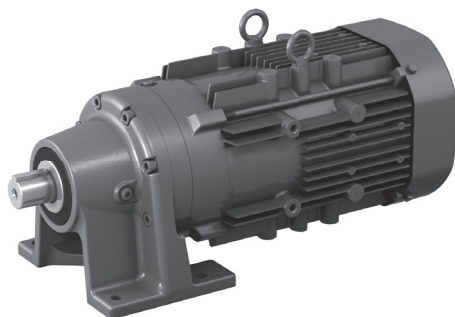


CYCLO[®] Drive

Small Frame Size (6060 - 6125)

SK series



《CAUTION》

- These Products should be handled, installed and maintained by trained technicians.
Carefully read the maintenance manual before use.
- A copy of this maintenance manual should be sent to the actual user.
- This maintenance manual should be kept by the user for future reference.

Introduction: 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.
After reading, retain this manual for future reference.
- Pay close attention to the “DANGER” and “CAUTION” warnings regarding safety and proper use.



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



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

Matters described in  may lead to serious danger depending on the situation.

Be sure to observe important matters described herein.



DANGER




- Transport, installation, plumbing, wiring, operation, maintenance, and inspections should be performed by trained technicians; otherwise, electric shock, 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 **explosion proof motor**, a technician with electrical expertise should supervise the transport, installation, plumbing, wiring, operation, maintenance and inspection of the equipment, so as to avoid a potentially hazardous situation that may result in electrical shock, fire, explosion, personal injury and/or damage to the equipment.
- When the unit is to be used in a system for human transport, a protecting device for human safety should be installed to prevent 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 falling; otherwise, personal injury, death, or damage to the equipment may result.

Introduction: How to Refer to the Maintenance Manual, Table of Contents

This maintenance manual is common for “gearmotors”, “reducers”.

The symbols shown below appear in the upper right or left corner of each page to indicate the classification. Please read the applicable pages.

On **Common** pages, symbols identify distinctions between specific specifications.

Specifications	All Specifications Are Common	Gearmotor		Reducer
		Without brake	With brake	
Symbol	Common			

Contents

Introduction: Safety Precautions	1
Introduction: Reading the Maintenance Manual, Table of Contents	2
1. Inspection Upon Delivery	3
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4. Installation	9
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1. Inspection upon Delivery Common

CAUTION

- 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 with 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?

1-1 Reading the Nameplates

There are two main types of nameplates: type 1 and type 2. Representative examples are shown below. Please observe them by type.

When contacting the company, please provide [1] Gearmotor or reducer nomenclature, [2] Reduction ratio, and [3] Serial number.

(1) For gearmotor

■ Nameplate Type 1: Gear Unit and Motor Unit Are Combined.

[1] Gearmotor nomenclature
(See P5)

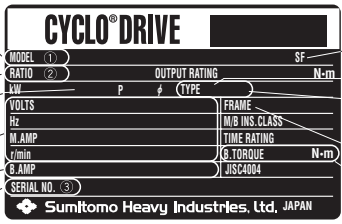
[2] Reduction Ratio

- Motor capacity

- Motor characteristics

- Brake current value
for motor with brake

[3] Serial number



CYCLO[®] DRIVE

MODEL (1) _____ SF _____

RATIO (2) _____ OUTPUT RATING _____ N-m

kW _____ P # (TYPE) _____

VOLTS _____ Hz _____ FRAME _____

Hz _____ IMB INS. CLASS _____

AMP _____ TIME RATING _____

min _____ G. TORQUE _____ N-m

G. AMP _____ JIS C4004 _____

SERIAL NO. (3) _____

Sumitomo Heavy Industries, Ltd., JAPAN

- Service factor

- Motor nomenclature (see P6)

- Brake type

- for motor with brake (see P6)

- Motor frame size

- Brake torque
for motor with brake

Figure 1-1 Gearmotor nameplate (type 1)

Common 1. Inspection upon Delivery

■ Nameplate Type 2: Separate Nameplates for Gear Unit and Motor Unit.

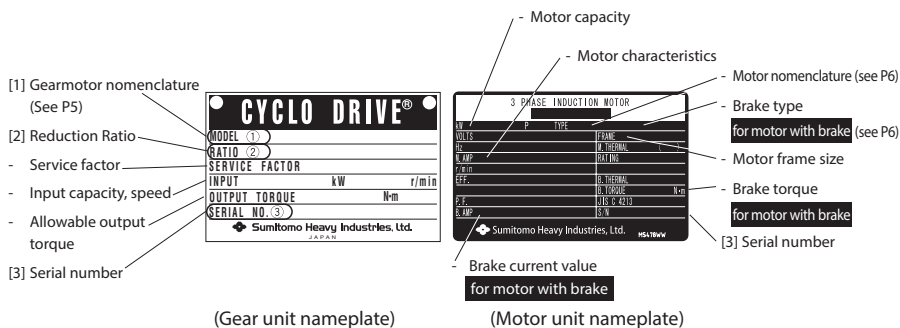


Figure 1-2 Gearmotor nameplate (type 2)

(2) For reducer

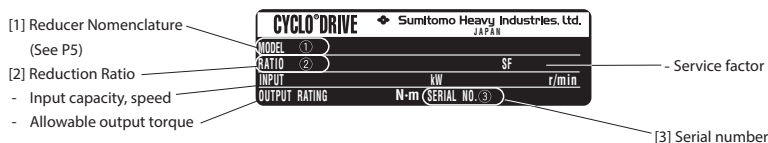


Figure 1-3 Reducer nameplate (type 1)

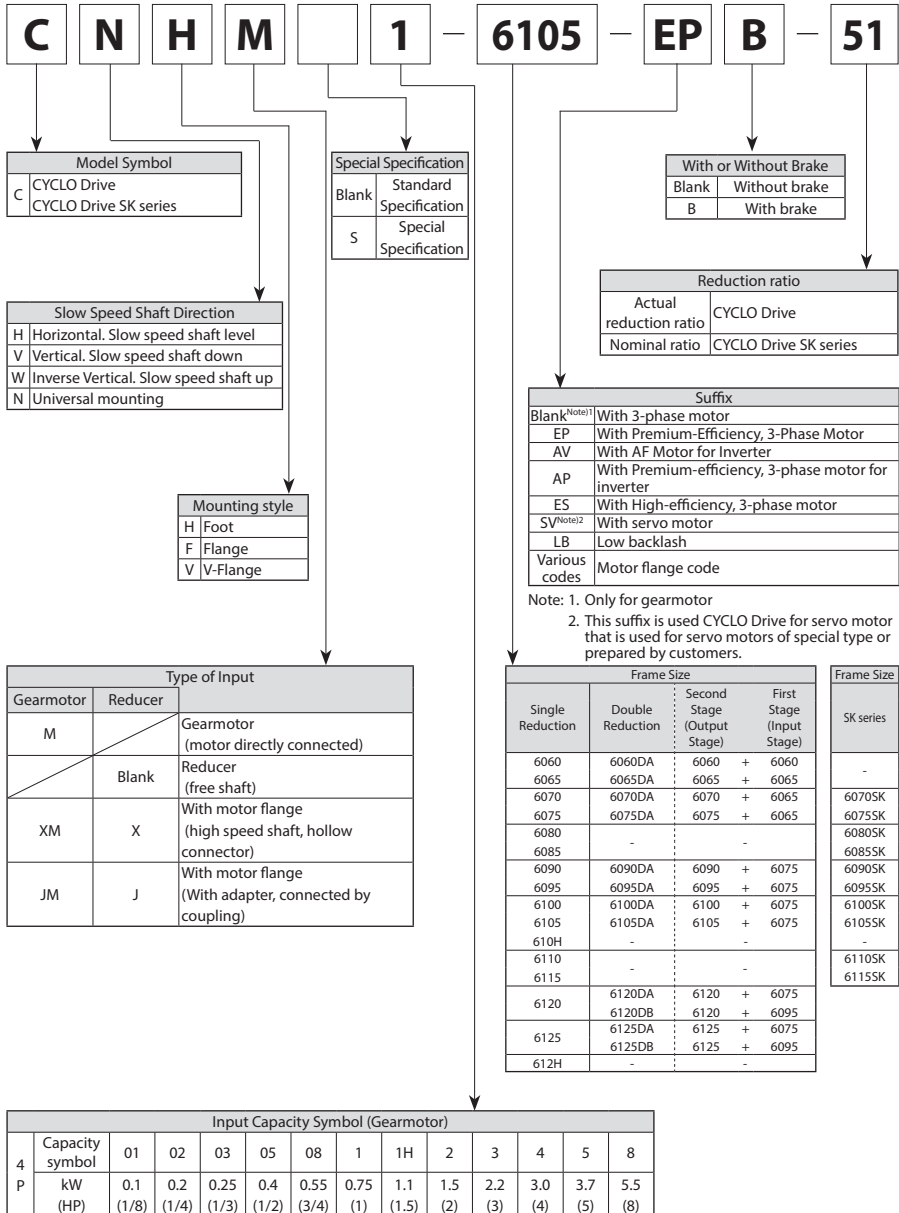
1-2 Lubrication Method

Frame size 6060 to 6125 and SK series of CYCLO Drive adopt grease lubrication so that grease is enclosed when shipped from the factory, lubrication is not needed.

1. Inspection upon Delivery Common

1-3 Gearmotor, Reducer Nomenclature

Symbol meanings are shown below. Please confirm that the nomenclature matches the order.



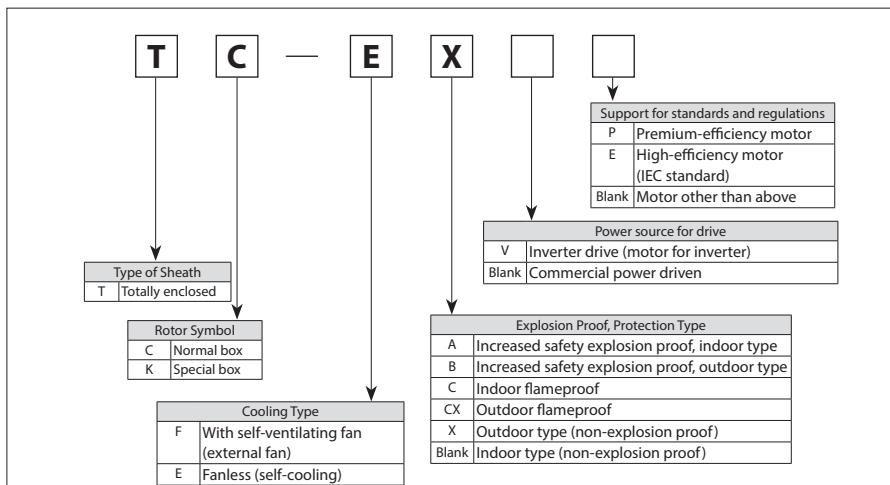


1. Inspection upon Delivery

1-4 Motor Nomenclature

Symbol meanings are shown below. Please confirm that the nomenclature matches the order.

When used with a servo motor, vector motor, or other manufacturer's motor, see the relevant operation manual.



1-5 Brake Type

Table 1-1 shows the relationship between standard brake type and motor type and capacity range.

Table 1-1 Brakes

Brake type	Motor Capacity (kW)				
	3-phase motor	Premium-Efficiency, 3-Phase Motor	AF Motor for Inverter	Premium-efficiency, 3-phase motor for inverter	High-efficiency, 3-phase motor
	4P	4P	4P	4P	4P
FB-01A1	0.1	-	-	-	-
FB-02A1	0.2 0.25	-	0.1	-	-
FB-05A1	0.4	-	0.2	-	0.2
FB-1D	0.55	-	0.4	-	0.4
FB-1E	-	0.75	-	0.75	-
FB-1HE	-	1.1	-	-	-
FB-2E	-	1.5	-	1.5	-
FB-3E	-	2.2	-	2.2	-
FB-4E	-	3.0	-	-	-
FB-5E	-	3.7	-	3.7	-
FB-8E	-	5.5	-	5.5	-

Note: Depending on the specification, brake type may differ from the types shown in Table 1-1. Check the nameplate.

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

2-1 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.

2-2 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.

2-3 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.

DANGER

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

CAUTION

- Exercise ample care so as not to drop the unit. When a hanging bolt or hole is provided, be sure to use it. After mounting a unit to a machine, do not hoist the entire machine using the hanging bolt or 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.

DANGER

- Do not use a standard unit in an explosive atmosphere (which is likely to be filled with explosive gas or steam). Under such conditions, an explosion proof motor should be used; otherwise, electric shock, personal injury, explosion fire, or damage to the equipment may result.
- In the case of an Explosion proof motor, use a motor that has specifications that are appropriate for a dangerous location (a location where gas or volatile vapor is present); otherwise explosion, ignition, electric shock, injury, fire, or equipment damage may result.
- Since the inverter itself is not explosion proof, when a flameproof motor is driven by an inverter install an inverter in a place free from explosive gas; otherwise, electric shock, personal injury, explosion fire, or damage to the equipment may result.

CAUTION

- Do not use the products for purposes other than those shown on the nameplate or in the manufacturing specifications; otherwise, electric shock, personal injury, or damage to the equipment may result.
- Do not place flammable objects around the products; otherwise, fire may result.
- Do not place any object around the products that will hinder ventilation. Insufficient ventilation can cause excessive heat build-up that may result in burns or fire.
- Do not step on or hang from the products; otherwise injury may result.
- Do not touch the shaft end of the products, inside keyways, or the edge of the motor cooling fan with bare hands; otherwise, injury may result.
- When the unit is used in food processing applications, machines for cleanroom and so on, vulnerable to oil contamination, install an oil pan or other such device to cope with oil leakage due to breakdown or failure; otherwise, oil leakage may damage products.

4-1 Installation Location

Ambient temperature:	-10 to +40°C
Ambient humidity:	Maximum 85%
Altitude:	Maximum 1,000 m
Atmosphere:	No corrosive or volatile gases, no steam Dust-free, well-ventilated area.
Installation location:	Indoor type: Indoors (area with minimal dust, no contact with water) Outdoor type: Indoors or outdoors (area with little contact with rain water)
Vibration:	Maximum 1 G

- Mounting in conditions other than the above requires adherence to optional specifications. Please consult with us.
- Drives built to specifications, such as explosion proofing, can be used in the specified mounting environments. However, concerning the connector to the machine used, implement measures based on the mounting environment.
- Mount in a location that enables easy operation, such as inspection and maintenance.
- Mount on a sufficiently rigid base.

4-2 Mounting Angle

Table 4-1 Mounting Angle

CYCLO Drive	Free
CYCLO Drive SK series	Slow speed shaft is horizontal or vertical (depends on nomenclature. See P5. Please consult with us for inclined mounting).

For machines built to a specified mounting angle, only use the specified 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.

4-3 When Load Condition Is Critical

In cases of extreme vibration or frequent startup, it is recommended to knock the foot unit, and use a mounting bolt of at least class 8.8 (JIS B 1051) strength.

4-4 Keyless Shaft Motor Assembly Issues (Hollow Connection High Speed Shaft for Servo Motor)

- [1] Remove oil, dirt, and other contaminants from the motor shaft and inside of the CYCLO Drive high speed shaft. (The inner surface of the high speed shaft is treated with rust prevention oil before shipping.)
- [2] Position the reducer on a platform so that the slow speed shaft is on the bottom.
- [3] Align the high speed shaft with the notch on the clamp ring.
- [4] Remove the adapter plate cap and insert a hexagonal wrench through the setting hole into the hexagon socket head bolt in the clamp ring. Next, insert the motor shaft into the high speed shaft.
- [5] When assembling the motor and CYCLO Drive, make sure that the centers of both shafts are aligned. Do not force the assembly if the shafts are slanted or misaligned.
- [6] Fasten the motor and adapter plate using the motor mounting bolt. Tighten after confirming that the motor fitting is securely inserted into the adapter plate fitting. 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.
- [7] Tighten the clamp ring hexagon socket head bolt to the torque shown in Table 4-2.
- [8] After operating at slow speed, increase the tightening torque as shown in Table 4-2.
- [9] Attach the adapter plate cap that had been removed.

