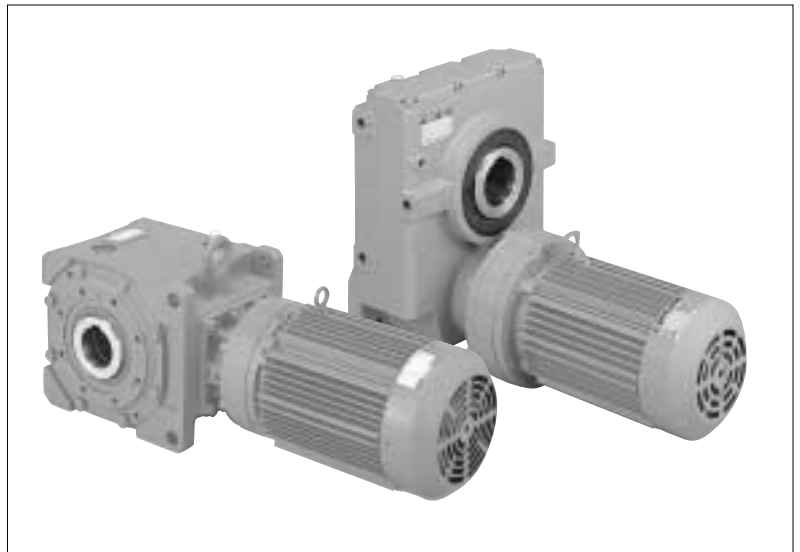




Maintenance Manual

6000 Series



(Note)

- The gear motor and reducer should be handled, installed, and maintained by trained technicians. Carefully read the maintenance manual before use.
- A copy of this maintenance manual should be sent to the actual user.
- This maintenance manual should be maintained by the user.

(Safety and other 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.
Maintain this manual for future reference.
- Pay particular 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 handled by properly trained technicians ; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- When using the equipment in conjunction with **an explosion proof motor**, a properly skilled technician thoroughly trained in electrical principles and functions, should supervise the proper transport, installation, plumbing, wiring, operation, maintenance, and inspection of the equipment; otherwise a potentially hazardous situation may result such as electric shock, fire, and explosion which can lead to injury and/or damage to the equipment.
- When the unit is to be used in a system for transport of human beings, a secondary safety device should be installed to minimize chances of accidents resulting in injury, death or damage to the equipment.
- When the unit is to be used for an elevator, install a safety device on the elevator side to prevent it from falling; otherwise, personal injury, death, or damage to the equipment may result.


(How to Refer to the Maintenance Manual)

- This maintenance manual is common for both gearmotor and reducer. The symbols shown below are put in the upper right hand corner of each page to indicate the classification. Read the applicable pages. Even on **COMMON** pages, such symbols identify distinctions between gearmotors and reducers.

• Refer to the brake maintenance manual (Cat. No.MM0202E) for the handling of **gearmotors with a brake** .

Specifications	Common specifications	Gearmotor	Reducer
Symbol	COMMON		

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1. Inspection Upon Delivery.....	3
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1. Inspection Upon Delivery

⚠ 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. When a different unit is installed, injury or damage to the equipment may result.
- Do not remove the rating plate.

Upon delivery and receipt of the gearmotor or reducer check the following. If a nonconformity or problem is found, contact our nearest agent, distributor, or sales office.

- (1) Do the items on the rating plate conform to what you ordered?
- (2) Was there any part broken during transport?
- (3) Are all bolts and nuts tightened firmly?

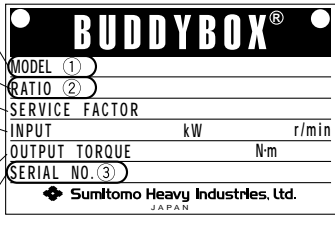
1-1) How to refer to the rating plate

• When making an inquiry, advise us of ① the type of gearmotor or reducer, ② reduction ratio, and ③ serial No.

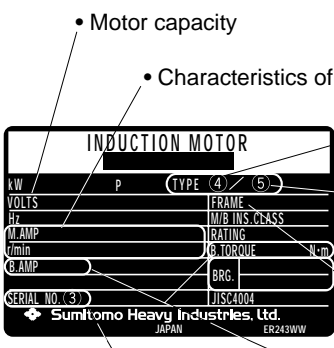
Gearmotor



- ① Type of gearmotor (Refer to page 4.)
- ② Reduction ratio
 - Service factor
 - Allowable input capacity and speed (r/min)
 - Allowable output torque
- ③ Serial No.



[Rating plate of gear]



[Rating plate of motor]

- Motor capacity
- Characteristics of motor
- ④ Type of motor (Refer to page 5.)
- ⑤ Type of brake of the motor with a brake (Refer to the brake maintenance manual.)
- Motor frame size
- Motor shaft bearing No.
- Characteristics of the brake of the motor with a brake

Fig.1 Rating plates of gearmotor

Reducer



- ① Type of reducer (Refer to page 4.)
- ② Reduction ratio
 - Service factor
 - Allowable input capacity, speed (r/min)
 - Allowable output torque
- ③ Serial No.

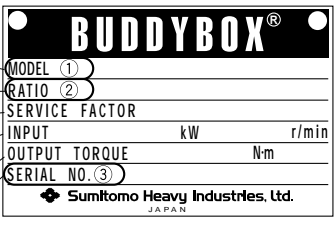


Fig.2 Rating plate of reducer

1-2) Lubrication method **COMMON**

Refer to "8-2. Confirmation of lubrication method" on page 18 to confirm the lubrication method.

- **Oil-lubricated** models are shipped without any oil inside the units. Proper amount of oil should be supplied before start-up.
- Some models need oil to be supplied in two distinct locations: Output side (Buddybox) and input side (Cyclo).

1-3) Nomenclature of gearmotor or reducer

Respective codes and Buddybox nomenclature is shown below. Please check to see if the type of gearmotor reducer you have

