



Instruction Manual

ZENMAI MOTOR

ZS-02

ZS-05

ZS-08

ZS-16

ZS-24

ZW-16

ZW-32

ZW-48

For safe and correct operation of the product, please be sure to read this manual and fully understand its content before use.

After reading, keep the manual safe so that you can find and use it readily.

In case of resale or transfer of this product, make sure to transfer the manual to the new owner.

Introduction



Thank you very much for purchasing the Zenmai Motor. To prevent any trouble and obtain the best performance, please be sure to read this Instruction Manual and fully understand its content.

Notation in this Instruction Manual

Hazard levels

This product is designed with ultimate priority on the safety of operators. However, due to the nature of the system, there are risks that cannot be removed.

In this manual, the level of significance and risk is defined and indicated in two stages, "WARNING" and "CAUTION". Thoroughly read and fully understand the indicated items before operating the product and performing maintenance procedures. The indications for "WARNING" and "CAUTION" are described below in order of risk significance (WARNING > CAUTION).

 WARNING	A situation that, if mishandled, may cause death or serious disability.
 CAUTION	A situation that, if mishandled, may cause minor or moderate injury, or property damage.

The extent of the problem described above (disability, injury, and property damage) is defined as follows.

Serious disability: Loss of eyesight, wound, burn (high-temperature or low-temperature), electric shock, bone fracture, poisoning, and other injuries that leave aftereffects and that require hospitalization or long-term outpatient treatment.

Moderate injury: Burn, electric shock, bone fracture, and other injuries that do not require hospitalization or long-term outpatient treatment.

Minor injury: Scratch, bruise, laceration, and other injuries that have a minor impact on health.

Property damage: Extended damage to buildings, household articles, and injury to domestic animals or pets.

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1. Signs and Precautions for Handling

1-1 Labels

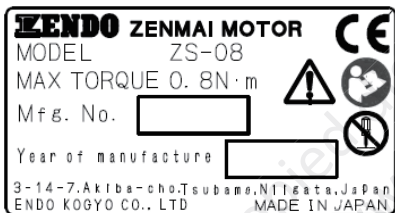

Symbols for hazard classifications are indicated on the nameplate of the product.

WARNING

- The operators must check the positions of all danger warning labels attached to the product, and thoroughly read and fully understand the information on the labels before performing any procedure.
- If the warning labels are peeling off or deteriorated and become illegible, contact us to replace them.

1-1-1 Types of label and nameplate

The following labels are attached to this product.

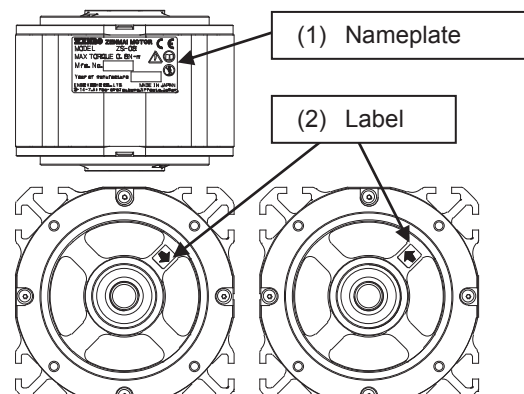
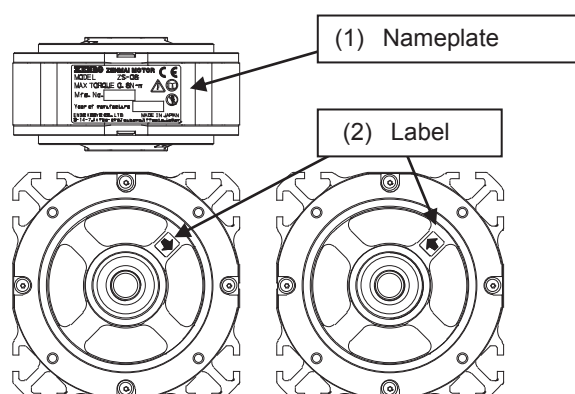
No.	Label appearance	Details
(1)		This is the nameplate of the product. The model name and the maximum torque of the product is indicated.
(2)		This label shows the rotation direction. Rotating the shaft toward the direction of the arrow generates torque.

1-1-2 Locations of label and nameplate

The label and nameplate are attached to the following locations of the product as shown below.