Table 4-2 Tightening torque for the clamp ring hexagon socket head bolt

Bolt size	M4	M5	M6	M8	M10	M12
Tightening Torque (N·m)	4.3	5.5	9.6	23	46	79

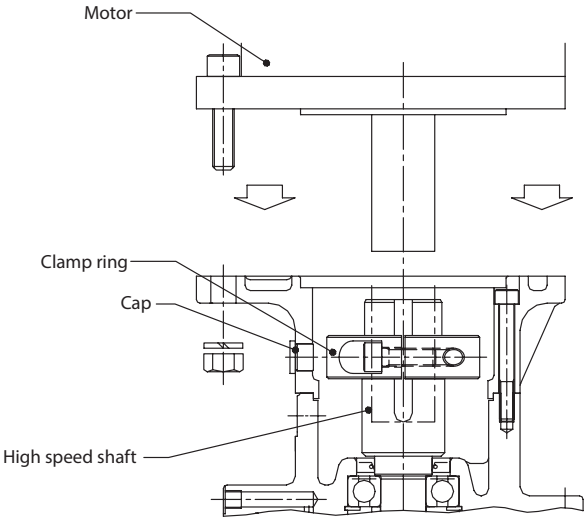


Figure 4-1 Assembly Diagram



4. Installation

4-5 Keyed Shaft Motor Assembly Issues (Hollow Connection High Speed Shaft for Servo Motor or General Flange Motor)

- [1] Remove oil, dirt, and other contaminants from the motor shaft and inside of the CYCLO Drive high speed shaft. (The inner surface of the high speed shaft is treated with rust prevention oil before shipping.)
- [2] Align the motor shaft key with the high speed hollow shaft keyway.
(Keyway dimensions conform to JIS B 1301-1996 (ISO) "Keys and Their Corresponding Keyways: Parallel keys (Normal Type)").
- [3] Coat the motor shaft with molybdenum disulfide grease to prevent fretting.
- [4] Depending on the motor combination, a spacer for preventing the key from falling out may be in a separate shipment. Before assembly, insert the spacer deep into the hole in the high speed shaft. Operation with uninserted spacer could result in the key falling out and damaging the shaft.
- [5] When assembling the motor and CYCLO Drive, make sure that the centers of both shafts are aligned.
Do not force the assembly if the shafts are slanted or misaligned or if the key is only partially engaged.
- [6] Fasten the motor and adapter plate (internal cover) using the motor mounting bolt. Tighten after confirming that the motor fitting is securely inserted into the adapter plate (internal cover) fitting. 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.

⚠ CAUTION

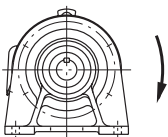
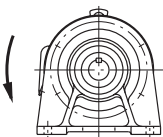
- Confirm the rotation direction before coupling the unit with the driven machine. Incorrect rotation direction may cause personal injury or damage to the equipment.
- When operating the product alone (uncoupled), remove the key that is temporarily attached to the low speed shaft; otherwise the key could fly off, and injury may result.
- Cover rotating parts so as not to be touched; otherwise, injury may result.
- When coupling the product with a load, check that the centering, the belt tension and parallelism of the pulleys are within the specified limits. When the unit is directly coupled with another machine, check that the direct coupling accuracy is within the specified limits. When a belt is used for coupling the unit with another machine, check the belt tension. Correctly tighten bolts on the pulley and coupling before operation; otherwise, injury may result because of misalignment.

5-1 Checking Rotational Direction

(1) For gearmotor

Table 5-1 shows the direction of slow speed shaft rotation when wiring is performed as on P18 - 25.

Table 5-1 Slow Speed Shaft Rotation Direction (Gearmotor)

When wiring is performed as shown on P18 - 25, the motor shaft rotates to the right as seen from the anti-load side. In the following diagrams, arrows show the direction of slow speed shaft rotation in this case.		
Gear Unit Construction	Single Reduction	Double Reduction Type SK series
Slow speed shaft Rotation direction (Seen from load side)		

Note: To cause reverse rotation, reverse R and T on P18 and P20 - 23.

(2) For reducer

Table 5-2 Slow Speed Shaft Rotation Direction (Reducer)

Gear Unit Construction	Single Reduction	Double Reduction Type SK series
Slow speed shaft Rotation direction	Rotates in opposite direction as the high speed shaft.	Rotates in same direction as the high speed shaft.

Note: For the SK series, "SK" is appended to frame sizes.

5-2 Attachment of Connecting Equipment

- When attaching connecting equipment, do not apply impact or excessive axial load to the shaft. The bearing could be damaged, or the collar could come off.
- Shrinkage fit is recommend.

(1) When using a coupling

The alignment accuracy (A, B, X) in figure 5-1 should be no greater than that shown in Table 5-3.

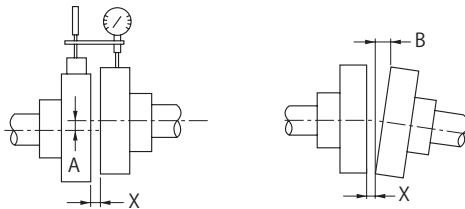


Figure 5-1

Table 5-3 Alignment Precision for Flexible Coupling

Allowable tolerance A	0.1mm or manufacturer-specified value
Allowable tolerance B	0.1mm or manufacturer-specified value
X	manufacturer-specified value

(2) When using chains, sprockets, or gears

- When using a chain, attach so that the chain tension angle is perpendicular to the shaft.
- Refer to the chain catalog or other reference for chain tension.
- Select a sprocket or gear pitch diameter that is at least three times the shaft diameter.
- The working load point of the sprocket or gear should go from the center of the shaft to this product.
(See Figure 5-2)

(3) When using a V belt

- Over-tightening the V belt will damage the shaft and bearing. Refer to the V belt catalog or other reference for V belt tension.
- The parallelism, eccentricity β of the two pulleys should be within 20'. (See Figure 5-3)
- When using multiple V belts, use a matched set having the same length.

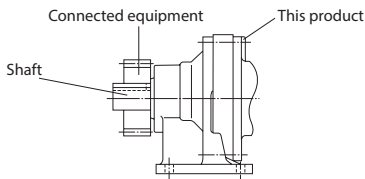


Figure 5-2

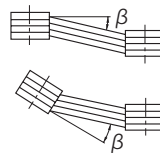


Figure 5-3



When using a servo motor, vector motor, or other manufacturer's motor, etc., follow the operation manual for that motor.

This manual shows wiring for motors with Japanese standard specifications. Please consult with us for motors with overseas specifications.

DANGER

- Do not handle the unit when cables are live. Be sure to turn off the power; otherwise, electric shock may result.
- Connect a power cable to the unit according to the diagram shown inside the terminal box or in the maintenance manual; otherwise, electric shock or fire may result.
- Do not forcibly bend, pull, or clamp the power cable and lead wires; otherwise, electric shock or fire may result.
- Correctly ground the grounding bolt; otherwise, electric shock may result.
- The lead-in condition of an **explosion proof motor** shall conform to the facility's electrical codes, extension regulations and explosion-proofing guide, as well as the maintenance manual; otherwise, electric shock, personal injury, explosion, fire or damage to the equipment may result.

CAUTION

- When wiring, follow the facility's electrical codes and extension regulations; otherwise, burning, electric shock, injury, or fire may result.
- The motor is not equipped with a protection device. However, it is compulsory to install an overload protector according to facility electrical codes. It is recommended to install other protective devices (earth leakage breaker, etc.), in addition to an overload protector, in order to prevent burning, electric shock, injury, and fire.
- Never touch the terminals when measuring insulation resistance; otherwise, electric shock may result.
- **When using a star-delta starter** select one with an electromagnetic switch on the primary side (3-contact point type); otherwise, fire may result.
- Voltage PWM inverters that use IGBT generate high-voltage surges at the motor terminals, which may degrade the insulation on the motor windings. In particular, if for example using a 400V class with long cables, a surge in excess of 1300V could be generated. Because of the the following measures are required.
 - Install an LCR filter or and AC reactor between the inverter and the motor
 - Enhance motor winding insulation
- **When using a motor with brake**, do not turn on connection power to the brake coil when the motor is stopped. Otherwise coil burnout fire, may result. Also, mistaken wiring could damage the rectifier.
- **When a explosion proof motor is driven by an inverter**, use one inverter for one motor. Use the approved inverter for the motor.
- When measuring the insulation resistance of a **explosion proof motor** confirm that there is no gas or explosive vapor in the vicinity, in order to prevent possible explosion or ignition.
- If ambient temperature exceeds 60°C , place the rectifier in a location where the temperature is 60°C or less. In this case, always protect the entire rectifier with a cover. However, standard ambient temperature conditions for units with and without brakes is -10 to 40°C . (Manufacture to special specification is required for operation in an environment where ambient temperature exceeds 40°C .)
- Long cables cause large voltage drops. Select cables with appropriate diameter so that the voltage drop will no greater than 2%.
- After wiring **outdoor types and explosion proof types**, check that terminal box mounting bolts are not loose, and correctly attach the terminal box cover.



6. Wiring

6-1 Removing and Attaching the Resin Terminal Box Cover

3-phase motor 4P: 0.1–0.4kW, high-efficiency, 3-phase motor 4P: 0.2kW, AF motor for inverter 4P: 0.1–0.2kW

(1) Removal

As shown in figure 6-1, to remove the cover, grab the sides of the terminal box, and pull it toward you.

(2) Attachment

Push the terminal box cover from above the terminal box case until a click is heard.

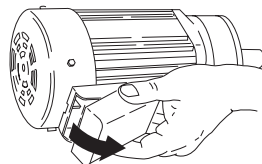


Figure 6-1

6-2 Measuring Insulation Resistance

When measuring insulation resistance, always disconnect the control panel and measure the motor alone.

Measure insulation resistance before wiring. Insulation resistance (R) is changed by a number of factors, including motor output, voltage, type of insulation, winding temperature, moisture, degree of fouling, time used, and amount of time test voltage is applied. However, normally, it must be above the values in Table 6-1.

Table 6-1 Values for Insulation Resistance

Motor voltage	Megohmmeter Voltage	Insulation Resistance (R)
Low-voltage electric motors of no more than 600V	500V	Minimum 1 MΩ

Reference: JEC -2100 contains the following equation:

$$R \geq \frac{\text{Rated Voltage (V)}}{\text{Rated output power (kW)} + 1,000} \quad (\text{M}\Omega)$$

$$R \geq \frac{\text{Rated Voltage (V)} + (r/\text{min}/3)}{\text{Rated output power (kW)} + 2,000} + 0.5 \quad (\text{M}\Omega)$$

Low insulation resistance is a sign that there is an insulation failure. Do not apply power. Consult an accredited service station.

6-3 Coordination of System Protection

- Use a wiring breaker for short circuit proofing.
- Use an overload protection device designed to handle currents that exceed the rated current on the nameplate.
- For **increased safety, explosion proof motors**, use an overload protection device capable of protecting the locked rotor current on the nameplate within the allowable locking time.

6-4 Connecting the Power Cable.

Connect the power cable and motor lead wire by clasping in a pressure connection terminal as shown in Figure 6-2.

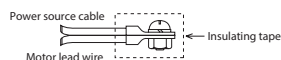


Figure 6-2



6-5 Motor Wiring

Shows the pages for motor wiring diagrams.

Table 6-2 Without Brake

Motor type		Number of Poles	Capacity (kW)	Number of lead wires	Page	
					Direct Input from Commercial Power Source	Inverter Drive
3-phase motor	Standard	4P	0.1 - 0.55	3	P18	P19
		4/8P	All	6	P18	-
	Increased safety, explosion proof	4P	0.1 - 5.5	3	P18	-
	Flameproof	4P	0.1 - 5.5	3	P18	-
Premium-Efficiency, 3-Phase Motor		4P	0.75 - 3.7 5.5	3 6	P18	P19
AF motor for inverter	Standard	4P	0.1 - 0.4	3	-	P19
	Flameproof	4P	0.2 - 5.5	3	-	P19
Premium-efficiency, 3-phase motor for inverter		4P	0.75 - 3.7 5.5	3 6	-	P19
High-efficiency, 3-phase motor		4P	0.2 - 0.4	3	P18	P19

Table 6-3 With Brake

Motor type	Number of Poles	Capacity (kW)	Brake type	Number of lead wires	Page		
					One-Direction Rotation	Both-Direction Rotation	Inverter Drive
3-phase motor	4P	0.1	FB-01A1	5	P20	P22	P24
		0.2 0.25	FB-02A1				
		0.4	FB-05A1				
		0.55	FB-1D				
Premium-Efficiency, 3-Phase Motor	4P	0.75	FB-1E	5	P20	P22	P24
		1.1	FB-1HE				
		1.5	FB-2E				
		2.2	FB-3E				
		3.0	FB-4E				
		3.7	FB-5E				
		5.5	FB-8E	8	P21	P23	P25
AF motor for inverter	4P	0.1	FB-02A1	5	-	-	P24
		0.2	FB-05A1				
		0.4	FB-1D				
Premium-efficiency, 3-phase motor for inverter	4P	0.75	FB-1E	5	-	-	P24
		1.5	FB-2E				
		2.2	FB-3E				
		3.7	FB-5E				
		5.5	FB-8E	8			P25
High-efficiency, 3-phase motor	4P	0.2	FB-05A1	5	P20	P22	P24
		0.4	FB-1D				

Note: 1. Brake type may differ depending on specification. Check the nameplate.

2. For motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.



6. Wiring

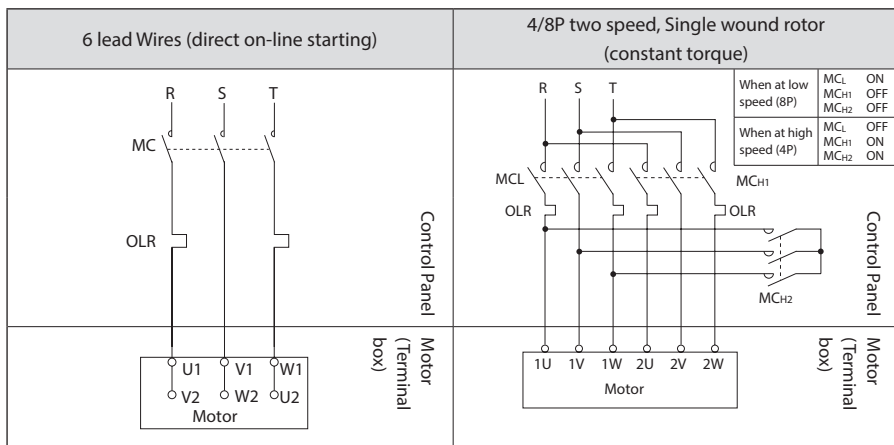
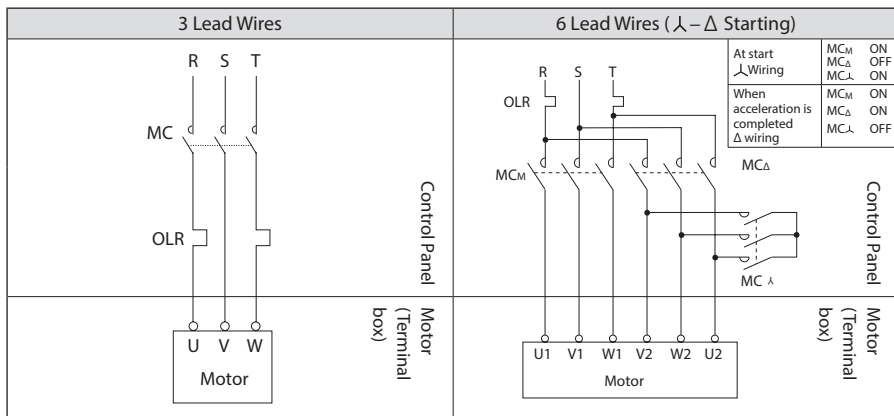
Shows motor wiring and standard specification for terminals and lead wires that are indicated by symbols.