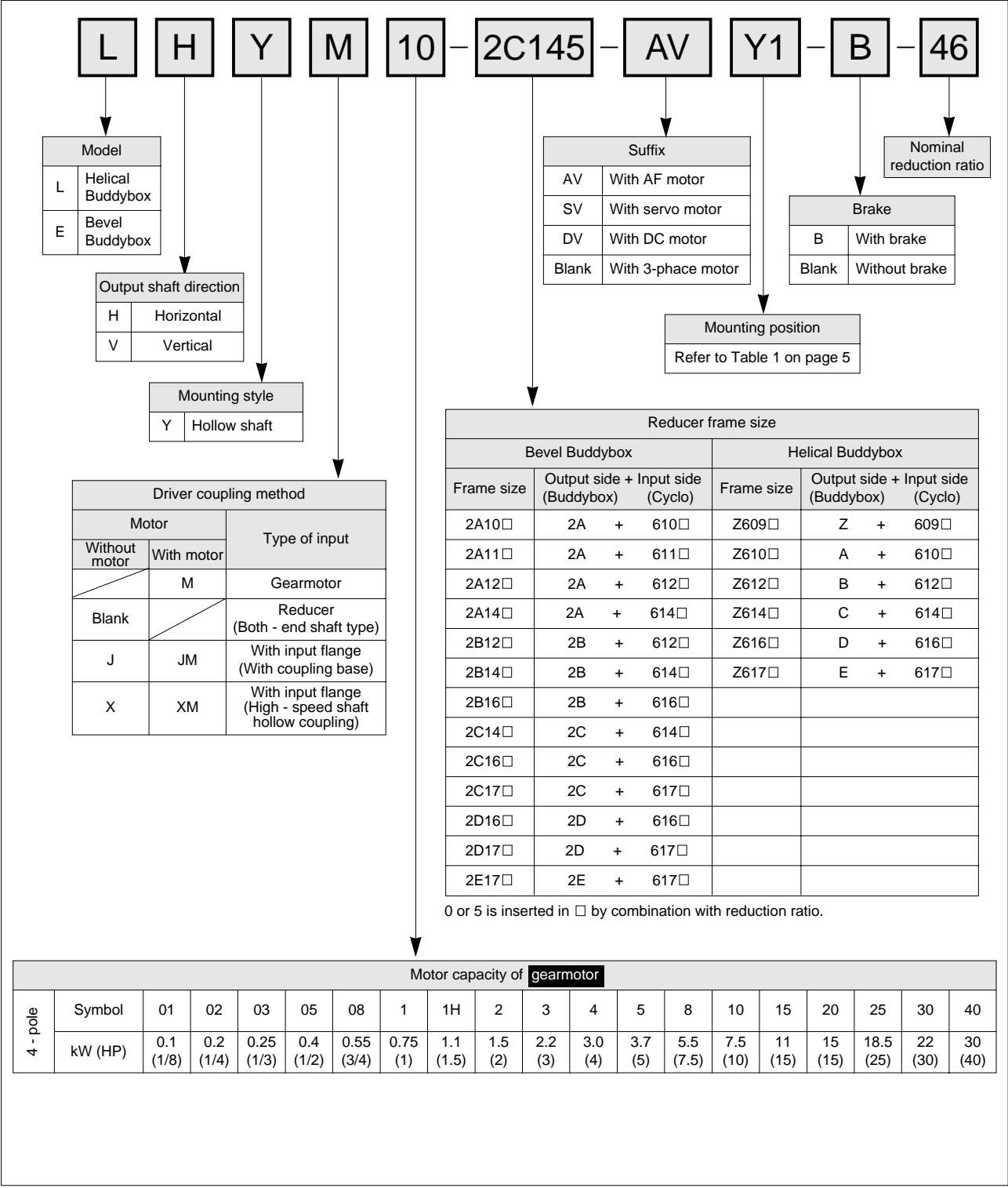


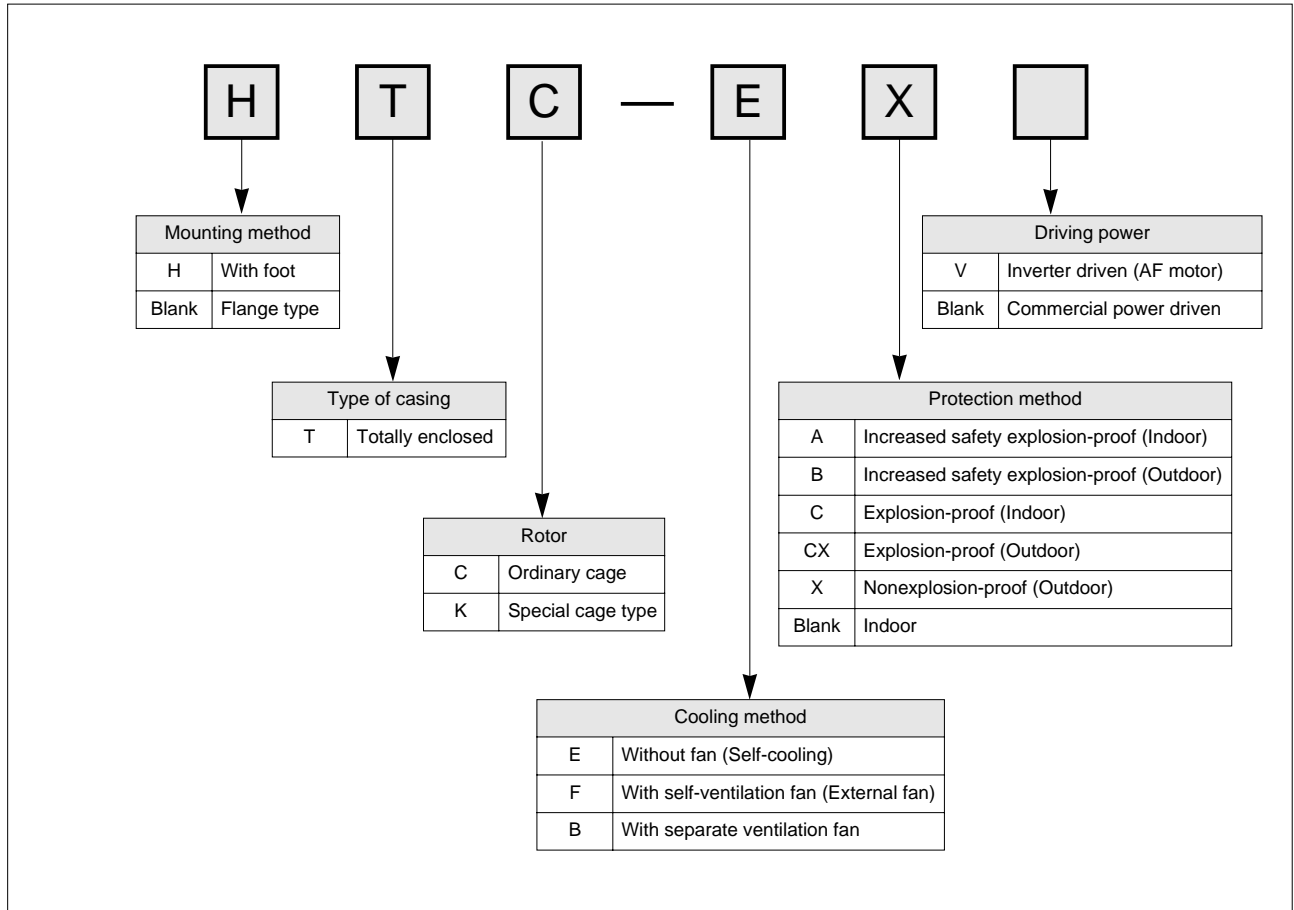
Table 1 Mounting position

Bevel Buddybox		Helical Buddybox	
Y1 	Y2 	Y1 	Y2
Y3 	Y4 	Y3 	Y4
Y5 	Y6 	Y5 	Y6
<p>◇ Oil inlet ◆ Oil level (Overflow hole) ◆ Oil outlet</p> <p>Note: Cyclo Drive for Y2 and Y4 is grease — lubricated, so oil Supply and discharge are unnecessary.</p>		<p>◇ Oil inlet ◆ Oil level (Overflow hole) ◆ Oil outlet</p> <p>Note: Cyclo Drive for Y5 and Y6 is grease — lubricated, so oil Supply and discharge are unnecessary.</p>	

1-4) Nomenclature of motor

Respective codes and motor nomenclature is shown below. Please check top see if the type of gearmotor you have conforms to what you ordered.

• For Buddybox **with a servo motor** or **with a DC motor** , refer to the respective motor maintenance manuals.



2. Storage

When storing gearmotors or reducers for any extended period of time, consider the following important points.

2-1) Storage location

Store the unit in a clean, dry place indoors.

- Avoid storage outdoors or in places with humidity, dust, sudden temperature changes or corrosive gas.

2-2) Storage period

- (1) Storage period should be less than 6 months.
- (2) When the storage period exceeds 6 months, special rust prevention is necessary. Contact us for details.
- (3) Export models need export rust prevention. Contact us for details.

2-3) Use after storage

- (1) Oil seals will deteriorate when exposed to high temperatures and UV rays. Inspect the oil seals before operation.
Replace the oil seals with new ones after long-term storage if there is any sign of deterioration.
- (2) After starting Buddybox, check that there is no abnormal sound, vibration, or heat rise. If supplied as a brakemotor check that the brake operates properly. If any anomaly is observed, contact our nearest agent, distributor, or sales

3. Transport

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 gearmotor or reducer. When a hanging bolt or hole is provided, be sure to use it. After mounting a unit to the equipment, do not hoist the entire equipment using the hanging bolt or hole; otherwise, injury or damage to the equipment and/or lifting device may result.
- Before hoisting, check the weight of the gearmotor or reducer by referring to the rating plate, crate, outline drawing, catalog, etc. Never hoist a unit that exceeds the rating of the crane or other mechanisms being used to lift it; otherwise, injury or damage to the equipment and/or lifting device may result.

5. Coupling with Other Machines

⚠ CAUTION

- Confirm the direction of rotation before coupling the unit with the driven machine. Difference in the direction of rotation may cause injury or damage to the equipment.
- When operating the gearmotor or reducer alone (uncoupled), remove the key that is temporarily attached to the output shaft; otherwise, injury may result.
- Cover the rotating parts; otherwise, injury may result.
- When coupling the gearmotor or reducer 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) Confirmation of direction of rotation

Gearmotor



Figures 3 and 4 show the direction of rotation of the output shaft when wires are connected as shown in Fig.18 on page15.

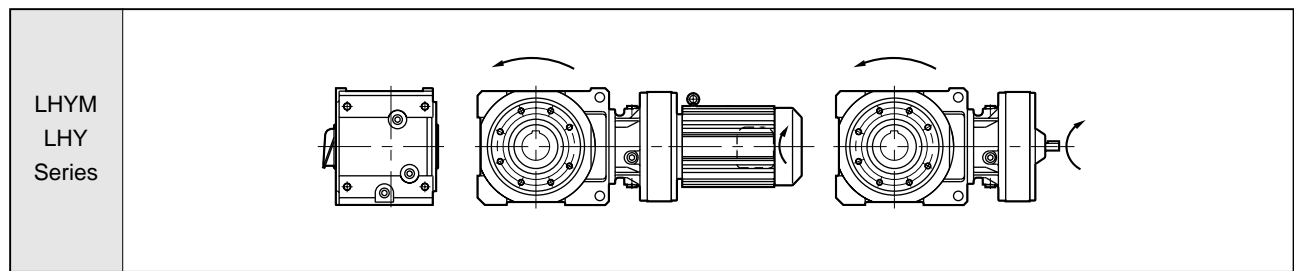
- If wires are connected as shown in Fig.18, the motor shaft will rotate clockwise when viewed from the non-load side. The direction of rotation of the output shaft is shown by the arrows in Fig.3 and 4.
- Change the position of R and T shown in Fig.18 to reverse the direction of rotation.

Reducer



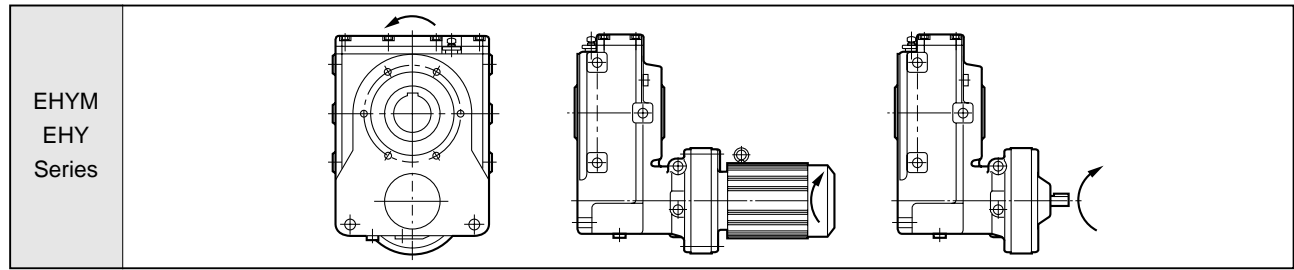
The direction of rotation of the input shaft and that of the output shaft are shown by the arrows in Figs.3 and 4.

Fig3. Direction of rotation of the output shaft of Bevel Buddybox



Note: If the reduction ratio is 11, 18 or exceeds 305, the direction of rotation of the output shaft, when the motor shaft and both-end shaft type input shaft turn clockwise, is opposite to the direction shown above.

Fig4. Direction of rotation of the output shaft of Helical Buddybox



Note: If the reduction ratio is 11, 18 or exceeds 305, the direction of rotation of the output shaft, when the motor shaft and both-end shaft type input shaft turn clockwise, is opposite to the direction shown above.

5-2) Installation of coupling

- When installing a coupling, do not impact or apply excessive thrust load to the shaft ; otherwise, the bearing may be damaged.
- Installation by thermal shrinking is recommended.

(1) When Coupling is used

The accuracy of the dimensions (A, B, and X) shown in Fig.5 should be within the tolerance shown in Table 2.

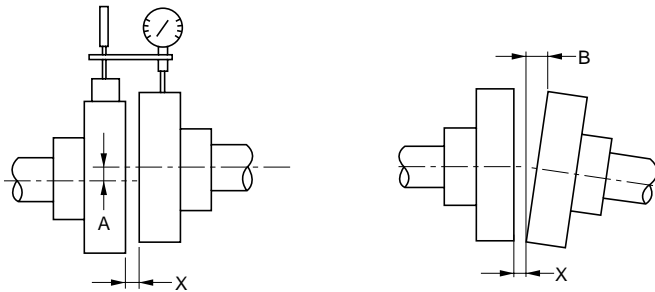


Fig. 5

Table 2 Centering Accuracy of Flexible Coupling

Tolerance for A dimension	0.1mm or maker's specification
Tolerance for B dimension	0.1mm or maker's specification
X dimension	Maker's specification

(2) When chain sprocket and gear are used

- The chain tension angle should be perpendicular to the shaft.
- Refer to the chain catalog for the chain tension magnitude.
- Select sprockets and gears whose pitch diameter are three times the shaft diameter or greater.
- Install sprocket and gears so that their point of load application will be closer to the gearmotor or reducer side with respect to the length of the shaft. (Fig.6)

(3) When V-belt is used

- Excessive V-belt tension will damage the shaft and bearing. Refer to the V-belt catalog for proper tension magnitude.
- The parallelism and eccentricity (β) between two pulleys should be within 20'. (Fig.7)
- Use a matched set with the same circumferential length when more than one belt is to be installed.

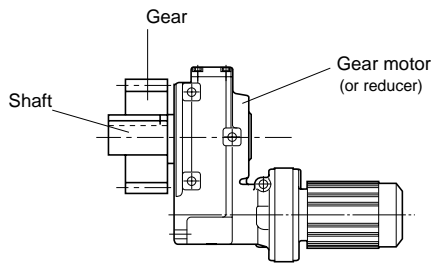


Fig.6

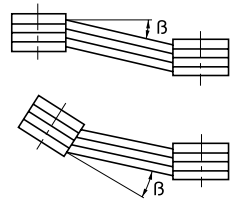


Fig.7

5-3) Coupling hollow shaft type with other machines

(1) Coupling/uncoupling hollow shaft with/from driven shaft.

(a) Coupling with driven shaft; clean and initially degrease all appropriate contact surfaces.

Apply molybdenum disulfide grease to the surface of the driven shaft and the inside of the hollow shaft, and couple the gearmotor or reducer with the driven shaft.

When engagement is tight, slightly strike the edge of the hollow shaft with a mallet. Never hammer the casing and oil seal. When the engagement is excessively tight, make a jig as shown in Fig.8 for smooth insertion.

