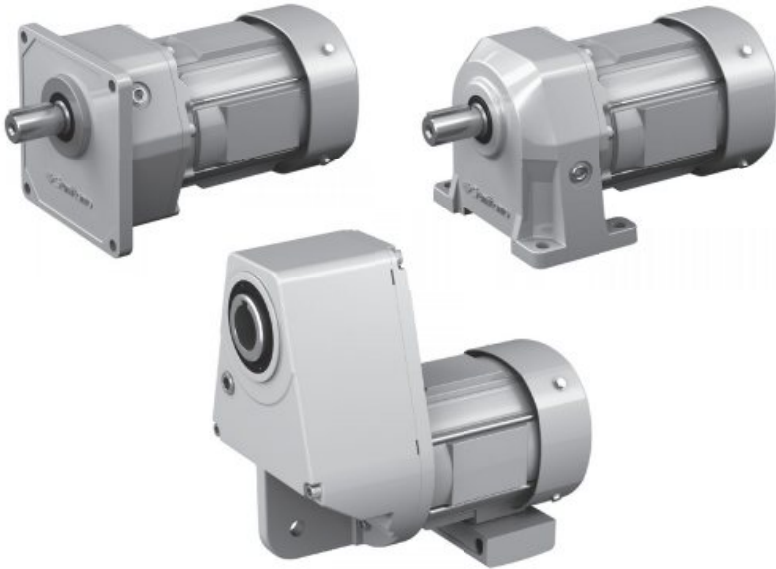


# PREST® NEO Gearmotor



<<CAUTION>>

- The product should be handled by an experienced and skilled personnel.  
Read the maintenance manual thoroughly before using the product.
- The maintenance manual should be delivered to a customer who uses the product.
- Make sure the maintenance manual should be stored securely.

# 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.






- 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 maintenance with disassembly, please 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, otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- When the unit is to be used in a system for human transport a protecting device for human safety should be installed to prevent chances of accidents resulting in personal injury, death, or damage to the equipment due to running out of control or falling.
- When the unit is to be used for an elevator or lifter, install a safety protecting device on the elevator side to prevent it from falling; otherwise, personal injury, death, or damage to the equipment may result.

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

This maintenance manual is common in “gearmotor without brake” and “gearmotor with brake”.

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                                                                         |                                                                                   |
|----------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|                |                                                                                   | Without brake                                                                     | With brake                                                                        |
| Symbol         |  |  |  |

## Contents

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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 type/specification symbol, [2] Reduction ratio, and [3] Serial number.

#### - Nameplate Type 1: Gear Unit and Motor Unit Are Combined.

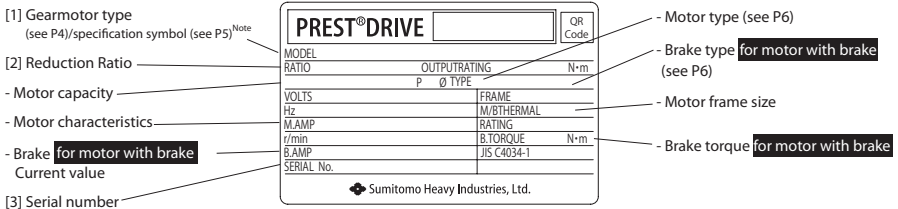
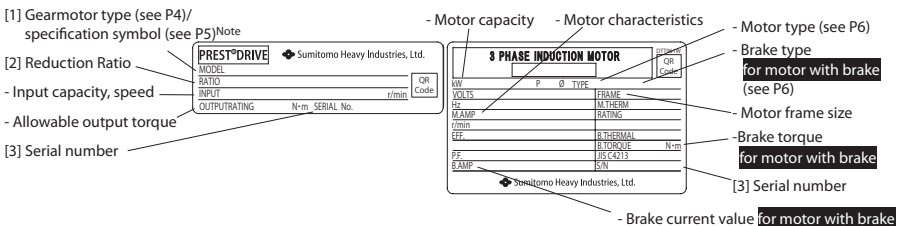


Figure 1-1 Gearmotor nameplate (type 1)

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



(Gear unit nameplate) (Motor unit nameplate)

Figure 1-2 Gearmotor nameplate (type 2)

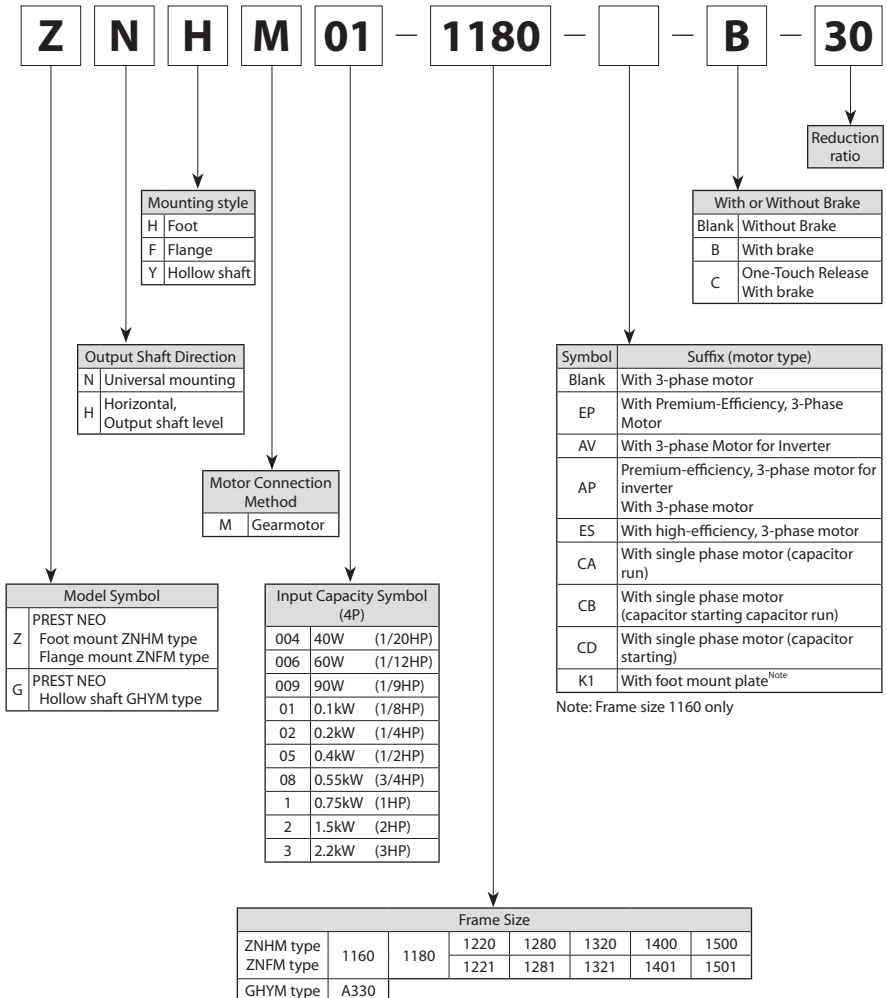
Note: A specification symbol may not be identified.

## 1-2 Lubrication Method

All series of Prest NEO Gearmotor adopt grease lubrication so that grease is enclosed when shipped from the factory, the motor is available out of the box.

## 1-3 Gearmotor Type

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

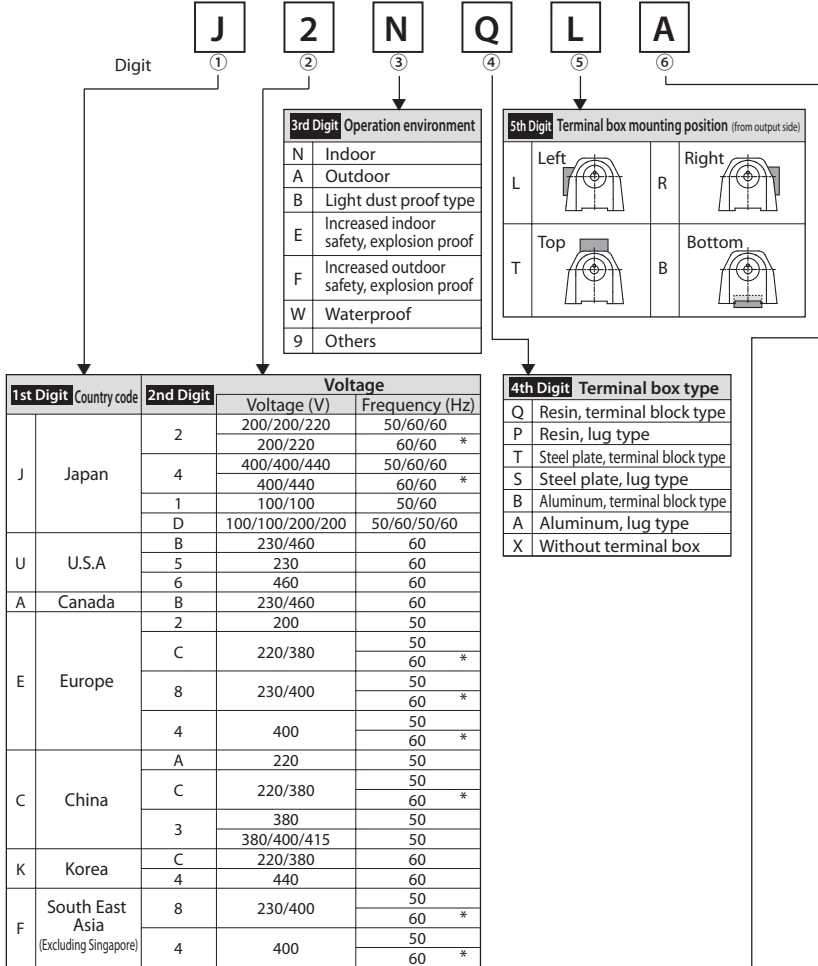


# 1. Inspection upon Delivery **Common**

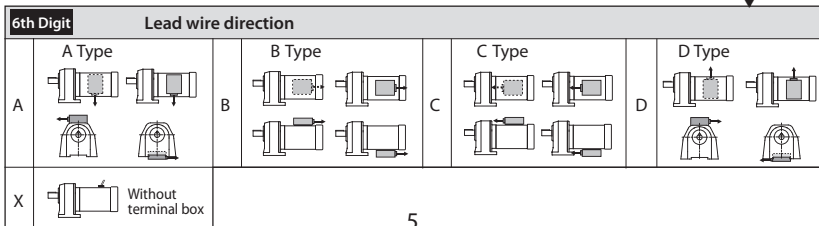
## 1-4 Gearmotor Specification Symbol

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

The specification symbol is on the nameplate as far as it is specified at an order.

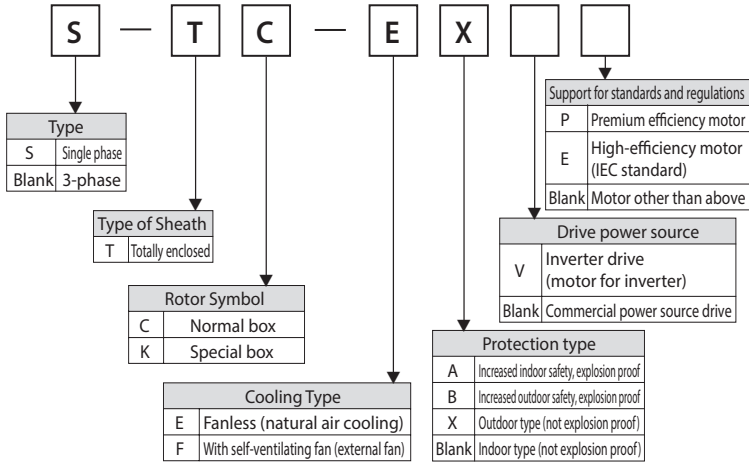


\* indicates when a motor for inverter is used.  
(Type with base frequency of 60Hz is as standard.)



## 1-5 Motor Type

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



## 1-6 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 | 3-phase Motor for Inverter | Premium-efficiency, 3-phase motor for Inverter | High-efficiency, 3-phase motor | Single phase motor |
| MB-003     | 40W                 | -                                 | -                          | -                                              | -                              | 40W                |
| MB-005     | 60W 90W             | -                                 | -                          | -                                              | -                              | 60W 90W            |
| FB-01A1    | 0.1                 | -                                 | -                          | -                                              | -                              | -                  |
| FB-02A1    | 0.2                 | -                                 | 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-2E      | -                   | 1.5                               | -                          | 1.5                                            | -                              | -                  |
| FB-3E      | -                   | 2.2                               | -                          | 2.2                                            | -                              | -                  |

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.



# Common 3. Transportation

---

## 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.
- Use an appropriate hanging bolt or hole, and make sure that the eye-bolt and/or nut is not loose before hoisting.

## 4. Installation **Common**

### 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, explosion, ignition, electric shock, or damage to the equipment may result.
- In the case of **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, 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 gearmotor; otherwise, fire may result.
- Do not place any object around the gearmotor 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, personal injury, or damage to the equipment may result.
- Do not touch the shaft end of the gearmotor, inside keyways, or the edge of the motor fan with bare hands; otherwise, injury may result.
- When the unit is used in food processing applications, machines for clean room and so on, vulnerable to oil contamination, install an oil pan or other such device to cope with grease leakage due to breakdown or failure; otherwise, grease leakage may damage products.

