

Thank you for purchasing ORIENTAL MOTOR products. Please read this operating manual thoroughly before installing and operating the motor, and always keep the manual where it is readily accessible.

## BH Series Induction Motors

# OPERATING MANUAL



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## 1. Precautions

### 1.1 Precautions for Installation

- Do not use in a place where there is flammable gas and/or corrosive gas.
- When installing the motor into your equipment, ensure that the motor lead wires are fixed and do not move. In addition, do not apply any pressure to these lead wires.
- Motors for use only in equipment of protection class I.  
*Motore zur Verwendung in Geräten der Schutzklasse I.*
- The motor housing must be mounted with a screw and spring washer to the ground point of the equipment.  
*Die Gehäuse der Motore sind mit einer Schraube und Zahnscheibe sicher mit dem geerdeten Gehäuse des Gerätes zu verbinden.*
- Installation must be performed by a qualified installer.

### 1.2 Precautions for Operation

- The motor case temperature can exceed 70°C (depending on operation conditions). In case motor is accessible during operation, please attach the following warning label so that it is clearly visible.
- Always turn off the power to the motor before conducting checks or performing work on the motor. Thermally protected motors will restart automatically when motor temperature falls below a certain level.



## 2. Checking the package contents

### 2.1 Checking the contents

Make sure that you have received all of the items listed below. If an accessory is missing or damaged, contact the nearest ORIENTAL MOTOR office.

- Motor ..... 1
- Capacitor ..... 1 (for only single-phase motors)
- Capacitor cap ..... 1 (for only single-phase motors)
- Key ..... 1 (for only combination types)  
For **BH6G2-□**, **BH8G-□** and **BH6G2-□RA**, a key is fixed on the gearhead's shaft.
- Set of mounting bolts ..... 1 (for only combination types **BH6G2-□**, **BH8G-□**)
  - Mounting screws ..... 4
  - Nuts ..... 4
  - Washers ..... 4
  - Spring washers ..... 4
- This operating manual ..... 1

## 2.2 Checking the product name

This operation manual covers the following products.

Make sure that the product is the one you ordered and is listed below by checking the model number listed on the nameplate.

Verify that the voltage and output listed on the nameplate are appropriate for your application and that the correct value capacitor has been provided.

### ■ Combination types

Model *1	Motor Model	Gearhead Model *2
BHI62A-□	BHI62A-G2	BH6G2-□ BH6G2-□RA BH6G2-□RH
BHI62AT-□	BHI62AT-G2	
BHI62C-□	BHI62C-G2	
BHI62CT-□	BHI62CT-G2	
BHI62E-□	BHI62E-G2	
BHI62ET-□	BHI62ET-G2	
BHI62F-□	BHI62F-G2	
BHI62FT-□	BHI62FT-G2	
BHI62ST-□	BHI62ST-G2	
BHI82A-□	BHI82A-G	
BHI82AT-□	BHI82AT-G	
BHI82C-□	BHI82C-G	
BHI82CT-□	BHI82CT-G	
BHI82E-□	BHI82E-G	
BHI82ET-□	BHI82ET-G	
BHI82F-□	BHI82F-G	
BHI82FT-□	BHI82FT-G	
BHI82ST-□	BHI82ST-G	

### ■ Separate types (gearhead are sold separately)

Model	Shaft Type	Gearhead Model *2
BHI62A-G2	Pinion Shaft	BH6G2-□, BH6G2-□RA, BH6G2-□RH
BHI62AT-G2		
BHI62A-A	Round Shaft	-
BHI62AT-A		
BHI62C-G2	Pinion Shaft	BH6G2-□, BH6G2-□RA, BH6G2-□RH
BHI62CT-G2		
BHI62C-A	Round Shaft	-
BHI62CT-A		
BHI62E-G2	Pinion Shaft	BH6G2-□, BH6G2-□RA, BH6G2-□RH
BHI62ET-G2		
BHI62E-A	Round Shaft	-
BHI62ET-A		
BHI62F-G2	Pinion Shaft	BH6G2-□, BH6G2-□RA, BH6G2-□RH
BHI62FT-G2		
BHI62F-A	Round Shaft	-
BHI62FT-A		
BHI62ST-G2	Pinion Shaft	BH6G2-□, BH6G2-□RA, BH6G2-□RH
BHI62ST-A		
BHI82A-G	Pinion Shaft	BH8G-□
BHI82AT-G		
BHI82C-G		
BHI82CT-G		
BHI82E-G		
BHI82ET-G		
BHI82F-G		
BHI82FT-G		
BHI82ST-G		

With combination types, the motor and gearhead are pre-assembled.