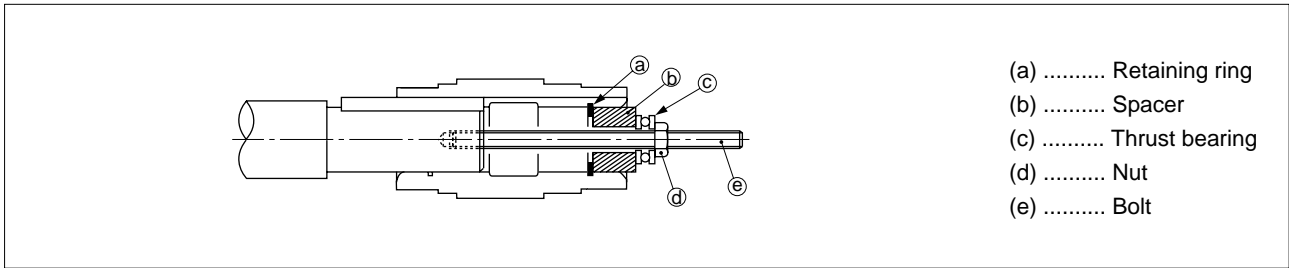


Fig.8 Coupling jig

Hollow shaft fit tolerance conforms to JIS H8. If there is excessive impact or radial load, the engagement between the hollow shaft and the driven shaft should be tight. (A tolerance of JIS js6 or k6 is recommended for the driven shaft.)

(b) Uncoupling from driven shaft

Exercise care so the excessive force will not be applied to the interface between the casing and hollow shaft. Make a jig as shown in Fig.9 for smooth uncoupling. Jigs and parts for coupling, fixing, and uncoupling should be furnished by the customer.

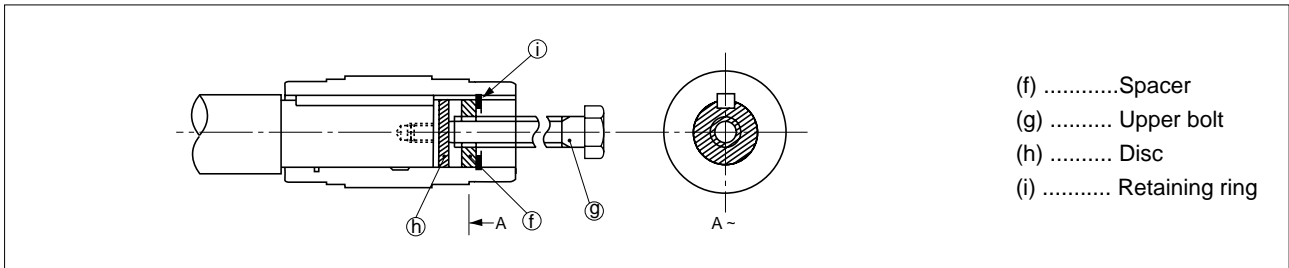


Fig.9 Uncoupling jig

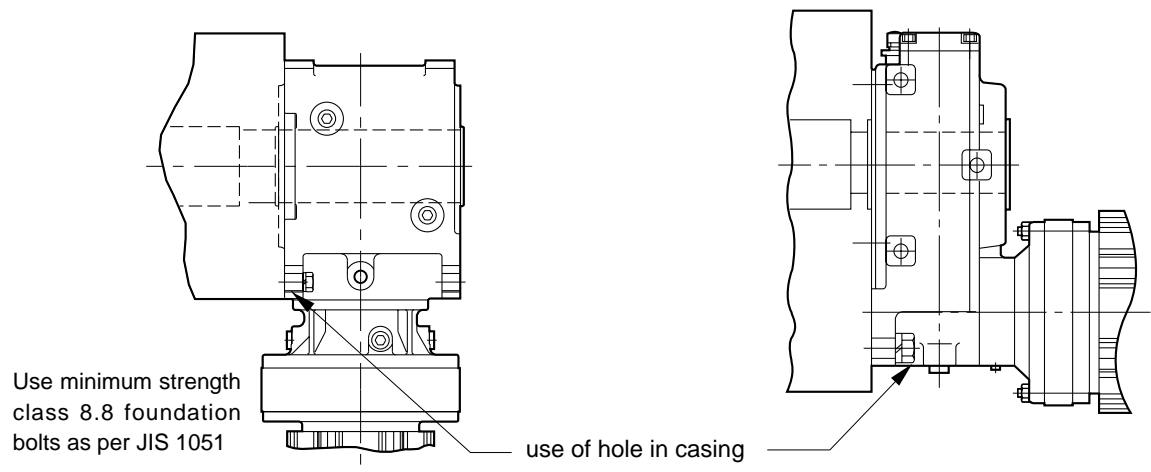
(2) Coupling with other machines

· Exercise care so that the gear motor or reducer will not be pried by the driven shaft and hollow shaft; otherwise, excessive force will be applied.

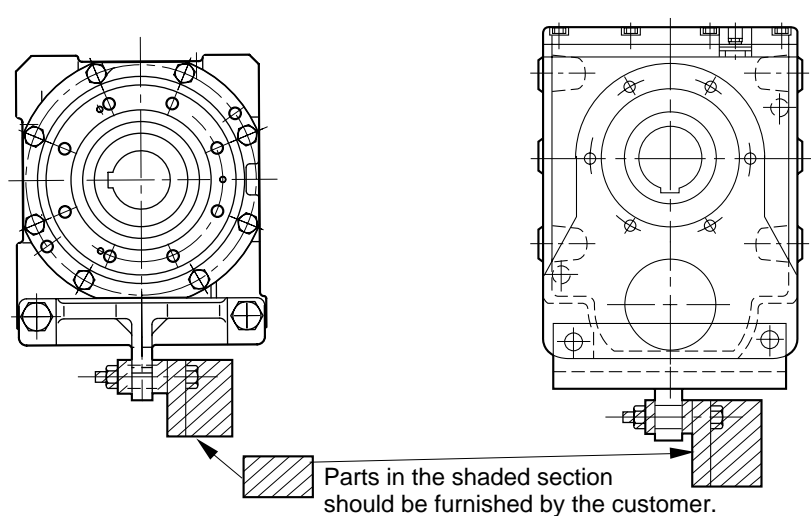
Installation of hollow shaft type torque arm

(a) Whirl-stop for torque arm

Standard installation type



Torque arm (1) Attachment type (Option)



Torque arm (2) Tie-rod type (Option)

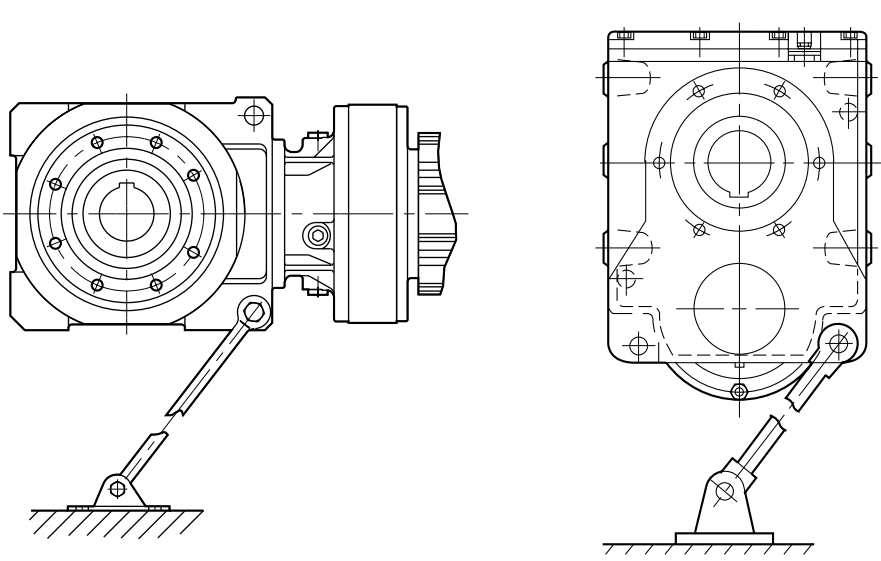
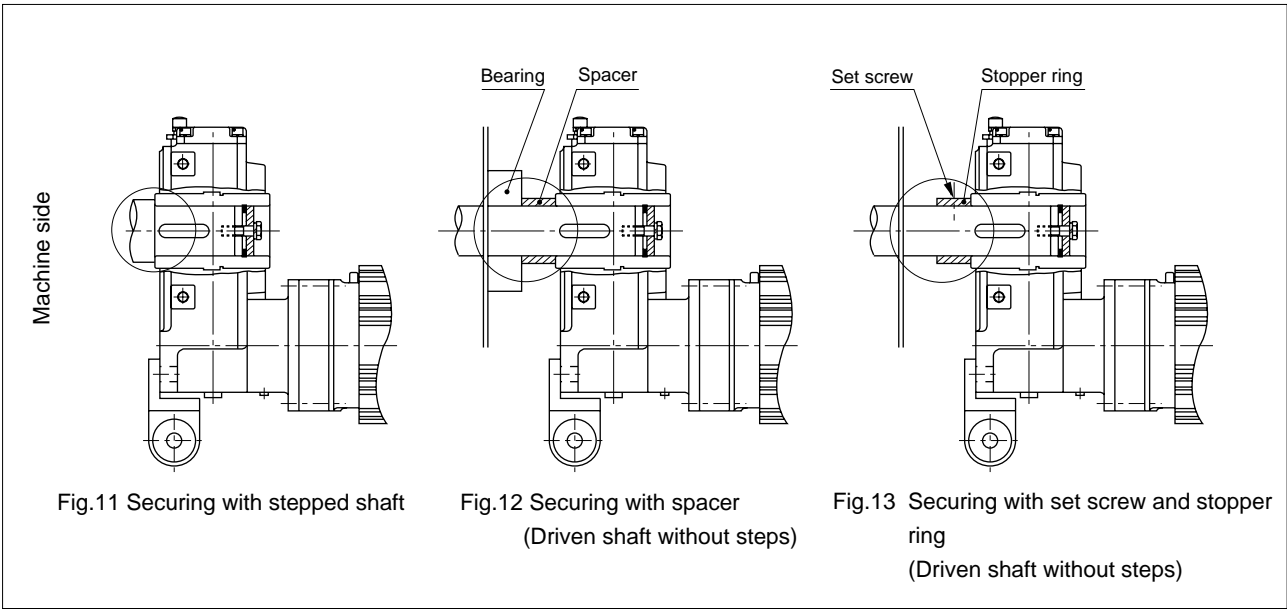