■ ZS-02, ZS-05, ZS-08, ZS-16, ZS-24

■ ZW-16, ZW-32, ZW-48



1-2 Precautions for handling

Incorrect handling of this product may cause damage to the product itself as well as an injury. Thoroughly read the following precautions and be sure to heed the instructions when handling the machinery.



WARNING

- Do not perform any modification or disassembly of the product.
- Do not use the product overhead or in any locations where an injury may result.



CAUTION

- Install the product correctly in accordance with the descriptions in this manual.
- Do not hold the keyway when you install the shaft.
The edge of the keyway may cause an injury.
- Install the main equipment of the Zenmai Motor before rotating the shaft or the parts that are installed on the shaft.
If you rotate the shaft or the main equipment before installation, the shaft or the main equipment may rotate when released and cause an injury.
- If you install and operate the Zenmai Motor on another device, install a safety cover on the rotating part or attach a warning label to the device.
- If the spring ruptures, there will be no torque or less torque generated.
If a loss of torque will create a safety risk, suitable precautions must be taken by the customer.
- Rotating the shaft or the parts that are installed on the shaft in the direction of the arrow generates torque.
When you release the rotated shaft or parts, they may quickly rotate in the reverse direction and cause an injury.
- A sudden release of the spring may damage the spring.
Do not release the spring when there is no load on it.
- If you wind the spring more than the maximum number of turns, a mechanism to prevent excess winding works and makes clicking sounds.
Do not operate the device in such a way that the mechanism to prevent excess winding is constantly activated.
- Be sure to perform daily inspections.
- Check that no torque is being applied to the shaft before removing the Zenmai Motor from the device.

2. Unpacking and Installation

2-1 Packaging arrangement and transportation

This product is packaged for delivery in a cardboard box.
When transporting the package, do not drop or apply excessive impact to it.

Standard product

(1) Zenmai Motor	ZS-02, ZS-05	Weight: Approximately 1.2 kg
	ZS-08, ZS-16, ZS-24	Weight: Approximately 1.3 kg
	ZW-16, ZW-32, ZW-48	Weight: Approximately 2.3 kg

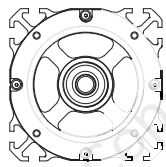
Optional parts

(1) Shaft set	Weight: Approximately 0.2 kg
(2) Pre-assembly insertion nut	Weight: Approximately 0.1 kg

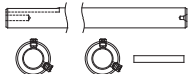
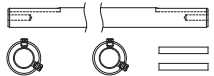




2-2 Checks after unpacking

After opening the package, check that the following products are included.
Please contact us if you find anything missing or damaged.

■ Packing contents (main equipment only)

Item	Appearance
Zenmai Motor	
Instruction Manual	(This manual)

■ Optional parts (sold separately)

Item	Appearance
Single axis shaft set (ZS type)	 Item No. LBP001953
Dual axes shaft set (ZS type)	 Item No. LBP001954
Single axis shaft set (ZW type)	 Item No. LBP001955
Dual axes shaft set (ZW type)	 Item No. LBP001956
Pre-assembly insertion nut (Size: M5, Quantity: 10)	 Item No. LBP001973
Pre-assembly insertion nut (Size: M6, Quantity: 10)	 Item No. LBP001974

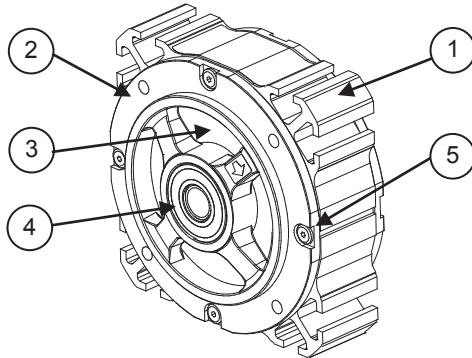
2-3 Disposal of packing materials

After opening the package, dispose of any packing and cushioning materials in accordance with the local regulations of the area where the product is used.