■ Without brake. 3-phase power source

3-phase motor

Premium-Efficiency, 3-Phase Motor

High-efficiency, 3-phase motor



MC: Electromagnetic contactor

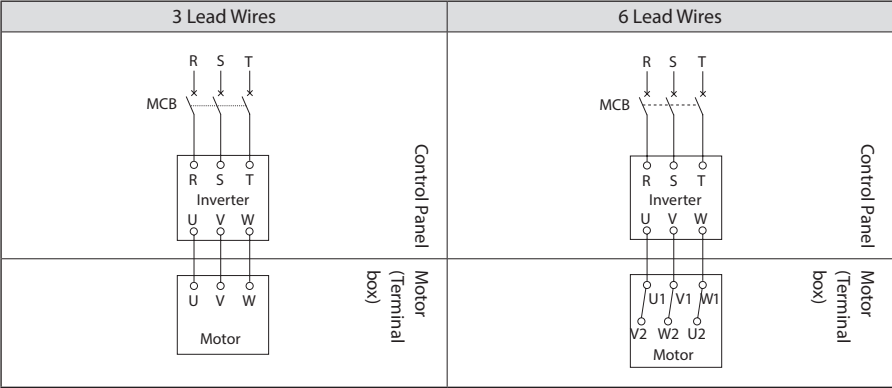
OLR: Overload protection device or electronic thermal relay

Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.

■ Without brake. Inverter drive

3-phase motor
Premium-Efficiency, 3-Phase Motor
AF Motor for Inverter
Premium-efficiency, 3-phase motor for inverter
High-efficiency, 3-phase motor



MCB: Breaker for wiring – Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
 - When inverter-driving a 400V class 3-phase motor or a 400V class high-efficiency, 3-phase motor, measures must be taken with motor insulation.



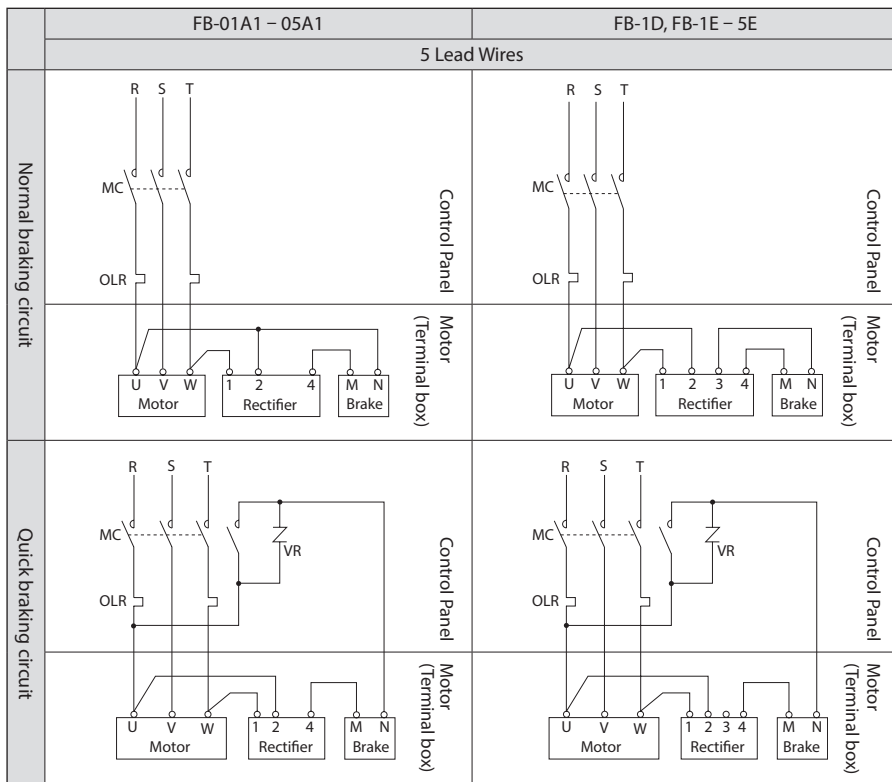
6. Wiring

■ With brake. 3-phase power source. Operates rotating in one direction.

3-phase motor

Premium-Efficiency, 3-Phase Motor

High-efficiency, 3-phase motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

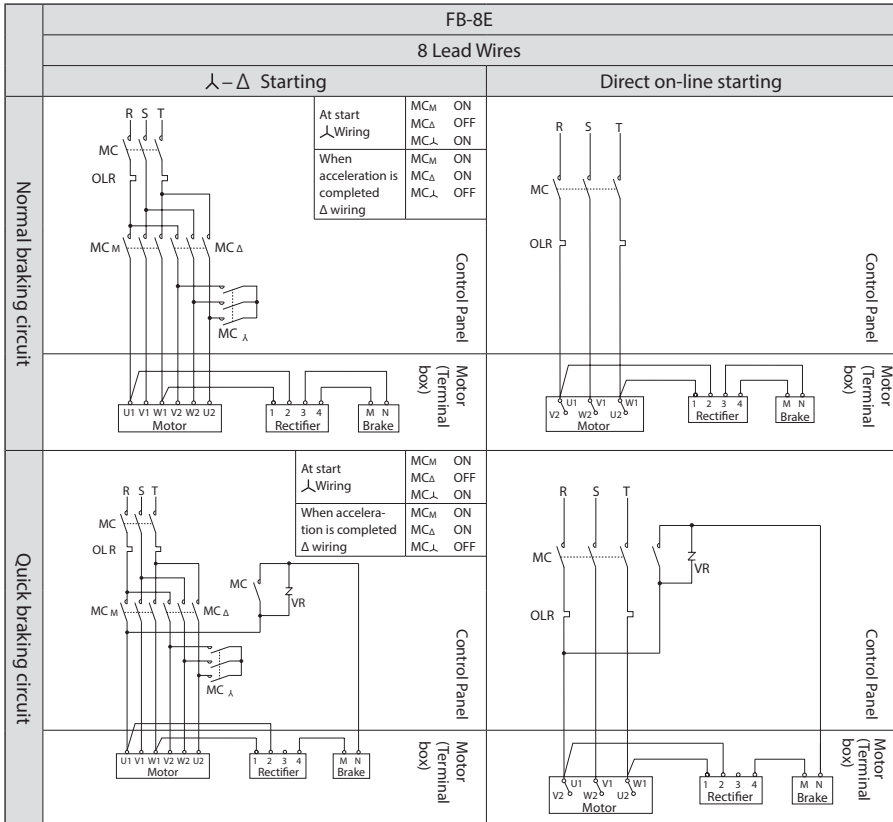
VR: Varistor (for protecting contact points, rectifier, etc.)

Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- For brake types, see Table 1-1 on P6.
- Brake action delay time is different between normal and quick braking circuits. Table 7-2 on P28 shows action delay time. Choose the circuit that matches work requirements.
- Use a quick braking circuit to improve hoisting equipment and stopping precision.
- Use a quick braking circuit when a phase-advancing capacitor is mounted.
- For information on electromagnetic contactors and varistors for quick braking circuits, see Table 6-4 on P26.
- For quick braking-circuits, gang the brake circuit's electromagnetic contactor to the motor's electromagnetic contactor.

■ With brake. 3-phase power source. Operates rotating in one direction.

Premium-Efficiency, 3-Phase Motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

VR: Varistor (for protecting contact points, rectifier, etc.)

— Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- For brake types, see Table 1-1 on P6.
- Brake action delay time is different between normal and quick braking circuits. Table 7-2 on P28 shows action delay time. Choose the circuit that matches work requirements.
- Use a quick braking circuit to improve hoisting equipment and stopping precision.
- Use a quick braking circuit when a phase-advancing capacitor is mounted.
- For information on electromagnetic contactors and varistors for quick braking circuits, see Table 6-4 on P26.
- For quick braking-circuits, gang the brake circuit's electromagnetic contactor to the motor's electromagnetic contactor.



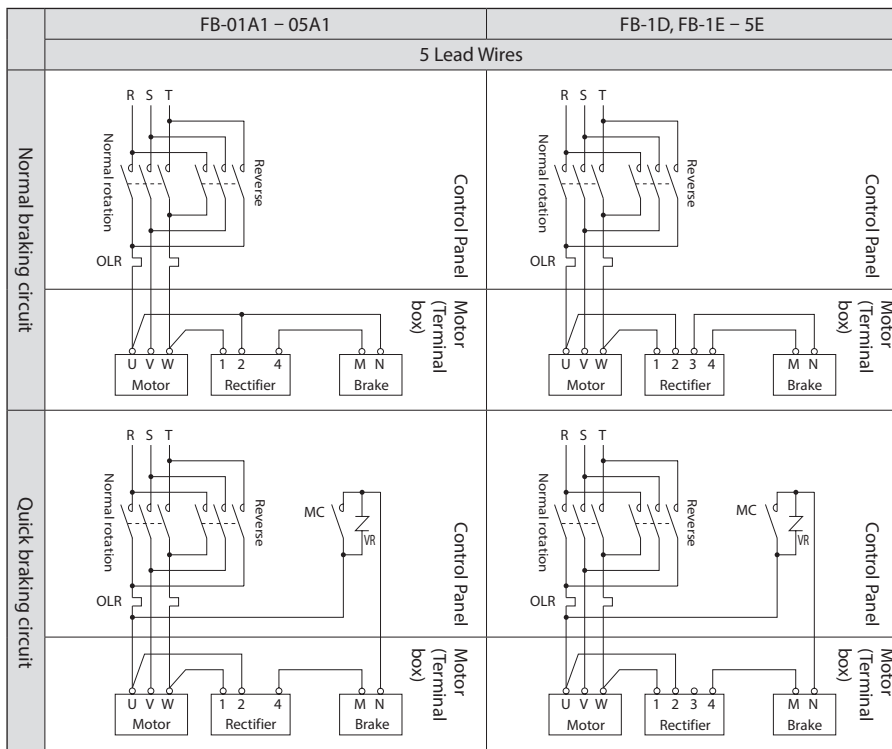
6. Wiring

■ With brake. 3-phase power source. Both-direction operation

3-phase motor

Premium-Efficiency, 3-Phase Motor

High-efficiency, 3-phase motor



Electromagnetic contactor for normal and reverse rotation

MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

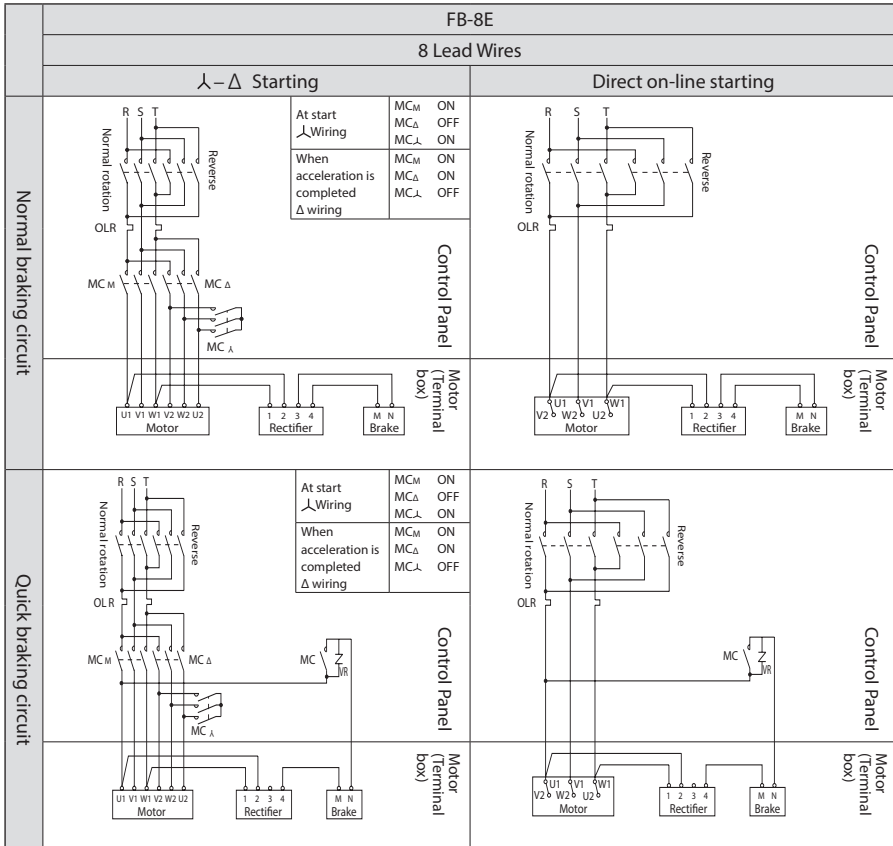
VR: Varistor (for protecting contact points, rectifier, etc.)

Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- For brake types, see Table 1-1 on P6.
- Brake action delay time is different between normal and quick braking circuits. Table 7-2 on P28 shows action delay time. Choose the circuit that matches work requirements.
- Use a quick braking circuit to improve hoisting equipment and stopping precision.
- Use a quick braking circuit when a phase-advancing capacitor is mounted.
- For information on electromagnetic contactors and varistors for quick braking circuits, see Table 6-4 on P26.
- For plugging operations using a quick braking circuit, gang the brake circuit's electromagnetic contactors to the motor's normal and reverse rotation electromagnetic contactors.

■ With brake. 3-phase power source. Both-direction operation

Premium-Efficiency, 3-Phase Motor



Electromagnetic contactor for normal and reverse rotation

MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

VR: Varistor (for protecting contact points, rectifier, etc.)

— Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- For brake types, see Table 1-1 on P6.
- Brake action delay time is different between normal and quick braking circuits. Table 7-2 on P28 shows action delay time. Choose the circuit that matches work requirements.
- Use a quick braking circuit to improve hoisting equipment and stopping precision.
- Use a quick braking circuit when a phase-advancing capacitor is mounted.
- For information on electromagnetic contactors and varistors for quick braking circuits, see Table 6-4 on P26.
- For plugging operations using a quick braking circuit, gang the brake circuit's electromagnetic contactors to the motor's normal and reverse rotation electromagnetic contactors.



6. Wiring

■ With Brake. Inverter Drive

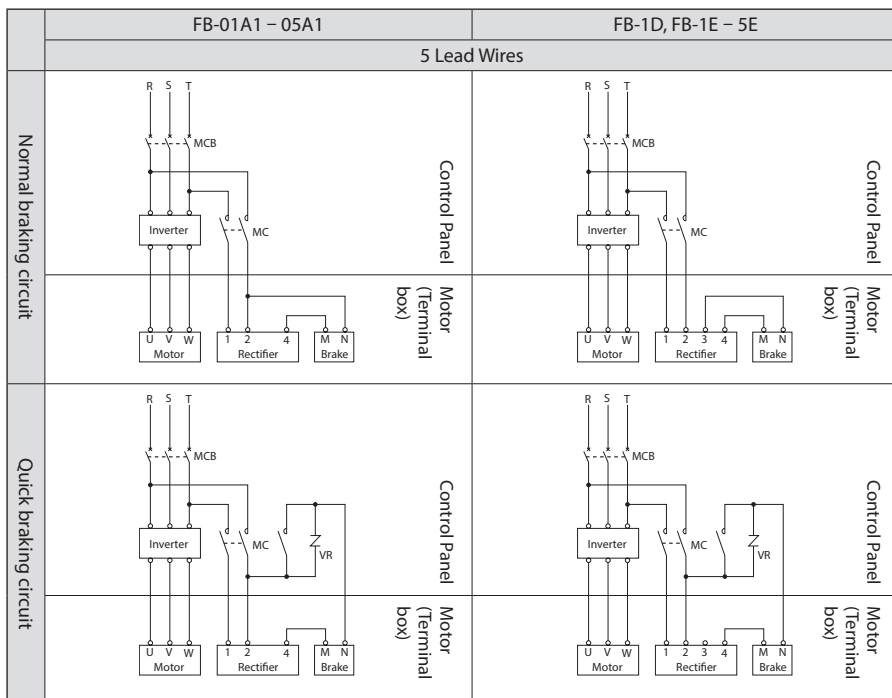
3-phase motor

Premium-Efficiency, 3-Phase Motor

AF Motor for Inverter

Premium-efficiency, 3-phase motor for inverter

High-efficiency, 3-phase motor



MC: Electromagnetic contactor

MCB: Breaker for wiring

VR: Varistor (for protecting contact points, rectifier, etc.)