- \*1 The gear ratio appears at the position in the model number indicated by the box (□).  
For example, BHI62ST-50 means that the model is equipped with a 50:1 gear ratio.  
For right angle shaft type, there is RA or RH in the end of the model number.
- \*2 The gear ratio appears at the position in the gearhead model number indicated by the box (□).

Motors are recognized by UL.

#### • Standards

UL1004, UL2111, CSA C22.2No. 100, CSA C22.2No. 77  
Standards File No. Motor: UL File No. E64197  
Capacitor: UL File No. E83671 (CYWT2)  
Capacitor cap: UL File No. E56078 (YDTU2)

#### • Applications for Standards

EN60950-1, EN60034-1, EN60034-5, IEC60034-11, IEC60664-1

A Running Heating Test and a Locked-Rotor Test has been conducted with an aluminium radiation plate of size indicated below. For the motor with a gearhead, tests has been conducted with a gearhead instead of the radiation plate.

size	thickness	material
230 × 230 (9.06 × 9.06)	5 (0.20)	aluminium

\* Dimensions in millimeters (inches).


#### • Installation Conditions

Overvoltage category II, Pollution degree 2, Class I equipment (For EN/IEC standard)  
When the machinery to which the motor is mounted requires overvoltage category III and pollution degree 3 specifications, install the motor in a cabinet that comply with IP54 and connect to power supply via an isolation transformer.  
The motor with a terminal box requires overvoltage category III and pollution degree 3 specifications (except for the motor installation surface of the round shaft type).

#### • Applications for Standards

The three-phase round shaft motor type with terminal box conforms to the requirements specified under the Product Safety of Electrical appliance and material.

#### • Electrical Appliance and Material Safety Law

The three-phase round shaft motor type with terminal box bears a  mark.

#### • Hazardous Substances

RoHS (Directive 2002/95/EC 27Jan.2003) compliant

### 3. Installation

#### Installation conditions

Install the motor and capacitor in a location that meets the following conditions.

Using the motor and capacitor in a location that does not satisfy these conditions could damage it.

- Indoors
- Ambient temperature:  $-10^{\circ}\text{C}$  (14°F) ~  $+40^{\circ}\text{C}$  (104°F) (avoid freezing)  
( $-10^{\circ}\text{C}$  (14°F) ~  $+50^{\circ}\text{C}$  (122°F) for 100/200 V)
- Ambient humidity: 85% max. (avoid condensation)
- Not exposed to explosive, flammable, or corrosive gases
- Not exposed to direct sunlight
- Not exposed to dust
- Not exposed to water or oil
- A place where heat can escape easily
- Not exposed to continuous vibration or excessive impact
- 1,000 meters or less above sea level
- Overvoltage category II, Pollution degree 2, Class I equipment (For EN/IEC standards)

When the machinery to which the motor is mounted requires overvoltage category III and pollution degree 3 specifications, install the motor in a cabinet that comply with IP54 and connect to power supply via an isolation transformer.

The motor with a terminal box requires overvoltage category III and pollution degree 3 specifications (except for the motor installation surface of the round shaft type).

#### 3.1 Install the motor

##### 1) Assembling the Motor and Gearhead (For only separate type)

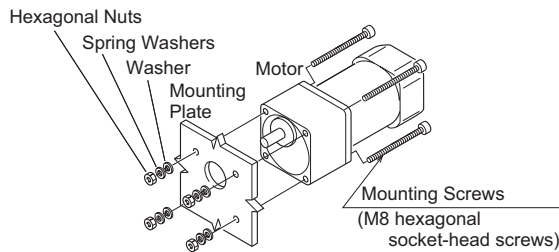
Use the gearhead of the **BH6G2** type or **BH8G** type. Confirm gearhead compatibility by checking the table in section 2.2.

