



BEIER VARIATOR® & BEIER-CYCLO VARIATOR 6000 Series

Maintenance Manual



<< Notes >>

- BEIER VARIATOR & BEIER-CYCLO VARIATOR should be handled, installed and maintained by trained technicians.
Carefully read the maintenance manual before use.
- Oil is removed from BEIER VARIATOR & BEIER-CYCLO VARIATOR before shipment.
Supply oil according to the maintenance manual before operation.
- A copy of this maintenance manual should be sent to the actual user of BEIER VARIATOR & BEIER-CYCLO VARIATOR.
- 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. Retain this manual for future reference.
- Pay close attention to the "DANGER" and "CAUTION" warnings regarding safety and proper use.



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



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

Matters described in  may lead to serious danger depending on the situation. Be sure to observe important matters described herein.



DANGER

- Transport, installation, plumbing, wiring, operation, maintenance, and inspections should be performed by trained technicians; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- When using the equipment in conjunction with **an explosion proof motor**, a technician with electrical expertise should supervise the transport, installation, plumbing, wiring, operation, maintenance and inspection of the equipment so as to avoid a potentially hazardous, situation that may result in electrical shock, fire, explosion, personal injury and/or damage to the equipment.
- When the unit is to be used in a system for human transport, a secondary safety device should be installed to minimize chances of accidents resulting in personal 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 Cyclo gearmotor and reducer. The symbols shown below appear in the upper right corner of each page to indicate the classification. Read the applicable pages. On **COMMON** pages, these symbols identify distinctions between gearmotors and reducers.

• Refer to the brake maintenance manual (Cat. No.MM0202E) for the handling of **beier variator**.

Specifications		Common specifications	Basic type Beier variator	Beier variator with built in gear	Beier Cyclo variator
Symbol	with motor	COMMON			
	without motor				

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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. Installing the wrong unit may result in personal injury or equipment damage.
- Do not remove the rating plate.

Verify the items listed below upon receiving the Beier Variator. If a nonconformity or problem is found, contact our nearest agent, distributor, or sales office.

- (1) Does the information 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, advice us of the model name, Serial no.