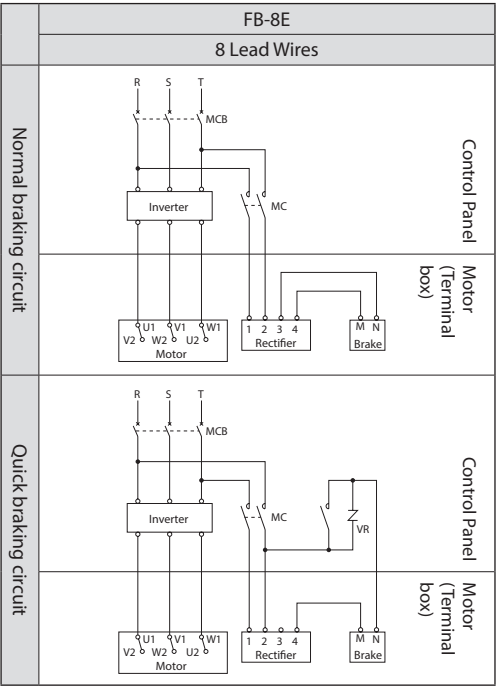
Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- For brake types, see Table 1-1 on P6.
- The motor must be insulated to inverter-drive a 400V class 3-phase motor/high-efficiency, 3-phase motor.
- Brake action delay time is different between normal and quick braking circuits. Table 7-2 on P28 shows action delay time. Choose the circuit that matches work requirements.
- Use a quick braking circuit to improve hoisting equipment and stopping precision.
- Use a quick braking circuit when a phase-advancing capacitor is mounted.
- For information on electromagnetic contactors and varistors for quick braking circuits, see Table 6-4 on P26.

- Always use the inverter's power source side for the brake power source.
- Match the opening and closing of the brake circuit's electromagnetic contactor to the timing of the inverter control.

■ With Brake. Inverter Drive

Premium-Efficiency, 3-Phase Motor
Premium-efficiency, 3-phase motor for inverter



MC: Electromagnetic contactor
MCB: Breaker for wiring
VR: Varistor (for protecting contact points, rectifier, etc.)

Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
 - For brake types, see Table 1-1 on P6.
 - Brake action delay time is different between normal and quick braking circuits. Table 7-2 on P28 shows action delay time. Choose the circuit that matches work requirements.
 - Use a quick braking circuit to improve hoisting equipment and stopping precision.
 - Use a quick braking circuit when a phase-advancing capacitor is mounted.
 - For information on electromagnetic contactors and varistors for quick braking circuits, see Table 6-4 on P26.
- Always use the inverter's power source side for the brake power source.
 - Match the opening and closing of the brake circuit's electromagnetic contactor to the timing of the inverter control.



6. Wiring

6-6 Points to Note when Using a Quick Braking Circuit

When using brakes with quick braking circuits, take note of the following items.

- Connect a varistor (protection element) to protect the quick braking circuit contact points from surge voltage generated by the brake action.
- Wire the quick braking circuit contact points to the brake power source secondary side contacts; otherwise, Contact points might not be protected.
- For information on using an alternating current electromagnetic contactor for contact points for quick braking circuits, see Table 6-4.

If multiple contact points are required, note the following issues.

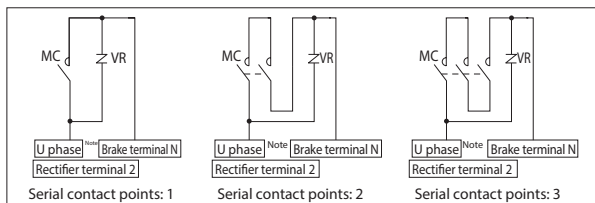
- Connect electromagnetic contactor contact points in serial. (See Figure 6-3)
- Connect the varistor (VR) as close to the unit as possible. (See Figure 6-3)

Table 6-4. Nomenclature for parts recommended when using a quick braking circuit (when using an alternating current electromagnetic contactor).

AC voltage	Brake type	Recommended Contactor Type				Recommended value of contact point capacity (DC-13 class)		Recommended Varistor (For Protecting Contactor Contact Points)			
		Made by Fuji Electric FA Components & Systems Co., Ltd.		Made by Mitsubishi Electric Corporation				Varistor Type	Maximum Allowable Circuit Voltage	Varistor Voltage	Power rating
200V 220V	FB-01A1	SC-05	Serial contact points: 1 (0.7A)	S-N11 or S-N12	Serial contact points: 1 (1.2A)	DC 110V	0.4A or higher	TND07V-471KB00AAA0	AC300V	470V (423~517V)	0.25W
	FB-02A1						0.5A or higher				
	FB-05A1						0.7A or higher				
	FB-1D						TND10V-471KB00AAA0	0.4W			
	FB-1E										
	FB-1HE										
	FB-2E	SC-05	Serial contact points: 2 (3.0A)	S-N11 or S-N12	Serial contact points: 2 (3.0A)		1.5A or higher	TND14V-471KB00AAA0			0.6W
	FB-3E										
	FB-4E										
	FB-5E	SC-05	Serial contact points: 3 (4.0A)	S-N18	Serial contact points: 3 (5.0A)		3.0A or higher				
FB-8E											
400V 440V	FB-01A1	SC-05	Serial contact points: 1 (0.25A)	S-N11 or S-N12	Serial contact points: 2 (0.5A)	DC 220V	0.2A or higher	TND10V-821KB00AAA0	AC510V	820V (738~902V)	0.4W
	FB-02A1	SC-05	Serial contact points: 2 (0.4A)				0.3A or higher				
	FB-05A1						0.5A or higher				
	FB-1D						0.5A or higher				
	FB-1E						S-N11 or S-N12	Serial contact points: 3 (2.0A)			1.0A or higher
	FB-1HE	1.5A or higher									
	FB-2E	S-N18	Serial contact points: 3 (2.0A)								
	FB-3E										
	FB-4E										
	FB-5E										
FB-8E											

- This recommended contactor type is for Fuji Electric FA Components & Systems Co., Ltd. and Mitsubishi Electric Corporation contactors. Products from other manufacturers are also allowable if they have equivalent capabilities.
- Recommended contactor contact point capacity indicates the case where durability regarding electronic opening and closing (service life) is approximately 2 million times.
- Of the recommended contactors, the Mitsubishi Electric Corporation S-N11 has one auxiliary contact point; the S-N18 has none. This applies if, for inverter drive or other reasons, two or more auxiliary contact points are required. (Other connectors in Table 6-4 have two or more auxiliary contact points.)
- This recommended varistor type is for Nippon Chemi-Con Corporation varistors. Products from other manufacturers are also allowable if they have equivalent capabilities.

Figure 6-3 Examples of Contact Point Connections with Quick Braking Circuits



Note: For inverter drives, connect to the R phase (power source side).

DANGER

- Do not approach or touch rotating parts (low speed shaft, etc.) during operation; otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.
- When the power supply is interrupted, be sure to turn off the power switch. Unexpected resumption of power may cause electric shock, personal injury, or damage to the equipment.
- Do not operate the unit with the terminal box cover removed. Return the terminal box cover to the original position after maintenance, in order to prevent electric shock.
- Do not operate the machine while the brake is released by the manual brake release bolt; otherwise, falling, going out of control, or damage to the equipment may result.

CAUTION

- Do not put fingers or foreign objects into the opening of the gearmotor or reducer; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The gearmotor or reducer becomes very hot during operation. Touching the unit may result in burns.
- If any abnormality occurs during operation, stop operation immediately; otherwise, electric shock, personal injury, or fire may result.
- Do not operate the unit in excess of the load rating; otherwise, personal injury, or damage to the equipment may result.

7-1 Items to Check Before Operation

After installation and wiring are completed, check the following items before operating.

- Is the wiring correct?
- Is the unit properly coupled with the driven machine?
- Are mounting bolts tightened firmly?
- Is the direction of rotation as required?

After confirming these items, operate without a load and gradually apply a load. Check the items shown in Table 7-1.

7-2 Items to Check During Operation

Table 7-1 Items to Check During Operation

Is abnormal sound or vibration generated?	<ul style="list-style-type: none"> - Is the housing deformed because the installation surface is not flat? - Is insufficient rigidity of the installation base generating resonance? - Is the shaft center aligned with the driven machine? - Is the vibration of the driven machine transmitted to the gearmotor or reducer?
Is the surface temperature abnormally high?	<ul style="list-style-type: none"> - Is the voltage rise or drop substantial? - Is the ambient temperature too high? - Does the current flowing to the gearmotor exceed the rated current shown on the nameplate?

If any abnormalities are found, immediately stop operation and contact the nearest authorized service station.



7. Operation

7-3 Brake Torque and Activation Delay Time

The table below shows standard specification brake types, their brake torque, and their relationship to brake activation delay time.

Table 7-2 Brake Torque and Activation Delay Time

Brake type	Motor Capacity (kW)						Brake activation delay time (sec)		
	3-phase motor	Premium-Efficiency, 3-Phase Motor	AF motor for inverter	Premium-efficiency, 3-phase motor for inverter	High-efficiency 3-phase motor	Brake torque (Dynamic friction torque) (N·m)	Normal braking (Simultaneous turn-off circuit)	Normal braking circuit for inverter (Separate turn-off circuit)	Quick braking circuit
	4P	4P	4P	4P	4P				
FB-01A1	0.1	—	—	—	—	1.0	0.15 - 0.2	0.08 - 0.12	0.015 - 0.02
FB-02A1	0.2 0.25	—	0.1	—	—	2.0			
FB-05A1	0.4	—	0.2	—	0.2	4.0	0.1 - 0.15	0.03 - 0.07	0.01 - 0.015
FB-1D	0.55	—	0.4	—	0.4	7.5	0.2 - 0.3	0.1 - 0.15	0.01 - 0.02
FB-1E	—	0.75	—	0.75	—	7.5	0.25 - 0.45	0.15 - 0.25	0.01 - 0.03
FB-1HE	—	1.1	—	—	—	11	0.45 - 0.65	0.25 - 0.35	
FB-2E	—	1.5	—	1.5	—	15	0.35 - 0.55	0.15 - 0.25	
FB-3E	—	2.2	—	2.2	—	22	0.75 - 0.95	0.4 - 0.5	0.02 - 0.04
FB-4E	—	3.0	—	—	—	30	0.65 - 0.85	0.3 - 0.4	
FB-5E	—	3.7	—	3.7	—	40	1.1 - 1.3	0.4 - 0.5	
FB-8E	—	5.5	—	5.5	—	55	1.0 - 1.2	0.3 - 0.4	

- Notes: 1. Brake type may differ depending on specification. Check the nameplate.
2. Brake torque will change according to operating environment, operating conditions, the condition of the friction surface, etc. In particular, brake torque may not be at the prescribed level for initial operation, and after a long period of inactivity. In such a case turn the brake on and off under as light load as possible to contact the brake's friction surfaces.
3. Brake activation delay time will change according to the brake's wiring circuit. Select the optimum circuit for the application.

8. Daily Inspection and Maintenance Common

DANGER

- Do not handle the unit when cables are live. Be sure to turn off the power when operating on the unit; otherwise, electric shock may result.
- Do not approach or touch any rotating parts (output shaft, etc.) during run-time maintenance or inspection of the unit; loose clothing may become caught in these rotating parts and cause serious injury or death.
- Customers must not disassemble or modify **explosion-proof motors**; otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- The lead-in condition of an **explosion-proof motors**, shall conform to the facilities electrical codes, extension regulations, and explosion-proofing guide, as well as the maintenance manual; Additionally, do not open the terminal box cover while operating. otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- Do not operate the machine while the brake is released by the manual brake release bolt; otherwise, falling, going out of control, or damage to the equipment may result.

CAUTION



- Do not put fingers or foreign objects into the opening of the gearmotor or reducer; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The gearmotor or reducer becomes very hot during operation. Touching the unit with bare hands may result in serious burns.
- Do not touch the terminals when measuring insulation resistance; otherwise, electric shock may result.
- Do not operate the unit without a safety cover (removed during inspection) in place to shield rotating parts; otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.
- Promptly identify and correct, according to instructions in this maintenance manual, any abnormalities observed during operation. Do not operate until the cause for the abnormality is understood, and the abnormality is corrected.
- Do not operate damaged gearmotors or reducers; otherwise, injury, fire, or damage to the equipment may result.
- We cannot assume any responsibility for damage or injury resulting from an unauthorized modification by a customer, as it is outside the scope of the warranty.
- Dispose of gearmotor or reducer lubricant as general industrial waste.
- When measuring the insulation resistance of an **explosion-proof motors**, confirm that there is no gas or other vaporized explosive substance around the unit in order to prevent explosion or ignition.
- Changing brake linings requires experience. Consult with the nearest authorized service station.
- Brake torque will change with operation environment and conditions, the condition of the friction surface, and other factors. In particular, brake torque may not be at the prescribed level for initial operation, and after a long period of inactivity. In such a case turn the brake on and off under as light load as possible to contact the brake's friction surfaces.

Common 8. Daily Inspection and Maintenance

8-1 Daily Inspection

Make certain to carry out daily inspections in accordance with Table 8-1. Neglecting inspections is a source of trouble.

Table 8-1 Daily Inspection

Inspection item	Inspection detail
Current value  	Is the current no greater than the rated value shown on the nameplate?
Noise	Are there unusual noises, or are there extreme changes in the noises?
Vibration	Is there abnormally large vibration? Are there extreme changes?
Surface temperature	Is surface temperature unusually high? Has there been a sudden rise? (Temperature rises during operation will differ according to model and type. However, in case the difference between the gear unit surface temperature and the environment temperature should be approximately 40°C, there is no particular trouble if fluctuation is slight.)
Grease leaks	Is grease leaking from the gear unit? Are the oil seal sliding surfaces corroded?
Mounting bolts	Are the mounting bolts loose?
Chain, V-belt	Are the chain or V-belt loose?

- If any problems are found in a daily inspection, follow "9. Troubleshooting" (on P46 and 47) to take appropriate actions. If these actions do not remedy the issue, immediately contact the nearest authorized service station.

8-2 Main Unit Maintenance

- Because long-life grease of Table 8-2 is used for gear, it can run for a long time without replenishment, overhauling after approximately 20,000 hours or 3 to 5 years will further increase lifetime. Contact the nearest authorized service station regarding overhaul.

Table 8-2 Recommended Grease (Grease Used when Shipped)

Type	Manufacturer	Description	Ambient Temperature °C
CYCLO Drive	Nippeco	BEN10-No.2	-10 to 50
	Mobil	UNIREX N2	
CYCLO Drive SK series	Shell	Shell Alvania EP Grease R000	-10 to 40

- Only use grease listed in Table 8-2.
- When regularly used in an ambient temperature outside the 0 - 40°C range, some specifications will differ. Please consult with us.