For the detail of assembling the motor and gearhead, see the operating manual of gearhead.

##### 2) Installing the motor

- Combination type, pinion shaft motor (separate type)

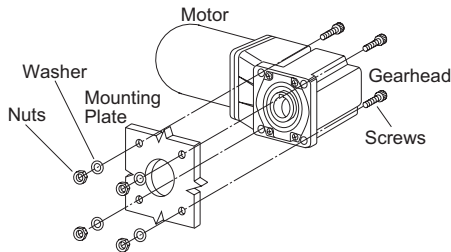
###### Parallel Shaft Type



Drill holes in the mounting plate and fasten the motor to the mounting plate with the provided mounting screws, hexagonal nuts, washers and spring washers. Be sure that no gaps are left between the gearhead and the surface of the mounting.

Mounting plate thickness is 10 mm (0.39 in.) when using the provided mounting screws.

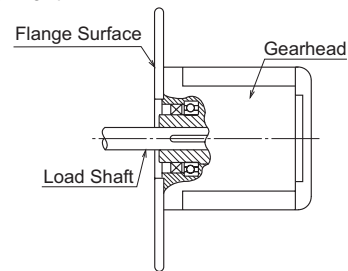
###### Right Angle Type



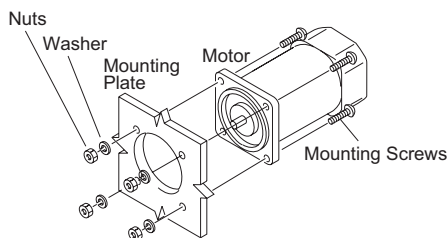
Drill holes in the mounting plate and fasten the motor to the mounting plate with screws, nuts, and washers (The mounting screws are not provided.). Be sure that no gaps are left between the motor and the surface of the mounting plate.

\* Illustration shows **BH6G2-□RH**.

- Note
- For **BH6G2-□RH**, when using the gearhead flange to mount the gearhead to equipment, proper alignment between the hollow shaft inside dimension and the load shaft is necessary.
  - The diameter of the boss of the shaft is  $\varnothing 58\text{h8}$ , use it as a guide for proper alignment.



- Round shaft motor



Drill holes in the mounting plate and fasten the motor to the mounting plate with screws, nuts, and washers (The mounting screws are not provided.). Be sure that no gaps are left between the motor and the surface of the mounting plate.

Motor frame size	Screw size	Tightening torque
□104 mm (4.09 in.)	M8	6.0 N·m (53.1 lb-in)
□120 mm (4.72 in.)	M10	12.0 N·m (106.2 lb-in)

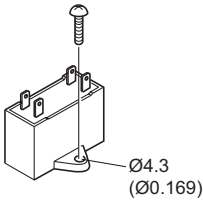
For motor frame size 104 mm (4.09 in.) type, optional mounting brackets for motors (sold separately) are available from ORIENTAL MOTOR.

Note Do not insert the motor into the mounting hole at an angle or force it in, as this may scratch the flange pilot section and damage the motor.

##### 3) Cooling fan

When installing a motor with a cooling fan onto a device, leave 10 mm (0.39 in.) or more behind the fan cover or open a ventilation hole so that the cooling inlet on the back of the motor cover is not blocked.

### 3.2 Mounting the capacitor (For only single-phase motors)



Before mounting the provided capacitor, check that the capacitor's capacitance matches that stated on the motor's name plate.

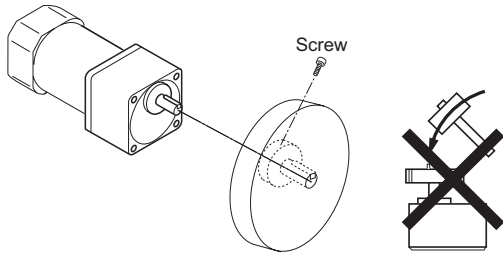
Use M4 screws to mount the capacitor (screws not provided).