Beier Variator Basic type , With Built-in gear type

(1) Beier **COMMON**

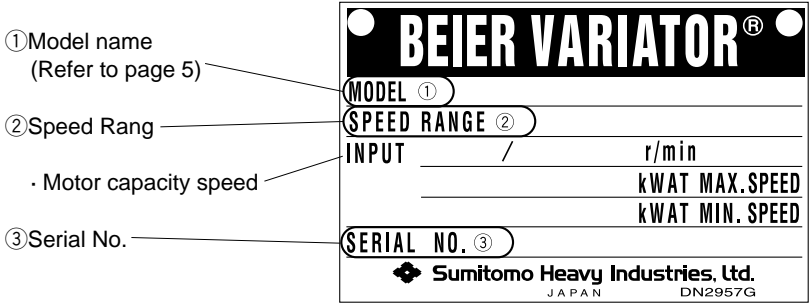


Fig.1 Rating Plates of Beier Variator Basic type, or with Built-in gear type

(2) Motor

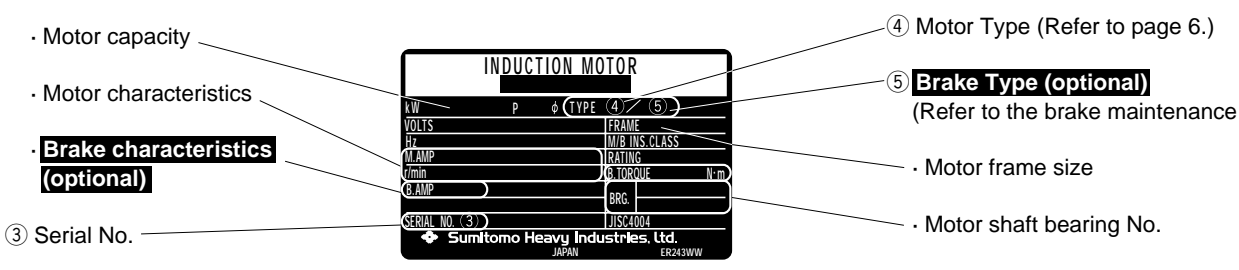


Fig.2 Motor Rating Plate

Beier Cyclo Variator

(1) Beier Cyclo **COMMON**

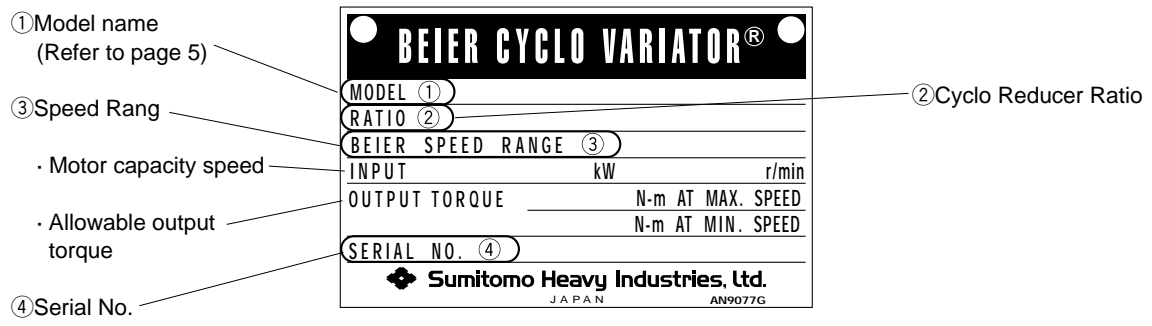


Fig.3 Rating Plates of Beier-Cyclo Variator

(2) Motor 

Same as page 3.

1-2) Lubrication Method **COMMON**

Refer to "8-2. Confirmation of Lubrication Method" on page 17 to confirm the lubrication method.

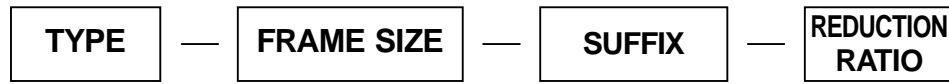
• **Oil-lubricated** models are shipped without oil. Units must be filled with the proper amount of recommended oil prior to start-up.

1-3) Type of Variator

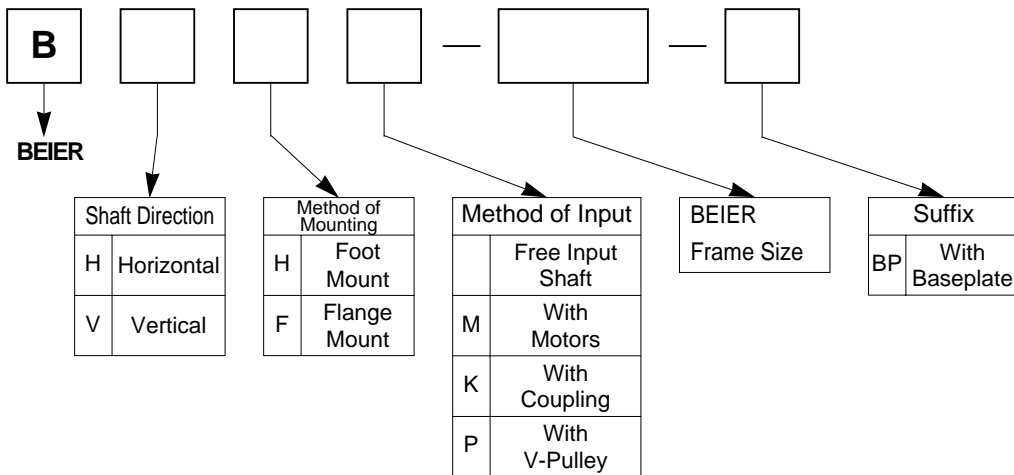
Respective codes and motor nomenclature are shown below. Please verify that the type you received conforms to what you ordered.