# Common 4. Installation

## 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<br>Dust-free, well-ventilated area.    |                                                                                                                                                                                                                                                                    |
| Installation location: | Indoor type:                                                                    | Indoors (area with minimal dust, no contact with water)                                                                                                                                                                                                            |
|                        | Outdoor type:                                                                   | Indoors or outdoors (place where are got wet with common rainwater not but direct heavy wind and rain)                                                                                                                                                             |
|                        | Waterproof type (Protection class IP65/Dust-tight, water jets protection type): | A structure that is not adversely affected by water jets from any direction.<br>It cannot be used in water or in environments where strong water jets are splashed (high-pressure cleaning) or cleaned with chemicals.                                             |
|                        | Waterproof type (Protection class IP67/Dust-tight, immersion protection type):  | A structure that is submerged in water at the specified water depth and time and is not adversely affected even if water enters.<br>It cannot be used in an environment where a strong water jets are splashed (high-pressure cleaning) or cleaned with chemicals. |
|                        | vibration:                                                                      | Maximum 1G                                                                                                                                                                                                                                                         |

- 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

|                        |                                        |
|------------------------|----------------------------------------|
| Foot mount ZNHM type   | There is no limit on a mounting angle. |
| Flange mount ZNFM type |                                        |
| Hollow shaft GHYM type | Output shaft is horizontal.            |

There is no limitation on a mounting angle unless it is originally specified the certain angle in manufacturing.

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.

# 5. Coupling with Other Machines Common

## ⚠ 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 output shaft; otherwise the key could fly off, and injury may result.
- Cover rotating parts; 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

Table 5-1 shows the direction of output shaft rotation when wiring is performed as on P20–32.

Table 5-1 Direction of Output Shaft Rotation

| When wiring is performed as shown on P20–32, the motor shaft rotates to the right as seen from the anti-load side. |                                                                                      |                                                                                         |
|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| In the following diagrams, arrows show the direction of output shaft rotation in this case.                        |                                                                                      |                                                                                         |
| Frame Size                                                                                                         | Reduction ratio                                                                      |                                                                                         |
| Foot mount<br>ZNHM type                                                                                            | 1160 7.5, 10, 12.5, 15, 20, 25 5, 30, 40, 50, 60, 70                                 |                                                                                         |
|                                                                                                                    | 1180 3, 5, 10, 15, 20, 25, 30, 40, 50 -                                              |                                                                                         |
|                                                                                                                    | 1220 3, 5, 10, 15, 20, 25, 30 60, 80, 100, 120, 160, 200                             |                                                                                         |
|                                                                                                                    | 1221 30 40, 50, 60, 80, 100                                                          |                                                                                         |
|                                                                                                                    | 1280 3, 5, 10, 15, 20, 25, 30 100, 120, 160, 200                                     |                                                                                         |
|                                                                                                                    | 1281 30 40, 50, 60, 80, 100                                                          |                                                                                         |
|                                                                                                                    | Flange mount<br>ZNFM type                                                            | 1320 3, 5, 10, 15, 20, 25, 30 100, 120, 160, 200                                        |
|                                                                                                                    |                                                                                      | 1321 30 40, 50, 60, 80, 100                                                             |
|                                                                                                                    |                                                                                      | 1400 3, 5, 10, 15, 20, 25, 30 100, 120, 160, 200                                        |
|                                                                                                                    |                                                                                      | 1401 30 40, 50, 60, 80, 100                                                             |
|                                                                                                                    |                                                                                      | 1500 - 100, 120, 160, 200                                                               |
| 1501 30 40, 50, 60, 80, 100                                                                                        |                                                                                      |                                                                                         |
| Hollow shaft<br>GHYM type                                                                                          | A330 - 15, 20, 25, 30, 40, 50                                                        |                                                                                         |
| Output Shaft<br>Rotation direction<br>(Seen from load side)                                                        | <p style="text-align: center;">Rotating in the same direction as the motor shaft</p> | <p style="text-align: center;">Rotating in the reverse direction as the motor shaft</p> |

- Note:
1. Switch the SW in the connection diagram on P22, P31, and P32 for reverse rotation of a 40 - 90W single phase power source motor.
  2. To cause reverse rotation of a 0.1 to 0.4kW single phase power source motor, reverse Z1 and Z2 in the connection diagram on P23 and P24.
  3. To cause reverse rotation of a 3-phase power source motor, reverse R and T in the connection diagram on P20, and P25 - 28.

# Common 5. Coupling with Other Machines

## 5-2 Mounting Connected Equipment

- When mounting connected equipment, do not apply impact or excessive axial load to the shaft. The bearing could be damaged, or the collar could come off.
- Shrinkage or shaft-end screw fit (see Figure 5-1) is recommended.

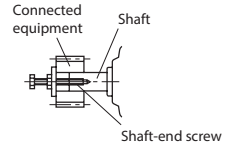


Figure 5-1

### (1) When using a coupling

The alignment accuracy (A, B, X) in figure 5-2 should be no greater than that shown in Table 5-2.

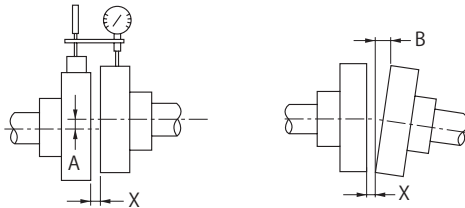


Figure 5-2

Table 5-2 Alignment Precision for Flexible Coupling

|                       |                                        |
|-----------------------|----------------------------------------|
| Allowable tolerance A | 0.1 mm or manufacturer-specified value |
| Allowable tolerance B | 0.1 mm 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 5-3)

### (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  $\beta$  of the two pulleys should be within  $20'$ . (See Figure 5-4)
- When using multiple V belts, use a matched set having the same length.

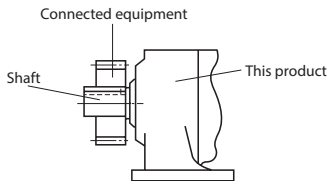


Figure 5-3

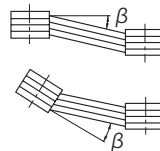


Figure 5-4

## 5-3 Precautions for Mounting the Hollow Shaft GHYM Type

### (1) Driven shaft size

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

### (2) Mounting on the driven shaft

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

### (3) Fixing on the driven shaft

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

### (4) Torque arm retainer

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

When using the hollow shaft GHYM Type, be sure to refer to the mounting procedure on P14 and P15.

# Common 5. Coupling with Other Machines

## 5-4 Hollow Shaft GHYM Type Torque Arm Mounting

### (1) Driven shaft length

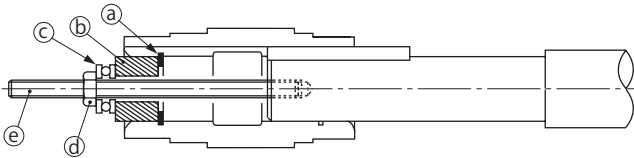
When mounting the driven shaft onto the hollow shaft, the effective length of the key should be 45mm or more.

Refer to consult us for more details.

### (2) Torque arm mounted option

#### [1] Mounting on the driven shaft

- Apply the molybdenum disulfide grease to the surface of the driven shaft and the bore of the hollow shaft, and insert the product into the driven shaft.
- If the fit is tight, lightly hit the end face of the hollow shaft with a wooden hammer to insert the shaft. When doing so, never hit the case or the oil seal directly. If the fit is particularly tight, use a jig such as the one shown in Figure 5-5 for a smoother insertion.



- (a)...Snap ring    (b)...Spacer    (c)...Thrust bearing    (d)...Nut    (e)...Double end threaded bolt

Figure 5-5 Mounting Jig

- The hollow shaft is created with a JIS H8 tolerance. If an impact is expected or the overhung load is significant, make the fit of the hollow shaft and the driven shaft tight. (JIS js6 or k6 is recommended for the driven shaft tolerance.)

#### [2] Fixing onto the driven shaft

- Be sure to fix the product onto the Stepped driven shaft.

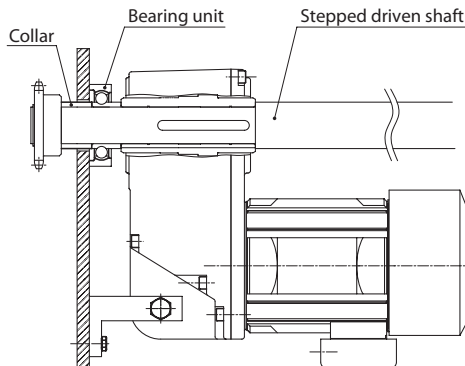
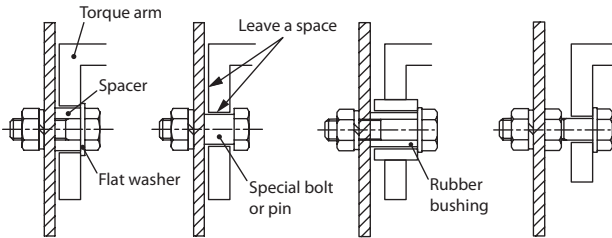
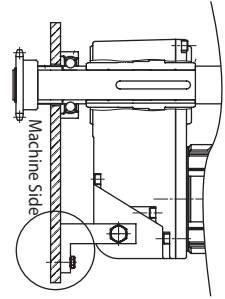


Figure 5-6 Method of Fixing In Which the Product Does Not Move to the Machine Side

# 5. Coupling with Other Machines Common

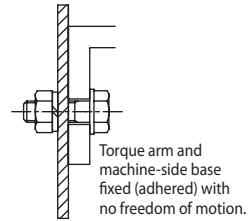
### [3] Torque arm retainer

- Mount the torque arm on the driven shaft machine side of the case. Use a hexagon socket head bolt to mount on the case. (See Table 5-3 for the size.)
  - Ensure there is some degree of freedom for the torque arm retainer so that no excessive force is applied between the product and the driven shaft.
- Never fix the torque arm using a retainer bolt.
- If a lot of starting and stopping are expected, or for repetitious plugging operations, attach a blanket cylinder between the torque arm and the mounting bolt (or the spacer) to lessen the impact.



Adjust the amount of the space to a size that does not result in excessive force or contact based on the movement of the machine.

Good example



The retainer bolt, machine or the product may be damaged due to excessive force.

Bad example

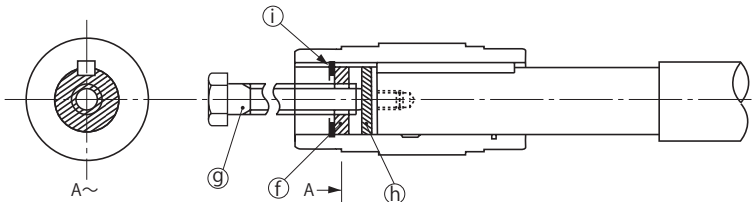
Figure 5-7 Retainer Mounting Examples

Table 5-3 Hexagon Socket Head Bolt Sizes

| Frame size | Bolt size |
|------------|-----------|
| A330       | M10       |

### (3) Removing from the driven shaft

- Be careful not to allow excessive force to apply between the case and the hollow shaft. Use a jig such as the one shown in Figure 5-8 to remove it more smoothly. The mounting, fixing and removal jig and parts are to be prepared by the customer.



(f) .....Spacer (g) .....Finished bolt (h) .....Disc (i) .....Snap ring

Figure 5-8 Removal Jig



# Common 6. Wiring

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 when operating on the unit; 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 **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.
- **For an explosion proof motor and single phase power source motor**, inverter drive is not allowed.
- For a waterproof motor, prevent the end of a cable, rectifier and capacitor from contacting water.

### CAUTION

- When wiring, follow the facility's electrical codes and extension regulations; in order to prevent burning, electric shock, injury, and fire.
- 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.
- Do not touch the terminals when measuring insulation resistance; otherwise, electric shock 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. Especially such as when the cable is long in the 400V class, a surge voltage over 1300V occurs. Therefore, in this case, install an LCR filter, AC reactor, etc. between the inverter and motor to inhibit the surge voltage.
- For units **For 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 measuring the insulation resistance of **Explosion proof motor**, confirm that there is no gas or explosive vapor in the vicinity, in order to prevent 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 - 40°C. (Manufacturing with a 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.
- **For a single phase motor**, do not take a starting capacitor as an operation capacitor when using it; otherwise, the capacitor will be damaged.
- **For a single phase motor**, do not scratch a plastic film of the starting capacitor, in order to prevent electric shock. otherwise, electric shock may result.
- **For a 40 - 90W waterproof motor**, do not open the cap of a waterproof/dust-proof box (see Figure 6-1); otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.

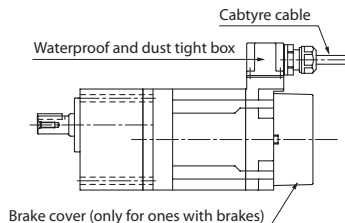


Figure 6-1

- **For a 40 - 90W waterproof motor with brake**, the brake rectifier is delivered in a separate shipment, and should be installed inside the control panel and wired accordingly.