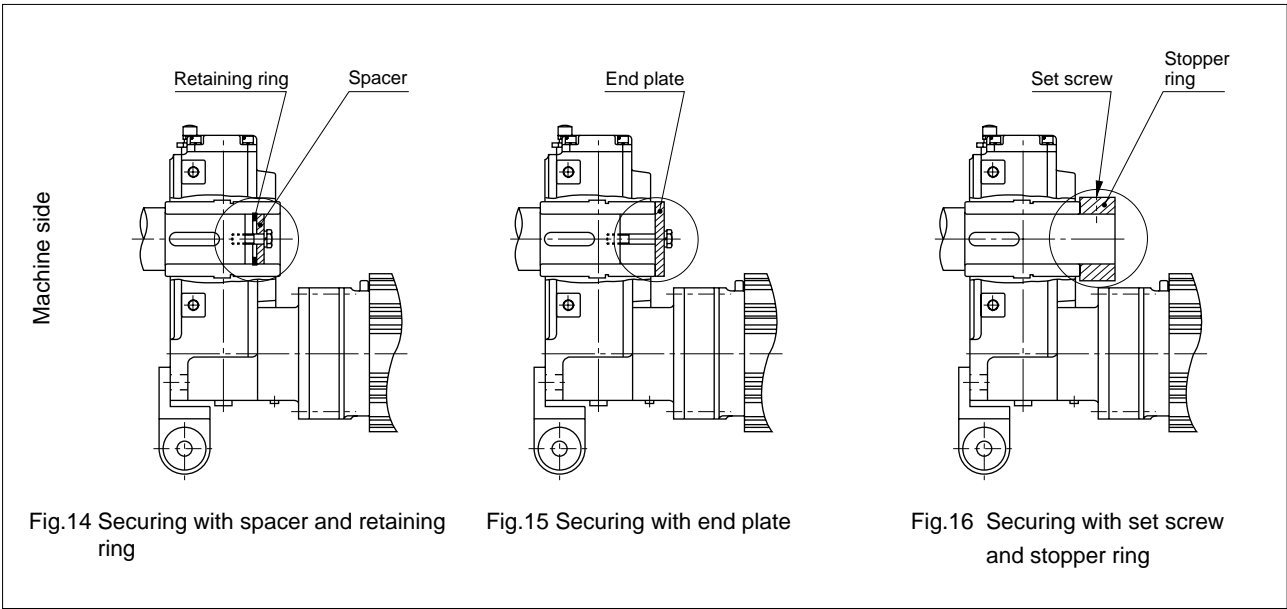
Fig.10 Installation of torque arm

(b) Securing to driven shaft....When whirl-stop is provided for the attachment type or tie-rod type, be sure to secure the gearmotor to the driven shaft.

Example of securing method that prevents the gearmotor from moving to the machine side (EHYM3-A6105 viewed from above)



Example of securing method that prevents the gearmotor from moving to the side opposite to the machine side (EHYM3-A6105 viewed from above)



5-4) Regarding the usage of hollow shaft type Taper-grip.

Please refer to exclusive operating manual in the case taper-grip bashing is used.



6. Wiring

- Wiring for **SUMITOMO standard 3-phase motor** is shown below. Refer to the respective instruction manuals for the motor with a **brake**, **servomotor**, **DC motor**, and **motors made by other companies** when they are used.

⚠ DANGER

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

⚠ CAUTION

- When wiring, follow the technical standards for electric facilities and extension regulations; otherwise, burning, electric shock, injury, or fire may result.
- The motor is not equipped with a protective device. However, it is compulsory to install an overload protector according to the technical standards for electric facilities. It is recommended to install other protective devices (earth leakage breaker, etc.), in addition to an overload protector, in order to prevent burning, electric shock, injury, and fire.
- Never touch the terminals when measuring insulation resistance; otherwise, electric shock may result.
- **When a star-delta starter is adopted**, select one with an electromagnetic switch on the primary side (3-contact type); otherwise, fire may result.
- When a **400V-class inverter** is used for driving the motor, mount a suppresser filter or reactor on the inverter side, or provide reinforced insulation on the motor side; otherwise, fire or damage to the equipment due to dielectric breakdown may result.
- **When driving an explosion-proof type motor with an inverter**, use one inverter for one motor. Use the approved inverter for the motor.
- When measuring the insulation resistance of an **explosion-proof type motor**, confirm that there is no gas, steam, or other explosive atmosphere in the vicinity, in order to prevent possible explosion or ignition.

- Long cables cause voltage to drop. Select cables with appropriate diameter so that the voltage drop will be less than 2%.
- After wiring for outdoor and explosion-proof type motors, check that terminal box mounting bolts are not loose, and attach the terminal box cover correctly.

6-1) How to attach/detach terminal cover (**0.1– 04kW 3-phase motor**)

(1) How to detach

As shown in Fig.17, hold the terminal box by its sides and pull it towards you. The cover will detach.

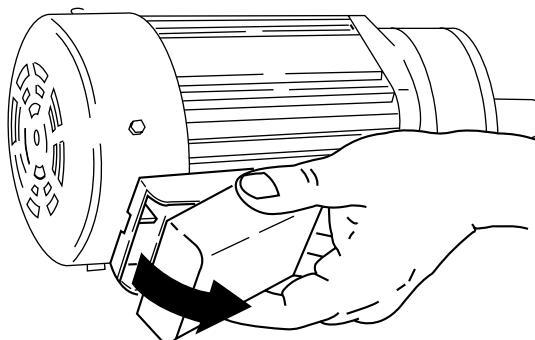


Fig. 17

(2) How to attach

Press the terminal box cover to the terminal box case until it clicks into place.



6-2) Measurement of insulation resistance

· When measuring the insulation resistance, disconnect the motor from the control panel. Check the motor individually.

Measure the insulation resistance before wiring. The insulation resistance (R) varies according to the motor output, voltage, type of insulation, coil temperature, humidity, dirt, period of operation, test electrification time, etc. Usually, the insulation resistance should exceed the values shown in Table 3.

Table 3 Insulation resistance

Motor voltage	Megohmmeter voltage	Insulation resistance (R)
Low-voltage motor of 600V or less	500V	1M (Ω) or more
High-voltage motor of 3000V or more	1000V	5M (Ω) or more

Reference: The following equations are shown in JEC-2100.

$$R > \text{ or } = \frac{\text{Rated voltage (V)}}{\text{Rated output (kW) + 1000}} \quad (\text{M}\Omega)$$

$$R > \text{ or } = \frac{\text{Rated voltage (V) + Speed (r/min)/3}}{\text{Rated output (kW) + 2000}} \quad +0.5 (\text{M}\Omega)$$

A drop in insulation resistance may be attributed to poor insulation. In that case, do not turn on the power. Contact our nearest agent, distributor, or sales office.

6-3) Protection coordination

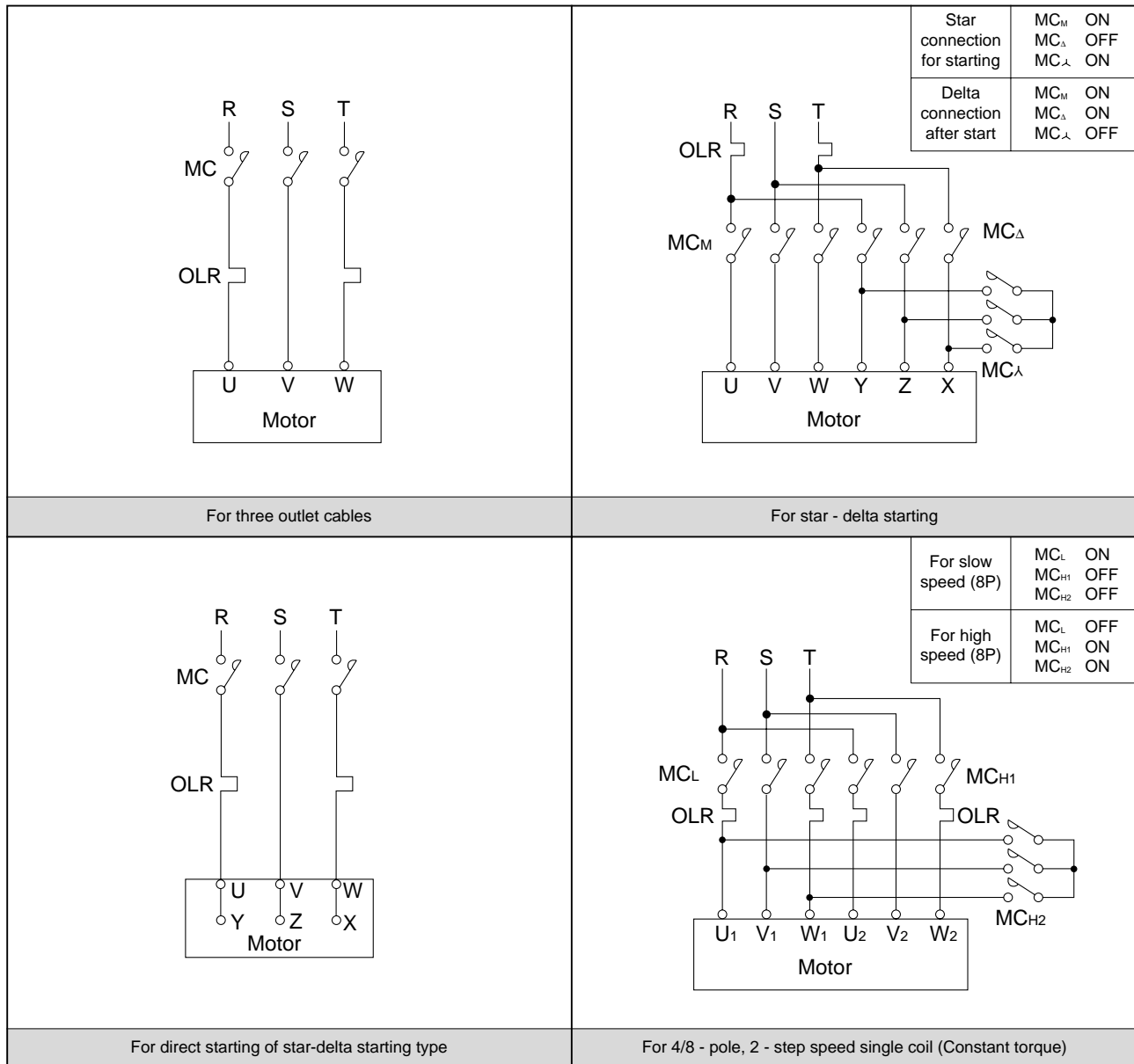
- (1) Use a molded case circuit breaker for protection from short circuit.
- (2) Use an overload protection device that protects the unit when an electric current exceeding that shown on the rating plate flows.
- (3) For an **explosion-proof type motor**, use an overload protector that can protect the unit within the allowable binding hour by means of the locked rotor current shown on the rating plate.



6-4) Motor connection

Fig.18 shows the motor connection and the standard specification for terminal codes.

Fig.18 Motor connection and terminal code



MC : Electromagnetic contactor

OLR: Overload protection device

These should be furnished by the customer.

7. Operation

⚠ DANGER

- Do not approach or touch rotating parts (output shaft, etc.) during operation; otherwise, loose clothing caught in these rotating parts may result in serious injury or death.
- When the power supply is interrupted, be sure to turn off the power switch; otherwise, unexpected resumption of power supply may cause electric shock, injury, or damage to the equipment.
- Do not operate the unit with the terminal box cover removed. After maintenance, return the terminal box cover to the original position; otherwise, electric shock may result.
- Do not open the terminal box cover when an **explosion-proof type motor** is being electrified; otherwise, explosion, ignition, electric shock, injury, fire, or damage to the equipment may result.

⚠ CAUTION

- Do not put fingers or foreign objects into the opening of the gearmotor or reducer; otherwise electric shock, injury, fire, or damage to the equipment may result.
- The gearmotor and reducer will become very hot during operation. Do not touch or come in contact with the unit; otherwise, burns may result.
- Do not loosen the oil filler plug during operation; otherwise, hot, splashing lubricant may cause burns.
- If an anomaly occurs during operation, stop operation immediately; otherwise, electric shock, injury, or fire may result.
- Do not operate the unit in excess of the rating; otherwise, injury or damage to the equipment may result.