● Nomenclature

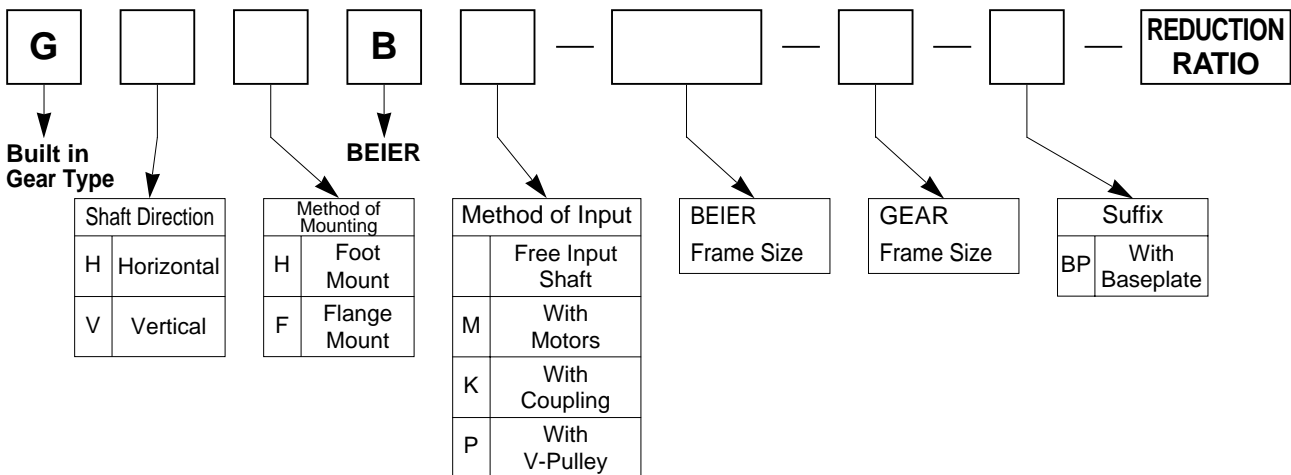
BASIC



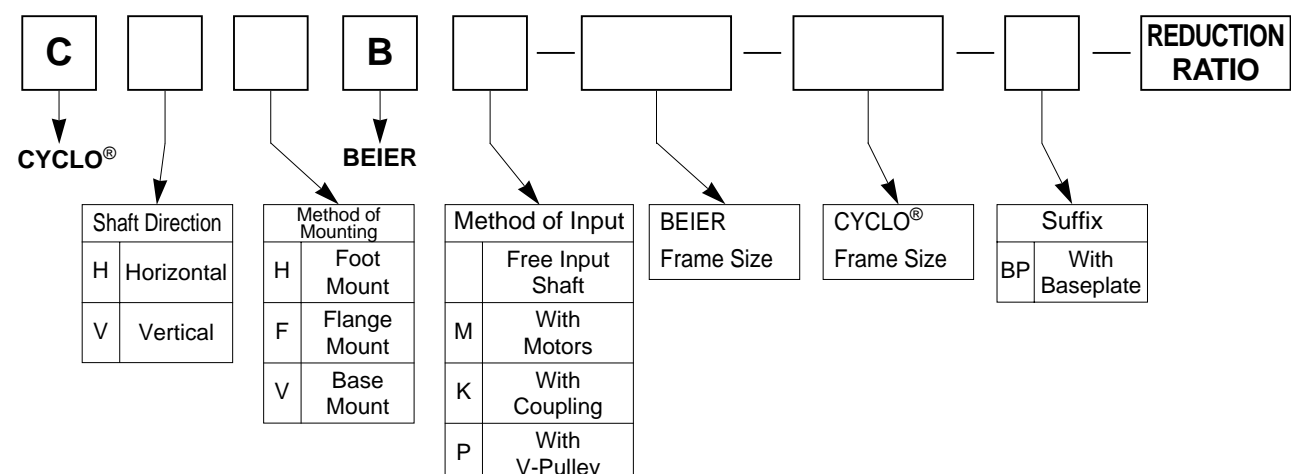
BEIER VARIATOR



BEIER VARIATOR (Built in Gear Type)