- Oil seals have a lifetime. During long use natural degradation and frictional wear will reduce effectiveness. Reducer operating conditions and ambient environment will cause lifetime to widely vary. Given normal operation, (uniform load, running 10 hours per day, normal temperature) as a guideline it is recommended to change them every 1 to 3 years. If the sliding surfaces of oil seals or V-rings show signs of wear or corrosion, replace them with new ones. Sliding surfaces are made of carbon steel, so rain water, condensation and other factors could cause rust to form and spread. Because this could lead to oil seal damage, take on-going rust prevention measures.
- If stop and start are frequent, mounting bolts (or nuts) and frame size fastening bolts (or nuts) may come loose. Periodically check for looseness as this is a source of miss-alignment, oil leakages, and load unbalance.

8-3 Brake Maintenance and Inspection

DANGER

- Do not handle the unit when cables are live. Be sure to turn off the power when operating on the unit; otherwise, electric shock may result.
- When using for lifting, do not release the brake while a load is suspended; otherwise it could fall, causing an accident.
- Do not operate the machine while the brake is released by the manual brake release bolt; otherwise, falling, going out of control, or damage to the equipment may result.
- Before operation turn power on and off to check brake action; otherwise falling or running out of control could occur.
- Do not bring water or oils in contact with the brake. Brake torque degradation could cause falling or running out of control.

CAUTION

- After gap inspection and adjustment do not operate with the fan cover removed. otherwise loose clothing may became caught in these rotating parts and cause serious injury or death.
- Changing brake linings requires experience. Consult with the nearest authorized service station.

Given normal operation conditions, brake mechanical lifetime is quite long at 2 million times. These conditions include the moment of inertia for the load being no greater than the moment of inertia for the brakemotor. However, please periodically inspect the brake gap (G). The brake lining wears after long hours of running time, making it impossible for the brake to release. When 2 million times is exceeded, wear and damage to mechanical parts may cause dropping or overdrive problems.

8-4 Brake Construction and Gap Inspection and Adjustment

- The brake is spring activated (power-off type).
- The brake lining wears after long hours of operating the brake, making it impossible for the brake to release. Therefore please periodically inspect the brake gap (G).
- If on inspection the gap is close to the limit, adjust the gap.
- In FB-1E - 4E a shock absorber is inserted between the stationary core and the armature plate to reduce the noise that results from the braking action.

When inspecting be careful that the gap gauge, other measuring tool or anything else does not damage the shock absorber or cause it to fall out.

There is danger that if the shock absorber is damaged or falls out, brake noise will increase and the brake will not function properly.

Table 8-3 Pages Containing Information on Brake Construction and Gap Inspection and Adjustment

Brake type	Indoor	Outdoor
FB-01A1, 02A1, 05A1	P32	P38
FB-1D	P33	P39
FB-1E	P34	P40
FB-1HE, 2E	P35	P41
FB-3E, 4E	P36	P42
FB-5E, 8E	P37	P43



8. Daily Inspection and Maintenance

■ FB-01A1, 02A1, 05A1 (Indoor type)

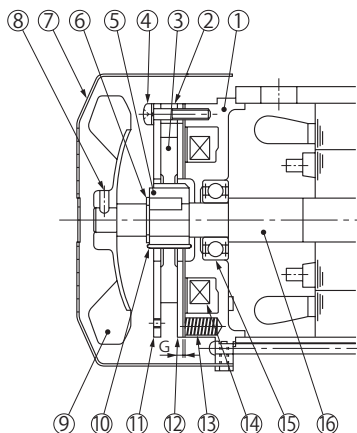


Figure 8-1

Code	Part Name
1	Stationary core
2	Spacer
3	Brake Lining
4	Attachment bolt
5	Boss
6	Shaft-retaining C-ring
7	Cover
8	Fan set screw
9	Fan
10	Leaf spring
11	Fixed plate
12	Armature plate
13	Spring
14	Electromagnetic coil
15	Bearing
16	Motor shaft

Note: FB-01A1 does not come with [8][9].

- Gap Inspection

- (1) Remove the cover [7].
- (2) Insert a gap gauge between the stationary core [1] and the armature plate [12], and measure the gap. Measure in 3 locations around the circumference.
- (3) Adjustment is required if the gap value is close to the limit.

Gap Value G (mm)	
Required value (original value)	Limit value
0.2 - 0.35	0.5

- Gap Adjustment

- (1) Remove the cover [7].
- (2) Loosen the fan set screw [8] and remove the fan [9].
- (3) Slightly loosen the attachment bolts [4] and rotate the fixed plate [11] counterclockwise, as far as it will go. Then tighten the attachment bolts [4]. After tightening, measure the gap (G) and check to see if the gap value is between the required value and the limit. (This operation will reduce the gap by 0.3 mm.)
- (4) Turn the power on and off to check brake action.
- (5) Attach the fan [9] and cover [7]. Use a fan set screw [8] coated with Three Bond TB2365 (Sumitomo part number EW444WW-01), and tighten to a torque of 0.3 - 0.5 N·m.

Note: If the optional brake release bolt is installed, disassemble after removing the release bolt.

■ FB-1D (Indoor Type)

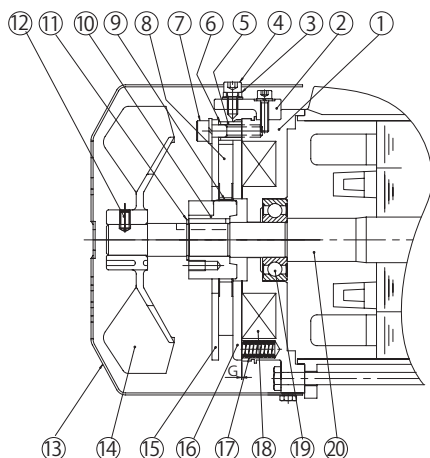


Figure 8-2

Code	Part Name
1	Stationary core
2	Brake release
3	Manual release protection spacer
4	Brake release bolt
5	Spacer
6	Gap adjusting shims
7	Attachment bolt
8	Brake Lining
9	Leaf spring
10	Boss
11	Shaft-retaining C-ring
12	Fan set screw
13	Cover
14	Fan
15	Fixed plate
16	Armature plate
17	Spring
18	Electromagnetic coil
19	Bearing
20	Motor shaft

- Gap Inspection

- Remove the brake release bolt [4] and the manual release prevention spacer [3].
- Remove the cover [13].
- Insert a gap gauge between the stationary core [1] and the armature plate [16] and measure the gap. Measure in 3 locations around the circumference.
- Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.2 - 0.25 mm. Adjustment cannot be made at a lower value.)

Gap Value G (mm)	
Required value (original value)	Limit value
0.3 - 0.4	0.6

- Gap Adjustment

- Remove the brake release bolt [4] and the manual release prevention spacer [3].
- Remove the cover [13].
- Remove the fan set screw [12] and remove the fan [14].
- Loosen the attachment bolts [7] and remove the spacers [5], gap adjustment shims [6], attachment bolts [7] and fixed plate [15] as a set. When removing the attachment bolts [7] make certain not to omit the gap adjustment shims [6].
- The gap adjustment shims [6] have a thickness of 0.2 - 0.25 mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [5], gap adjustment shims [6], attachment bolts [7] and the fixed plate [15] as a set.
- Check the gap G, and readjust the shims if there is a large difference between the gap and the required value.
- Turn the power on and off to check brake action.
- Attach the fan [14], fan set screw [12] and cover [13]. Use a fan set screw [12] coated with Three Bond TB2365 (Sumitomo part number EW445WW-01), and tighten to a torque of 0.85 - 1.05 N·m. Finally, attach the brake release bolt [4] and the manual release prevention spacer [3].



8. Daily Inspection and Maintenance

■ FB-1E (Indoor Type)

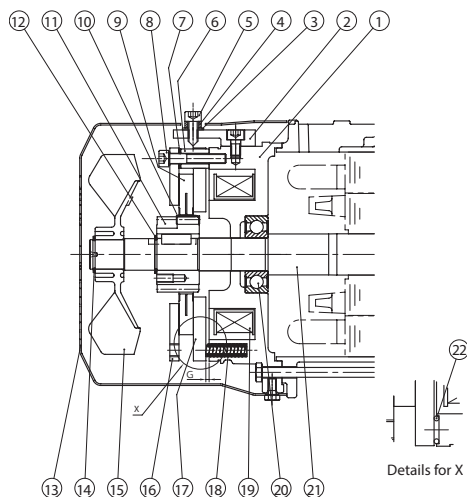


Figure 8-3

Code	Part Name
1	Stationary core
2	Brake release
3	Seal washer
4	Manual release prevention spacer
5	Brake release bolt
6	Spacer
7	Gap adjusting shims
8	Attachment bolt
9	Brake Lining
10	Leaf spring
11	Boss
12	Shaft-retaining C-ring
13	Cover
14	Shaft-retaining C-ring
15	Fan
16	Fixed plate
17	Armature plate
18	Spring
19	Electromagnetic coil
20	Ball bearings
21	Motor shaft
22	Shock absorber

- Gap Inspection

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Insert a gap gauge between the stationary core [1] and the armature plate [17] and measure the gap. Measure in 3 locations around the circumference.
- (4) Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.2 - 0.25 mm. Adjustment cannot be made at a lower value.)

Gap Value G (mm)	
Required value (original value)	Limit value
0.25 - 0.35	0.6

- Gap Adjustment

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Remove the shaft-retaining C-ring [14], and remove the fan [15].
- (4) Loosen the attachment bolts [8] and remove the spacers [6], gap adjustment shims [7], attachment bolts [8] and fixed plate [16] as a set. When removing the attachment bolts [8] make certain not to omit the gap adjustment shims [7] or the shock absorber [22].
- (5) The gap adjustment shims [7] have a thickness of 0.2 - 0.25 mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [6], gap adjustment shims [7], attachment bolts [8] and the fixed plate [16] as a set.
- (6) Check the gap G, and readjust the shims if there is a large difference between the gap and the required value.
- (7) Turn the power on and off to check brake action.
- (8) Attach the fan [15], shaft-retaining C-ring [14] and cover [13].
- (9) Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].

■ FB-1HE, 2E (Indoor Type)

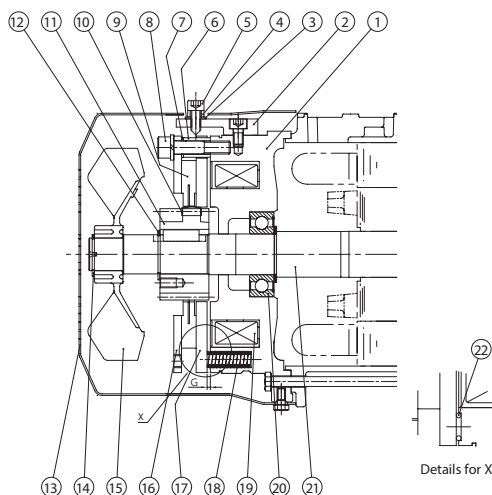


Figure 8-4

Code	Part Name
1	Stationary core
2	Brake release
3	Seal washer
4	Manual release prevention spacer
5	Brake release bolt
6	Spacer
7	Gap adjusting shims
8	Attachment bolt
9	Brake Lining
10	Leaf spring
11	Boss
12	Shaft-retaining C-ring
13	Cover
14	Shaft-retaining C-ring
15	Fan
16	Fixed plate
17	Armature plate
18	Spring
19	Electromagnetic coil
20	Ball bearings
21	Motor shaft
22	Shock absorber

- Gap Inspection

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Insert a gap gauge between the stationary core [1] and the armature plate [17] and measure the gap. Measure in 3 locations around the circumference.
- (4) Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.35 - 0.45mm. Adjustment cannot be made at a lower value.)

Gap Value G (mm)	
Required value (original value)	Limit value
0.25 - 0.35	0.75

- Gap Adjustment

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Remove the shaft-retaining C-ring [14], and remove the fan [15].
- (4) Loosen the attachment bolts [8] and remove the spacers [6], gap adjustment shims [7], attachment bolts [8] and fixed plate [16] as a set. When removing the attachment bolts [8] make certain not to omit the gap adjustment shims [7] or the shock absorber [22].
- (5) The gap adjustment shims [7] have a thickness of 0.35 - 0.45mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [6], gap adjustment shims [7], attachment bolts [8] and the fixed plate [16] as a set.
- (6) Check the gap G, and readjust the shims if there is a large difference between the gap and the required value.
- (7) Turn the power on and off to check brake action.
- (8) Attach the fan [15], shaft-retaining C-ring [14] and cover [13].
- (9) Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].



8. Daily Inspection and Maintenance

■ FB-3E, 4E (Indoor Type)

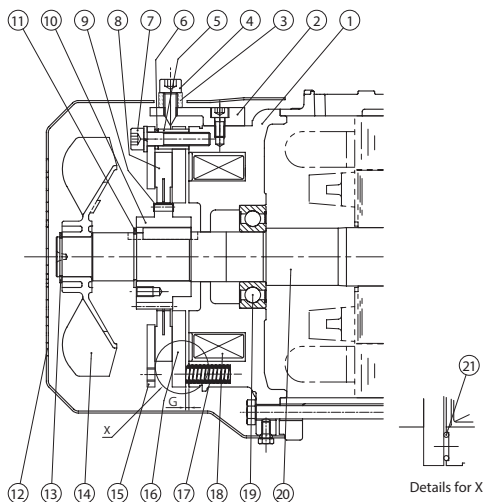


Figure 8-5

Code	Part Name
1	Stationary core
2	Brake release
3	Manual release prevention spacer
4	Brake release bolt
5	Spacer
6	Gap adjusting shims
7	Attachment bolt
8	Brake Lining
9	Leaf spring
10	Boss
11	Shaft-retaining C-ring
12	Cover
13	Shaft-retaining C-ring
14	Fan
15	Fixed plate
16	Armature plate
17	Spring
18	Electromagnetic coil
19	Ball bearings
20	Motor shaft
21	Shock absorber

- Gap Inspection

- Remove the brake release bolt [4] and the manual release prevention spacer [3].
- Remove the cover [12].
- Insert a gap gauge between the stationary core [1] and the armature plate [16] and measure the gap. Measure in 3 locations around the circumference.
- Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.45 - 0.55mm. Adjustment cannot be made at a lower value.)

Gap Value G (mm)	
Required value (original value)	Limit value
0.25 - 0.35	0.85

- Gap Adjustment

- Remove the brake release bolt [4] and the manual release prevention spacer [3].
- Remove the cover [12].
- Remove the shaft-retaining C-ring [13] and the fan [14].
- Loosen the attachment bolts [7] and remove the spacers [5], gap adjustment shims [6], attachment bolts [7] and fixed plate [15] as a set. When removing the attachment bolts [7] make certain not to omit the gap adjustment shims [6] or the shock absorber [21].
- The gap adjustment shims [6] have a thickness of 0.45 - 0.55 mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [5], gap adjustment shims [6], attachment bolts [7] and fixed plate [15] as a set.
- Check the gap G, and readjust the shims if there is a large difference between the gap and the required value.
- Turn the power on and off to check brake action.
- Attach the fan [14], shaft-retaining C-ring [13] and cover [12].
- Finally, attach the brake release bolt [4] and the manual release prevention spacer [3].