# Common 6. Wiring

## 6-1 Removing and Attaching the Resin Terminal Box Cover

3-phase motor: 0.1–0.4kW, high-efficiency, 3-phase motor: 0.2kW, 3-phase motor for inverter: 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.

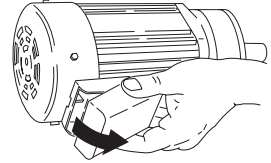


Figure 6-1

### (2) Attachment

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

## 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:

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

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

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.

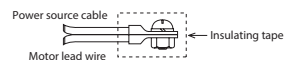


Figure 6-2

## 6-5 Motor Wiring

Shows the pages for motor wiring diagrams.

Table 6-2 Without Brake

| Motor type                                     |                                   | Capacity range (kW) | Number of Lead Wires | Page                                      |                |
|------------------------------------------------|-----------------------------------|---------------------|----------------------|-------------------------------------------|----------------|
|                                                |                                   |                     |                      | Direct Input from Commercial Power Source | Inverter Drive |
| 3-phase motor                                  | Standard                          | 40W - 0.55          | 3                    | P20                                       | P21            |
|                                                | Increased safety, explosion proof | 0.1 - 2.2           | 3                    | P20                                       | -              |
| Premium-efficiency, 3-phase motor              | Standard                          | 0.75 - 2.2          | 3                    | P20                                       | P21            |
|                                                | Increased safety, explosion proof | 0.75 - 2.2          | 3                    | P20                                       | -              |
| 3-phase motor for Inverter                     |                                   | 0.1 - 0.4           | 3                    | -                                         | P21            |
| Premium-efficiency, 3-phase motor for Inverter |                                   | 0.75 - 2.2          | 3                    | -                                         | P21            |
| High-efficiency, 3-phase motor                 |                                   | 0.2 - 0.4           | 3                    | P20                                       | P21            |
| Single phase motor                             |                                   | 40W - 90W           | 3                    | P22                                       | -              |
|                                                |                                   | 0.1 - 0.2           | 4                    | P23                                       |                |
|                                                |                                   | 0.1 - 0.4           | 6                    | P24                                       |                |

Table 6-3 With Brake

| Motor type                                     | Capacity range (kW) | Brake type      | Number of Lead Wires | Page                   |                   |                |
|------------------------------------------------|---------------------|-----------------|----------------------|------------------------|-------------------|----------------|
|                                                |                     |                 |                      | One-Direction Rotation | Plugging Rotation | Inverter Drive |
| 3-phase motor                                  | 40W                 | MB-003          | 5                    | P25                    | P27               | P29            |
|                                                | 60 - 90W            | MB-005          |                      |                        |                   |                |
|                                                | 0.1                 | FB-01A1         |                      | P26                    | P28               | P30            |
|                                                | 0.2                 | FB-02A1         |                      |                        |                   |                |
|                                                | 0.4                 | FB-05A1         |                      |                        |                   |                |
| Premium-efficiency, 3-phase motor              | 0.55                | FB-1D           | 5                    | P26                    | P28               | P30            |
|                                                | 0.75                | FB-1E           |                      |                        |                   |                |
|                                                | 1.5                 | FB-2E           |                      |                        |                   |                |
| 3-phase motor for Inverter                     | 2.2                 | FB-3E           | 5                    | -                      | -                 | P30            |
|                                                | 0.1                 | FB-02A1         |                      |                        |                   |                |
|                                                | 0.2                 | FB-05A1         |                      |                        |                   |                |
| Premium-efficiency, 3-phase motor for Inverter | 0.4                 | FB-1D           | 5                    | -                      | -                 | P30            |
|                                                | 0.75                | FB-1E           |                      |                        |                   |                |
|                                                | 1.5                 | FB-2E           |                      |                        |                   |                |
| High-efficiency, 3-phase motor                 | 2.2                 | FB-3E           | 5                    | P26                    | P28               | P30            |
|                                                | 0.2                 | FB-05A1         |                      |                        |                   |                |
| Single phase motor                             | 40W                 | FB-1D           | 5                    | P31                    | P31               | -              |
|                                                |                     | MB-003 (Indoor) |                      |                        |                   |                |
|                                                | MB-003 (Waterproof) | P32             |                      | P32                    |                   |                |
| 60 - 90W                                       | MB-005              | P31             | P31                  |                        |                   |                |

Note: 1. Single phase motors 0.1 to 0.2kW are available in two types: four lead wires (capacitor starting type/suffix type CD) and six lead wires (capacitor starting capacitor run type/suffix type CB).

Check P4 and the nameplate for the suffix type.

2. Brake type may differ depending on specification. Check the nameplate.

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

# Common 6. Wiring

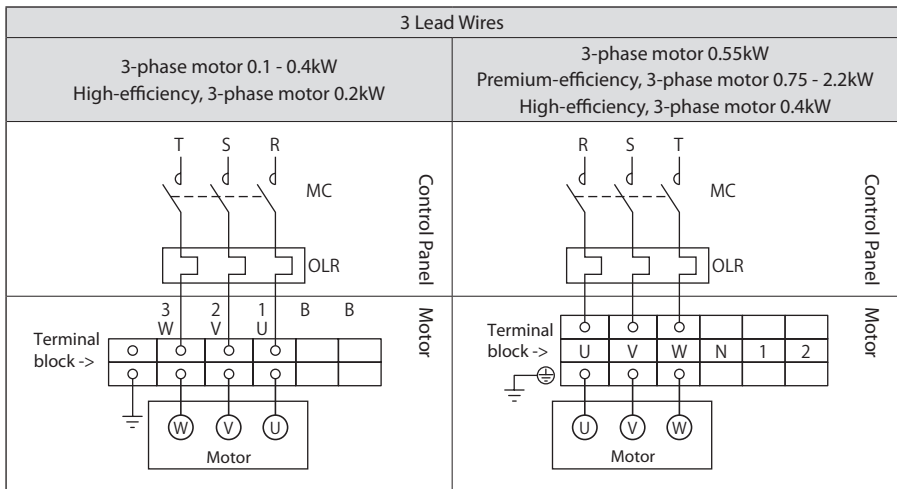
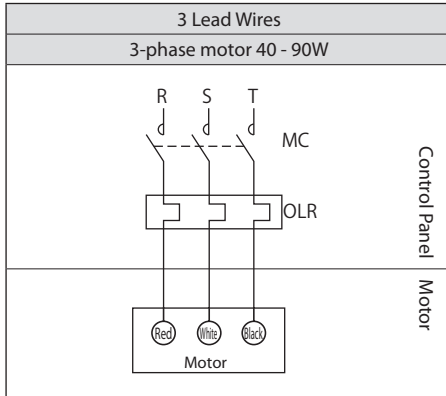
Shows motor wiring and standard specification for terminals and lead wires that are indicated by symbols.

■ **Without brake. 3-phase power source**

3-phase motor

Premium-Efficiency, 3-Phase Motor

High-efficiency, 3-phase motor



MC: Electromagnetic contactor

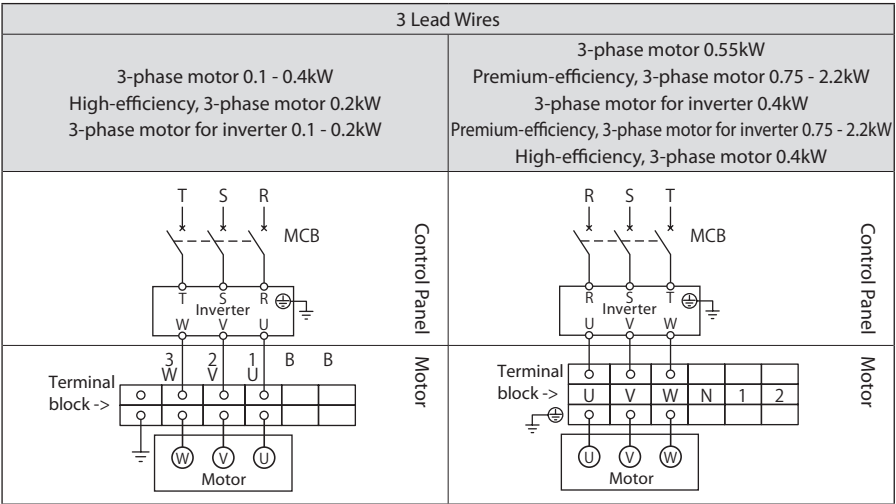
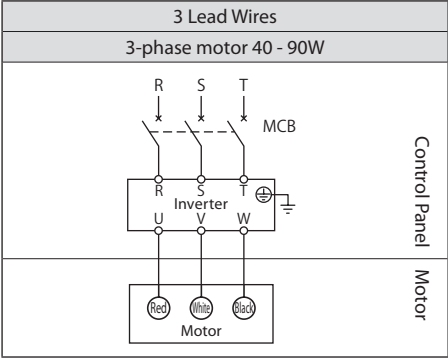
OLR: Overload protection device or electronic thermal rela

} Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- The terminal block is arrayed in two rows as shown in the above figure. Make sure that wiring of the motor power source is connected to the upper side on the above figure (on which symbols 1, 2, 3, U, V, W, and B are written; cable port side).
- Do not open the cap of a waterproof/dust-proof box (see P17) of a 40 - 90W waterproof motor. Otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.

■ Without brake. Inverter drive

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



MCB: Breaker for wiring – Customer to prepare.

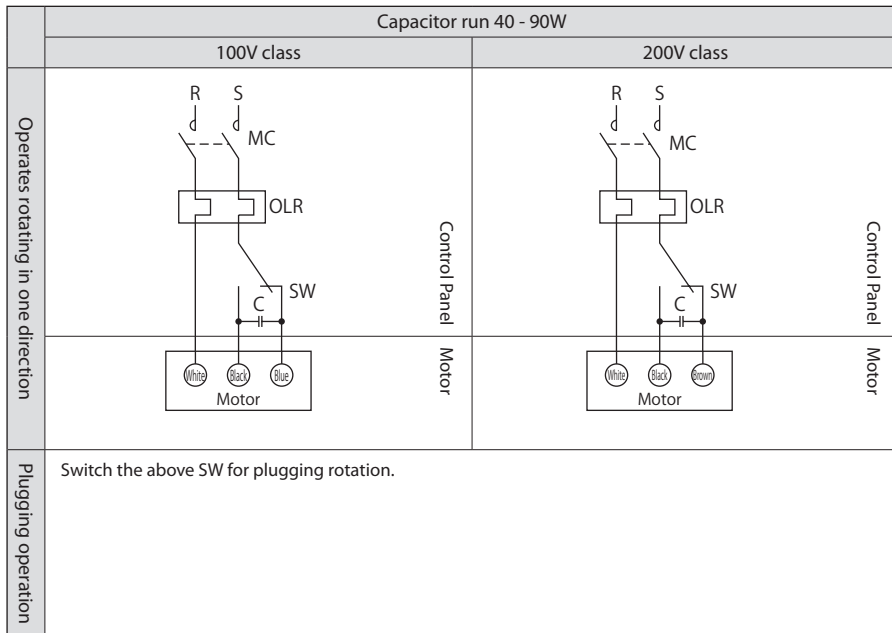
- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- The motor must be insulated to inverter-drive a 400V class 3-phase motor/high-efficiency, 3-phase motor.
- The terminal block is arrayed in two rows as shown in the above figure. Make sure that wiring of the motor power source is connected to the upper side on the above figure (on which symbols 1, 2, 3, U, V, W, and B are written; cable port side).
- Do not open the cap of a waterproof/dust-proof box (see P17) of a 40 - 90W waterproof motor. Otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.



# 6. Wiring

## ■ Without brake. Single phase power source

Single phase motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

SW: Plugging switch

C: Capacitor (accessory)

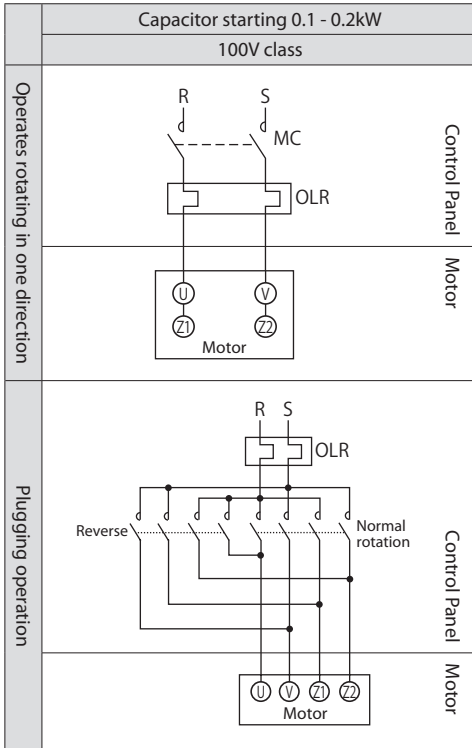
} Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult us for motors with overseas specifications.
- Use a capacitor bundled with the product (see Table 6-5 on P34) for wiring.
- Do not open the cap of a waterproof/dust-proof box (see P17) of a 40 - 90W waterproof motor. Otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.
- The capacitor is not waterproof for a waterproof motor.