- Oil-lubricated models are shipped without any oil inside the units. Proper amount of oil should be supplied before start-up.
- Some models need oil to be supplied in two distinct locations: Output side (Buddybox) and input side (Cyclo).

After the unit is installed, supplied with oil and properly wired, check the following before starting operation.

- (1) Is the wiring correct ?
- (2) Is the coupling with the driven machine correct ?
- (3) Are foundation bolts tightened firmly ?
- (4) Is the direction of rotation as required ?
- (5) Does the oil level in **the oil-lubricated model** reach the lower portion of the overflow hole when the unit is at rest?

After confirming the above items, conduct break-in initially without a load; then gradually apply a load.

Check the items shown in Table 4.

Table 4 Items to check during initial start-up and break-in period

Is abnormal sound or vibration generated ?	<ol style="list-style-type: none"> (1) Is the housing deformed because the installation surface is not flat ? (2) Is resonance generated due to insufficient rigidity of the installation base ? (3) Is the shaft center aligned with the driven machine ? (4) Is the vibration of the driven machine transmitted to the gearmotor or reducer ?
Is the surface temperature of the gearmotor or reducer abnormally high ?	<ol style="list-style-type: none"> (1) Is the voltage rise or drop substantial ? (2) Is the ambient temperature too high ? (3) Does the current flowing to the gearmotor exceed the rated current shown on the rating plate ?

If an anomaly is found, stop operation, and contact our nearest agent, distributor, or sales office.

8. Daily inspection and maintenance

⚠ DANGER

- Do not handle the unit when cables are live. Be sure to turn off the power; otherwise, electric shock may result.
- Do not approach or touch any rotating parts (output shaft, etc.) during maintenance or inspection of the unit; otherwise, loose clothing caught in these rotating parts may result in injury or death.
- Customers shall not disassemble or modify **explosion-proof type motors**; otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- The lead-in condition of an **explosion-proof type motor** shall conform to the technical standards for electric facilities, extension regulations, and explosion-proofing guide, as well as the maintenance manual; otherwise, explosion, ignition, electric shock, or damage to the equipment may result.

⚠ CAUTION


- Do not put fingers or foreign objects into the opening of the gearmotor or reducer; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The gearmotor or reducer will become very hot during operation. Do not touch the unit with bare hands; otherwise, burns may result.
- Do not touch the terminal when measuring insulation resistance; otherwise, electric shock may result.
- Do not operate the unit without a safety cover in place to protect against rotating parts; otherwise loose clothing caught in the unit may cause injury.
- Identify and provide appropriate corrective action in a timely fashion and according to this maintenance manual if any abnormal operating characteristics are observed. Do not operate the unit until corrective action has been taken.
- Change lubricant according to the maintenance manual. Be sure to use lubricant recommended by us.
- Do not change lubricant during operation or right after operation is stopped; otherwise, burns may result.
- Supply/discharge grease to/from the motor bearing according to the maintenance manual, and be careful of rotating parts; otherwise, injury may result.
- Do not use damaged gear motor or reducers; otherwise, injury, fire, or damage to the equipment may result.
- We can not assume any responsibility for damage or injury as a result of an unauthorized modification by a customer.
- Dispose of the gearmotor, reducer, lubricant as general industrial waste.
- When measuring the insulation resistance of an **explosion-proof type motor**, confirm that there is no gas, steam, or other explosive medium around the unit; otherwise, explosion or ignition may result.

- It is recommended to overhaul the gearmotor or reducer after 20,000 hours or 3 to 5 years of operation to ensure a longer service life, although it depends on the operating conditions.
- Overhauls should be done by appropriately skill our factory technician. Please contact our nearest agent, distributor or sales office.

8-1) Daily inspection

To ensure proper and continued optimum operation, use Table 5 to perform daily inspections.

Table 5 Daily inspection

Inspection item	Details of inspection
Electric current 	Is the current below the rated current shown on the rating plate?
Noise	Is there abnormal sound? Is there sudden change in sound?
Vibration	Is the vibration abnormally large? Does vibration change suddenly?
Surface temperature	Is the surface temperature abnormally high? Does the surface temperature rise suddenly? (The temperature rise during operation differs according to the operating conditions and models. When the difference between the temperature of the gear surface and the ambient temperature is approx. 60 degrees, there will be no problem if there is no fluctuation.)
Oil level (Oil - lubricated mode)	Does the oil level in the oil-lubricated model reach the lower portion of the overflow hole when the unit is at rest?
Oil or grease leakage	Does oil or grease leak from the gear section?
Foundation bolt	Are foundation bolts loose?
Chain and V - belt	Are chain and V-belt loose?

When some anomaly is found during the daily inspection, take corrective measures according to section 10.

Troubleshooting (pages 25 and 26.) If the anomaly cannot be eliminated, contact our nearest agent, distributor, or sales office.

8-2) Confirmation of lubrication method

· Refer to the applicable items regarding maintenance. If proper maintenance is not carried out, unit life may decrease.

- (1) Refer to Table 6 to confirm the gear lubrication method for your unit.
- (2) Table 7 lists pages that can be referenced regarding lubrication maintenance.

Table 6 Lubrication method for respective gear types (For driving at standard input speed)

Frame size	Bevel Buddybox	—	2A10□	2A11□	2A12□ 2B12□	2A14□ 2B14□ 2C14□	2B16□ 2C16□ 2D16□	2C17□ 2D17□ 2E17□
	Helical Buddybox	Z609□	A610□	—	B612□	C614□	D616□	E617□
Output side (Buddybox)		Oil bath						
Input side (Cyclo)	Motor: Horizontal	Grease (Maintenance-free)				Oil bath		
	Motor: Vertical	Grease (Maintenance-free)				Grease		

- Notes: 1. 0 or 5 is inserted in □.
 2. Contact us when the input speed is different.
 3. Maintenance-free type.

Table 7 Maintenance manual pages that can be referenced regarding lubrication maintenance

Lubrication method		Supply of oil/grease before initial operation after purchase	Pages where maintenance method is shown			
			Oil/grease change period	Recommended oil/grease	Qty of oil/grease	Disposal of oil/grease
Oil	Self-lubrication	Necessary	8-3)	8-3)	8-3)	8-3)
			(1) P18	(2) P19	(3) P20	(4),(5) P21
Grease	Self-lubrication	Unnecessary	8-4)	8-4)	8-4)	8-4)
			(1) P21	(2) P22	(3) P22	(4) P22

8-3) Supply and chang of oil for oil-lubricated gear

- (1) Oil change interval

Table 8 Oil change interval

Change interval		Operating condition	
Oil supply	Right after purchase		—
	1 st change	500 hrs	
Oil change	Subsequent change	6 months	Operation for 10 hrs max./day
		2500 hrs	Operation for 10 – 24 hrs/day
	1-3 months	Operation in severe environment including high temperature, humidity and active gas presence	

(2) Recommended lubricants

Be sure to use a lubricant recommended by our company.

Table 9 Recommended lubricants (Equivalent to SP type industrial extreme-pressure gear oil or JIS K2219)

Ambient temp.	Gulf Oil	Esso Oil	Mobil Oil	Shell Oil	Caltex Oil	BP Oil
-10°C to 5°C	EP Lubricant HD 68	Spartan EP 68	Mobil gear 626 (ISO VG 68)	Omala Oil 68		Energol GR-XP 68
0°C to 35°C	EP Lubricant HD 100 HD 150	Spartan EP 100 EP 150	Mobil gear 627 629 (ISO VG100,150)	Omala Oil 100 150	Meropa 100 150	Energol GR-XP 100 GR-XP 150
30°C to 50°C	EP Lubricant HD 220 HD 320 HD 460	Spartan EP 220 EP 320 EP 460	Mobil gear 630 632 633 634 (ISO VG220-460)	Omala Oil 220 320 460	Meropa 220 320 460	Energol GR-XP 220 GR-XP 320 GR-XP 460

- ① For use in winter or at comparatively low temperatures, use a lubricant with low viscosity.
- ② Table 10 shows allowable viscosities. The viscosity you use should not exceed the standard range shown.

Table 10 Allowable viscosities

Min. allowable viscosity	15 mm ² /s or more at operating oil temperature		Viscosity that ensures oil film strength adequate for load transmission
Max. allowable viscosity	Oil-bath lubrication	4300 mm ² /s max.	Viscosity that permits start-up of Buddybox

- ③ For smooth start-up, use oil with a pour point 5°C lower than the ambient temperature.
- ④ When operating conditions vary greatly, use oil with a high viscosity index meeting requirements of ② and ③.
- ⑤ When the unit is operated in ambient temperatures either below or above the 0-40°C range, it may be necessary to either preheat or cool the lubricant and/or use special parts. Contact us for details.

(3) Qty of oil

Tables 11 and 12 show approx. quantity of oil. Be sure to check the oil level through the overflow hole (Helical Buddybox) or by oil gauge (Bevel Buddybox).

Table 11 Approx qty of oil for Bevel Buddybox (ℓ)

Output side: Buddybox Input side : Cyclo - : Glease

	Mounted Method											
	Y1		Y2		Y3		Y4		Y5		Y6	
	Output side	Input side	Output side	Input side	Output side	Input side	Output side	Input side	Output side	Input side	Output side	Input side
2A10□	1.1	-	1.0	-	1.1	-	1.0	-	1.7	-	1.6	-
2A11□		-		-		-		-				
2A12□		-		-		-		-				
2A14□		0.3		-		0.3		-		0.3		-
2B12□	1.8	-	1.4	-	1.8	-	1.8	-	2.3	-	2.5	-
2B14□		0.45		-		0.45		-		0.45		-
2B16□		0.75		-		0.75		-		0.75		-
2C14□	3.3	0.45	3.5	-	3.3	0.45	4.4	-	3.6	0.45	5.3	0.45
2C16□		0.75		-		0.75		-		0.75		-
2C17□		1.05		-		1.05		-		1.05		-
2D16□	4.4	0.7	5.0	-	4.4	0.7	4.2	-	5.6	0.7	6.0	0.7
2D17□		0.9		-		0.9		-		0.9		-
2E17□	7.4	0.9	7.3	-	7.4	0.9	6.0	-	7.2	0.9	10.6	0.9

0 or 5 is inserted in □.

Table 12 Approx. qty of oil Helical Buddybox (ℓ)

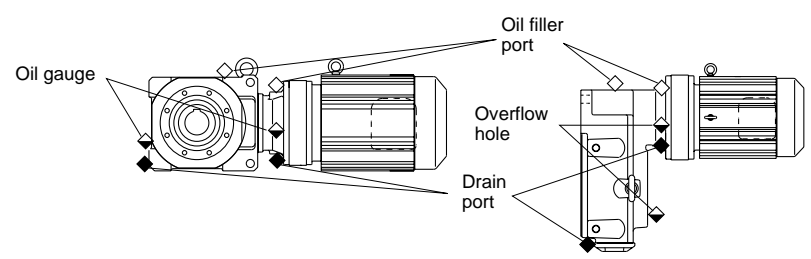
		Y1	Y2	Y3	Y4	Y5	Y6
Z609□	Output side (Buddybox)	0.6	0.6	0.5	0.6	1.1	1.0
	Input side (Cyclo)	-	-	-	-	-	-
Z610□	Output side (Buddybox)	0.8	0.9	0.7	0.9	1.5	1.4
	Input side (Cyclo)	-	-	-	-	-	-
B612□	Output side (Buddybox)	1.0	1.5	1.0	1.5	2.0	1.8
	Input side (Cyclo)	-	-	-	-	-	-
C614□	Output side (Buddybox)	1.7	2.1	1.3	2.1	4.7	3.5
	Input side (Cyclo)	0.4	0.4	0.4	0.4	-	-
D616□	Output side (Buddybox)	2.7	3.5	2.0	3.5	7.0	5.5
	Input side (Cyclo)	0.7	0.7	0.7	0.7	-	-
E617□	Output side (Buddybox)	3.5	4.2	2.5	4.2	9.0	7.0
	Input side (Cyclo)	0.9	0.9	0.9	0.9	-	-

0 or 5 is inserted in □.