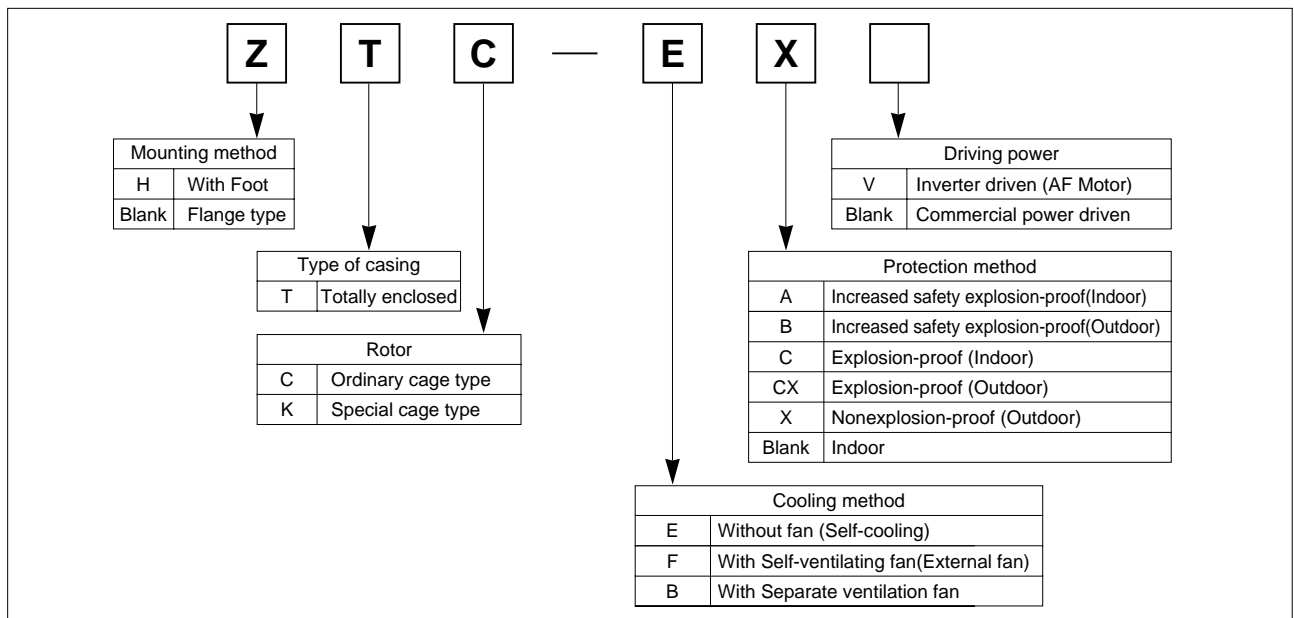
BEIER-CYCLO® VARIATOR



1-4) Type of Motor 

Respective codes and motor nomenclature are shown below. Please verify that the type you received conforms to what you ordered.

• For Cyclo **with a servo motor**, **DC motor** or **Vector motor**, refer to the respective motor maintenance manual.



2. Storage

When storing Beier variators 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 the "Rust-Proofing period" listed below.
- (2) When the storage period exceeds the standard "rust-proofing period", special rust-proofing is necessary. Contact the factory for details.
- (3) Export models need export rust prevention. Contact the factory for details.
- (4) Standard rust-proofing specification:
 - ① Outside rust-proofing
Before shipment, rust-proofing treatment is administered. Check the effect of rust-proofing, whenever necessary it should be administered.
 - ② Inside rust-proofing

Table 1

Lubrication	Grease lubricated models	Oil lubricated models
Rust-proofing period	1 Year	6 Months
Storage condition	Generally to be stored inside the shop or warehouse, relatively free of humidity, dust, extreme temperature fluctuation, corrosive gas and similar atmosphere.	