\* Dimensions in millimeters (inches).

- Note**
- Do not let the screw fastening torque exceed 1 N·m (8.85 lb-in) to prevent damage to the mounting feet.
  - Mount capacitor at least 10 cm (3.94 in.) away from the motor. If it is located closer, the life of the capacitor will be shortened.

### 3.3 Attaching Load

- BH6G2-□, BH8G-□, BH6G2-□RA**

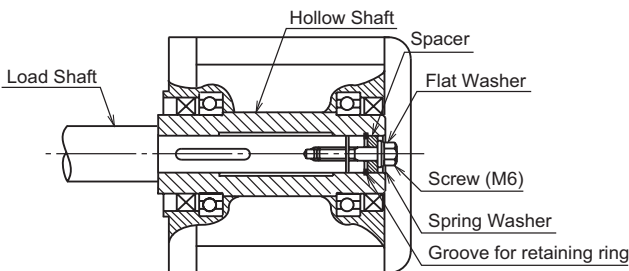


The shaft of the gearhead has been machined to an outer diameter tolerance of h7 and is provided with a key slot for connecting the transmission parts. When connecting the transmission parts, ensure that the shaft and parts have a clearance fit, and secure with a screw to prevent the parts from wobbling.

**Note** Do not use excessive force, or hammer the transmission parts onto the gearmotor shaft as damage may occur.

- BH6G2-□RH (Hollow shaft type)**

When the load shaft is stepped



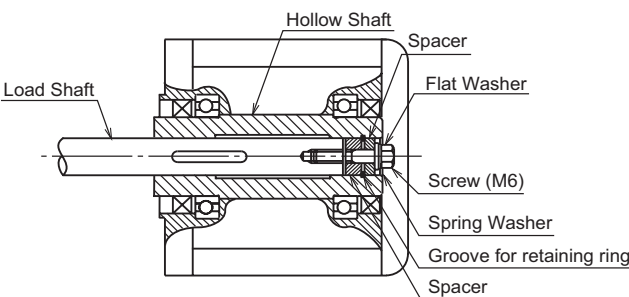
Refer to chart below for hollow shaft inside dimensions and the recommended load shaft dimensions.

Attach the load according to load shaft conditions as shown in either figure above or below. The hollow shaft inside dimension is processed to a tolerance of H8, and incorporates a key slot for load shaft attachment. A load shaft tolerance of h7 is recommended. Apply a lubricant such as molybdenum disulphide grease etc. to the load shaft and to the inner circumference of the hollow shaft.

Hollow Shaft Inside Dimensions and Recommended Load Shaft Dimensions [Unit: mm(inch)]

Gearhead Model	<b>BH6G2-□RH</b>
Hollow Shaft Inside Dimensions (H8)	Ø25 <sup>+0.033</sup> <sub>0</sub> (Ø0.9843 <sup>+0.0013</sup> <sub>0</sub> )
Recommended Load Shaft Dimensions (h7)	Ø25 <sup>0</sup> <sub>-0.021</sub> (Ø0.9843 <sup>0</sup> <sub>-0.0008</sub> )

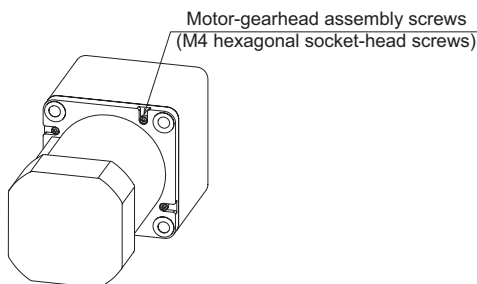
When the load shaft is not stepped



After attaching the load, attach the safety cover.

- Note**
- Do not apply excessive force when inserting the load shaft into the gearhead. Excessive or abrupt force may damage the gearhead internal bearings.
  - When the hollow-shaft gearhead or solid-shaft gearhead with a low gear ratio (5, 6, 7.5 or 9) is combined with a single-phase motor, noise (resonance sound) may occur during operation under no or light load. This noise can be reduced by adding a frictional load.