3. Product Description

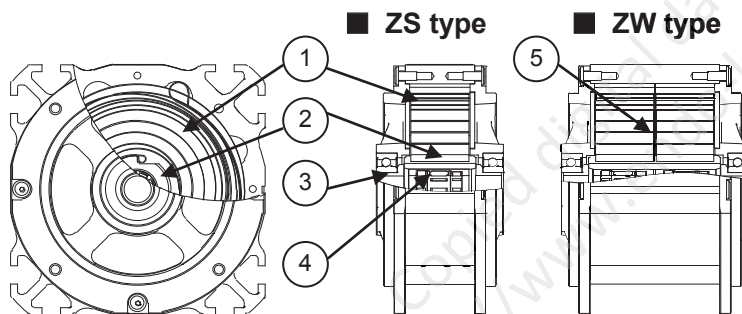
3-1 Components

3-1-1 Main equipment of Zenmai Motor (external view)



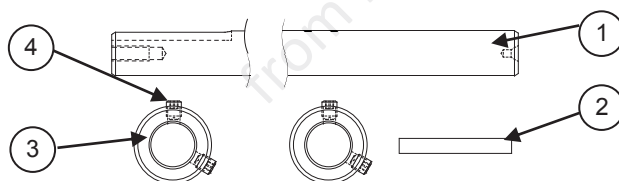
Ref. No.	Part name
(1)	Casing
(2)	Cover
(3)	Plate (transparent)
(4)	Deep groove ball bearing
(5)	Hexagon socket head cap screw

3-1-2 Main equipment of Zenmai Motor (internal view)



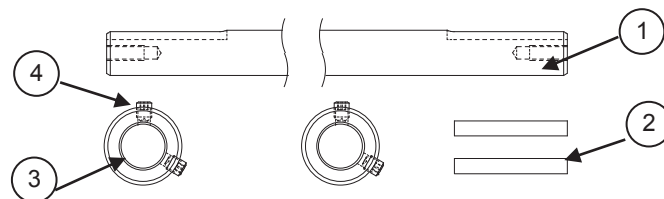
Ref. No.	Part name
(1)	Spring
(2)	Bushing
(3)	Collar
(4)	One-way clutch
(5)	Plate (spacing plate)

3-1-3 Single axis shaft set (optional part)



Ref. No.	Part name
(1)	Shaft
(2)	Key
(3)	Collar
(4)	Hexagon socket set screw

3-1-4 Dual axes shaft set (optional part)



Ref. No.	Part name
(1)	Shaft
(2)	Key
(3)	Collar
(4)	Hexagon socket set screw

3-2 Product specifications

Model	ZS-02	ZS-05	ZS-08	ZS-16	ZS-24	ZW-16	ZW-32	ZW-48
Maximum torque	0.2 N·m	0.5 N·m	0.8 N·m	1.6 N·m	2.4 N·m	1.6 N·m	3.2 N·m	4.8 N·m
Maximum number of turns	27	20	15	12	10	15	12	10
Main equipment mass	1.2 kg	1.2 kg	1.3 kg	1.3 kg	1.3 kg	2.3 kg	2.3 kg	2.3 kg

Note: See “5. Torque Adjustment” (page 10) for the details of torque and the number of turns.

3-3 Operating environment

Installation location: General indoor
Ambient temperature: -10°C to +50°C (no freezing)

3-4 Disposal of product

WARNING

- Do not disassemble the Zenmai Motor.
If you disassemble the main equipment without sufficient care, there is a danger that the spring may spring out.

When disposing of the product, the customer should not disassemble the product. Please contact an appropriate collection service that deals with recycling materials.

4. Installation

CAUTION

- Install the product correctly in accordance with the descriptions in this manual. Incorrect installation may cause an injury, property damage, or damage to the Zenmai Motor.

4-1 Preparation and checks before installation

4-1-1 Tools for installation

For installation of a shaft set (optional part): Hexagonal rod spanner (2 mm across flats)

4-1-2 Check of installation location

Before installing the product, check that the installation location does not have any of the following problems.

- 1 Check that the support member can withstand a force of 1 kN or more.
- 2 Check that the installation location has the installation environment described in “3-3 Operating environment” (page 7).

4-2 Shaft installation

In order to operate the Zenmai Motor, it is necessary to install a shaft on the main equipment.