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 after long-term storage if there is any sign of deterioration.
- (2) After starting the Beier, verify 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 office.

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 Beier unit to the equipment, do not hoist the entire machine using the hanging bolt or hole; otherwise, personal injury or damage to the equipment and/or lifting device may result.
- Before hoisting, refer to the rating plate, crate, outline drawing, catalog, etc. for the weight of the Beier gearmotor or reducer. Never hoist a unit that exceeds the rating of the crane or other mechanism being used to lift it; otherwise, personal injury or damage to the equipment and/or lifting device may result.

4. Installation

⚠ DANGER

- Do not use a standard unit in an explosive atmosphere (which is likely to be filled with explosive gas or steam). Under such conditions, an explosion-proof motor should be used; otherwise, electric shock, personal injury, explosion fire, or damage to the equipment may result.
- Since the inverter itself is not explosion-proof, install an **inverter-driven, explosion-proof type motor** in a place free from explosive gas; otherwise, electric shock, personal injury, explosion fire, or damage to the equipment may result.

⚠ CAUTION

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

4-1) Installation Location

- Ambient temperature : -10°C to +40°C
- Ambient humidity : 85% max.
- Altitude : 1000m max.
- Ambient atmosphere : There should be no corrosive gas, explosive gas, or steam.
The location should be well ventilated without dust.
- Installation location : Indoors, with minimum dust and no water splashing.

- Units made to special specifications are necessary for installation under conditions other than the above.
- Units made according to the outdoor, explosion-proof or other specifications can be used under the specified conditions without any problem.
- Install units where inspection, maintenance, and other such operations can be easily carried out.
- Install units on a sufficiently rigid base.

4-2) Installation Angle

Table 2 Installation Angle

Grease lubricated model	Free
Oil lubricated model	Low speed shaft Horizontal or Vertical (Refer to page 5. Contact us inclined installation.)

When the unit is made according to your specification for inclined installation, do not install it at any angle other than the specified angle. (The shaft orientation of the standard **outdoor variator** is horizontal. Contact us for other shaft orientations.)

- Do not remove the eyebolt on the motor. Should the eyebolt be removed, put a bolt into the threaded hole or take other water-proofing measures to prevent water from entering the motor through the threaded hole.

5. Coupling with Other Machines

⚠ CAUTION

- Confirm the rotation direction before coupling the unit with the driven machine. Incorrect rotation direction may cause personal injury or damage to the equipment.
- When operating the variator 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 variator 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) Confirming Rotation Direction

With motor



Figure 4 shows the rotation direction of the output shaft when wires are connected as shown in Fig.9 on page 13.

Fig.4 Rotation Direction of slow speed shaft.(with motor)

When the motor wiring conforms to Fig. 9 the motor shaft turns clockwise viewed from the opposite side of the load side. At that time, the rotation direction of slow speed shaft is in the direction of the arrow shown below.

Type		Basic, Beier-Cylo (2 stages)	with Built-in Gear	Beier Cyclo (1 stage)
A-B Type	Rotation direction of slow speed shaft (Viewed from load side)			
	Rotation direction of slow speed shaft (Viewed from load side)		—————	

· For reverse rotation, change the positions of R and T of the motor wiring.

Without motor



Table 3 Rotation Direction of slow speed shaft.(without motor)

Type		Basic, Beier-Cylo (2 stages)	with Built-in Gear	Beier Cyclo (1 stage)
A-B Type	Rotation direction of slow speed shaft	As compared with high speed shaft, opposite direction.	As compared with high speed shaft, opposite direction.	As compared with high speed shaft, same direction.
D Type	Rotation direction of slow speed shaft	As compared with high speed shaft, same direction.	—————	As compared with high speed shaft, opposite direction.

