0.9863	1	0.7355	75
1 KW =	1.341	1.360	1	102.0

NOTES

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SPEED REDUCER

SM-CYCLO
Concentric

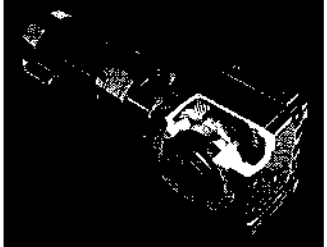
GEARMOTOR

SM-CYCLO
Concentric

SHAFT MOUNTED
GEARMOTOR

SM-HELICAL BUDDYBOX
Parallel Offset

BEVEL GEARMOTOR



SM-BEVEL BUDDYBOX
Right Angle

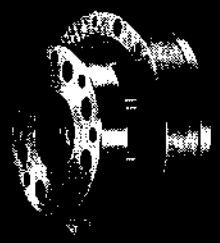
WORM GEARMOTOR

SM-WORM BUDDYBOX
Right Angle

LOW RATIO PLANETARY

SM-CYCLO
Concentric

ZERO BACKLASH CYCLO

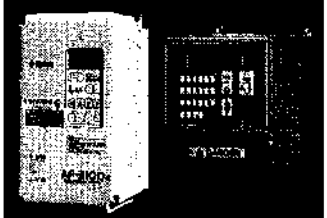


SM-SERVO-MATCH
Concentric

MECHANICAL
VARIABLE SPEED

SM-BEIER
SM-BEISTER

ELECTRICAL
VARIABLE SPEED



AF-3100α
AC Drive

NTAC-2000
AC Drive

HELICAL
GEAR REDUCER

PARAMAX
Parallel Offset &
Right Angle

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- MOTORS
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ALL TYPES
- CONCENTRIC
- PARALLEL OFFSET
- RIGHT ANGLE

ALL SPEEDS
- CONSTANT SPEED
- MECHANICAL VS
- ELECTRICAL VS

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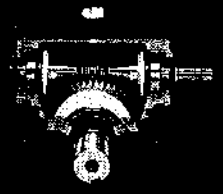
SHAFT MOUNT
SPEED REDUCER

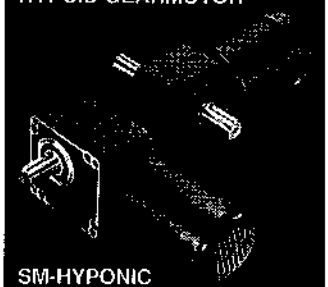
SM-SHAFT MOUNT
Parallel Offset

DOUBLE ENVELOPING
WORM GEAR



SM-HEDCON
Right Angle

HYPOID GEARMOTOR



SM-HYPONIC
Right Angle

WORM GEARMOTOR

SM-ULYSSES
Right Angle

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