## ■ Without brake. Single phase power source

Single phase motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

Electromagnetic contactor for normal and reverse rotation

} Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- Single phase motors 0.1 to 0.2kW are available in two types: four lead wires (capacitor starting type/suffix type CD) and six lead wires (capacitor starting capacitor run type/suffix type CB). Check P4 and the nameplate for the suffix type.
- Reverse Z1 and Z2 after the motor stopped to rotate the motor reversely in one-direction rotation.
- The capacitor is secured on the motor frame.

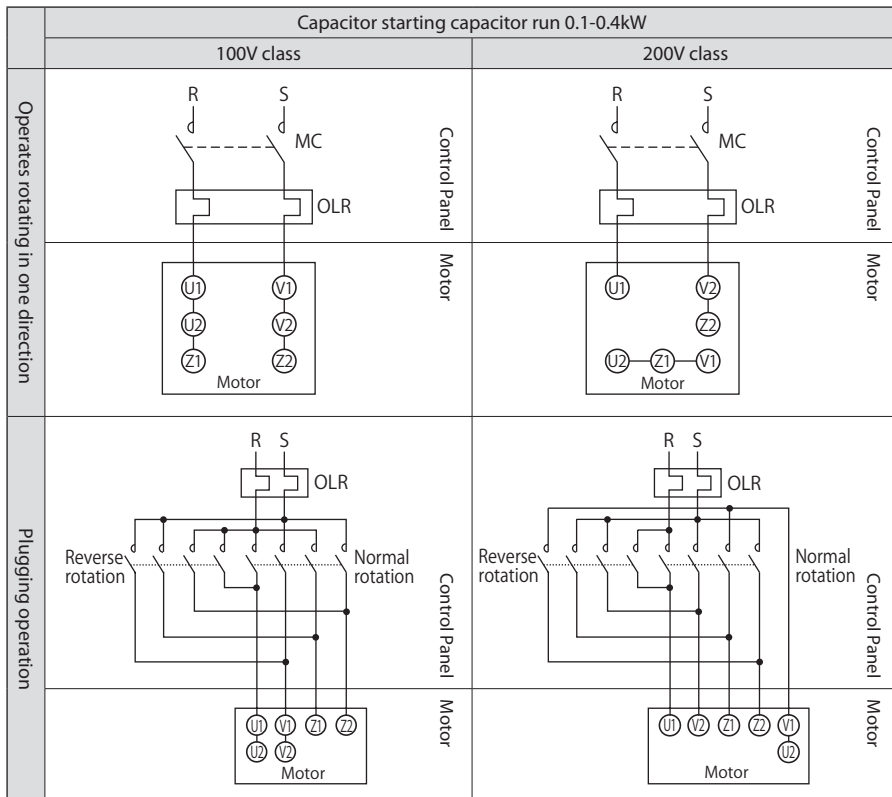




## 6. Wiring

### ■ Without brake. Single phase power source

Single phase motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

Electromagnetic contactor for normal and reverse rotation

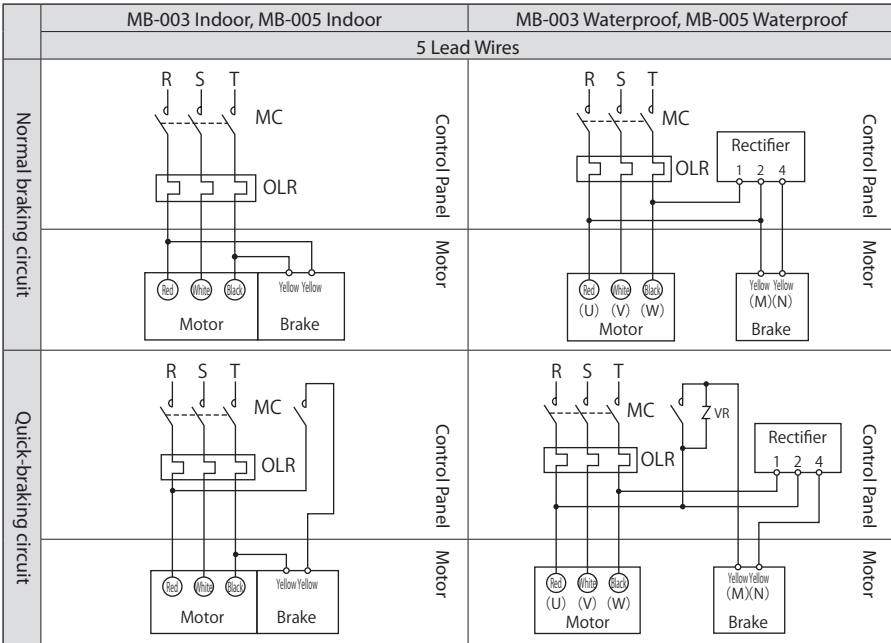
Customer to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult us for motors with overseas specifications.
- Single phase motors 0.1 to 0.2kW are available in two types: four lead wires (capacitor starting type/suffix type CD) and six lead wires (capacitor starting capacitor run type/suffix type CB). Check P4 and the nameplate for the suffix type.
- Reverse Z1 and Z2 after the motor stopped to rotate the motor reversely in one-direction rotation.
- The capacitor is built-in the terminal box.



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

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 P37 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 for quick braking circuits, see Table 6-4 on P33.
- For quick braking-circuits, gang the brake circuit's electromagnetic contactor to the motor's electromagnetic contactor.

- A rectifier for MB-003 indoor type and MB-005 indoor type are built-in the brake unit.
- A rectifier for MB-003 waterproof type and MB-005 waterproof type are placed separately. (Rectifier is not waterproof.)
- A flag ( ) is attached at the lead wire for the MB-003 waterproof type and MB-005 waterproof type 400V class.
- For a waterproof motor, do not open the cap of a waterproof/dust-proof box (see P17); otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.



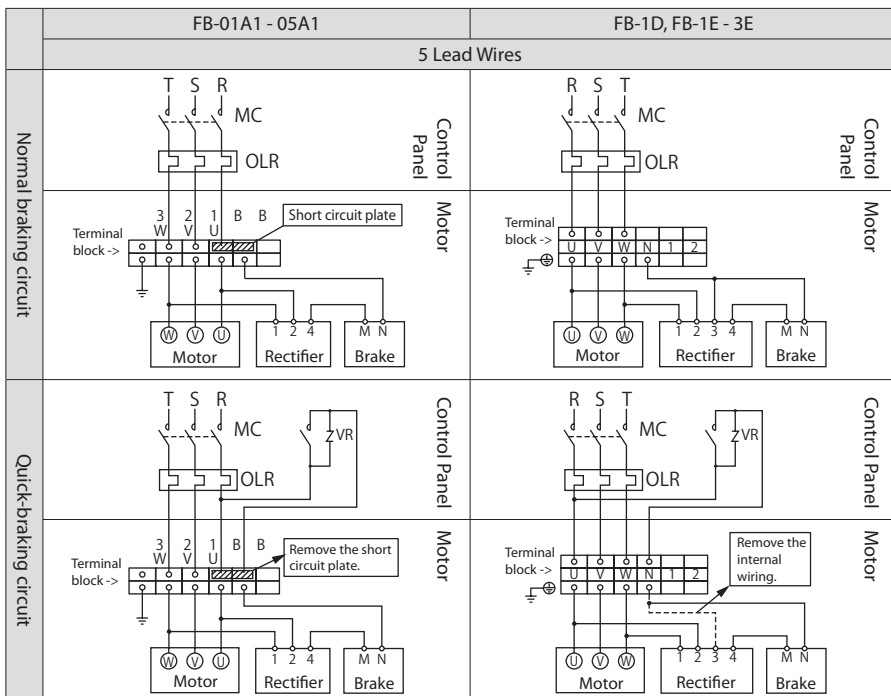
# 6. Wiring

■ **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.)

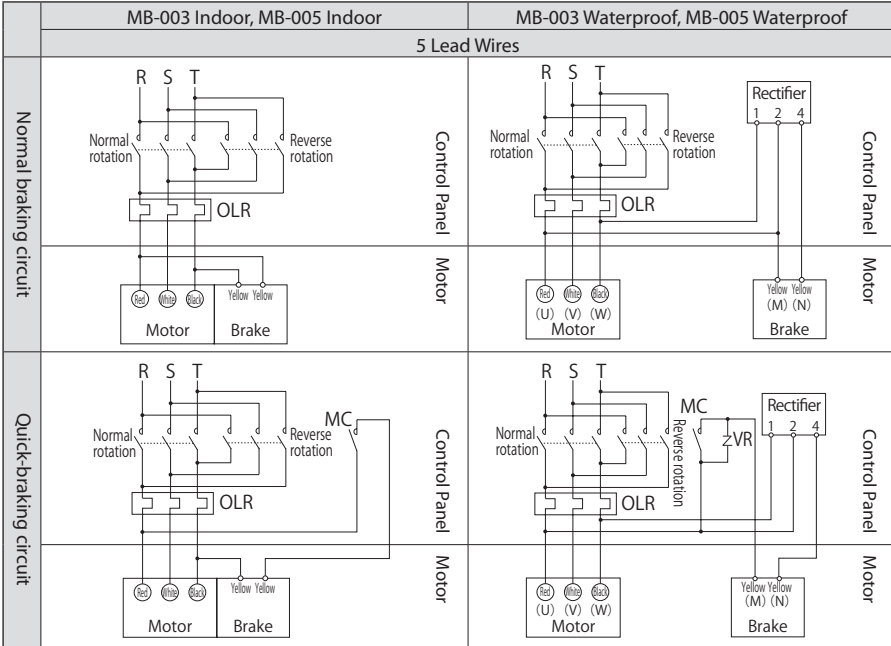
} Customer to prepare.

- 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.
- The terminal block is arrayed in two rows as shown in the above figure. Make sure that wiring of the motor power source is connected to the upper side on the above figure (on which symbols 1, 2, 3, U, V, W, and B are written; cable port side).
- Brake action delay time is different between normal and quick-braking circuits. Table 7-2 on P37 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 P33.
- For quick braking-circuits, gang the brake circuit's electromagnetic contactor to the motor's electromagnetic contactor.
- For quick braking circuits of FB-01A1 - 05A1, remove the short circuit plate between the terminal block 1/U and B.
- For quick braking circuits of FB-1D and FB-1E - 3E, remove the internal wiring between terminal block N and rectifier 3.



## ■ With brake. 3-phase power source. Plugging operation

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 P37 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 for quick braking circuits, see Table 6-4 on P33.
- 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.

- A rectifier for MB-003 indoor type and MB-005 indoor type are built-in the brake unit.
- A rectifier for MB-003 waterproof type and MB-005 waterproof type are placed separately. (Rectifier is not waterproof.)
- A flag ( ) is attached at the lead wire for the MB-003 waterproof type and MB-005 waterproof type 400V class.
- For a waterproof motor, do not open the cap of a waterproof/dust-proof box (see P17); otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.



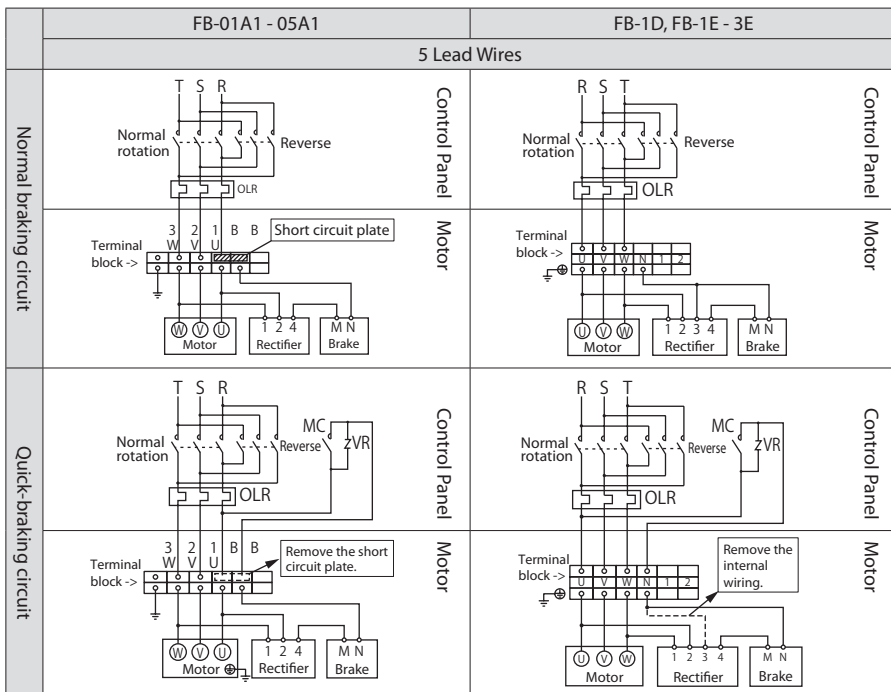
## 6. Wiring

### ■ With brake. 3-phase power source. Plugging 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.)

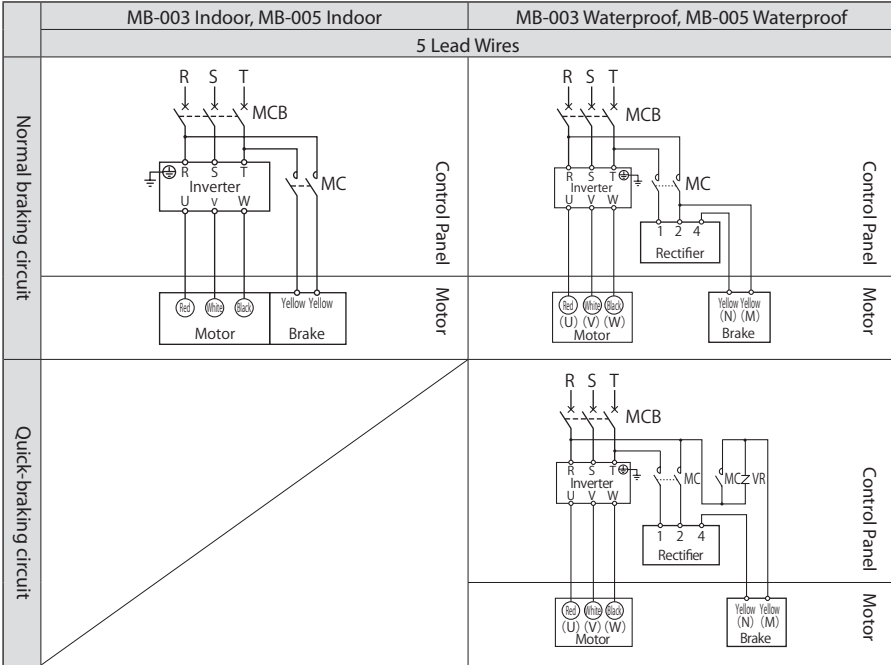
— Customer to prepare.