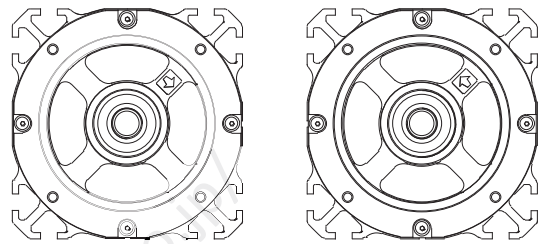


CAUTION

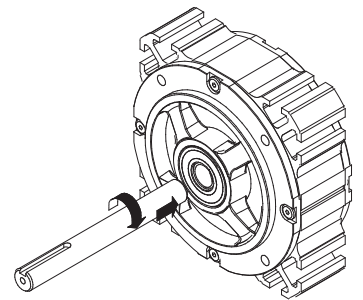
- Do not hold the keyway when you install the shaft.
The edge of the keyway may cause an injury.

4-2-1 Installation of optional shaft set

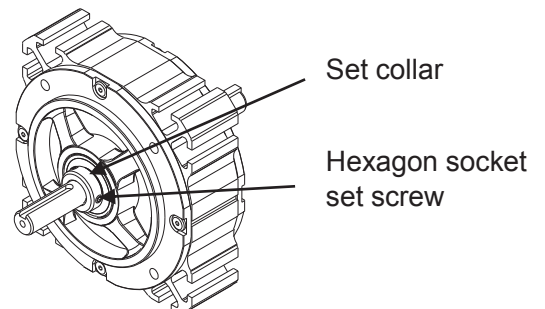
- 1 Torque is generated in the direction of the arrow on the label attached to the main equipment.
Decide the installation direction according to your operating conditions.



- 2 Install the shaft while rotating it.
The direction of this rotation should be opposite to the arrow on the label.



- 3 Install the collar on the shaft. See "8. Outline Drawings" (page 12) for the installation position.
- 4 Tighten the hexagon socket set screws that are temporarily assembled to the collar.



4-2-2 Customer-manufactured shafts

- 1 Shafts manufactured by the customer should conform to the following specifications:

Diameter: $\varnothing 12 \text{ h}6_{-0.011}^0$
Surface hardness: 58 to 64 HRC
Surface roughness: Ra 0.4

- 2 See "4-2-1 Installation of optional shaft set" (page 8) for installation of the shaft on the main equipment.

4-3 Installation procedures

CAUTION

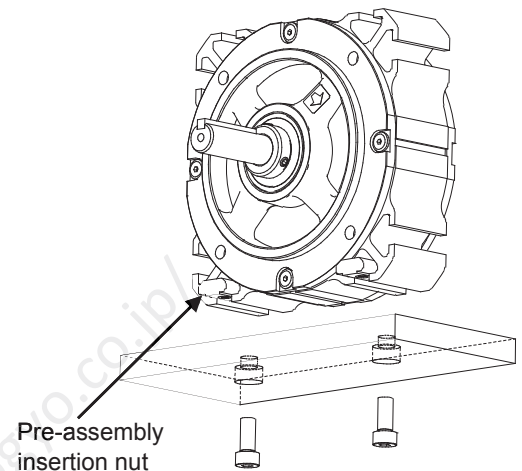
- Prepare support members that have a strength of 1 kN or more.
- Use at least 2 pre-assembly insertion nuts when an installation is performed using the grooves on the side of the main equipment.

4-3-1 Example of installation using grooves on side of main equipment

You can use the grooves on the side of the main equipment for the installation.

See “8. Outline Drawings” (page 12) for detailed dimensions.

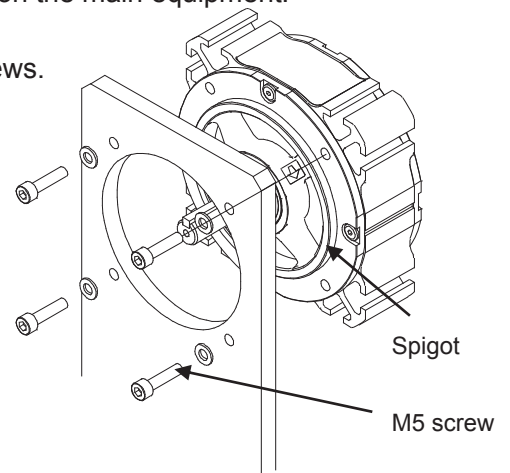
- 1 Prepare commercially available pre-assembly insertion nuts (8 mm groove width).
(For reference: SUS Corporation, MISUMI Corporation)
Alternatively, prepare pre-assembly insertion nuts that are available as optional parts.
- 2 Insert the pre-assembly insertion nuts into the grooves on the main equipment.
- 3 Fix the main equipment to the plate or bracket with screws.