■ FB-5E and 8E (Indoor type)

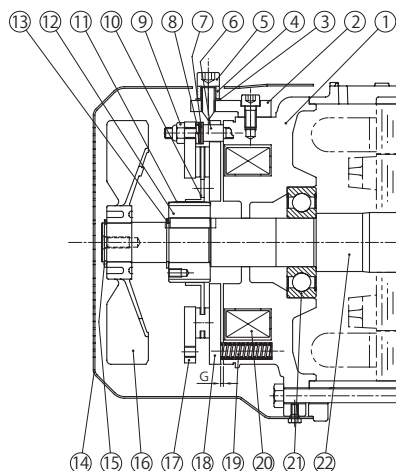


Figure 8-6

Code	Part Name
1	Stationary core
2	Brake release
3	Seal washer
4	Manual release prevention spacer
5	Brake release bolt
6	Stud bolt
7	Adjusting washer
8	Spring washer
9	Gap adjusting nut
10	Brake Lining
11	Leaf spring
12	Boss
13	Shaft-retaining C-ring
14	Cover
15	Shaft-retaining C-ring
16	Fan
17	Fixed plate
18	Armature plate
19	Spring
20	Electromagnetic coil
21	Ball bearings
22	Motor shaft

- Gap Inspection

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [14].
- (3) Insert a gap gauge between the stationary core [1] and the armature plate [18] and measure the gap. Measure in 3 locations around the circumference.
- (4) Adjustment is required if the gap value is close to the limit.

Gap Value G (mm)	
Required value (original value)	Limit value
0.35 - 0.45	1.0

- Gap Adjustment

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [14].
- (3) Insert a gap gauge between the stationary core [1] and the armature plate [18] and rotate to the right the gap adjusting nuts [9] that are attached to ends of the stud bolts [6]. If large adjustments to the gap are not possible, decrease the number of adjusting washers [7]. There are 3 gap adjusting nuts [9]. Adjust these in turn so that 3 positions on the circumference are uniformly at the required gap.
- (4) Turn the power on and off to check brake action.
- (5) Attach the cover [14].
- (6) Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].



8. Daily Inspection and Maintenance

■ FB-01A1, 02A1, 05A1 (Outdoor type)

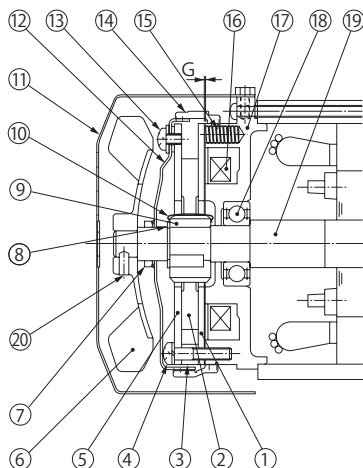


Figure 8-7

Code	Part Name
1	Armature plate
2	Brake Lining
3	Spacer
4	Attachment bolt
5	Fixed plate
6	Fan
7	V-ring
8	Shaft retaining C-ring
9	Boss
10	Leaf spring
11	Cover
12	Waterproof cover
13	Waterproof cover attachment bolts
14	Waterproof seal
15	Spring
16	Electromagnetic coil
17	Stationary core
18	Bearing
19	Motor shaft
20	Fan set screw

Note: FB-01A1 does not come with [6]
[7][20].

Gap Value G (mm)	
Required value (original value)	Limit value
0.2 - 0.35	0.5

- Gap Inspection

- (1) Remove the cover [11].
- (2) Loosen the fan set screw [20] and remove the fan [6].
- (3) Remove the waterproof seal [14].
- (4) Insert a gap gauge between the stationary core [17] and the armature plate [1], and measure the gap. Measure in 3 locations around the circumference.
- (5) Adjustment is required if the gap value is close to the limit.

- Gap Adjustment

- (1) Remove the cover [11].
- (2) Loosen the fan set screw [20] and remove the fan [6].
- (3) Remove the waterproof seal [14].
- (4) Pull off the V-ring [7].
- (5) Remove the waterproof cover attachment bolts [13], and remove the waterproof cover [12].
- (6) Slightly loosen the attachment bolts [4] and rotate the fixed plate [5] counter clockwise, as far as it will go. Then tighten the attachment bolts [4]. After tightening, measure the gap (G) and check to see if the gap value is between the required value and the limit. (This operation will reduce the gap by 0.3 mm.)
- (7) Attach the waterproof cover [12] using the attachment bolts [13]. Attach the waterproof cover [12] so that the gap (A) between its hole and the motor shaft [19] is nearly uniform around the circumference.
- (8) Clean the surface of the waterproof seal [14] to remove impurities.
- (9) As shown in the construction drawings, install the waterproof seal [14] between the stationary core [17] and the waterproof cover [12]. Insert the waterproof seal [14] with its arrow mark pointing toward the load side. (Align the hole in the waterproof seal [14] for the release bolt with the position of the release bolt.) Attach the waterproof seal [14] so that its protrusion fits snugly around the entire circumference of the groove for the stationary core [17]. Otherwise water could leak in.
- (10) Turn the power on and off to check brake action.
- (11) Attach the V-ring [7]. Wipe off the lip and surface near the lip of the V-ring [7], lightly coat the lip surface with grease and attach. Observe the attaching dimension (B = 4.5mm).
- (12) Attach the fan [7] and cover [11]. Use a fan set screw [20] coated with Three Bond TB2365 (Sumitomo part number EW444WW-01), and tighten to a torque of 0.3 - 0.5 N·m.



Note: If the optional brake release bolt is installed, disassemble after removing the release bolt.

■ FB-1D (Outdoor type)

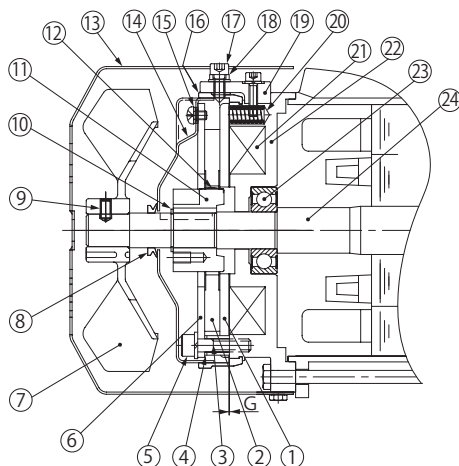


Figure 8-8

Code	Part Name
1	Armature plate
2	Brake Lining
3	Spacer
4	Gap adjusting shims
5	Attachment bolt
6	Fixed plate
7	Fan
8	V-ring
9	Fan set screw
10	Shaft retaining C-ring
11	Boss
12	Leaf spring
13	Cover
14	Waterproof cover
15	Waterproof cover attachment bolts
16	Waterproof seal
17	Brake release bolt
18	Manual release protection spacer
19	Brake release
20	Spring
21	Electromagnetic coil
22	Stationary core
23	Bearing
24	Motor shaft

- Gap Inspection

- (1) Remove the brake release bolt [17] and the manual release prevention spacer [18].
- (2) Remove the cover [13].
- (3) Loosen the fan set screw [9] and remove the fan [7].
- (4) Remove the brake release [19]. (2 Places)
- (5) Remove the waterproof seal [16].
- (6) Insert a gap gauge between the stationary core [22] and the armature plate [1], and measure the gap. Measure in 3 locations around the circumference.
- (7) Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.2 - 0.25 mm.
Adjustment cannot be made at a lower value.)

Gap Value G (mm)	
Required value (original value)	Limit value
0.3 - 0.4	0.6

- Gap Adjustment

- (1) Remove the brake release bolt [17] and the manual release prevention spacer [18].
- (2) Remove the cover [13].
- (3) Loosen the fan set screw [9] and remove the fan [7].
- (4) Pull off the V-ring [8].
- (5) Remove the brake release [19]. (2 Places)
- (6) Remove the waterproof seal [16].
- (7) Remove the waterproof cover attachment bolts [15], and remove the waterproof cover [14].
- (8) Loosen the attachment bolts [5] and remove the spacers [3], gap adjusting shims [4], attachment bolts [5], fixed plate [6] as a set. When removing the attachment bolts [5] make certain not to omit the gap adjustment shims [4].
- (9) The gap adjusting shims [4] have a thickness of 0.2 - 0.25 mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [3], gap adjustment shims [4], attachment bolts [5] and the fixed plate [6] as a set.
- (10) Check the gap G, and readjust the shims if there is a large difference between it and the required value.
- (11) Attach the waterproof cover [14] using the attachment bolts [15]. Attach the waterproof cover [14] so that the gap (A) between its hole and the motor shaft [24] is nearly uniform.
- (12) Clean the surface of the waterproof seal [16] to remove impurities.
- (13) As shown in the construction drawings, install the waterproof seal [16] between the stationary core [22] and the waterproof cover [14]. Then attach the brake release [19]. Insert the waterproof seal [16] with its arrow mark pointing toward the load side. Align the hole in the waterproof seal [16] for the release bolt with the position of release bolt [17]. Attach the waterproof seal [16] so that its protrusion fits snugly around the entire circumference of the groove for the stationary core [22]. Otherwise water could leak in.
- (14) Turn the power on and off to check brake action.
- (15) Attach the V-ring [8]. Wipe off the lip and surface near the lip of V-ring [8], lightly coat the lip surface with grease, and attach. Observe the attaching dimension (B = 4.5mm).
- (16) Attach the fan [7] and cover [13]. Use a fan set screw [9] coated with Three Bond TB2365 (Sumitomo part number EW445WW-01), and tighten to a torque of 0.85 - 1.05 N·m. Finally, attach the brake release bolt [17] and the manual release prevention spacer [18].





8. Daily Inspection and Maintenance

■ FB-1E (Outdoor Type)

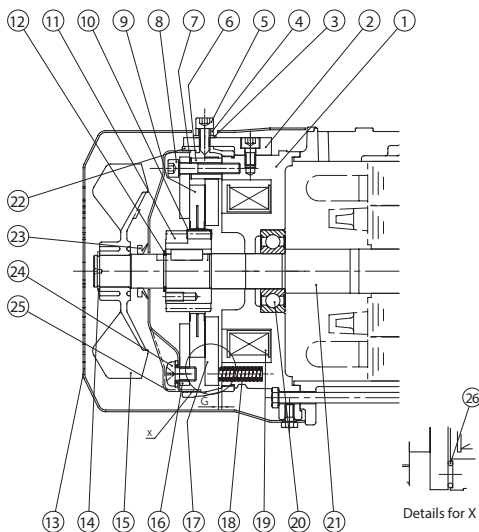


Figure 8-9

Code	Part Name
1	Stationary core
2	Brake release
3	Seal washer
4	Manual release prevention spacer
5	Brake release bolt
6	Spacer
7	Gap adjusting shims
8	Attachment bolt
9	Brake Lining
10	Leaf spring
11	Boss
12	Shaft-retaining C-ring
13	Cover
14	Shaft-retaining C-ring
15	Fan
16	Fixed plate
17	Armature plate
18	Spring
19	Electromagnetic coil
20	Ball bearings
21	Motor shaft
22	Waterproof seal
23	V-ring
24	Waterproof cover attachment bolts
25	Waterproof cover
26	Shock absorber

- Gap Inspection

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Remove the shaft-retaining C-ring [14], and remove the fan [15].
- (4) Remove the brake release [2] (2 locations) and remove the waterproof seal [22].
- (5) Insert a gap gauge between the stationary core [1] and the armature plate [17] and measure the gap. Measure in 3 locations around the circumference.
- (6) Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.2 - 0.25 mm. Adjustment cannot be made at a lower value.)

- Gap Adjustment

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Remove the shaft-retaining C-ring [14], and remove the fan [15].
- (4) Pull off the V-ring [23].
- (5) Remove the brake release [2] (2 locations) and remove the waterproof seal [22].
- (6) Remove the waterproof cover attachment bolts [24], and remove the waterproof cover [25].
- (7) Loosen the attachment bolts [8] and remove the spacers [6], gap adjustment shims [7], attachment bolts [8] and fixed plate [16] as a set. When removing the attachment bolts [8] make certain not to omit the gap adjustment shims [7] or the shock absorber [26].
- (8) The gap adjustment shims [7] have a thickness of 0.2 - 0.25 mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [6], gap adjustment shims [7], attachment bolts [8] and the fixed plate [16] as a set.
- (9) Check the gap G, and readjust the shims if there is a large difference between it and the required value.
- (10) Attach the waterproof cover [25] using the waterproof cover attachment bolts [24]. At this time align the cutout area on the side of the waterproof cover [25] with the brake release bolt [5]. Attach the waterproof cover [25] so that the gap (A) between its hole and the motor shaft [21] is nearly uniform.
- (11) Clean the surface of the waterproof seal [22] to remove impurities.
- (12) As shown in the construction drawings, install the waterproof seal [22] between the stationary core [1] and the waterproof cover [25]. Then attach the brake release [2]. Insert the waterproof seal [22] with its arrow mark pointing toward the load side. Align the hole in the waterproof seal [22] for the brake release bolt with the position of the release bolt [5]. Attach the waterproof seal [22] so that its protrusion fits snugly around the entire circumference of the groove for the stationary core [1]. (Be careful that the waterproof seal [22] does not meander. Otherwise water could leak in.)
- (13) Turn the power on and off to check brake action.
- (14) Attach the V-ring [23]. Wipe off the lip and surface near the lip of the V-ring [23], lightly coat the lip surface with grease, and attach. Observe the attaching dimension (B = 6mm).
- (15) Attach the fan [15], shaft-retaining C-ring [14] and cover [13].
- (16) Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].

Gap Value G (mm)	
Required value (original value)	Limit value
0.25 - 0.35	0.6



■ FB-1HE, 2E (Outdoor Type)

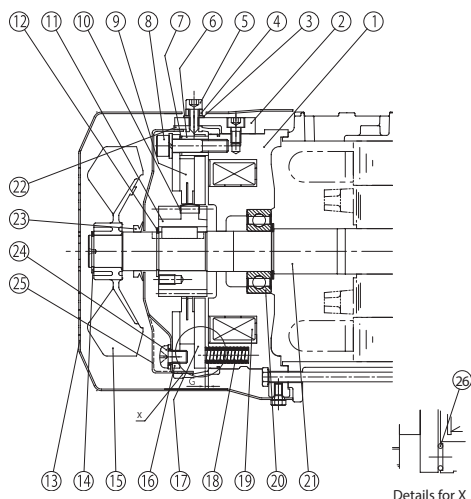


Figure 8-10

Code	Part Name
1	Stationary core
2	Brake release
3	Seal washer
4	Manual release prevention spacer
5	Brake release bolt
6	Spacer
7	Gap adjusting shims
8	Attachment bolt
9	Brake Lining
10	Leaf spring
11	Boss
12	Shaft-retaining C-ring
13	Cover
14	Shaft-retaining C-ring
15	Fan
16	Fixed plate
17	Armature plate
18	Spring
19	Electromagnetic coil
20	Ball bearings
21	Motor shaft
22	Waterproof seal
23	V-ring
24	Waterproof cover attachment bolts
25	Waterproof cover
26	Shock absorber

- Gap Inspection

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Remove the shaft-retaining C-ring [14], and remove the fan [15].
- (4) Remove the brake release [2] (2 locations) and remove the waterproof seal [22].
- (5) Insert a gap gauge between the stationary core [1] and the armature plate [17] and measure the gap. Measure in 3 locations around the circumference.
- (6) Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.35 - 0.45mm. Adjustment cannot be made at a lower value.)