- 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.
- The terminal block is arrayed in two rows as shown in the above figure. Make sure that wiring of the motor power source is connected to the upper side on the above figure (on which symbols 1, 2, 3, U, V, W, and B are written; cable port side).
- Brake action delay time is different between normal and quick-braking circuits. Table 7-2 on P37 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 P33.
- 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.
- For quick braking circuits of FB-01A1 - 05A1, remove the short circuit plate between the terminal block 1/U and B.
- For quick braking circuits of FB-1D and FB-1E - 3E, remove the internal wiring between terminal block N and rectifier 3.



## ■ With Brake. Inverter Drive

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.
- Brake action delay time is different between normal and quick-braking circuits.  
Table 7-2 on P37 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 P33.

- 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.

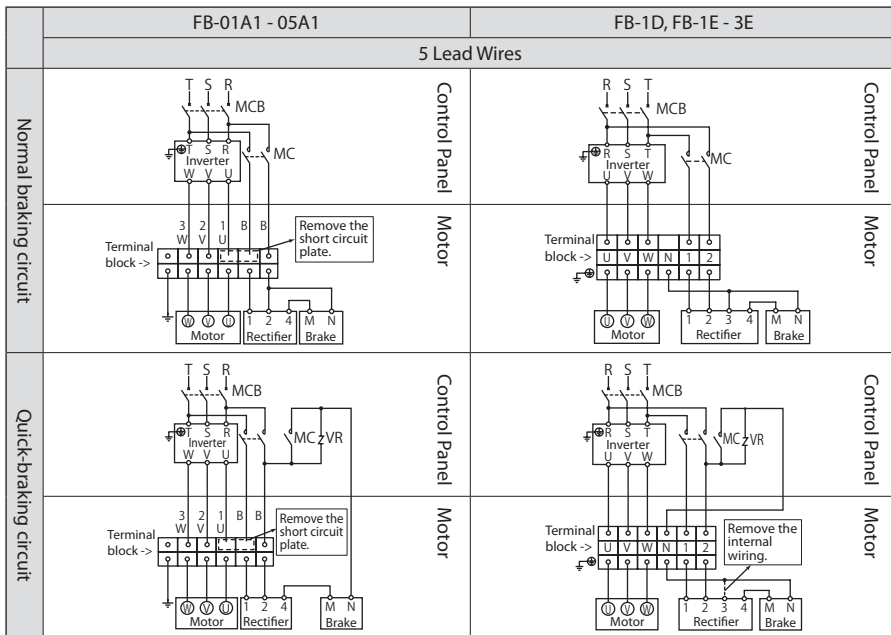
- A rectifier for MB-003 indoor type and MB-005 indoor type are built-in the brake unit.
- A rectifier for MB-003 waterproof type and MB-005 waterproof type are placed separately. (Rectifier is not waterproof.)
- A flag ( ) is attached at the lead wire for the MB-003 waterproof type and MB-005 waterproof type 400V class.
- For a waterproof motor, do not open the cap of a waterproof/dust-proof box (see P17); otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.



# 6. Wiring

## ■ With Brake. Inverter Drive

3-phase motor  
 Premium-Efficiency, 3-Phase Motor  
 3-phase 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.

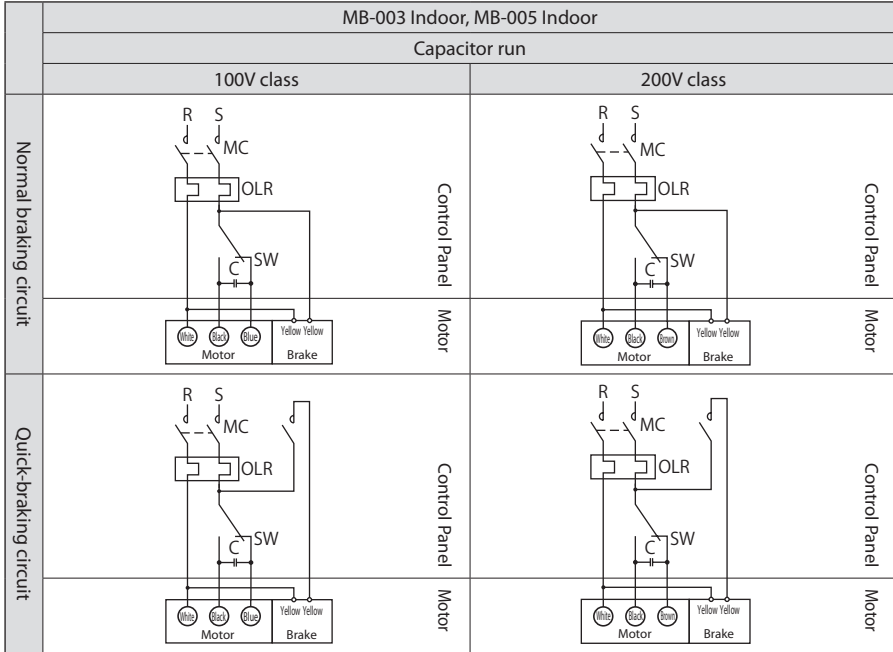
- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- For brake types, see Table 1-1 on P6.
- The motor must be insulated to inverter-drive a 400V class 3-phase motor/high-efficiency, 3-phase motor.
- The terminal block is arrayed in two rows as shown in the above figure. Make sure that wiring of the motor power source is connected to the upper side on the above figure (on which symbols 1, 2, 3, U, V, W, and B are written; cable port side).
- Brake action delay time is different between normal and quick-braking circuits. Table 7-2 on P37 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 P33.
- For inverter drive of a 3-phase motor, premium-efficiency, 3-phase motor, high-efficiency, 3-phase motor, remove the short circuit plate between terminal block 1/U and B.  
 (A 3-phase motor for inverter and premium-efficiency 3-phase motor for inverter do not have a short circuit plate.)
- For quick braking circuits of FB-1D and FB-1E - 3E, remove the internal wiring between terminal block N and rectifier 3.

- 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. Single phase power source

Single phase motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

SW: Plugging switch

C: Capacitor (accessory)

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.
- Use a capacitor bundled with the product (see Table 6-5 on P34) for wiring.
- Brake action delay time is different between normal and quick-braking circuits.  
Table 7-2 on P37 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 for quick braking circuits, see Table 6-4 on P33.
- For quick braking-circuits, gang the brake circuit's electromagnetic contactor to the motor's electromagnetic contactor.

- Switch the above SW for plugging rotation. (Immediate plugging rotation is not allowed.)
- A rectifier is built-in the brake unit.

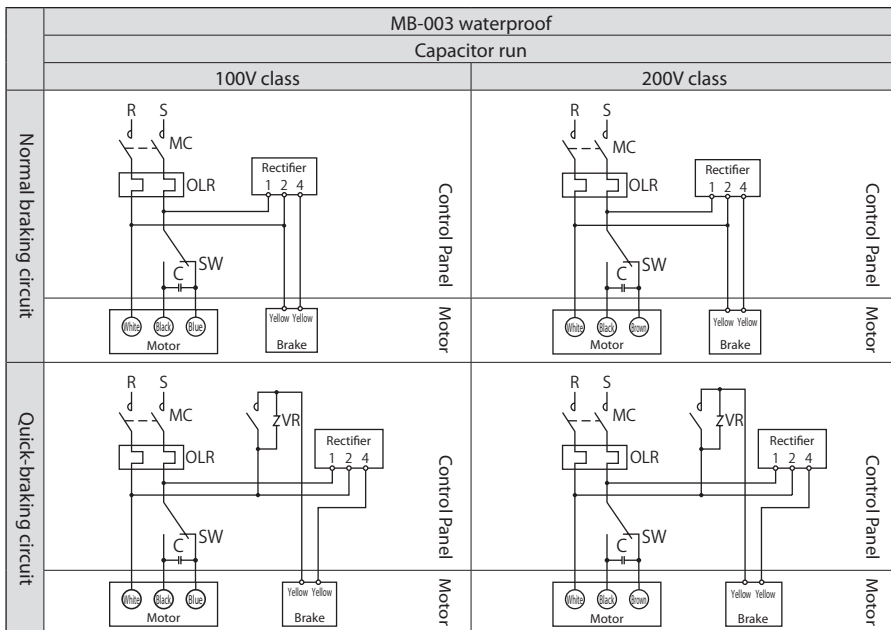




# 6. Wiring

## ■ With brake. Single phase power source

Single phase motor



MC: Electromagnetic contactor

OLR: Overload protection device or electronic thermal relay

SW: Plugging switch

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

C: Capacitor (accessory)

} 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.
- Use a capacitor bundled with the product (see Table 6-5 on P34) for wiring.
- Brake action delay time is different between normal and quick-braking circuits. Table 7-2 on P37 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 P33.
- For quick-braking circuits, gang the brake circuit's electromagnetic contactor to the motor's electromagnetic contactor.

- Switch the above SW for plugging rotation. (Immediate plugging rotation is not allowed.)
- Rectifier and capacitor are placed separately. (Rectifier and capacitor are not waterproof.)
- Do not open the cap of a waterproof/dust-proof box (see P17). Otherwise, waterproof/dust-proof effects will be lost and electric shock, damage, and fire may result.

## 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. 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)

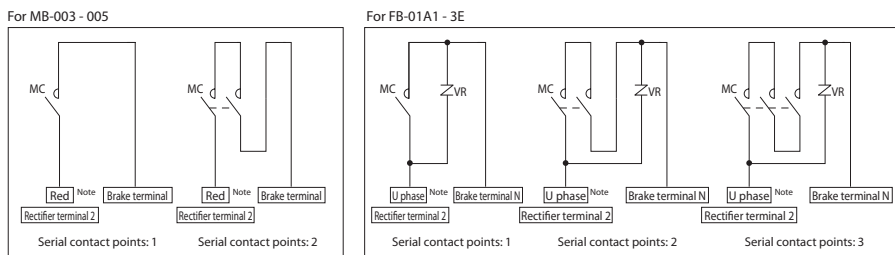
Table 6-4. Type for parts recommended when using a quick braking circuit (when using an alternating current electromagnetic contactor).

| AC Voltage   | Brake type                      | Recommended Contactor Type                                      |                                                 | Recommended Contactor                |                                 | Recommended Varistor (For Protecting Contactor Contact Points) |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|--------------|---------------------------------|-----------------------------------------------------------------|-------------------------------------------------|--------------------------------------|---------------------------------|----------------------------------------------------------------|---------------------------------|--------------------|--------|-----------------|-------|---------------------------------|---------------------------------|--------------------|--------------------|------|
|              |                                 | Manufactured by Fuji Electric FA Components & Systems Co., Ltd. | Manufactured by Mitsubishi Electric Corporation | Contact Point Capacity (DC-13 class) | Varistor type                   | Maximum Allowable Circuit Voltage Circuit Voltage              | Varistor Voltage                | Power Rating Power |        |                 |       |                                 |                                 |                    |                    |      |
| 200V<br>220V | MB-003                          | SC-05                                                           | Serial contact points: 1 (0.7A)                 | S-N11<br>or S-N12                    | Serial contact points: 1 (1.2A) | DC110V                                                         | Minimum 0.4A                    | TND07V-471KB00AAA0 | AC300V | 470V (423-517V) | 0.25W |                                 |                                 |                    |                    |      |
|              | MB-005                          |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-01A1                         |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-02A1                         |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-05A1                         |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-1D                           |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-1E                           |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
| FB-2E        | Serial contact points: 2 (3.0A) | Serial contact points: 2 (3.0A)                                 | Minimum 0.5A                                    | TND10V-471KB00AAA0                   | 0.4W                            |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
| FB-3E        | Serial contact points: 2 (3.0A) | Serial contact points: 2 (3.0A)                                 | Minimum 0.7A                                    | TND14V-471KB00AAA0                   | 0.6W                            |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
| 400V<br>440V | MB-003                          | SC-05                                                           | Serial contact points: 1 (0.25A)                | S-N11<br>or S-N12                    | Serial contact points: 2 (0.5A) | DC220V                                                         | Minimum 0.2A                    | -                  | -      | -               | -     |                                 |                                 |                    |                    |      |
|              | MB-005                          |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-01A1                         |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-02A1                         |                                                                 |                                                 |                                      |                                 |                                                                | Serial contact points: 2 (0.4A) |                    |        |                 |       | Serial contact points: 2 (0.5A) | Minimum 0.3A                    | TND10V-821KB00AAA0 | 0.4W               |      |
|              | FB-05A1                         |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
|              | FB-1D                           |                                                                 |                                                 |                                      |                                 |                                                                | Serial contact points: 3 (2.0A) |                    |        |                 |       |                                 | Serial contact points: 3 (2.0A) | Minimum 0.5A       | TND14V-821KB00AAA0 | 0.6W |
|              | FB-1E                           |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
| FB-2E        |                                 |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
| FB-3E        |                                 |                                                                 |                                                 |                                      |                                 |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |
| FB-3E        | Serial contact points: 3 (2.0A) | Serial contact points: 3 (2.0A)                                 | Minimum 1.0A                                    | TND20V-821KB00AAA0                   | 1.0W                            |                                                                |                                 |                    |        |                 |       |                                 |                                 |                    |                    |      |

# Common 6. Wiring

- 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.
- A varistor for a single phase 100V is the same as the one for a single phase 200V.