4-3-2 Example of installation using spigot and M5 tapped holes

You can use the spigot and M5 tapped holes of the main equipment for the installation.

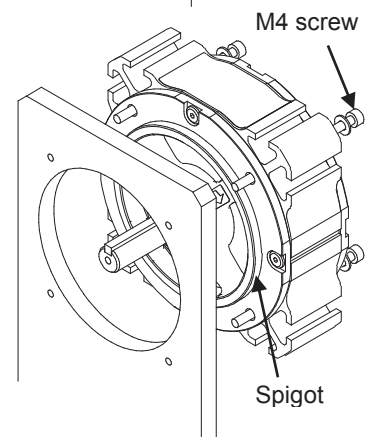
See “8. Outline Drawings” (page 12) for the detailed dimensions.



4-3-3 Example of installation using spigot and $\varnothing 4.2$ through holes

You can use the spigot and $\varnothing 4.2$ through holes of the main equipment for the installation.

See “8. Outline Drawings” (page 12) for the detailed dimensions.



5. Torque Adjustment



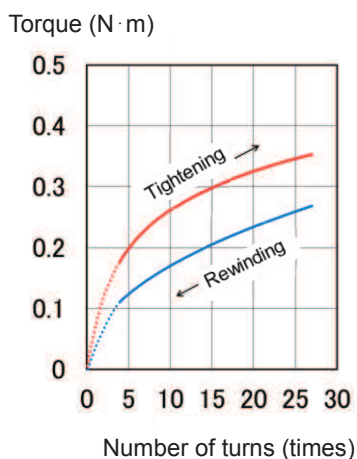
CAUTION

- Rotating the shaft or the parts that are installed on the shaft in the direction of the arrow generates torque.
When you release the rotated shaft or parts, they may quickly rotate in the reverse direction and cause an injury.
- A sudden release of the spring may damage the spring.
Do not release the spring when there is no load on it.
- If you wind the spring more than the maximum number of turns, a mechanism to prevent excess winding works and makes clicking sounds.
Do not operate the device in such a way that the mechanism to prevent excess winding is constantly activated.

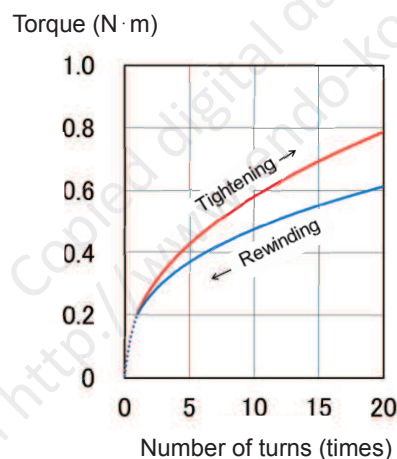
Perform the initial turn and other settings as indicated in the graphs below.

[Torque and number of turns]

Model: ZS-02

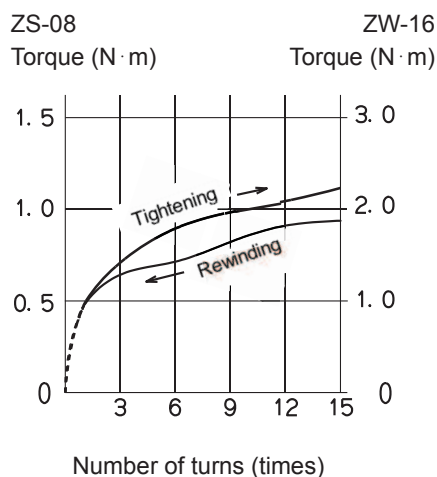


Model: ZS-05

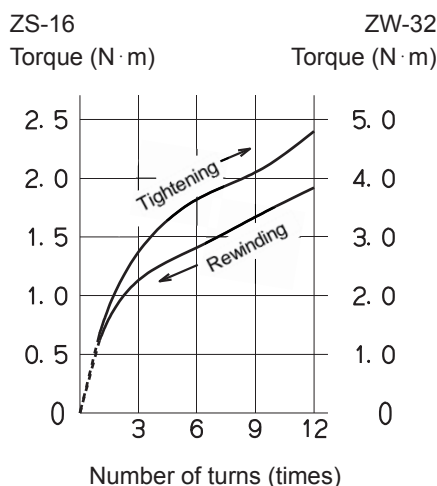


Due to the characteristics of the product, the spring may not fully return, even without any torque. This makes the product inoperable within the ranges that are indicated by the broken lines in the graphs. Allow a little leeway for the maximum turns.