(4) Oil supply

- Be sure to supply oil when the unit is at rest, and not operating.
- When the viscosity of oil is high, it may take some time until the oil level uniformly settles. Be careful not to supply too much oil.
- Depending on the viscosity of lubricant, the oil level may drop during operation, but additional oil supply is unnecessary. Check the oil level when the unit is at rest.
- Some models have two oil filler ports: Output side (Buddybox) and input side (Cyclo).
- It may take some time until the oil level in input side (Cyclo) uniformly settles. Be sure not to supply too much oil.

- a) Bevel Buddybox
- ① Remove the plug from the oil filler port.
 - ② Supply oil from the oil filler port over making sure of the oil level.
 - ③ After for a while, check that the oil level is at the center of the oil gauge.
 - ④ Wrap seal tape around the plug of the oil filler port and attach it.
- b) Helical Buddybox
- ① Remove the plug from the oil filler port and overflow hole.
 - ② Supply oil from the oil filler port until it overflows through the ouverflow hole.
 - ③ Check that the oil level is at the lower surface of the overflow hole.
 - ④ Wrap seal tape around the plugs of the oil filler port and the overflow hole, and attach them.



(5) Oil discharge

Remove the drain plug to discharge oil.

Fig.19 Locations of oil supply/discharge ports
(ex. LHYM-Y1 (left), EHYM-Y1 (right))

(6) Long-term stoppage

Table 13 Long-term stoppage

Stoppage period	Approx. 1 month	Change the oil and operate the unit for several minutes before stopping the unit.
	More than 1 month	Flush the unit, supply rust-preventive oil, and operate the unit without a load for several minutes before stopping the unit.

· Before starting operation after long-term stoppage, always change the oil. This will ensure correct lubricant free from deterioration that may have been caused from the long-term stoppage.

8-4) Replenishment and change of gease for grease-lubricated type on the input side (Cyclo)

(1)Grease replenishment/change interval

Table 14 Grease supply/change intervals

Model	Grease supply/change interval
Maintenance-free series (■ section in Table 6 on page 18)	Long-life grease (ALVANIA GREASE RA) is supplied with these modesl, so operation can be continued for extended operating periods. However, disassembly to change the grease after 20,000 hr or 3 to 5 years operation will ensure a longer service life.
Gease-lubricated models other than maintenance-free	Refer to Tables 15 and 16 for supply and change of grease.

Table 15 Grease replenishment interval
(Excl.maintenance-free type)

Hours of operation	Replenishment interval	Remarks
10 hr max./day	3 – 6 months	Shorten the supply interval when the operating conditions are severe or the frame size is large.
10 – 24 hr/day	500 – 1000 hrs	

Table 16 Grease change interval
(Excl. maintenance-free type)

Change interval	Remarks
Every 20,000 hrs or 3—5 years	Shorten the supply interval when the operating conditions are severe or the frame size is large.

(2) Recommended grease

Table 17 Recommended grease

Ambient temperature °C	Reduction ratio	Unit			
		i)	ii)		iii)
			2A14□, 2B14□, 2C14□ 2B16□, 2C16□, 2D16□		
		2A10□, 2A11□ 2A12□, 2B12□ Z609□, A610□, B612□	C614□, C616□		2C17□, 2D17□, 2E17□ E417□
-10—50	11,18	Shell Oil	Shell Oil		Shell Oil
		ALVANIA GREASE EPR.O	ALVANIA GREASE EPR.O		ALVANIA GREASE EPR.O
	21—	Shell Oil	Cosmo Oil	Shell Oil	Shell Oil
		ALVANIA GREASE RA	COSMO GREASE DYNAMAX SH No.2	ALVANIA GREASE 2	ALVANIA GREASE EP2

0 or 5 is inserted in □.

- Do not use any grease other than those shown in Table 17.
- Models ii) in Table 17 are filled with COSMO GREASE DYNAMAX SH No.2 before shipment from our factory.
- The two kinds of grease for ii) in Table 17 may be mixed with each other.
- When the ambient temperature continuously exceeds the range of 0 – 40°C, modified specifications are needed.

(3) Quantity of grease

Table 18 shows the quantity of grease required when grease needs to be changed. Approximately 1/3 – 1/2 of the volume of the reduction mechanism section is appropriate.

Table 18 Qty of grease on exchanging

Input side (Cyclo)	Bevel Buddybox	Frame size		2A10□	2A11□	2A12□	2A14□	2B12□	2B14□	2B16□	2C14□	2C16□	2C17□	2D16□	2D17□	2E17□
		Reduction portion	Qty of grease (g)	110	250	260	490	260	490	820	470	790	1100	780	100	1000
		Slow speed shaft bearing portion	Qty of grease (g)	58	70	78	130	97	130	300	130	300	520	300	520	520
Helical Buddybox	Frame size		Z609□	A610□	B612□	C614□	D616□	E617□								
	Reduction portion	Qty of grease (g)	60	100	240	450	750	1000								
	Slow speed shaft bearing portion	Qty of grease (g)	65	110	140	300	300	500								

- 0 or 5 is inserted in □.
- Maintenance-free type.
- Output sides are oil both type lubrications for all models.

(4) Supply and discharge of grease

Procedure for supplying grease for **grease-lubricated models** (excl. maintenance-free type)

- ① Remove the grease discharge plug from the outside cover.
- ② Supply grease with a grease gun from the grease nipple in the inside cover section or motor connection cover.
- ③ Attach the grease discharge plug.

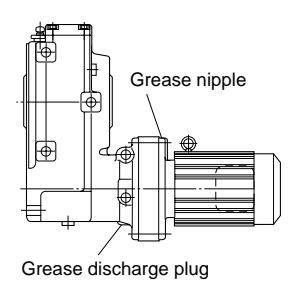


Fig.20 Location of grease discharge port (ex. EHYM type)

- Supply grease during operation to ensure proper, uniform circulation.
- Supply grease slowly.
- Grease supply exceeding the quantity shown in Table 18 will cause temperature rise due to agitation heat or leakage of grease into the motor.
- Supply a large quantity of grease to bearings (especially to eccentric bearings), pins, rollers, and toothed section of the cyclo discs. (Refer to 10. Construction Drawing on pages 27 and 28.)

Grease change for **grease-lubricated models and maintenance-free series**.

- Long-life grease is supplied for extended operating periods. However, it is recommended to overhaul the gear motor or reducer after 20,000-hours or 3 to 5 years of operation for longer service life.
- Overhauls should be done by appropriately skilled our factory technicians. Please contact our nearest agent, distributor or sales office.

9. Disassembly and Assembly

⚠ DANGER

- Customers shall not disassemble or modify **explosion-proof type motors**; otherwise, explosion, ignition, electric shock or damage to the equipment may result.

⚠ CAUTION

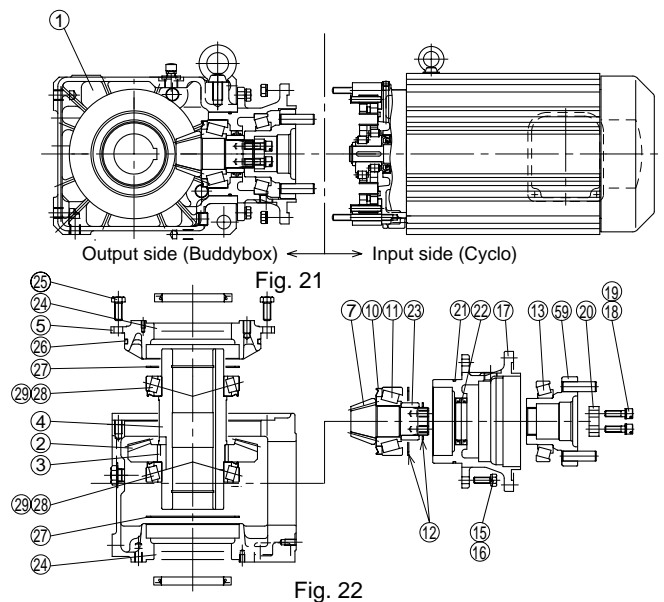
- Trained technicians should repair, disassemble and assemble gearmotors or reducers; otherwise, electric shock, personal injury, fire, or damage to the equipment may result.

- To avoid injury, take care when working around keyways and parts having sharp edges. Observe all safety precautions.
- Avoid disassembling gearmotors or reducers in dusty or humid locations.
- Keep screws and other small parts in a box to avoid losing them.
- Take care not to damage parts. Avoid contact with dust and water.
- After disassembly, clean and inspect all parts. Replace all damaged parts.

9-1) Disassembly of Bevel Buddybox Gear Portion

Discharge oil from **the oil lubricated unit** before the disassembly.

(Refer to 8-3 (5) oil discharge on page 21)



Disassembly of mainparts

Follow these steps to disassemble the unit. (Refer to Fig.21 and 22)

- (1) Place the unit with the output side (Buddybox) up → Remove the bolts for ring gear housing → Separate the output side (Buddybox)
- (2) Pinion shaft
Remove bolts ⑮ → Separate flanged casing ⑰ from casing ① using screw holes on flanged casing ⑰ → Remove hex socket head bolts ⑱, spring washer ⑲ and end plate ⑳ → Push out pinion shaft ⑦ using press.
- (3) Output shaft
Remove bolts ⑳ → Separate cover ⑤ from casing ① using screw holes on cover ⑤ → Disassemble parts in order of the following: Output Shaft ④, Gear ②, Key ③, Output shaft bearing ⑳, Nilosring ㉑, Shim ㉒.

9-2) Assembly of Bevel Buddybox Gear Portion

Assembly procedures are the reverse of disassembly procedures.