### 3.4 Disassembling the Motor and Gearhead (For only combination types)



In combination types, motor and gearhead are attached by means of motor-gearhead assembly screws (hexagonal sockethead screws). These screws must be removed in order to replace the gearhead. Once the gearhead has been replaced, reassemble the unit using the screws included with the gearhead for this purpose.

To install the unit in machinery, use the mounting screws, and follow the instructions given in section 3.1 ~ 3.3.

The screw tightening torque for assembling motor and gearhead is shown in the below chart.

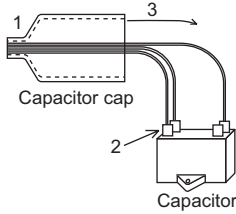
Motor Model	Screw size*	Tightening torque
<b>BH6G2-□, BH8G-□</b>	M4	1.0 N·m (8.85 lb-in)
<b>BH6G2-□RH, BH6G2-□RA</b>	M8	10 N·m (88.5 lb-in)

\* The number of screws is two for **BH6G2-□** and four with other models.

\* Illustration shows parallel shaft type.

## 4. Connection and Operation

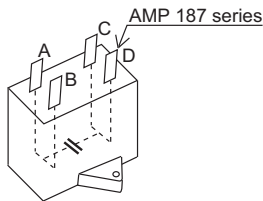
- Connect the motor according to the “wiring diagram” shown below.
- Insulate all the wire connections, such as the connection between the motor and the capacitor connection.  
Capacitor caps are available to insulate capacitor connection.



### Capacitor caps

1. Pass the lead wires through the capacitor cap as shown in the figure.
2. Connect the lead wires to the terminals or use terminal ends.
3. Cover the capacitor with the capacitor cap.

### ■ Capacitor connection (For only single-phase motors)

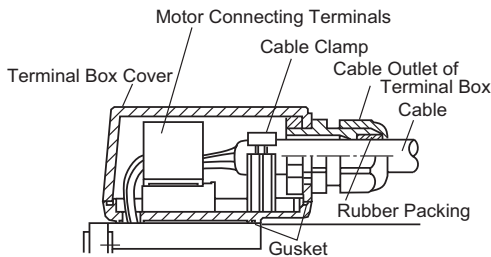


The capacitor internal wiring is as follows:

Capacitor terminals are internally electrically connected in twos; A-B and C-D for easy connection.

For easy to install terminals use 187 series AMP FASTON Terminals. (Tyco Electronics AMP)  
For lead wire connection, use one lead wire for each individual terminal.

### ■ Connection method to a terminal box (Terminal box type)



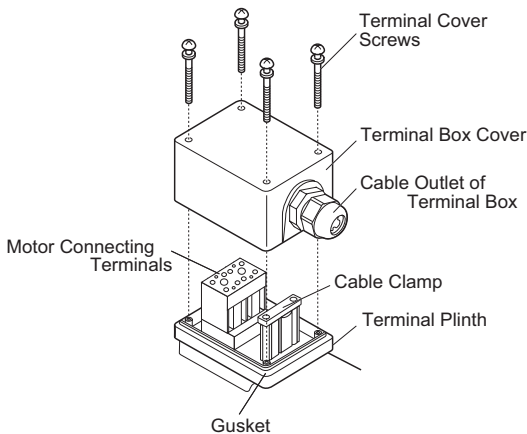
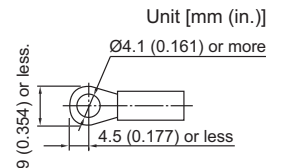
- To ensure safety, ground the motor using the protective earth terminal inside the terminal box. On the three phase round shaft motor type, refer to the following specifications.