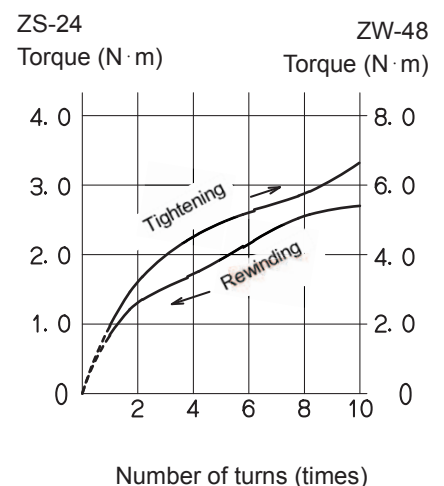
Model: ZS-08, ZW-16



Model: ZS-16, ZW-32



Model: ZS-24, ZW-48



6. Maintenance

CAUTION

- If you notice any damage or deformation, stop using the product.

Daily inspections are required for the product to be used safely and properly.
If any failure is found in the inspections, the relevant parts must be replaced. For details, contact us or your dealer.

6-1 Daily inspections

Before starting the operation, check the following items daily:

- Check for loose screws.
- Check for damage or deformation of the main equipment.

7. Troubleshooting

7-1 Countermeasures

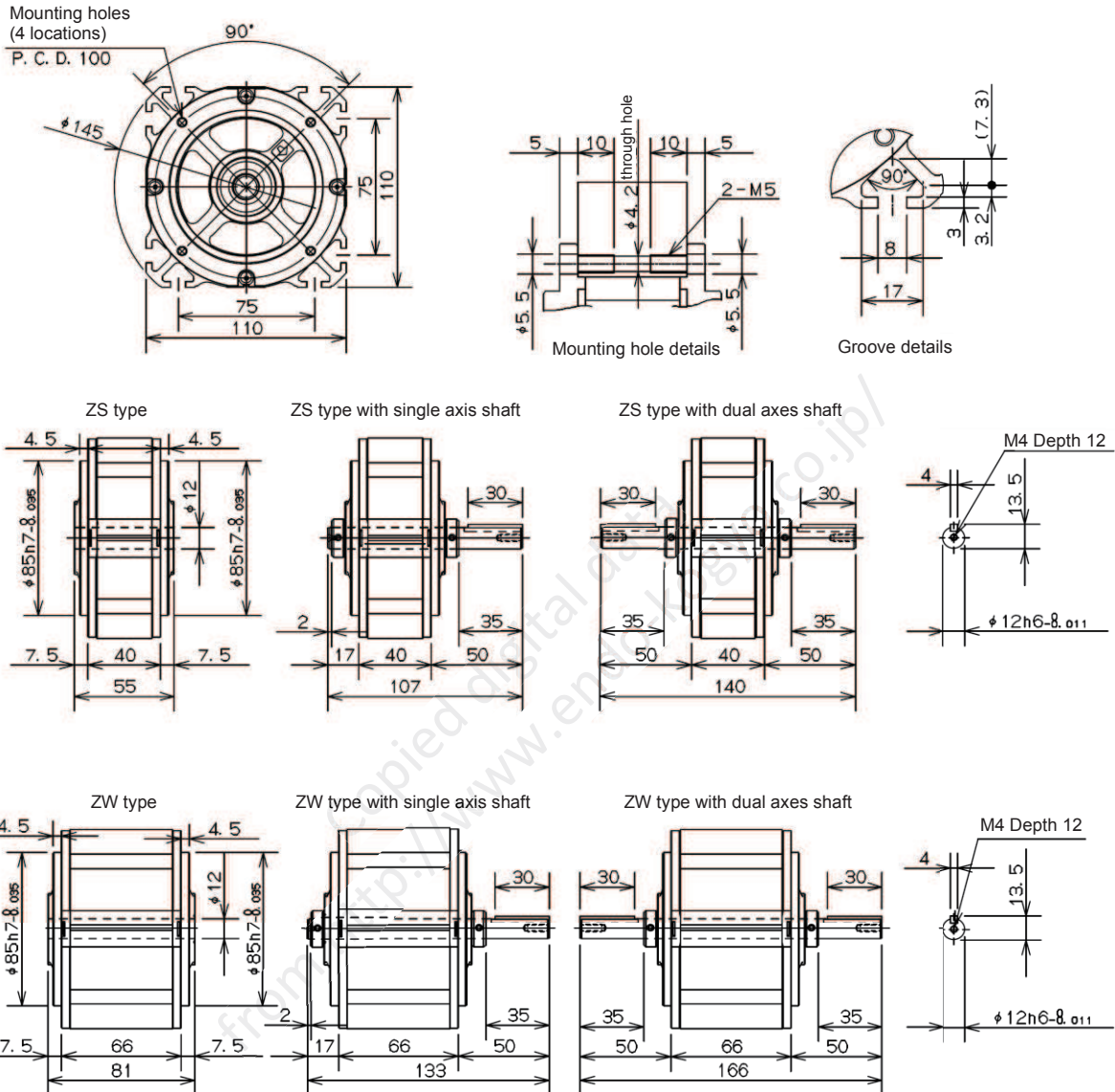
CAUTION

- If you notice anything unusual, stop the operation immediately. Take appropriate measures after checking the items listed in the table below.
- If the situation does not relate to any of the listed items in the table below, contact us or your dealer.

Failure	Reason	Measure
Rotating the shaft does not generate torque during installation.	The shaft rotates in the opposite direction.	Check the rotation direction.