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



Note: 1. For inverter drives, connect to the R phase (power source side).

2. A motor with the indoor type MB brake does not have a rectifier's terminal 2 and a varistor (VR).

## 6-7 Capacitor Specification of Single Phase Power Source Motor

Table 6-5 Capacitor Run 40 - 90W (Accessory)

| Motor       |              | Capacitor for Operation |                         |
|-------------|--------------|-------------------------|-------------------------|
| Voltage (V) | Capacity (W) | Capacity range (μF)     | Pressure Resistance (V) |
| 100         | 40           | 14                      | 220                     |
|             | 60           | 18                      |                         |
|             | 90           | 25                      |                         |
| 200         | 40           | 3.5                     | 440                     |
|             | 60           | 4.5                     |                         |
|             | 90           | 6.5                     |                         |

Table 6-6 Capacitor Starting 0.1 - 0.2kW (Motor Frame Fixed)

| Motor       |               | Capacitor for Starting |                         |
|-------------|---------------|------------------------|-------------------------|
| Voltage (V) | Capacity (kW) | Capacity range (μF)    | Pressure Resistance (V) |
| 100         | 0.1           | 100                    | 125                     |
|             | 0.2           | 200                    |                         |

Table 6-7 Capacitor Starting Capacitor Run 0.1 - 0.4kW (Built in Terminal Box)

| Motor       |               | Capacitor for Starting |                         | Capacitor for Operation |                         |
|-------------|---------------|------------------------|-------------------------|-------------------------|-------------------------|
| Voltage (V) | Capacity (kW) | Capacity range (μF)    | Pressure Resistance (V) | Capacity range (μF)     | Pressure Resistance (V) |
| 100/200     | 0.1           | 60                     | 125                     | 10                      | 230                     |
|             | 0.2           | 100                    |                         | 20                      |                         |
|             | 0.4           | 200                    |                         | 40                      |                         |

### DANGER

- Do not approach or touch rotating parts (output 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, otherwise, electric shock 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.
- Do not use a single phase power source motor for applications in the maximum torque or more is loaded on the motor; otherwise, reverse overdrive may result.
- To reverse a single phase power source motor other than a reversible motor, be sure to stop the motor then reverse it; otherwise, overdrive may result with the rotation direction unchanged.

### CAUTION

- Do not put fingers or foreign objects into the opening of the gearmotor; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The gearmotor becomes very hot during operation. Be careful not to touch with hands or body. Otherwise, burns may result.
- 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.
- Do not touch the current-carrying part of a capacitor for starting a single phase motor until it is fully discharged; otherwise, electric shock may result.

# Common 7. Operation

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

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

## 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 (s)                        |                                                                        |                       |
|------------|---------------------|-----------------------------------|----------------------------|------------------------------------------------|--------------------------------|--------------------|----------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------|-----------------------|
|            | 3-phase Motor       | Premium-efficiency, 3-phase motor | 3-phase motor for Inverter | Premium-efficiency, 3-phase motor for Inverter | High-efficiency, 3-phase motor | Single phase Motor | Brake Torque (Dynamic friction torque) (N·m) | Normal braking circuit (Simultaneous turn-off circuit) | Premium-efficiency, Normal braking circuit (Separate turn-off circuit) | Quick-braking circuit |
| MB-003     | 40W                 | -                                 | -                          | -                                              | -                              | 40W                | 0.3                                          | 0.07 - 0.12                                            | 0.03 - 0.06                                                            | 0.03 - 0.06           |
| MB-005     | 60W<br>90W          | -                                 | -                          | -                                              | -                              | 60W<br>90W         | 0.5                                          |                                                        |                                                                        |                       |
| FB-01A1    | 0.1                 | -                                 | -                          | -                                              | -                              | -                  | 1.0                                          | 0.15-0.2                                               | 0.08 - 0.12                                                            | 0.015 - 0.02          |
| FB-02A1    | 0.2                 | -                                 | 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-2E      | -                   | 1.5                               | -                          | 1.5                                            | -                              | -                  | 15                                           |                                                        | 0.15 - 0.25                                                            |                       |
| FB-3E      | -                   | 2.2                               | -                          | 2.2                                            | -                              | -                  | 22                                           | 0.75 - 0.95                                            | 0.4-0.5                                                                | 0.02 - 0.04           |

Note: 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.

# Common 8. Daily Inspection and Maintenance

## 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.
- For **explosion proof motor**, customers must not disassemble or modify; otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- For **explosion proof motor**, the lead-in condition 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; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The gearmotor becomes very hot during operation. Do not touch the product with bare hands. Otherwise, burns may result.
- 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; 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 lubricant as general industrial waste.
- For **explosion proof motor**, when measuring the insulation resistance, confirm that there is no gas or explosive vapor in the vicinity 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.

# 8. Daily Inspection and Maintenance **Common**

## 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?<br>( Temperature rises during operation will differ according to model and type.<br>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?                                                                                                                                                                                                                                                                                                                               |

- For a motor with the capacity of 90W or less, the current value of the motor may stay high temporarily due to increased viscosity of grease for the gear unit and motor bearing grease during cold winter. There are no concerns of burnout of a motor even if the current may exceed the rated current value for 5 to 15 minutes in a no load operation.  
 Considerations may be needed for the current value setting of an overload protection device, including an electronic thermal relay and selection of an inverter capacity range. Contact us for details.
- If any problems are found in a daily inspection, follow "9. Troubleshooting" (on P48 and 49) 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 is used for gear, it can run for a long time without replenishment, maintenance with disassembly after approximately 20,000 hours or 3 to 5 years will further increase lifetime. Contact the nearest authorized service station regarding maintenance with disassembly.
- Oil seals have a lifetime. During long use natural degradation and frictional wear will reduce effectiveness. 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) may come loose. Periodically check for looseness as this is a source of miss-alignment, oil leakages, and load unbalance.





# 8. Daily Inspection and Maintenance

## 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 become 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 brakes a shock absorber is inserted between the stationary core and the armature plate to reduce the noise that results from the braking action.

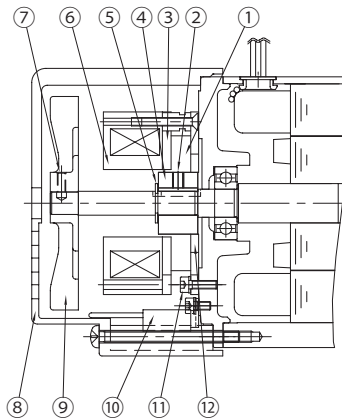
When inspecting be careful that the gap gauge, other measuring tool or anything else does not damage the shock absorber or cause it to fall out.

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 8-2 Pages Containing Information on Brake Construction and Gap Inspection and Adjustment

| Brake type          | Indoor | Outdoor/waterproof |
|---------------------|--------|--------------------|
| MB-003, 005         | P35    | P41                |
| FB-01A1, 02A1, 05A1 | P36    | P42                |
| FB-1D               | P37    | P43                |
| FB-1E               | P38    | P44                |
| FB-2E               | P39    | P45                |
| FB-3E               | P40    | P46                |

## ■ MB-003, 005 (Indoor type)



| Code | Part Name                                            |
|------|------------------------------------------------------|
| 1    | Brake Lining                                         |
| 2    | Boss set screw                                       |
| 3    | Armature plate                                       |
| 4    | Boss                                                 |
| 5    | Shaft-retaining E-ring                               |
| 6    | Stationary core                                      |
| 7    | Fan set screw                                        |
| 8    | Cover                                                |
| 9    | Fan<br>(mounted for single phase<br>60 and 90W only) |
| 10   | Rectifier                                            |
| 11   | Brake mounting bolt                                  |
| 12   | Fixed plate                                          |

Figure 8-1

### - Gap Inspection

- (1) Remove cover [8].
- (2) Insert a gap gauge between the stationary core [6] and the armature plate [3], and measure the gap. Measure in 3 locations around the circumference.
- (3) The brake lining must be replaced if the gap value is close to the limit.  
(Gap adjustment is not allowed.)

| Gap Value G (mm)                   |             |
|------------------------------------|-------------|
| Required value<br>(original value) | Limit value |
| 0.05 - 0.25                        | 0.35        |



## 8. Daily Inspection and Maintenance

### ■ FB-01A1, 02A1, 05A1 (Indoor Type)

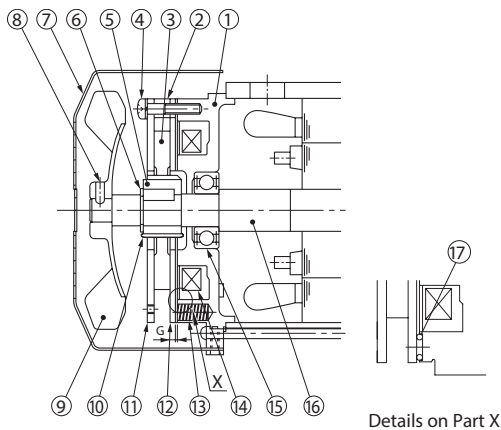


Figure 8-2

| 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            |
| 17   | Shock absorber         |

Note: FB-01A1 of a 3-phase motor 0.1kW does not have [8] and [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 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.

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

## ■ FB-1D (Indoor Type)

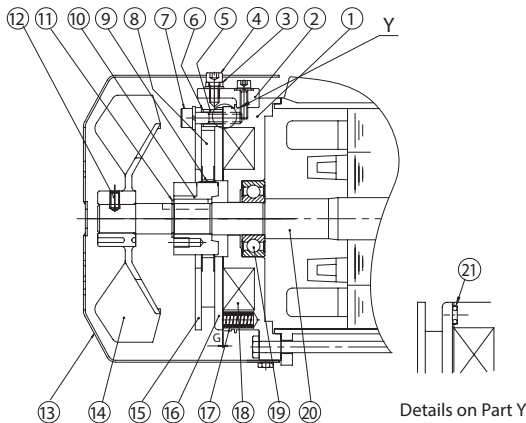


Figure 8-3

| 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                      |
| 21   | Shock absorber                   |

### - 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] only, make sure not to fall the gap adjustment shims [6] or the shock absorber [21].
- 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)

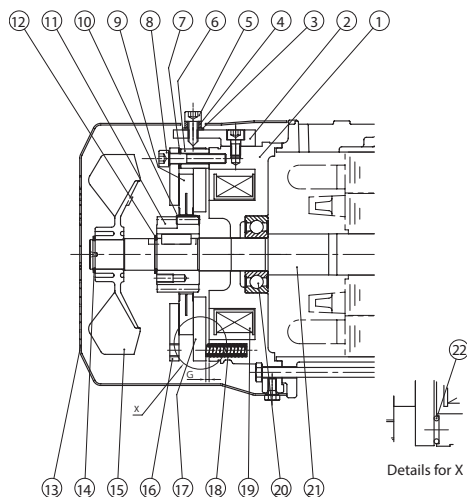


Figure 8-4

| 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

- Remove the brake release bolt [5] and the manual release prevention spacer [4].
- Remove the cover [13].
- 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.
- 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

- Remove the brake release bolt [5] and the manual release prevention spacer [4].
- Remove the cover [13].
- Remove the shaft-retaining C-ring [14], and remove the fan [15].
- 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].
- 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.
- 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 [15], shaft-retaining C-ring [14] and cover [13].
- Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].