5-2) Coupling Installation

- When installing a coupling, do not impact or apply excessive thrust load to the shaft ; otherwise, the bearing may be damaged or collar may be left.
- Thermal shrinking is the recommended installation method.
- when a sprocket, gear or pulley is coupled with the variator, use within the range of the allowable radial and axial load defined on our catalog.

(1) When Using a Coupling

The accuracy of the dimensions (A, B, and X) shown in Fig.5 should be within the tolerance shown in Table 4.

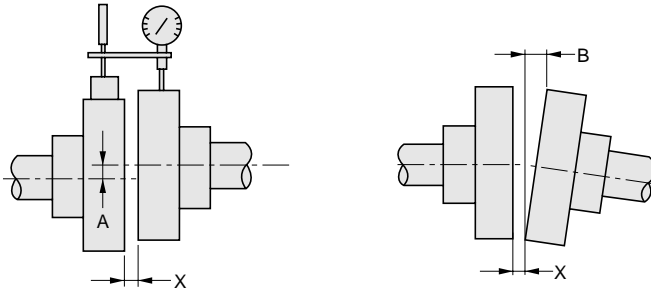


Fig. 5

Table 4 Centering Accuracy of Flexible Coupling

Dimension A Tolerance	0.1mm or manufacturer's specification
Dimension B Tolerance	0.1mm or manufacturer's specification
X dimension	Manufacturer's specification

(2) When Using a Chain Sprocket and Gear

- The chain tension angle should be perpendicular to the shaft.
- Refer to the chain catalog for the chain tension.
- 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 variator side with respect to the length of the shaft. (Fig.6)

(3) When Using a V-belt

- Excessive V-belt tension will damage the shaft and bearing. Refer to the V-belt catalog for proper tension.
- 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.
- Install V-pulley so that their point of load application will be closer to the variator side with respect to the length of the shaft.

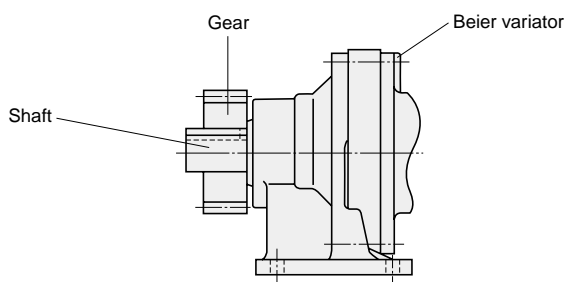


Fig. 6

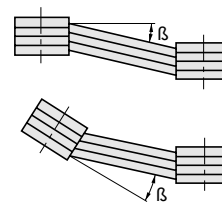


Fig. 7



6. Wiring

- Wiring for **SUMITOMO standard 3-phase motor** is shown below.
Refer to the respective instruction manual **for brakemotors** , **servomotors** , **DC motors** 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 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 facility's electrical codes, extension regulations and explosion-proofing guide, as well as the maintenance manual; otherwise, electric shock, personal injury, explosion, fire or damage to the equipment may result.

⚠ CAUTION

- When wiring, follow the facility's electrical codes and extension regulations; otherwise, burning, electric shock, injury, or fire may result.
- The motor is not equipped with a protective device. However, it is compulsory to install an overload protector according to facility electrical codes. It is recommended to install other protective devices (earth leakage breaker, etc.), in addition to an overload protector, in order to prevent burning, electric shock, injury, and fire.
- Never touch the terminals when measuring insulation resistance; otherwise, electric shock may result.
- **When using a star-delta starter** , select one with an electromagnetic switch on the primary side (3-contact type); otherwise, fire may result.
- When using a **400V-class inverter** to drive the motor, mount a suppresser filter or reactor on the inverter side, or provide reinforced insulation on the motor side; otherwise, dielectric breakdown may cause fire or damage to the equipment.
- **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 substance 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 **outdoor and explosion-proof type motors** , check that terminal box mounting bolts are not loose, and correctly attach the terminal box cover.

6-1) Attaching and Detaching the Terminal Cover (**0.1~04kW 3-phase motor**)

(1) Detaching

As shown in Fig.8, hold both sides of the terminal box and pull it towards you. The cover will detach.