The available number of turns is reduced.	The spring does not fully rewind.	Operate with some allowance.
An abnormal noise is audible.	The mechanism to prevent excess winding is working.	Check the number of turns.
No torque is generated during the operation.	The spring is ruptured.	Contact your dealer.
Torque is reduced during operation.	The spring is ruptured.	Contact your dealer.
In ZW type, the number of turns is decreased and the torque is reduced.	The spring is ruptured.	Contact your dealer.

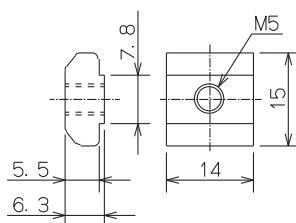
8. Outline Drawings

8-1 Drawings of main equipment and shaft installation

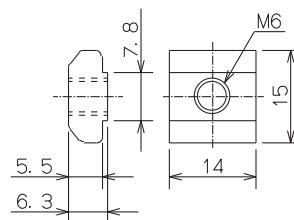


8-2 Pre-assembly insertion nut (optional part)

Item No. LBP001973



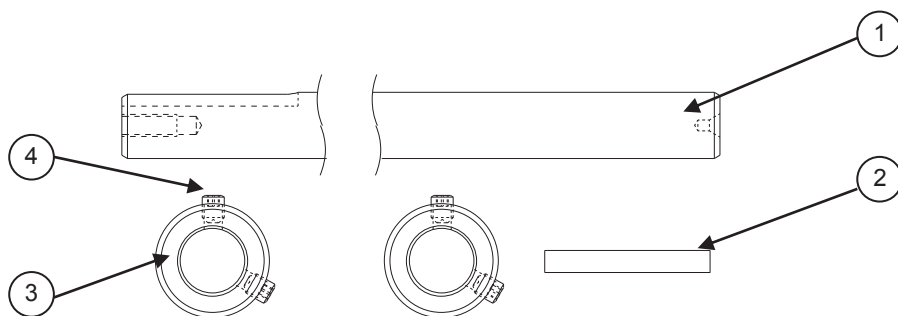
Item No. LBP001974



9. Parts List

9-1 Optional parts

9-1-1 Single axis shaft set



■ ZS type

Ref. No.	Part No.	Part name	Quantity
-	LBP001953	Single axis shaft set	1
-	LBP001957	- Shaft set	1
(1)	-	- - Shaft	1
(2)	P2B402517	- - Key	1
-	LBP001975	- Set collar	1
(3)	-	- - Set collar	2
(4)	P2B402516	- - Hexagon socket set screw	4