9-3) Disassembly of Helical Buddybox Gear Portion

Discharge oil from **the oil lubricated unit** before the disassembly.
 ([8-3 (5) Oil discharge] on page 21)

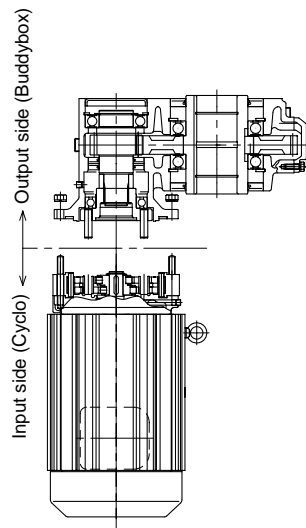


Fig.23

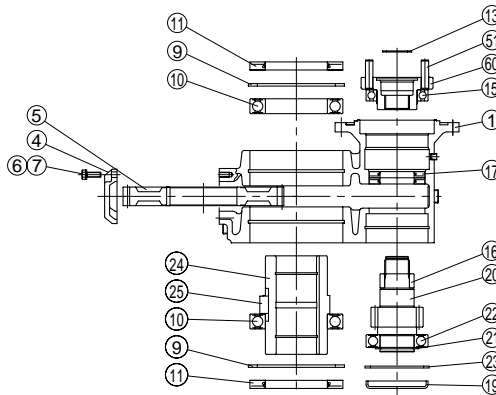


Fig.24

Disassembly of main parts

Follow these steps to disassemble the unit. (Refer to Fig. 23 and 24)

- (1) Place the unit with the output side (Buddybox) up → Remove the bolts for ring gear housing → Separate the output side (Buddybox)
- (2) Pinion shaft
 Remove seal cap ⑱ and retaining ring ⑬, ⑲ → Push out pinion shaft ⑳ using press → Disassemble parts according to the following steps: Retaining ring ㉑, Pinion shaft A bearing ㉒, Oil seal ⑰, Pinion shaft B bearing ⑮.
- (3) Output shaft
 Remove oil seal ⑪ and retaining ring ⑨ → Push out output shaft ㉔ using press → Disassemble parts in order of the following : Output bearing ⑩, Key ㉕.

9-4) Assembly of Bevel Buddybox Gear Portion

Assembly procedures are reverse of disassembly procedures.


10. Troubleshooting

If an anomaly occurs in the gearmotor or reducer, refer to Table 19 below and take appropriate measures as soon as possible. If the anomaly can not be eliminated, contact our nearest agent, dealer or sales office.

Table 19 Troubleshooting

Problem		Possible cause	Correction	
	The motor will not operate under load.	Power failure	Contact the electric power company.	
		Defective electric circuit	Check the circuit.	
		Blown fuse	Replace the fuse with a new one.	
		Protective device is engaged	Disengage protective device.	
		Load locking	Check the load and safety device.	
		Poor switch contact	Adjust the contact area section.	
		Disconnection of motor stator coil	Return the unit to factory for servicing.	
		Bearing is broken	Return the unit to factory for servicing.	
		3-phase is functioning as single-phase.	Check the power supply with a voltmeter. Check the motor, coil in the transformer, contactor, fuse, etc. and repair or replace them.	
The motor runs without a load but the output shaft does not rotate.		Damage due to overloading of gears	Return the unit to factory for servicing.	
The output shaft turns without a load	When a load is applied	The switch is heated.	Insufficient capacity of switch	Replace the switch with a specified one.
			Overload	Decrease the load to the specified value.
		Fuse tripping	Insufficient capacity of fuse	Replace the fuse with a specified one.
			Overload	Decrease the load to the specified value.
		The speed will not increase and the motor is overheating.	Voltage drop	Contact the electric power company.
			Overload	Decrease the load to the specified value.
	The motor stops.	Short-circuited motor stator coil	Return the unit to factory for servicing.	
		The key is missing	Install a key.	
		The bearing is burned.	Return the unit to factory for servicing.	
	The motor runs in the reverse direction.	Poor adjustment of protective device	Adjust the protective device.	
		Connection error	Change the connection.	
	Fuse tripping	The outlet wire is short-circuited.	Return the unit to factory for servicing.	
Poor contact between motor and starter		Complete the connection.		
Excessive temperature rise		Overload	Decrease the load to the specified value.	
		Voltage drop or voltage rise	Contact the electric power company.	
		The ambient temperature is high.	Improve the ventilation method.	
		Damaged bearing or gear	Return the unit to factory for servicing.	
Oil leakage	Leakage of oil/grease from input/output shaft section	Damaged oil seal	Return the unit to factory for servicing.	
	Leakage of oil/grease from the contact surfaces of frame and outside cover	Loose bolts	Tighten bolts correctly.	
	Leakage of oil/grease into motor	Damaged oil seal	Replace the oil seal with a new one.	
		Excessive oil/grease supply	Remove excess oil/grease.	
Abnormal sound Abnormal vibration		Entry of dust and foreign matter into bearings or damaged bearings.	Return the unit to factory for servicing.	
		Damaged gear.	Return the unit to factory for servicing.	
		Distortion of housing because the installation surface is not flat	Make the installation base flat or make adjustment using shims.	
		Resonance due to insufficient rigidity of installation base	Reinforce the installation base to increase rigidity.	
		Nonalignment of shaft with driven machine	Align the shaft centers.	
		Transmission of vibration from the driven machine	Individually operate the gearmotor or reducer to check the source of the sound.	
Abnormal sound from motor		Entry of foreign matter	Remove the foreign matter.	
		Damaged bearings	Return the unit to factory for servicing.	

Table19 Troubleshooting

Problem		Possible cause	Correction
Inverter tripping	Shut-off due to overcurrent	Sudden acceleration/deceleration	Make the acceleration/deceleration time longer.
		Sudden change in load	Decrease the load change.
	Grounding overcurrent	Grounding on the output side	Make correction to eliminate grounding.
	DC overcurrent	Short-circuiting on the output side	Make correction to eliminatge short-circuiting. Check cables.
	Shut-off due to regenerative overvoltage	Sudden deceleration	Make the deceleration time longer. Reduce the braking frequency.
	Thermal relay operation	Overloading	Decrease the load to the specified value.

11. Construction Drawing

11-1) Construction of gearmotor and reducer

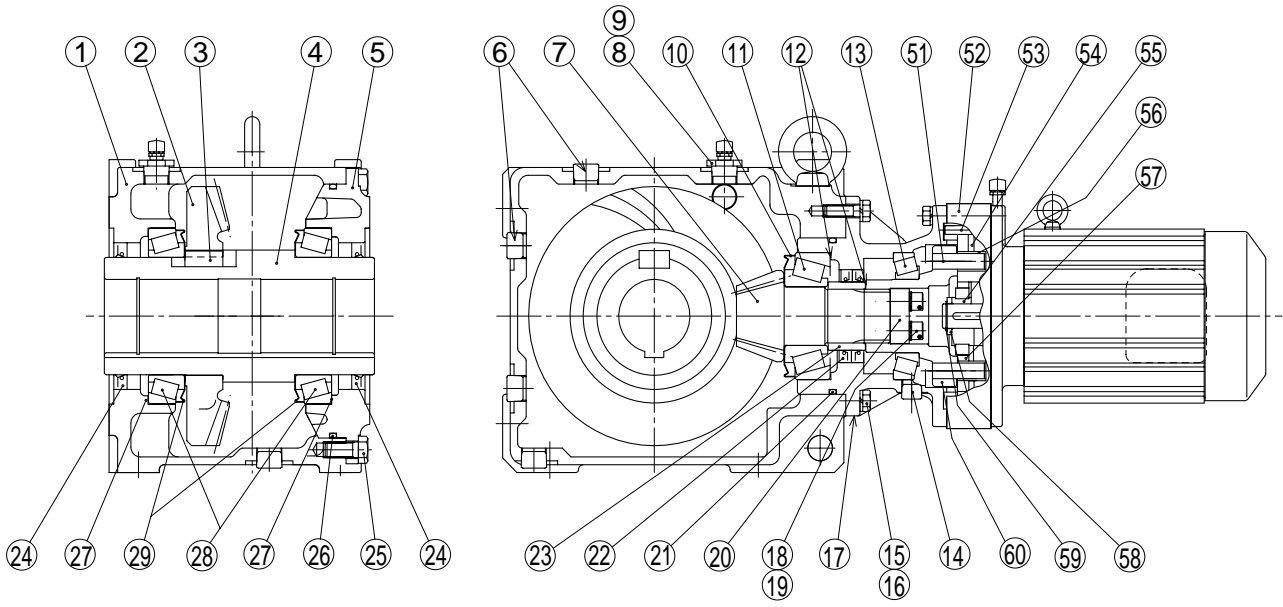


Fig.25 LHYM3-2C145

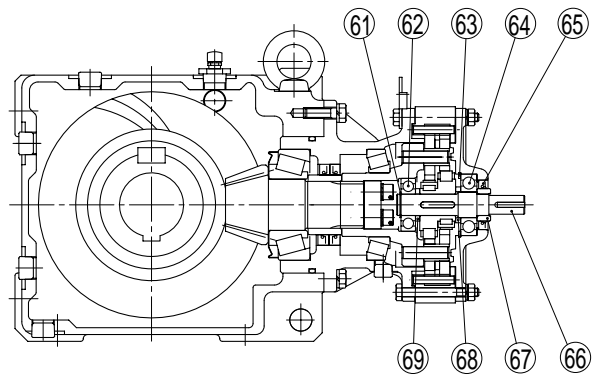


Fig.26 LHY-2C145

Table20 Main parts of Bevel Buddybox gears

No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Casing	16	Spring washer	51	Pin carrier pin	66	High speed shaft
2	Gear	17	Flanged casing	52	Ring gear housing	67	Collar
3	Rectangular parallel key	18	Hexagon socket head bolt	53	Ring gear pin	68	Spacer
4	Hollow shaft	19	Spring washer	54	Spacer ring	69	Spacer
5	Cover	20	End plate	55	Eccentric bearing		
6	Hexagon socket head plug	21	O-ring	56	Pin carried roller		
7	Pinion shaft	22	Oil seal	57	Cycloid disc		
8	Bush	23	Collar	58	Spacer		
9	Air vent	24	Oil seal	59	External retaining ring		
10	Nilosring	25	Hexagon head bolt	60	Pin carrier		
11	Pinion shaft A bearing	26	O-ring	61	External retaining ring		
12	Shim	27	Shim	62	High speed shaft A bearing		
13	Pinion shaft B bearing	28	Output shaft bearing	63	Internal retaining ring		
14	Hexagon socket head plug	29	Nilosring	64	High speed shaft B bearing		
15	Hexagon head bolt			65	Oil seal		