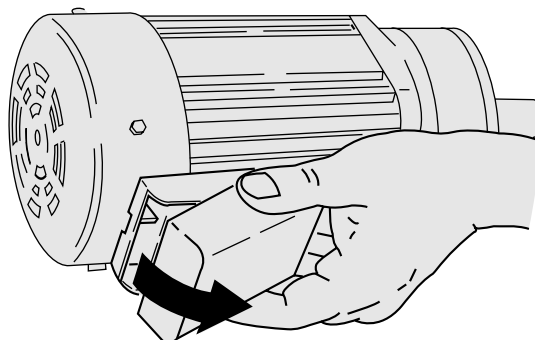


Fig. 8

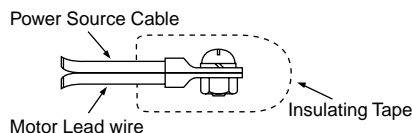
(2) Attaching

Press the terminal box cover onto the terminal box case until it snaps into place.



6-2) Connection with Power Source Cable

Connecting method is shown below.



6-3) Measuring Insulation Resistance

- When measuring the insulation resistance, disconnect the motor from the control panel. Check the motor separately.

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 exceeds the values shown in Table 10.

Table 10 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.

$$R \geq \frac{\text{Rated Voltage (V)}}{\text{Rated Output (kW)} + 1000} \quad (\text{M}\Omega)$$

$$R \geq \frac{\text{Rated Voltage(V)} + \text{Speed(rpm)}/3}{\text{Rated Output(kW)} + 2000} \quad +0.5(\text{M}\Omega)$$

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.

6-4) Protection Coordination

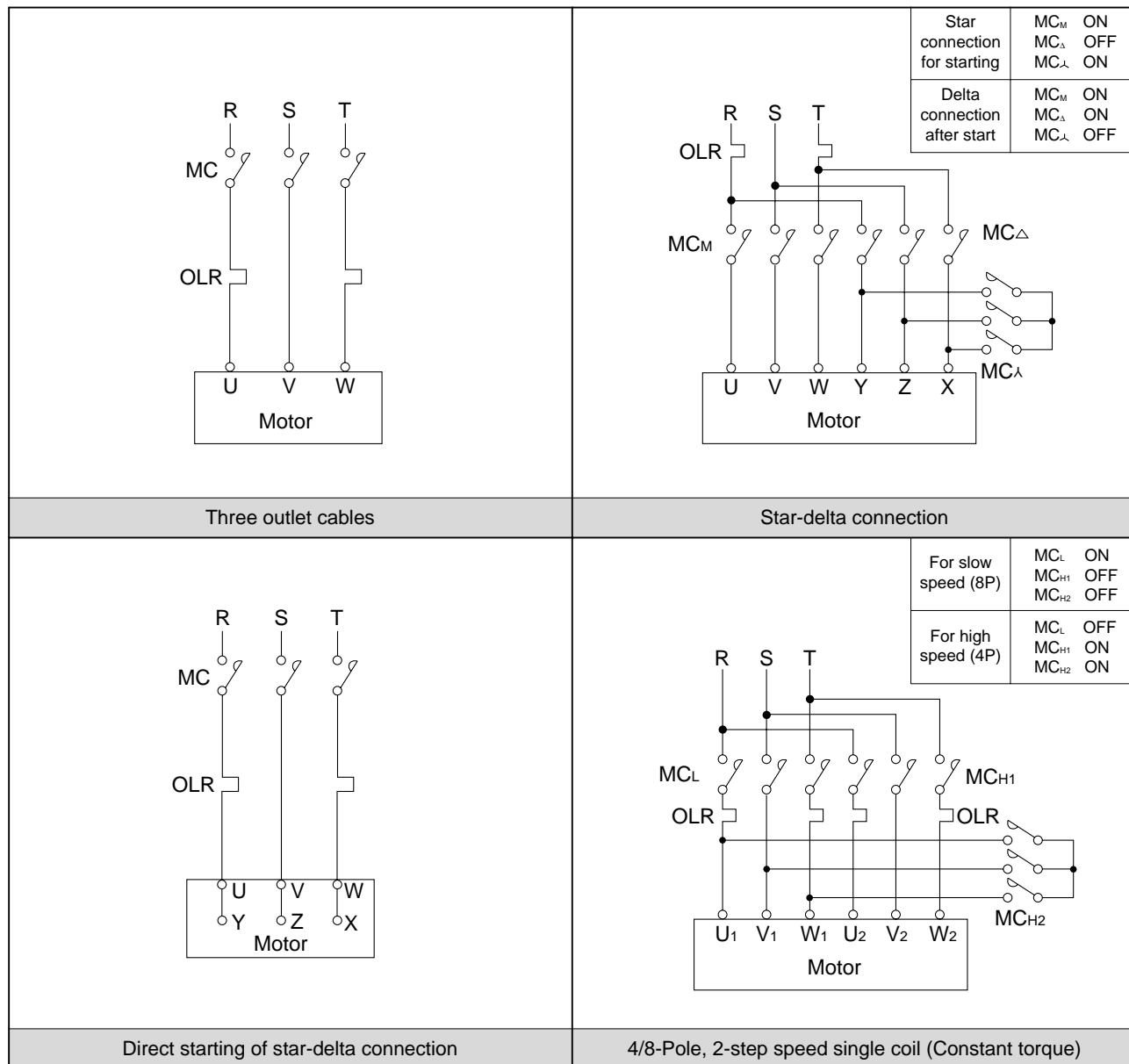
- (1) Use a molded case circuit breaker for protection against short circuit.
- (2) Use an overload protection device that protects the unit against a surge of electric current exceeding that shown on the rating plate.
- (3) For an **explosion-proof type motor**, use an overload protector that can protect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