Applicable crimp terminal: Insulated round crimp terminal

Terminal screw size: M4

Tightening torque: 1.0 N·m to 1.3 N·m  
(8.8 lb-in to 11.5 lb-in)

Applicable minimum lead wire size  
: AWG18 (0.75 mm<sup>2</sup>) or more



- For wiring, be sure to use cable that meets the following specifications.  
Cable: Diameter is 6.0 mm ~ 12.0 mm (Ø0.236 ~ Ø0.472 in.)  
Lead Wires: Thickness is AWG24 ~ 12 (0.2 mm<sup>2</sup> ~ 3.5 mm<sup>2</sup>)  
Length of strip is 8 mm (0.31 in.)
  - When sealing the terminal cover, ensure that no scraps or particles get caught between the contact surfaces.
  - The terminal cover screws are specifically designed for mounting the terminal cover. They are provided with a rubber seal and metal washer that keep the terminal box splashproof. In order to maintain a tight seal around the terminal box, use only the provided screws. Also, this terminal box is constructed to hold a gasket. If this gasket comes out of the box, please reseal it correctly on the box.
- Also refer to the tightening torque table (below) to determine the appropriate tightening torque to use when fastening the terminal box cover and cable outlet.

### Tightening Torque

	Tightening Torque	
	N·m	oz-in
Terminal Box Cover	0.5 ~ 0.7	71 ~ 99
Cable Outlet of Terminal Box Cover	2.5 ~ 3.8	350 ~ 530
Cable Clamp	0.2 ~ 0.3	28 ~ 42
Motor Connecting Terminals	0.5 ~ 0.8	71 ~ 113

- Note
- To make shielding function fully effective, use a cable of an appropriate diameter.
  - Securely affix the cable exposed outside the motor so that it does not receive stress.

## ■ Connection diagram

The direction of rotation is as viewed from the side of the motor's output shaft.

"CW" indicates clockwise and "CCW" counterclockwise. The gearhead's output shaft may, depending on the gear ratio, turn in the opposite direction of the motor shaft. For right angle type, it turns in the opposite direction of the motor shaft.

[Single-phase motor]

Motor Model *	Wiring Diagram		
	Cable clamp type	Terminal box type	
<b>BHI62□-3 ~ 9</b> <b>BHI62□-50 ~ 180</b> <b>BHI82□-60 ~ 180</b> <b>BHI62□T-3 ~ 9</b> <b>BHI62□T-50 ~ 180</b> <b>BHI82□T-60 ~ 180</b>			<p>[Direction of Rotation]</p> <p>To rotate the motor in a clockwise (CW) direction, flip switch SW to CW.</p> <p>To rotate the motor in a counterclockwise (CCW) direction, flip switch SW to CCW.</p> <p>Layout of Terminals</p> <p>Cable Clamp / Motor Connecting Terminal</p> <p>4 Motor Connecting Terminal Screws</p>
<b>BHI62□-12.5 ~ 36</b> <b>BHI82□-30 ~ 50</b> <b>BHI62□-5 ~ 180RA</b> <b>BHI62□-5 ~ 180RH</b> <b>BHI62□T-12.5 ~ 36</b> <b>BHI82□T-30 ~ 50</b> <b>BHI62□T-5 ~ 180RA</b> <b>BHI62□T-5 ~ 180RH</b>			
<b>BHI62□-A</b> <b>BHI62□T-A</b>			

\* A, C, E, F appear at the position in the model number indicated by the box (□).

[Three-phase motor]

Motor Model	Clockwise (CW)	Counterclockwise (CCW)	Layout of Terminals
<b>BHI62ST-3 ~ 9</b> <b>BHI62ST-50 ~ 180</b> <b>BHI82ST-60 ~ 180</b>			<p>● Pinion shaft motor</p> <p>Cable Clamp / Motor Connecting Terminal</p> <p>4 Motor Connecting Terminal Screws</p>
<b>BHI62ST-12.5 ~ 36</b> <b>BHI82ST-30 ~ 50</b> <b>BHI62ST-5 ~ 180RA</b> <b>BHI62ST-5 ~ 180RH</b>		<p>To change the direction of rotation, change any two connections between U, V and W.</p>	<p>● Round shaft motor</p> <p>Cable Clamp / Motor Connecting Terminal</p> <p>4 Motor Connecting Terminal Screws</p> <p>"NC" is not used</p> <p>Motor Connecting Terminal</p> <p>Protective Earth Terminal</p>
<b>BHI62ST-A</b>			