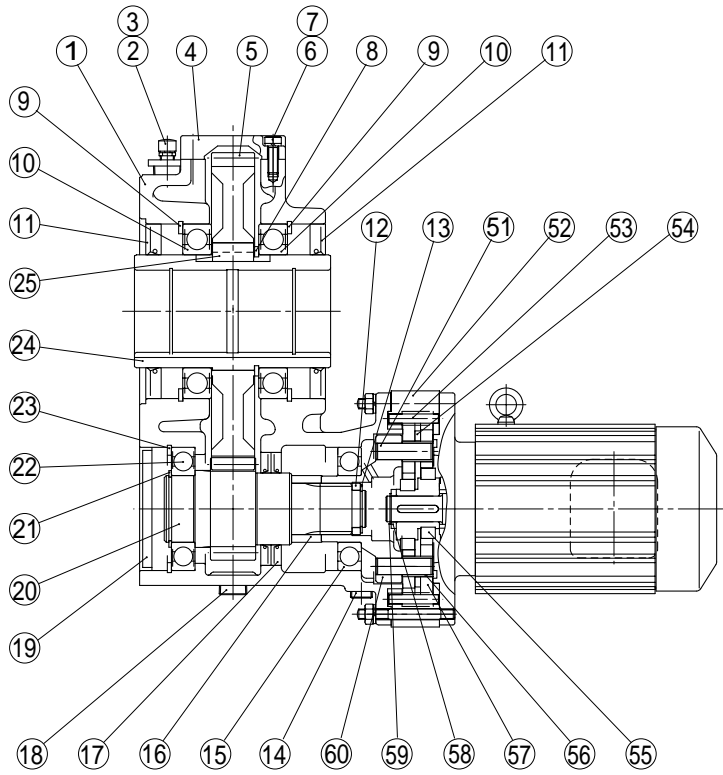


Fig.27 EHYM3-C6145

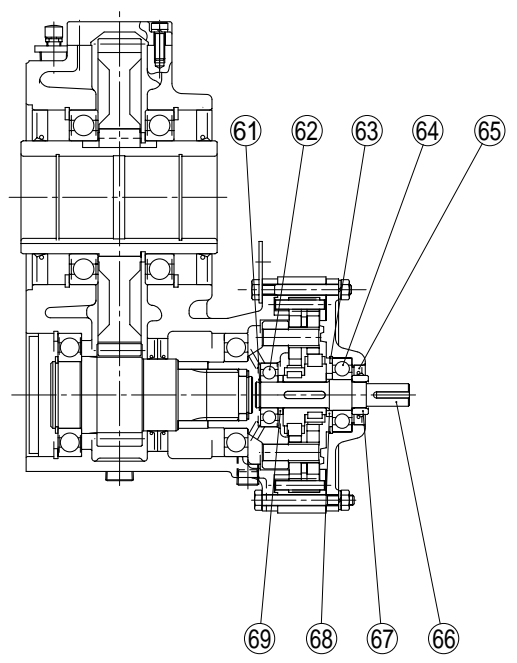


Fig.28 EHY-C6145

Table 21 Main parts of Helical Buddybox gears

No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Casing	14	Hexagon socket head plug	51	Pin carrier pin	64	High speed shaft B bearing
2	Bush	15	Pinion shaft B bearing	52	Ring gear housing	65	Oil seal
3	Air vent	16	Pinion shaft spacer	53	Ring gear pin	66	High speed shaft
4	Cover	17	Oil seal	54	Spacer ring	67	Collar
5	Gear	18	Hexagon socket head plug	55	Eccentric bearing	68	Spacer
6	Hexagon head bolt	19	Seal cap	56	Pin carrier roller	69	Spacer
7	Spring washer	20	Pinion shaft	57	Cycloid disc		
8	External retaining ring	21	External retaining ring	58	Spacer		
9	Internal retaining ring	22	Pinion shaft A bearing	59	External retaining ring		
10	Output shaft bearing	23	Internal retaining ring	60	Pin carrier		
11	Oil seal	24	Hollow shaft	61	External retaining ring		
12	Spacer	25	Rectangular parallel key	62	High speed shaft A bearing		
13	External retaining ring			63	Internal retaining ring		

11-2) Construction drawing of motor (for direct coupling with Cyclo drive)

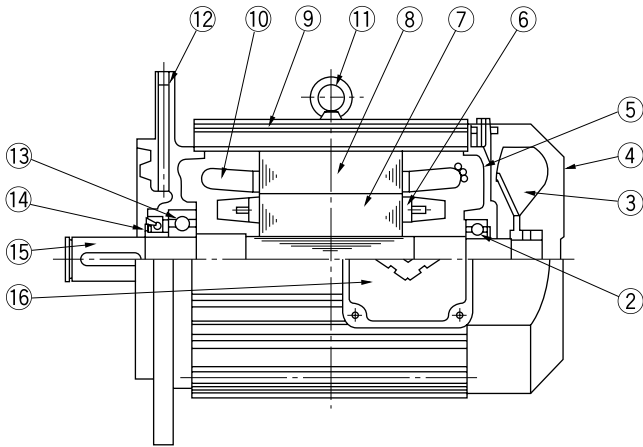


Fig.29 Example of construction of 80—112M frame

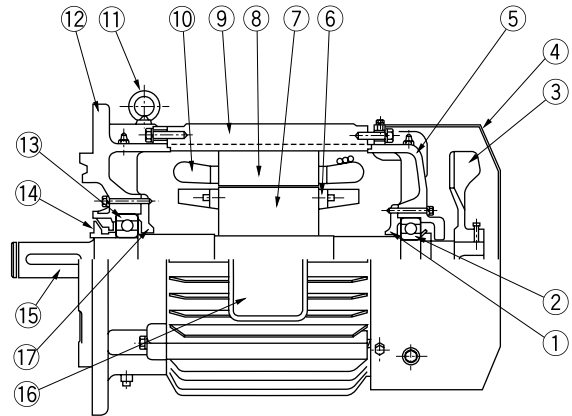


Fig.30 Example of construction of frame size 180 or above

Table 22 Main parts of motor

No.	Part name	No.	Part name	No.	Part name
1	Bearing cover	7	Rotor core	13	Motor shaft bearing A
2	Motor shaft bearing B	8	Stationary core	14	Oil slinger (Oil seal)
3	Fan	9	Stator frame	15	Motor shaft
4	Fan cover	10	Stator windings	16	Conduit box
5	End bracket	11	Eyebolt	17	Bearing cover
6	Rotor conductor short circuit ring	12	Cyclo flange bracket		

12. List of Bearings and Oil Seals

12-1) Bearing

Tables 23—27 shows the types of bearings according to frame size. The numbers in the tables indicate the part No. shown in the construction drawings (Fig.25—28).

0 or 5 is inserted in □.

Table 23 Output shaft bearing

Bevel Buddybox		Helical Buddybox	
Frame size	㉘	Frame size	㉙
—	—	Z609□	6013ZZ
2A10□	32017XU	A610□	6017ZZ
2A11□			
2A12□			
2A14□			
2B12□	32020XU	B612□	6020ZZ
2B14□			
2B16□			
2C14□	32024XU	C614□	6022ZZ
2C16□			
2C17□			
2D16□	32028XU	D616□	6026ZZ
2D17□			
2E17□	32032XU	E617□	6030ZZ

Table 24 Pinion shaft A bearing

Bevel Buddybox		Helical Buddybox	
Frame size	㉑	Frame size	㉒
—	—	Z609□	6207ZZ
2A10□	32308U	A610□	6208ZZ
2A11□			
2A12□			
2A14□			
2B12□	32310U	B612□	6211ZZ
2B14□			
2B16□			
2C14□	32312U	C614□	6213ZZ
2C16□			
2C17□			
2D16□	32314U	D616□	6216ZZ
2D17□			
2E17□	32315U	E617□	6218ZZ

Table 25 Pinion shaft B bearing

Bevel Buddybox		Helical Buddybox	
Frame size	㉓	Frame size	㉔
—	—	Z609□	6011
2A10□	4T-32011X	A610□	16011
2A11□			
2A12□	4T-32013X		
2B12□			
2A14□	4T-320215	B612□	6013
2B14□			
2C14□			
2B16□	30217U	C614□	6213
2C16□			
2D16□			
2C17□	30220U	D616□	6125
2D17□			
2E17□		E617□	6218

Table 26 High speed shaft bearing (Motor shaft)

Bevel Buddybox	Helical Buddybox	Bearing A	Bearing B
Frame size	Frame size	㉕	㉖
—	Z609□	6302RSH2	6302Z
2A10□	A610□	6302RSH2	6302Z
2A11□	—	6302RSH2	6302Z
2A12□	B612□	6304	6305Z
2B12□			
2A14□	C614□	6305R	6306
2B14□			
2C14□			
2B16□	D616□	6307R	6308
2C16□			
2D16□			
2C17□	E617□	6406	6407
2D17□			
2E17□			

Table 27 Eccentric bearing 55

Frame size Reduction		2A10□	2A12□ 2B12□	2A14□ 2B14□ 2C14□	2B16□ 2C16□ 2D16□	2C17□ 2D17□ 2E17□
	Z609□	A610□	B612□	C614□	D616□	E617□
21	60906YRX	6100608YRX	6120608YRX	61406-11YSX	6160608YRX2	617YSX
28	60908-15YSX	6100608YRX	6120608YRX	61406-11YSX	6160608YRX2	
39	60908-15YSX	61011-15YRX	6121115YSX	61406-11YSX	61611-15YSX	
46	60908-15YSX	61011-15YRX	6121317YSX	61413-17YSX	61611-15YSX	
53	60908-15YSX	61011-15YRX	6121115YSX	61413-17YSX	61611-15YSX	
60	60917YSX	61017YSX	6121317YSX	61413-17YSX	61617-25YSX	
74	60921YSX	61021YRX	61221YRX	6142125YSX	61617-25YSX	
88	6092529YSX	6102529YRX	6122529YSX	6142125YSX	61617-25YSX	
102	6092529YSX	6102529YRX	6122529YSX	6142935YSX	6162935YSX	
123	60935YSX	61035YRX	61235YRX	6142935YSX	6162935YSX	
151	60943YSX	61043YRX	61243YSX	61443-59YSX	6164351YSX	
179	60951YSX	61051YRX	612519YSX	61443-59YSX	6164351YSX	
209	60959YSX	61059YRX	6125159YSX	61443-59YSX	61659YSX	
249	60971YRX	61071YRX	6127187YSX	6147187YSX	61671YRX2	
305	60987YSX	61087YRX	6127187YSX	6147187YSX	61687YSX	
417	609119YSX	610119YSX	—	—	—	

- Our service department should be contacted for disassembly, inspection, and replacement of bearings.
- NTN bearing nomenclature is shown in the tables above.

12-2) Oil seal

Tables 28–30 show the type of oil seals according to frame size. The numbers in the table indicate the part No. shown in the construction drawings (Figs.25–28).
0 or 5 is inserted in □.

Table 28 Output shaft oil seal

Bevel Buddybox		Helical Buddybox	
Frame size	㉔	Frame size	㉑
	–	Z609□	D65X100X10
2A10□	D85X110X13	A610□	D85X130X10
2A11□			
2A12□			
2A14□			
2B12□	D100X125X13	B612□	D100X150X13
2B14□			
2B16□			
2C14□	DS120X150X14	C614□	D110X170X15
2C16□			
2C17□			
2D16□	D140X170X14	D616□	D130X200X15
2D17□			
2E17□	D160X190X16	E617□	D150X225X15

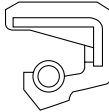

Table 29 Pinion shaft A oil seal

Bevel Buddybox		Helical Buddybox	
Frame size	㉒	Frame size	㉓
	–	Z609□	S40X80X10
2A10□	S50X68X19	A610□	S40X80X10
2A11□			
2A12□			
2A14□			
2B12□	S60X75X9	B612□	S65X90X10
2B14□			
2B16□			
2C14□	S70X95X13	C614□	S70X110X10
2C16□			
2C17□			
2D16□	S90X115X13	D616□	S80X128X13
2D17□			
2E17□	S90X115X13	E617□	S95X145X13

Table 30 High speed shaft oil seal

Bevel Buddybox	Helical Buddybox	㉕
Frame size	Frame size	
–	Z609□	S20X35X7
2A10□	A610□	S20X35X7
2A11□		
2A12□	B612□	D32X52X8
2B12□		
2A14□	C614□	D38X58X11
2B14□		
2C14□		
2B16□	D616□	D55X78X12
2C16□		
2D16□		
2C17□	E617□	D60X82X12
2D17□		
2E17□		

Table 31 Type and shape of oil seal

Type		Shape	NOK	Koyo Chicago Rawhide
S	Circumferential rubber with spring (JIS S type)		SC	MHS
D	Dust-proofing circumferential rubber with spring (JIS D type)		TC	MHSA

(JIS B2402-1976 Oil Seal)

13. Warranty

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

Warranty (period and contents)

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

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