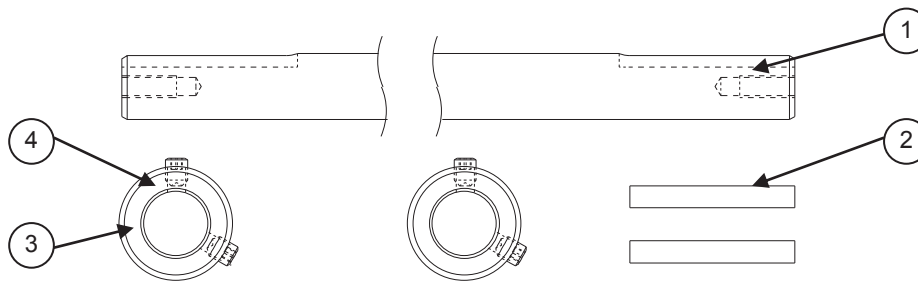
● The symbols (" - ") before the part name indicate the range of the set of parts or complete part.

■ ZW type

Ref. No.	Part No.	Part name	Quantity
-	LBP001955	Single axis shaft set	1
-	LBP001959	- Shaft set	1
(1)	-	- - Shaft	1
(2)	P2B402517	- - Key	1
-	LBP001975	- Set collar	1
(3)	-	- - Set collar	2
(4)	P2B402516	- - Hexagon socket set screw	4

Note: Please provide us with the part names and numbers when you place your order.
Parts without part numbers cannot be obtained separately. Please purchase parts as a set or as a complete part.

9-1-2 Dual axes shaft set



■ ZS type

Ref. No.	Part No.	Part name	Quantity
-	LBP001954	Dual axes shaft set	1
-	LBP001958	- Shaft set	1
(1)	-	- - Shaft	1
(2)	P2B402517	- - Key	2
-	LBP001975	- Set collar	1
(3)	-	- - Set collar	2
(4)	P2B402516	- - Hexagon socket set screw	4

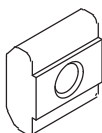
■ ZW type

Ref. No.	Part No.	Part name	Quantity
-	LBP001956	Dual axes shaft set	1
-	LBP001960	- Shaft set	1
(1)	-	- - Shaft	1
(2)	P2B402517	- - Key	2
-	LBP001975	- Set collar	1
(3)	-	- - Set collar	2
(4)	P2B402516	- - Hexagon socket set screw	4

Note: Please provide us with the part names and numbers when you place your order.

Parts without part numbers cannot be obtained separately. Please purchase parts as a set or as a complete part.

9-1-3 Pre-assembly insertion nut



Part No.	Part name	Screw size	Quantity
LBP001973	Pre-assembly insertion nut	M5	1 (10 screws)
LBP001974	Pre-assembly insertion nut	M6	1 (10 screws)

Note: Please provide us with the part names and numbers when you place your order.



ENDO KOGYO CO., LTD.

Head Office: 3-14-7, Akiba-cho, Tsubame, Niigata, Japan
Tel. 0256-62-5133 Fax. 0256-62-5772

Tokyo Office: JBSL Kanda Bldg., 2F, 12-2, Kanda Higashimathushita-cho,
Chiyoda-ku, Tokyo Japan
Tel. 03-5295-3711 Fax. 03-5295-3717

Osaka Office: Daito Bldg., 3F, 3-14, Saiwai-cho 2-chome,
Naniwa-ku, Osaka, Japan
Tel. 06-6568-1571 Fax. 06-6568-1573

Nagoya Office: Park IM Bldg., 3F, 1-7-14, Osu,
Naka-ku, Nagoya, Aichi, Japan
Tel. 052-253-6231 Fax. 052-253-6240

Kyusyu Office: Bunki Bldg., 3F, 11-15, Hakataekihigashi 3-chome,
Hakata-ku, Fukuoka, Japan
Tel. 092-412-5281 Fax. 092-412-5280

URL <http://www.endo-kogyo.co.jp>

- This manual and the specifications of this product are subject to change for improvement without advance notice.
- It is strictly prohibited to reprint or copy any information contained in this manual.