## ■ FB-2E (Indoor Type)

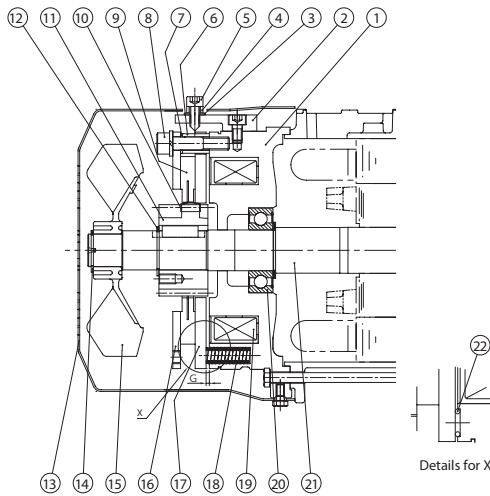


Figure 8-5

| 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

- Remove the brake release bolt [5] and the manual release prevention spacer [4].
- Remove the cover [13].
- 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.
- 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

- Remove the brake release bolt [5] and the manual release prevention spacer [4].
- Remove the cover [13].
- Remove the shaft-retaining C-ring [14], and remove the fan [15].
- 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].
- 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.
- 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 [15], shaft-retaining C-ring [14] and cover [13].
- Finally, attach the brake release bolt [5] and the manual release prevention spacer [4].

## ■ FB-3E (Indoor Type)

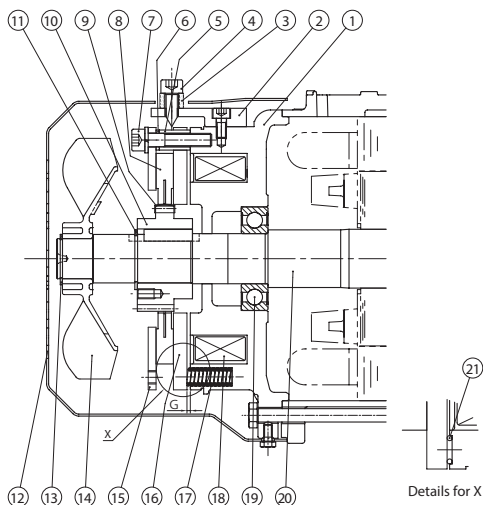


Figure 8-6

| 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].

## ■ MB-003, 005 (Waterproof)

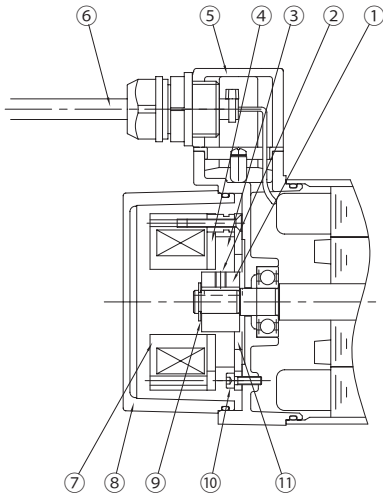


Figure 8-7

| Code | Part Name                 |
|------|---------------------------|
| 1    | Boss                      |
| 2    | Boss set screw            |
| 3    | Brake Lining              |
| 4    | Armature plate            |
| 5    | waterproof/dust-proof box |
| 6    | cab tire cable            |
| 7    | Stationary core           |
| 8    | Cover                     |
| 9    | Shaft-retaining E-ring    |
| 10   | Brake mounting bolt       |
| 11   | Fixed plate               |

### - Gap Inspection

- (1) Remove the cover [8].
- (2) Insert a gap gauge [8]. Insert a gap gauge between the stationary core [7] and the armature plate [4], and measure the gap. Measure in 3 locations around the circumference.
- (3) The brake lining must be replaced if the gap value is close to the limit. (Gap adjustment is not allowed.)

| Gap Value G (mm)                |             |
|---------------------------------|-------------|
| Required value (original value) | Limit value |
| 0.05 - 0.25                     | 0.35        |





## 8. Daily Inspection and Maintenance

### ■ FB-01A1, 02A1, 05A1 (Outdoor type)

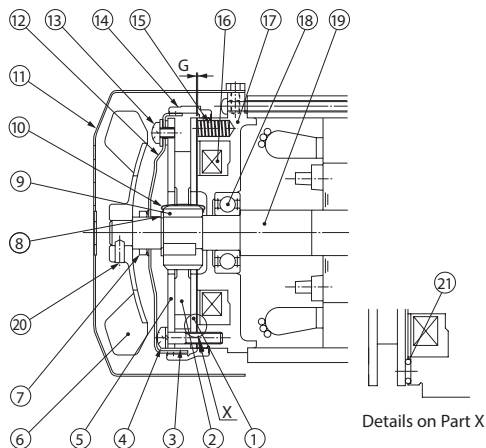


Figure 8-8

| 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                     |
| 21   | Shock absorber                    |

#### - 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.

Note: FB-01A1 of a 3-phase motor 0.1kW does not have [6], [7] and [20].

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

#### - 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)

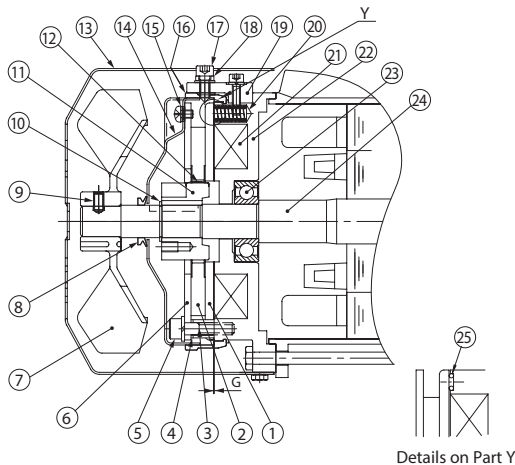


Figure 8-9

| 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                       |
| 25   | Shock absorber                    |

### - 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 locations)
- (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 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 locations)
- (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 only, make sure not to fall the gap adjustment shims [4] and the shock absorber [25].
- (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].

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



## ■ FB-1E (Outdoor Type)

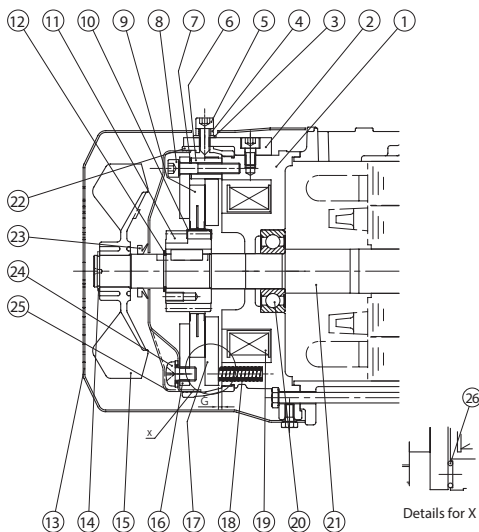


Figure 8-10

| 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 0.2 - 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<br>(original value) | Limit value |
| 0.25 - 0.35                        | 0.6         |



# 8. Daily Inspection and Maintenance



## ■ FB-2E (Outdoor Type)

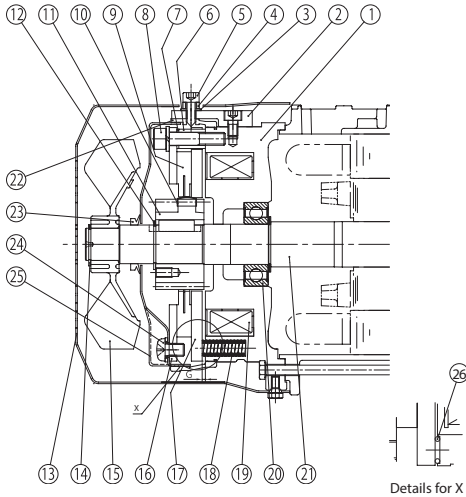


Figure 8-11

| 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 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) 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 (Outdoor Type)

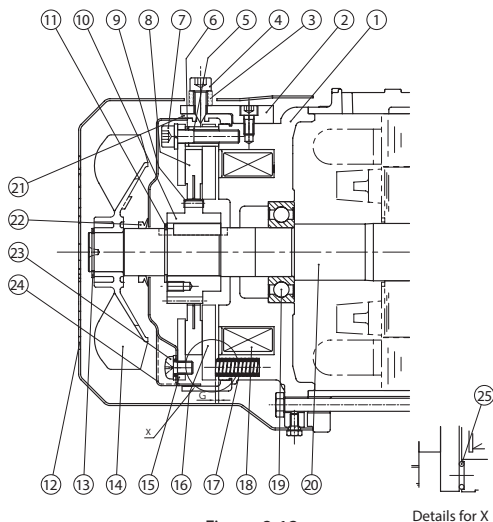


Figure 8-12

Details for X

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

### - 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 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 of 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].





## 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-1D, 1E - 3E

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

### (2) MB-003, 005

When the gap reaches the limit (see P41, P47)

### (3) FB-01A1 - 05A1

When the brake gap still reaches the limit after the gap adjustment (see P42, P48)

Table 8-3 Brake Lining Dimensions

| Brake type          | Brake Lining Dimension drawing | Original thickness | Usable Thickness Limit |
|---------------------|--------------------------------|--------------------|------------------------|
|                     |                                | $t_0$ (mm)         | $t_0$ (mm)             |
| MB-003, 005         |                                | 7.0                | -                      |
| FB-01A1, 02A1, 05A1 |                                |                    | 6.0                    |
| FB-1D               |                                |                    | 7.8                    |
| FB-1E               |                                |                    | 8.0                    |
| FB-2E               |                                |                    | 8.4                    |
| FB-3E               |                                |                    |                        |
| FB-5E               |                                | 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, replace the boss and leaf springs 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. Daily Inspection and Maintenance

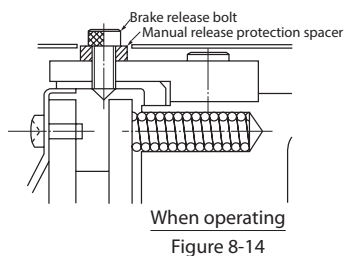
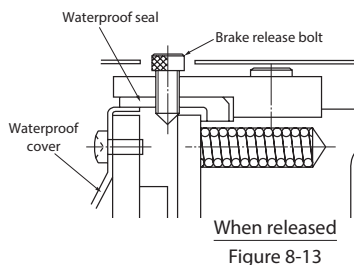
## 8-7 Manually Releasing the Brake

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

### ■ FB-1D, 1E - 3E (FB-01A1 - 05A1 are options)

- (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, 2E               | M6        |
| FB-3E                   | M8        |



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

### ■ One-Touch Release Lever Method (Optional)

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.

Note: The brake is released while the lever is tilted by a hand, and it works when the lever is released the hold.

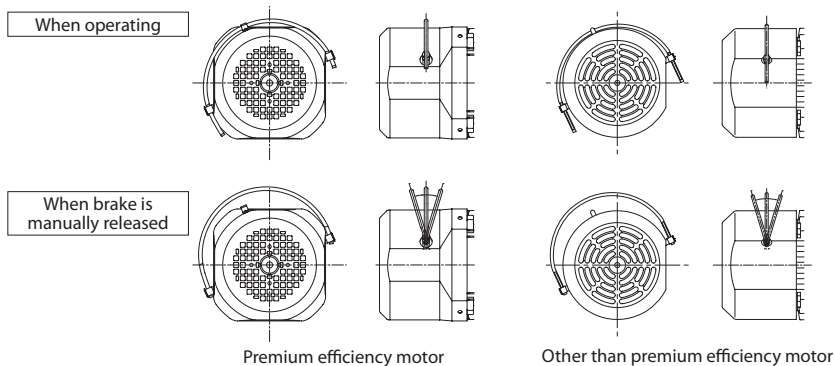


Figure 8-15

# 9. Troubleshooting **Common**

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                                                                           | Confirm with authorized service station.                                                                                          |                                                                           |
|                                                                            |                                                           | Bearing damage                                                                                         | Confirm with authorized service station.                                                                                          |                                                                           |
|                                                                            |                                                           | Defective governor switch (0.1 - 0.4kW single phase motor)                                             | Confirm with authorized service station.                                                                                          |                                                                           |
|                                                                            |                                                           | Damaged capacitor (single phase motor)                                                                 | Confirm 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 P42 - 52)                       |                                                                                                        |                                                                                                                                   |                                                                           |
| The motor rotates without a load but the slow speed shaft does not rotate. |                                                           | Damage to gear unit due to overloading of gears, etc.                                                  | Confirm with authorized service station.                                                                                          |                                                                           |
| The slow speed shaft turns with no load                                    | When a load is applied                                    | The switch overheats                                                                                   | Insufficient switch capacity<br>Overload                                                                                          | Replace with specified fuse.<br>Decrease the load to the specified value. |
|                                                                            |                                                           | Fuse tripping                                                                                          | Insufficient fuse capacity<br>Overload                                                                                            | Replace with specified fuse.<br>Decrease the load to the specified value. |
|                                                                            | The speed will not increase and the motor is overheating. |                                                                                                        | Defective governor switch (0.1 - 0.4kW single phase motor)                                                                        | Confirm with authorized service station.                                  |
|                                                                            |                                                           | Voltage drop                                                                                           | Contact the electric power company.                                                                                               |                                                                           |
|                                                                            |                                                           | Overload<br>Lowered capacitor capacity range (single phase motor)<br>Short-circuited motor stator coil | Decrease the load to the specified value.<br>Confirm with authorized service station.<br>Confirm with authorized service station. |                                                                           |
|                                                                            | It stops.                                                 | The key is not inserted                                                                                | Insert key.                                                                                                                       |                                                                           |
|                                                                            |                                                           | Bearing burnout                                                                                        | Confirm 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.                                                                      | Confirm 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.                                       |
|                                                                            |                                                           |                                                                                                        | Defective governor switch (0.1 - 0.4kW single phase motor)                                                                        | Confirm with authorized service station.                                  |
|                                                                            |                                                           |                                                                                                        | Lowered capacity range of a capacitor for operation (40 - 90W, 0.4kW single phase motor)                                          | Confirm with authorized service station.                                  |
| The ambient temperature is high                                            |                                                           |                                                                                                        | Improve the ventilation method.                                                                                                   |                                                                           |
| Damaged bearing                                                            |                                                           |                                                                                                        | Confirm with authorized service station.                                                                                          |                                                                           |
| Abnormal wear of Gear Unit parts due to overload, etc.                     |                                                           |                                                                                                        | Confirm with authorized service station.                                                                                          |                                                                           |