- Note
- Make sure that the motor case temperature does not exceed 90°C (194°F) during motor operation. Operating the motor above 90°C (194°F) will shorten the life of the coil and the ball bearings. Motor case temperature can be measured by fastening a thermometer to the motor's surface, or with thermo-tape.
  - Bring single-phase motors to a complete stop before switching the direction of rotation. If you try to switch the direction of rotation before the motor has stopped, it may not change or may require time.
  - Use the provided capacitor for single-phase motors and always keep the capacitor connected after the motor is started.
  - Refer to the capacitor connection method on page 5.

## 5. Time Rating

This motor can be operated continuously (continuous rating).

## 6. Locked rotor burnout protection of motor

This motor is equipped with a feature listed below to prevent the motor from burning out as a result of abnormal heating which may be caused by misapplication.

### ■ Thermal protection (“THERMALLY PROTECTED” “TP212” is stamped on the motor name plate)

When the motor reaches a predetermined temperature, the internal thermal protector is activated and the motor is stopped.

With the automatic resume feature, the motor automatically begins operating again as soon as the motor temperature falls.

Always turn the power off before performing inspections.

**Thermal protector activation range:** Power is turned off at 150°C ±5°C (302°F ±9°F)

Power is turned back on at 96°C ±15°C (205°F ±27°F)

## 7. Troubleshooting

When the motor is not functioning normally, perform an inspection covering the points listed in the table below.

If the inspection shows that everything is normal but the motor and control unit still are not functioning correctly, contact the nearest ORIENTAL MOTOR office.

Problem	Things to check
The motor does not rotate or motor rotates at low speed	<ol style="list-style-type: none"> <li>1. Is the correct voltage being supplied to the motor?</li> <li>2. Are lead wires properly and firmly connected?</li> <li>3. Is the load too large?</li> <li>4. If lead wires have been extended by using a terminal strip or terminal block, are the lead wires properly and firmly connected at all points?</li> <li>5. For a single-phase motor, is the provided capacitor connected as shown in the wiring diagram of page 6?</li> </ol>
The motor rotate correctly or properly	<ol style="list-style-type: none"> <li>1. Are lead wires properly and firmly connected?</li> <li>2. If lead wires have been extended by using a terminal strip or terminal block, are the lead wires properly and firmly connected at all points?</li> <li>3. For a single-phase motor, is the provided capacitor connected as shown in the wiring diagram of page 6?</li> </ol>
The motor rotates in the wrong direction	<ol style="list-style-type: none"> <li>1. Is the connected as shown in the wiring diagram? Check the wiring diagram of page 6 again.</li> <li>2. The gearhead output shaft's rotation direction differs depending on the gearheads deceleration ratio. Refer to the gearhead operation manual.</li> <li>3. For a single-phase motor, is the provided capacitor connected as shown in the wiring diagram of page 6?</li> <li>4. Are you looking at the motor from the wrong side? Rotation is defined as viewed from the output shaftside.</li> </ol>
The motor becomes extraordinarily hot (motor case temperature exceeds 90°C (194°F))	<ol style="list-style-type: none"> <li>1. Is the correct voltage being supplied to the motor?</li> <li>2. Does the ambient temperature exceed the specified range?</li> <li>3. For a single-phase motor, is the provided capacitor connected as shown in the wiring diagram of page 6?</li> </ol>
The motor makes a strange noise	<ol style="list-style-type: none"> <li>1. For separate type, or after disassembling the motor and gearhead, are the motor and gearhead correctly fastened? Refer to the operating manual of gearhead.</li> <li>2. Is the coupled gearhead the same pinion type as the motor shaft?</li> </ol>

- Characteristics, specifications and dimensions are subject to change without notice.
- **Orientalmotor** is a trademark of Oriental Motor Co., Ltd.
- Please contact your nearest Oriental Motor office for further information.

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