- Gap Adjustment

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [13].
- (3) Remove the shaft-retaining C-ring [14], and remove the fan [15].
- (4) Pull off the V-ring [23].
- (5) Remove the brake release [2] (2 locations) and remove the waterproof seal [22].
- (6) Remove the waterproof cover attachment bolts [24], and remove the waterproof cover [25].
- (7) Loosen the attachment bolts [8] and remove the spacers [6], gap adjustment shims [7], attachment bolts [8] and fixed plate [16] as a set. When removing the attachment bolts [8] make certain not to omit the gap adjustment shims [7] or the shock absorber [26].
- (8) The gap adjustment shims [7] have a thickness of 0.35 - 0.45mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [6], gap adjustment shims [7], attachment bolts [8] and the fixed plate [16] as a set.
- (9) Check the gap G, and readjust the shims if there is a large difference between it and the required value.
- (10) Attach the waterproof cover [25] using the waterproof cover attachment bolts [24]. At this time align the cutout area on the side of the waterproof cover [25] with the brake release bolt [5]. Attach the waterproof cover [25] so that the gap (A) between its hole and the motor shaft [21] is nearly uniform.
- (11) Clean the surface of the waterproof seal [22] to remove impurities.
- (12) As shown in the construction drawings, install the waterproof seal [22] between the stationary core [1] and the waterproof cover [25]. Then attach the brake release [2]. Insert the waterproof seal [22] with its arrow mark pointing toward the load side. Align the hole in the waterproof seal [22] for the brake release bolt with the position of the release bolt [5]. Attach the waterproof seal [22] so that its protrusion fits snugly around the entire circumference of the groove for the stationary core [1]. (Be careful that the waterproof seal [22] does not meander. Otherwise water could leak in.)
- (13) Turn the power on and off to check brake action.
- (14) Attach the V-ring [23]. Wipe off the lip and surface near the lip of the V-ring [23], lightly coat the lip surface with grease, and attach. Observe the attaching dimension (B = 6mm).
- (15) Attach the fan [15], shaft-retaining C-ring [14] and cover [13].
- (16) Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].





8. Daily Inspection and Maintenance

■ FB-3E and 4E (Outdoor type)

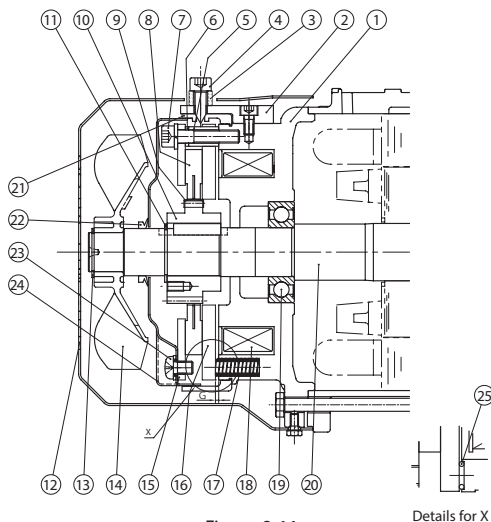


Figure 8-11

Code	Part Name
1	Stationary core
2	Brake release
3	Manual release prevention spacer
4	Brake release bolt
5	Spacer
6	Gap adjusting shims
7	Attachment bolt
8	Brake Lining
9	Leaf spring
10	Boss
11	Shaft-retaining C-ring
12	Cover
13	Shaft-retaining C-ring
14	Fan
15	Fixed plate
16	Armature plate
17	Spring
18	Electromagnetic coil
19	Ball bearings
20	Motor shaft
21	Waterproof seal
22	V-ring
23	Waterproof cover attachment bolts
24	Waterproof cover
25	Shock absorber

- Gap Inspection

- (1) Remove the brake release bolt [4] and the manual release prevention spacer [5].
- (2) Remove the cover [12].
- (3) Remove the shaft-retaining C-ring [13] and the fan [14].
- (4) Remove the brake release [2] (2 locations) and remove the waterproof seal [21].
- (5) Insert a gap gauge between the stationary core [1] and the armature plate [16] and measure the gap. Measure in 3 locations around the circumference.
- (6) Adjustment is required if the gap value is close to the limit.
(Gap adjustment shim thickness is approximately 0.45 - 0.55mm. Adjustment cannot be made at a lower value.)

Gap Value G (mm)	
Required value (original value)	Limit value
0.25 - 0.35	0.85



- Gap Adjustment

- (1) Remove the brake release bolt [4] and the manual release prevention spacer [5].
- (2) Remove the cover [12].
- (3) Remove the shaft-retaining C-ring [13] and the fan [14].
- (4) Pull off the V-ring [22].
- (5) Remove the brake release [2] (2 locations) and remove the waterproof seal [21].
- (6) Remove the waterproof cover attachment bolts [23], and remove the waterproof cover [24].
- (7) Loosen the attachment bolts [7] and remove the spacers [5], gap adjustment shims [6], attachment bolts [7] and fixed plate [15] as a set. When removing the attachment bolts [7] make certain not to omit the gap adjustment shims [6] or the shock absorber [25].
- (8) The gap adjustment shims [6] have a thickness of 0.45 - 0.55 mm. Reduce the number of shims according to the wear conditions, then reassemble the spacers [5], gap adjustment shims [6], attachment bolts [7] and fixed plate [15] as a set.
- (9) Check the gap G, and readjust the shims if there is a large difference between it and the required value.
- (10) Attach the waterproof cover [24] using the waterproof cover attachment bolts [23]. At this time align the cutout area on the side of the waterproof cover [24] with the brake release bolt [4]. Attach the waterproof cover [24] so that the gap (A) between its hole and the motor shaft [20] is nearly uniform.
- (11) Clean the surface of the waterproof seal [21] to remove impurities.
- (12) As shown in the construction drawings, install the waterproof seal [21] between the stationary core [1] and the waterproof cover [24]. Then attach the brake release [2]. Align the hole in the waterproof seal [21] for the brake release bolt with the position of the release bolt [4]. Attach the waterproof seal [21] so that its protrusion fits snugly around the entire circumference of the groove for the stationary core [1]. (Be careful that the waterproof seal [21] does not meander. Otherwise water could leak in.)
- (13) Turn the power on and off to check brake action.
- (14) Attach the V-ring [22]. Wipe off the lip and surface near the lip of the V-ring [22], lightly coat the lip surface with grease, and attach. Observe the attaching dimension (B = 6mm).
- (15) Attach the fan [14], shaft-retaining C-ring [13] and cover [12].
- (16) Finally, attach the brake release bolt [4] and the manual release prevention spacer [3].



■ FB-5E and 8E (Outdoor type)

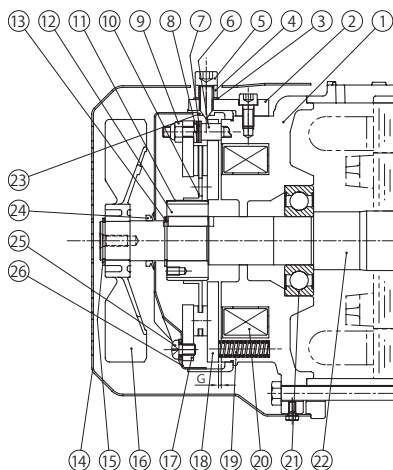


Figure 8-12

Code	Part Name
1	Stationary core
2	Brake release
3	Seal washer
4	Manual release prevention spacer
5	Brake release bolt
6	Stud bolt
7	Adjusting washer
8	Spring washer
9	Gap adjusting nut
10	Brake Lining
11	Leaf spring
12	Boss
13	Shaft-retaining C-ring
14	Cover
15	Shaft-retaining C-ring
16	Fan
17	Fixed plate
18	Armature plate
19	Spring
20	Electromagnetic coil
21	Ball bearings
22	Motor shaft
23	Waterproof seal
24	V-ring
25	Waterproof cover attachment bolts
26	Waterproof cover

- Gap Inspection

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [14].
- (3) Remove the shaft-retaining C-ring [15] and the fan [16].
- (4) Remove the brake release [2] (2 locations) and remove the waterproof seal [23].
- (5) Insert a gap gauge between the stationary core [1] and the armature plate [18] and measure the gap. Measure in 3 locations around the circumference.
- (6) Adjustment is required if the gap value is close to the limit.

- Gap Adjustment

- (1) Remove the brake release bolt [5] and the manual release prevention spacer [4].
- (2) Remove the cover [14].
- (3) Remove the shaft-retaining C-ring [15] and the fan [16].
- (4) Pull off the V-ring [24].
- (5) Remove the brake release [2] (2 locations) and remove the waterproof seal [23].
- (6) Remove the waterproof cover attachment bolts [25], and remove the waterproof cover [26].
- (7) Insert a gap gauge between the stationary core [1] and the armature plate [18] and rotate to the right the gap adjusting nuts [9] that are attached to ends of the stud bolts [6]. If the gap is large, and adjustments are not possible, decrease the number of adjustment washers [7]. There are 3 adjusting nuts [9]. Adjust these in turn so that 3 positions on the circumference are uniformly at the required gap.
- (8) Attach the waterproof cover [26] using the waterproof cover attachment bolts [25]. At this time align the cutout area on the side of the waterproof cover [26] with the brake release bolt [5]. Attach the waterproof cover [26] so that the gap (A) between its hole and the motor shaft [22] is nearly uniform.
- (9) Clean the surface of the waterproof seal [23] to remove impurities.
- (10) As shown in the construction drawings, install the waterproof seal [23] between the stationary core [1] and the waterproof cover [26]. Then attach the brake release [2]. Align the hole in the waterproof seal [23] for the brake release bolt with the position of the release bolt [5]. Next, attach along the machined surfaces around the stationary core [1]. Be careful that the waterproof seal [23] does not meander. Otherwise water could leak in.)
- (11) Turn the power on and off to check brake action.
- (12) Attach the V-ring [24]. Wipe off the lip and surface near the lip of the V-ring [24], lightly coat the lip surface with grease, and attach. Observe the attaching dimension (B = 6mm).
- (13) Attach the fan [16], shaft-retaining C-ring [15] and cover [14].
- (14) Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].

Gap Value G (mm)	
Required value (original value)	Limit value
0.35 - 0.45	1.0





8. Daily Inspection and Maintenance

8-5 Changing the Brake Lining

If the following conditions occur, ask the nearest authorized service station to exchange the brake linings with new ones.



(1) FB-01A1 - 05A1

When the brake gap still reaches the limit after the gap adjustment (see P32 and P38)

(2) FB-1D, 1E - 8E

When the thickness of brake lining reaches the use limit thickness in Table 8-4

Table 8-4 Brake Lining Dimensions

Brake type	Brake Lining Dimension drawing	Original thickness	Usable Thickness Limit
		t_0 (mm)	t_0 (mm)
FB-01A1, 02A1, 05A1		7.0	—
FB-1D			6.0
FB-1E		8.8	7.8
FB-1HE, 2E		9.0	8.0
FB-3E, 4E		10.4	8.4
FB-5E, 8E		10	6.0

- Brake torque may not be at the prescribed level during initial operation. In such case, turn motor and brake power on and off under the lightest possible load, to rub the brake lining friction surfaces.
- When changing the brake lining, change the boss and leaf springs (for FB-5E, 8E, include the gap adjusting nuts) as a set.
- After 2 million or more cycles of operation, or after 10 years or more have passed since shipment from the factory, inspect to check whether continued operation is possible, even if the lining is not at the usable thickness limit.
- Check the following items concerning the condition of each mechanical part.
 - Are the linings split or chipped?
 - Is there any peeling or gap between the lining and the disc?
 - Does the lining spline unit exhibit any cracking, chipping, or stepped wear?
 - Is there any stepped wear on the surfaces around the stud bolts or armature plate?
- Change the brake lining, even if it has not reached the usable thickness limit, if 10 or more years have elapsed since the manufacturing date and the brake is used outdoors or in a high-humidity environment, or if it is stored or rested for a long period of time.

8-6 Changing the V-Ring and Waterproof Seal (Outdoor Type)

V-rings and waterproof seals degrade over the years, losing their waterproofing abilities. As a guideline contact the nearest authorized service station every 3 years. If the sliding surfaces of oil seals or V-rings show signs of wear or corrosion, replace them with new ones. Sliding surfaces are made of carbon steel, so rain water, condensation and other factors could cause rust to form and spread. Because this could lead to oil seal damage, take on-going rust prevention measures.



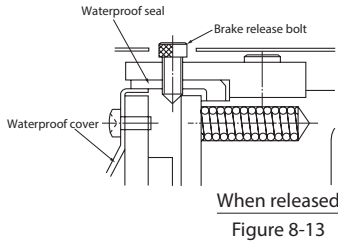
8-7 Manually Releasing the Brake

■ FB-1D, 1E - 8E (FB-01A1 - 05A1 are options)

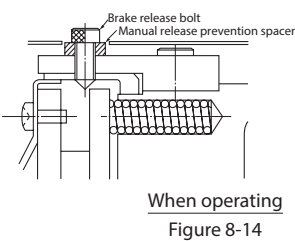
To manually release the brake with the power off, operate the brake release mechanism as shown below.

- (1) First remove the brake release bolts from the 2 opposing angles and remove the release prevention spacers. Reinsert the bolts and rotate with a hexagonal wrench to release the brake. Be careful not to over rotate the brake release bolts. (Rotate the brake release bolts while checking to see if the brake is released. (See Figures 8-13, 8-14)
- (2) After releasing the brake, to return it to its original condition, for safety, return the manual release prevention spacers that were removed in (1) to their original positions. (See Figure 8-14)
- (3) This table show brake release bolt sizes.

Brake type	Bolt size
FB-01A1, 02A1, 05A1, 1D	M5
FB-1E, 1HE, 2E	M6
FB-3E, 4E	M8
FB-5E, 8E	M10



When released
Figure 8-13



When operating
Figure 8-14

Note: Indoor types do not come with waterproof seals or waterproof covers.

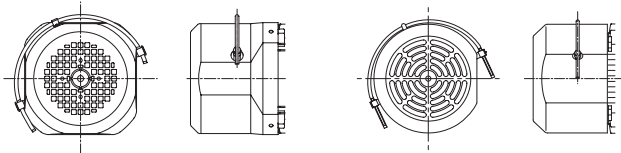
■ One-Touch Release Lever Type (Optional)

Do the following to release the brake using the one-touch release lever type.

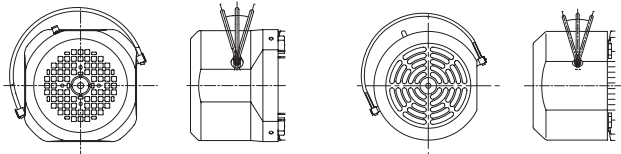
All you need to do to release the brake is push the release lever over. (See Figure 8-15)

- (1) To release the brake, pull the release lever out of the holder, and push it toward the load or anti-load side. (Some specifications do not allow pushing the release lever toward the load side.)
Be careful not to push the lever too far. Pushing the lever too far could damage the brake. (Push the release lever while checking to see if the brake is released.)
- (2) When operating the motor make certain to return the lever to its original position and set it inside the holder. Start operation after confirming that the brake operates properly.

When operating



When brake is manually released



Premium efficiency motor

Other than premium efficiency motor

Figure 8-15

Common 9. Troubleshooting

If any abnormal condition occurs, refer to Table 9-1, 9-2 and promptly take appropriate measures. If these actions do not remedy the issue, immediately contact the nearest authorized service station.