# Common 9. Troubleshooting

Table 9-2 Troubleshooting

| Problem                               |                                                                                           | Cause                                                             | Correction                                                                                    |
|---------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Grease leaks                          | Blot or a small amount of drip of trace of oil at the seal section of input/output shaft. | Grease applied to the oil seal seeps out at first.                | Wipe off around the oil seal, and observe.                                                    |
|                                       | Leakage of grease from input/output shaft section                                         | Damaged oil seal or maybe damaged shaft (or collar)               | Confirm with authorized service station.                                                      |
|                                       | Leakage of grease from the contact surfaces of casing, etc.                               | Loose fastener bolts                                              | Tighten fastener bolts correctly.                                                             |
|                                       | Leakage of grease into motor                                                              | Oil seal damage                                                   | Confirm with authorized service station.                                                      |
| Abnormal sound<br>Excessive vibration |                                                                                           | Dust and foreign matter in bearings, or damaged bearings          | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Gear Unit parts grinding on foreign matter                        | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Gear Unit parts are damaged                                       | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Warping of casing due to uneven installation surface              | 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 the center of axle with driven machine            | Align the center of axle.                                                                     |
|                                       |                                                                                           | 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                                      | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Bearing damage                                                    | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Improper brake gap adjustment                                     | Adjust the brake gap.<br>(See P42 - 52)                                                       |
|                                       |                                                                                           | Brake lining wear                                                 | Request brake lining replacement from an authorized service station.                          |
|                                       |                                                                                           | Brake unit electromagnetic coil burnout                           | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Rectifier damage                                                  | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | A leaf spring in the brake boss unit has come off or is damaged   | Confirm with authorized service station.                                                      |
|                                       |                                                                                           | Defective governor switch (0.1 - 0.4kW single phase motor)        | Confirm 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<br>(Braking takes a long time)                                                      | Not using the quick braking circuit                               | Change to quick braking circuit.<br>(See P25 - 32)                                            |
|                                       |                                                                                           | Foreign objects in brake lining unit, oil adhesion                | Request cleaning from authorized service station.                                             |
|                                       |                                                                                           | Brake lining wear                                                 | Adjust the brake gap.<br>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<br>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.<br>Inspect wiring.                                            |
|                                       | Regenerative overvoltage shut-off                                                         | Sudden speed reduction                                            | Increase the time for speed reduction.<br>Decrease brake frequency.                           |
| Thermal operation                     | Overload                                                                                  | Decrease the load to the specified value.                         |                                                                                               |



## 10-1 Construction Drawings

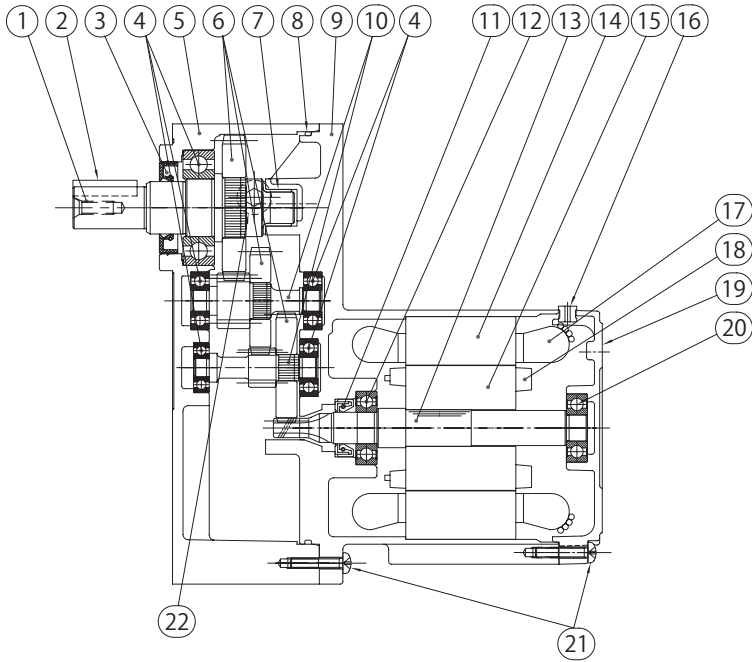


Figure 10-1 ZNFM Type 40 - 90W

Table10-1 Gearmotor, Principal Parts

| Code | Part Name    | Code | Part Name       | Code | Part Name       | Code | Part Name            |
|------|--------------|------|-----------------|------|-----------------|------|----------------------|
| 1    | Output shaft | 7    | Sliding bearing | 13   | Motor shaft     | 19   | Anti-load side cover |
| 2    | Key          | 8    | O-ring          | 14   | Stationary core | 20   | Bearing              |
| 3    | Oil seal     | 9    | Motor frame     | 15   | Rotor core      | 21   | Bolt                 |
| 4    | Bearing      | 10   | Pinion gear     | 16   | Bushing         | 22   | Plug                 |
| 5    | Casing       | 11   | Oil seal        | 17   | Stationary coil |      |                      |
| 6    | Gear         | 12   | Bearing         | 18   | Rotor conductor |      |                      |

Note: The construction drawing is not a scale drawing.



# 10. Construction Drawings

## 10-2 Construction Drawings

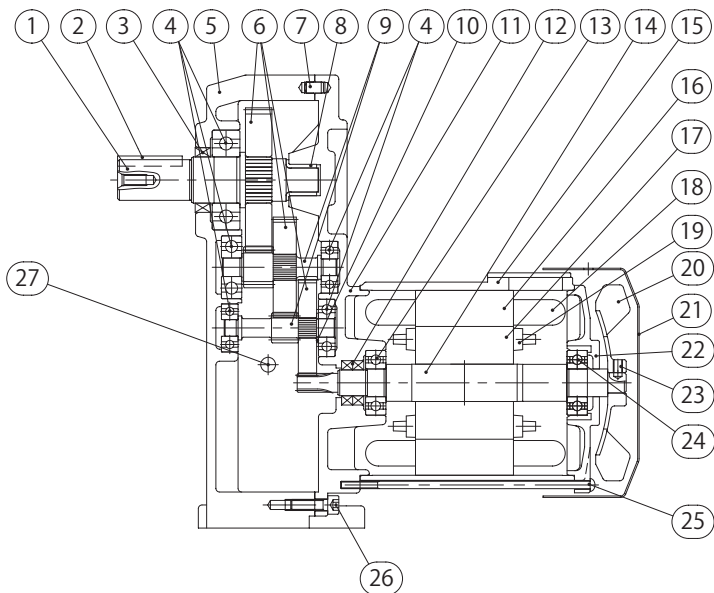


Figure 10-2 ZNHM Type 0.1 - 2.2kW

Table10-2 Gearmotor, Principal Parts

| Code | Part Name    | Code | Part Name            | Code | Part Name       | Code | Part Name            |
|------|--------------|------|----------------------|------|-----------------|------|----------------------|
| 1    | Output shaft | 8    | Sliding bearing      | 15   | Motor frame     | 22   | Anti-load side cover |
| 2    | Key          | 9    | Pinion gear          | 16   | Stationary core | 23   | Snap ring            |
| 3    | Oil seal     | 10   | Spacer               | 17   | Rotor core      | 24   | Bearing              |
| 4    | Bearing      | 11   | Motor flange bracket | 18   | Stationary coil | 25   | Bolt                 |
| 5    | Casing       | 12   | Oil seal             | 19   | Rotor conductor | 26   | Bolt                 |
| 6    | Gear         | 13   | Bearing              | 20   | Fan             | 27   | Plug                 |
| 7    | Parallel pin | 14   | Motor shaft          | 21   | Fan cover       |      |                      |

Note: The construction drawing is not a scale drawing.



## 10-3 Construction Drawings

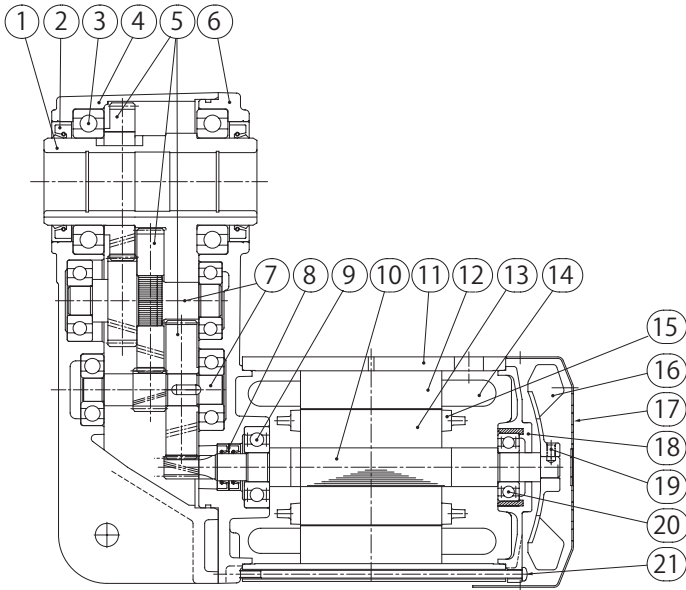


Figure 10-3 GHYM Type 0.2 - 0.75kW

Table 10-3 Gearmotor, Principal Parts

| Code | Part Name    | Code | Part Name       | Code | Part Name            | Code | Part Name |
|------|--------------|------|-----------------|------|----------------------|------|-----------|
| 1    | Output shaft | 7    | Pinion gear     | 13   | Rotor core           | 19   | Snap ring |
| 2    | Oil seal     | 8    | Oil seal        | 14   | Stationary coil      | 20   | Bearing   |
| 3    | Bearing      | 9    | Bearing         | 15   | Rotor conductor      | 21   | Bolt      |
| 4    | Casing       | 10   | Motor shaft     | 16   | Fan                  |      |           |
| 5    | Gear         | 11   | Motor frame     | 17   | Fan cover            |      |           |
| 6    | Cover        | 12   | Stationary core | 18   | Anti-load side cover |      |           |

# Common 11 Warranty

The scope of warranty of our delivered products is limited only to what we manufactured.

Warranty (period and description)

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Period              | The warranty period applies only to new products and represents 18 months after the shipment or 12 months after the actual operation, whichever is shorter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Description         | <p>If the product failed within the warranty period, during which despite a proper mounting, connection and maintenance &amp; administration are followed according to the maintenance manual, and the product is properly run based on the specification on the catalog or under conditions agreed separately, we will repair or provide an alternative product at our discretion for free of charge, except the exclusions below.</p> <p>However, as far as the product is connected with customers' other devices, we will not indemnify those expenses on dismounting from/mounting on the devices, etc. and other associated construction expenses, transportation expenses and opportunity loss and operation loss the customers suffered from, and other indirect damages.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Warranty exclusions | <p>The following items will be excluded from the warranty:</p> <ol style="list-style-type: none"> <li>1. A breakdown resulting from defects in the mounting of the product and connection with other devices, etc.</li> <li>2. A breakdown resulting from insufficient maintenance &amp; administration and improper handling of the product, including a case that the product is not stored according to our defined storage manual.</li> <li>3. A breakdown resulting from operation which does not fall within our specification and other operation conditions and use status we hardly can know or a failure caused by the use of lubricant which we do not recommended.</li> <li>4. A breakdown resulting from defects in or special specification of devices, etc. connected by customers.</li> <li>5. A breakdown resulting from modification or reconstruction of the product.</li> <li>6. A breakdown resulting from defects in parts supplied or specified by customers.</li> <li>7. A breakdown caused by inevitable force including earthquake, fire, flood disaster, salt damage, gas damage, and lightning strike, etc.</li> <li>8. Warranty of natural wear and tear, abrasion, and deterioration of such relevant consumable parts as a bearing and oil seal, etc. under normal usage.</li> <li>9. A breakdown caused for reasons not attributable to each of the above item.</li> </ol> |

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

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