Table 9-1 Troubleshooting

Problem			Cause	Correction
The motor will not operate under no load			Power failure	Contact the electric power company.
			Defective electric circuit	Check the circuit.
			Blown fuse	Replace the fuse.
			Protective device is engaged	Fix the problem and recover.
			Load locking	Check the load and safety device.
			Poor switch contact	Adjust the contact unit.
			Motor stator coil disconnect	Confer with authorized service station.
			Bearing damage	Confer with authorized service station.
			3-phase is functioning as single-phase	Check the power supply with a voltmeter. Check the motor, transformer coil, contactor, fuse, etc. and repair or replace them.
			Friction surface of brake is corroded	Request brake cleaning from an authorized service station.
			Incorrect brake gap adjustment	Re-adjust brake gap. (See P32 - 43)
The motor rotates without a load but the slow speed shaft does not rotate.			Damage to gear unit due to overloading of gears, etc.	Confer with authorized service station.
The slow speed shaft turns with no load	When a load is applied	The switch overheats	Insufficient switch capacity	Replace with specified fuse.
			Overload	Decrease the load to the specified value.
		Fuse tripping	Insufficient fuse capacity	Replace with specified fuse.
			Overload	Decrease the load to the specified value.
		The speed will not increase and the motor is overheating.	Voltage drop	Contact the electric power company.
			Overload	Decrease the load to the specified value.
			Short-circuited motor stator coil	Confer with authorized service station.
		It stops.	The key is not inserted	Insert key.
			Bearing seized	Confer with authorized service station.
			Poor adjustment of protection device	Adjust the protection device.
The motor runs in the reverse direction.		Wiring error	Change the connection.	
Fuse tripping		The lead wire is short circuited.	Confer with authorized service station.	
		Poor contact between motor and starter	Make good connection.	
Excessive temperature rise			Overload	Decrease the load to the specified value.
			Voltage drop or rise	Contact the electric power company.
			The ambient temperature is high	Improve the ventilation method.
			Damaged bearing	Confer with authorized service station.
			Abnormal wear of reducer parts due to overload, etc.	Confer with authorized service station.
Grease leaks	Blot or drip of a small amount of oil or grease at seal section of high speed or slow speed shaft.	Grease applied to the oil seal seeps out at first.	Wipe off around the oil seal, and observe.	
	Leakage of grease from high speed or slow speed shaft section	Damaged oil seal or maybe damaged shaft (or collar)	Confer with authorized service station.	
	Leakage of grease from the contact surfaces of frame size and casing, etc.	Loose fastener bolts	Tighten fastener bolts correctly.	
	Leakage of grease into motor	Oil seal damage	Confer with authorized service station.	

Table 9-2 Troubleshooting

Problem		Cause	Correction
Abnormal sound Excessive vibration		Dust and foreign matter in bearings, or damaged bearings	Confer with authorized service station.
		Reducer parts grinding on foreign matter	Confer with authorized service station.
		Reducer parts are damaged	Confer with authorized service station.
		Warping of housing because the installation surface is not flat	Make the installation base flat or make adjustment using liners, etc.
		Resonance due to insufficient rigidity of the installation base	Reinforce the installation base to increase rigidity.
		Nonalignment of shaft with driven machine	Align the shaft centers.
		Transmission of vibration from the driven machine	Individually operate the product to check the source of the sound.
Abnormal motor sounds		Foreign objects have entered	Confer with authorized service station.
		Bearing damage	Confer with authorized service station.
		Improper brake gap adjustment	Adjust the brake gap. (See P32 - 43)
		Brake lining wear	Request brake lining replacement from an authorized service station.
		Brake unit electromagnetic coil burnout	Confer with authorized service station.
		Rectifier damage	Confer with authorized service station.
		A leaf spring in the brake boss unit has come off or is damaged	Confer with authorized service station.
Brake is ineffective	Does not activate	Forgot to restore the brake release bolt to its original position	Restore the release bolt.
		Improper adjustment after disassembly	Request authorized service station to re-adjust.
	Slips (Braking takes a long time)	Not using the quick braking circuit	Change to quick braking circuit. (See P20 - 25)
		Foreign objects or oil adhesion in brake lining unit	Request cleaning from authorized service station.
		Brake lining wear	Adjust the brake gap. Request brake lining replacement from an authorized service station.
		Brake gap not uniform	Adjust the brake gap.
		Overload	Decrease the load to the specified value.
		Brake release bolt not sufficiently restored	Restore the release bolt.
Inverter Tripping	Overcurrent shut-off	Sudden speed changes	Increase the time for speed changes.
		Extreme load fluctuation	Decrease load fluctuation.
	Overcurrent due to ground fault	Ground fault on output side	Take measures to prevent ground fault.
	Direct current overcurrent	Short on output side	Take measures to prevent short. Inspect wiring.
	Regenerative overvoltage shut-off	Sudden speed reduction	Increase the time for speed reduction. Decrease brake frequency.
	Thermal operation	Overload	Decrease the load to the specified value.



10. Construction Drawings

10-1 Gear Unit Construction Drawings (Single Reduction, Double Reduction)

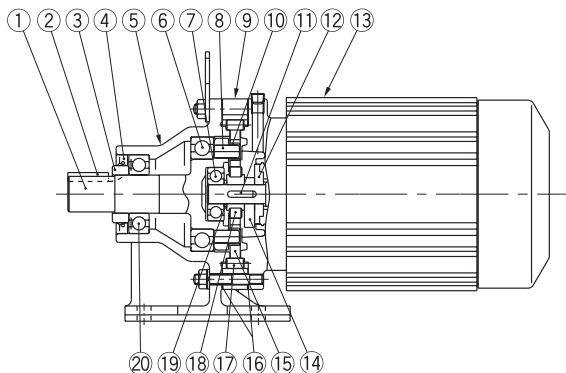


Figure 10-1 Type CNHM (Horizontal, Gearmotor), Single Reduction (Ex.: Frame size 6095)

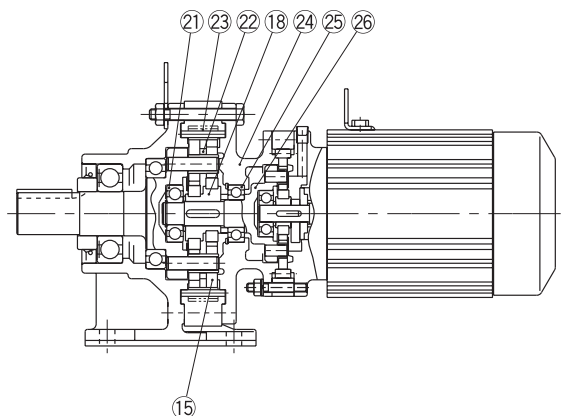


Figure 10-2 Type CNHM (Horizontal, Gearmotor), Double Reduction (Ex.: Frame size 6125DB)

Table10-1 Gear Unit, Principal Parts Single Reduction, Double Reduction

Code	Part Name
1	Slow speed shaft (Output shaft)
2	Key
3	Collar
4	Oil seal
5	Horizontal casing
6	Slow speed shaft bearing B
7	High speed shaft bearing A
8	Slow speed shaft pin
9	Frame size
10	Slow speed shaft roller
11	Key
12	Oil slinger
13	Motor
14	Counter weight
15	Cycloid disc
16	Gasket
17	Ring gear pin
18	Eccentric cam
19	Spacer ring
20	Slow speed shaft bearing A
21	Intermediate shaft bearing A
22	Spacer ring
23	Ring gear roller
24	Intermediate cover
25	Intermediate shaft bearing B
26	Intermediate shaft

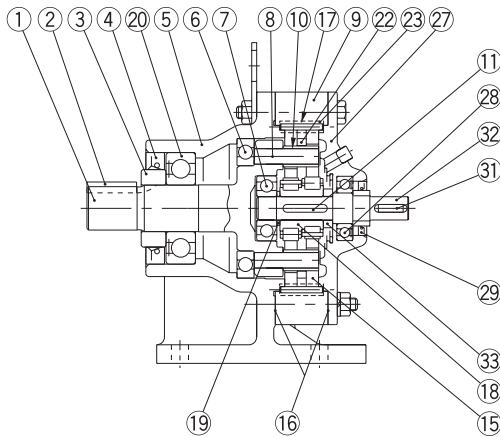


Figure 10-3 Type CNH (Horizontal, Reducer), Single Reduction (Ex.: Frame size 6105)

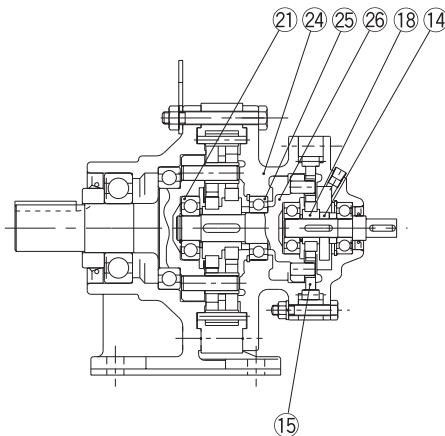


Figure 10-4 Type CNH (Horizontal, Reducer), Double Reduction (Ex.: Frame size 6125DB)

Table10-2 Gear Unit, Principal Parts Single Reduction, Double Reduction

Code	Part Name
1	Slow speed shaft (Output shaft)
2	Key
3	Collar
4	Oil seal
5	Horizontal casing
6	Slow speed shaft bearing B
7	High speed shaft bearing A
8	Slow speed shaft pin
9	Frame size
10	Slow speed shaft roller
11	Key
14	Counter weight
15	Cycloid disc
16	Gasket
17	Ring gear pin
18	Eccentric cam
19	Spacer ring
20	Slow speed shaft bearing A
21	Intermediate shaft bearing A
22	Spacer ring
23	Ring gear roller
24	Intermediate cover
25	Intermediate shaft bearing B
26	Intermediate shaft
27	Internal cover
28	High speed shaft bearing B
29	Oil seal
30	Collar
31	Key
32	High speed shaft
33	Spacer ring

10-2 Gear Unit Construction Drawings (SK Series)

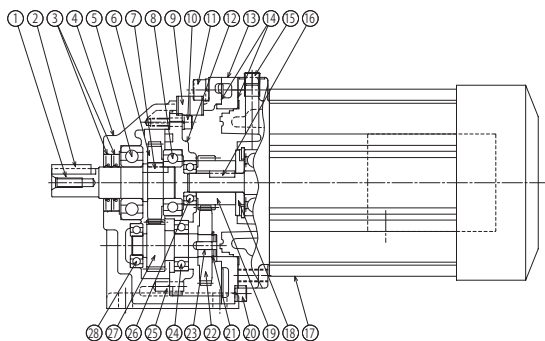


Figure 10-5 Type CHHM (6000SK Series Horizontal, Gearmotor) (Ex.: Frame size 6075SK)

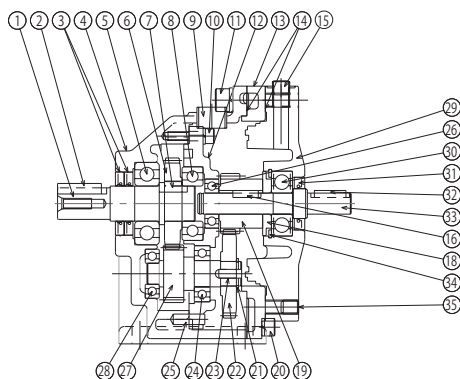


Figure 10-7 Type CHH (6000SK Series Horizontal, Reducer) (Ex.: Frame size 6075SK)

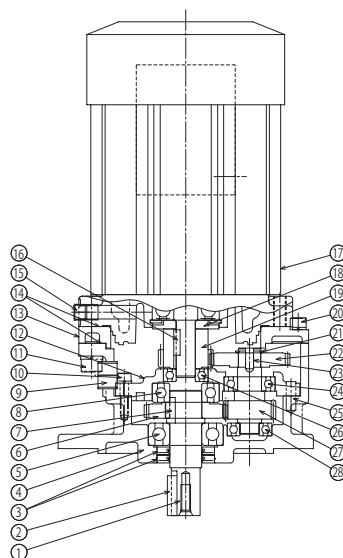


Figure 10-6 Type CVVM (6000SK Series Vertical, Gearmotor) (Ex.: Frame size 6075SK)

Table 10-3 Gear Unit, Principal Parts (SK Series)

Code	Part Name	Code	Part Name	Code	Part Name	Code	Part Name
1	Slow speed shaft (Output shaft)	10	Hexagon socket head bolt	19	First stage pinion	28	Mid speed shaft bearing A
2	Key	11	Hexagon socket head bolt	20	Hexagon socket head bolt	29	Internal cover
3	Oil seal	12	Bearing plate	21	Snap ring	30	High speed shaft bearing B
4	Horizontal casing	13	Adaptor plate	22	First stage gear	31	Oil seal
5	Slow speed shaft bearing A	14	Liquid gasket	23	Key	32	Key
6	Second stage gear	15	Plug	24	Mid speed shaft bearing B	33	High speed shaft
7	Key	16	Key	25	Pin	34	Snap ring
8	Slow speed shaft bearing B	17	Motor	26	High speed shaft bearing A	35	Hexagon socket head bolt
9	Plug	18	Oil slinger	27	Second stage pinion (Mid speed shaft)		



10-3 Motor Unit Construction Drawing (CYCLO, Direct Coupling)

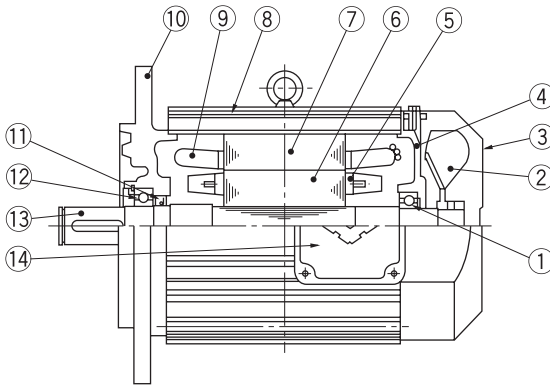


Figure 10-8 Example of Construction of 80–112M Frame Size

Table10-4 Principal Parts of Motor

Code	Part Name
1	Motor shaft bearing B
2	Fan
3	Fan cover
4	Anti-load side cover
5	Rotor conductor
6	Rotor core
7	Stationary core
8	Frame
9	Stationary coil
10	Motor flange bracket
11	Oil seal
12	Motor shaft bearing A
13	Motor shaft
14	Terminal box

The scope of our warranty for our products is limited to the range of our manufacture.

Warranty (period and contents)

Warranty Period	The warranty period for the products shall be earlier, 18 months after the shipment of the products from the seller's factory, or 12 months after starting operation, whichever is first.
Warranty Conditions	<p>In the event that any problem or damage to the Product arises during the "Warranty Period" from defects in the Product whenever the Product is properly installed and combined with the Buyer's equipment or machines, maintained as specified in the maintenance manual, and properly operated under the conditions described in the catalog or as otherwise agree upon in writing between the Seller and the Buyer or its customers; the Seller will provide, at its sole discretion, appropriate repair or replacement of the Product, without charge, at a designated facility, except as stipulated in the "Warranty Exclusions" described below.</p> <p>However, if the Product is installed or integrated into the Buyer's equipment or machines, the Seller shall not reimburse the cost of: removal or re-installation of the Product or other incidental costs related thereto, any lost opportunity, any profit loss or other incidental or consequential losses or damages incurred by the Buyer or its customers.</p>
Warranty Exclusions	<p>Notwithstanding the above warranty, the warranty as set forth herein shall not apply to any problem or damage to the Product that is caused by:</p> <ol style="list-style-type: none"> 1. installation, connection, combination or integration of the Product in or to the other equipment or machine that is rendered by any person or entity other than the Seller; 2. insufficient maintenance or improper operation by the Buyer or its customers, such that the Product is not maintained in accordance with the maintenance manual provided or designated by the Seller; 3. improper use or operation of the Product by the Buyer or its customers that is not informed to the Seller, including, without limitation, the Buyer's or its customers' operation of the Product not in conformity with the specifications, or use of lubricating oil in the Product that is not recommended by the Seller; 4. Any problem or damage to any equipment or machine to which the Product is installed, connected or combined, or on any specifications particular to the Buyer or its customers; 5. Any changes, modifications, improvements or alterations to the Product or those functions that are rendered on the Product by any person or entity other than the Seller; 6. Any parts in the Product that are supplied or designated by the Buyer or its customers; 7. Earthquake, fire, flood, sea-breeze, gas, thunder, acts of God or any other reasons beyond the control of the Seller; 8. Normal wear and tear, or deterioration of the Product's parts, such as bearings, oil-seals; 9. Any other troubles, problems or damage to the Product that are not attributable to the Seller.

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Specifications, dimensions, and other items are subject to change without prior notice.