6-5) Motor Connection

Fig.9 shows the motor connection and the standard specifications for terminal codes.

Fig. 9 Motor Connection and Terminal Code



MC : Electromagnetic contactor
 OLR : Overload protection device

These should be furnished by the customer.

6-6) Trochoid Pump Connection

⚠ CAUTION

● Conduct priming shown in the maintenance manual, before the start up of the main motor, in case of forced oil lubrication by the trochoid pump; otherwise damage to the equipment may result.
 For forced oil lubrication by trochoid pump, prime the pump, as shown in the maintenance manual, before starting the main motor; otherwise, the equipment may be damaged.

- (1) Because forced lubrication by the trochoid pump is necessary for the models with trochoid pump system as in "8-2 Confirmation of Lubrication Method (page 17)", a separate power source should be prepared for the pump. (Refer to Table 6, 7 and Fig.10)
- (2) Refer to Fig.11 for the trochoid pump wiring. At this point, connect so that the pump motor will rotate the designated direction.
- (3) Establish an electrical interlocking device between the trochoid pump motor and main motor that satisfies the following two functions; (Refer to Fig.11)
 - ① Start-up time-The main motor stops when the trochoid pump stops.
 - ② During operation-The main motor stops when the trochoid pump stops for some unknown reason.
- (4) To assure optimal lubrication conditions, the trochoid pump should be started-up at least 30 seconds before the start-up of the main motor. (priming)

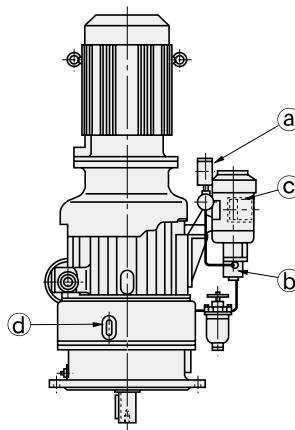
Table 6 Trochoid Pump Specification for **Beier portion**

Beier frame size		Horizontal type		Vertical type	
A type	B type	Trochoid pump	Pump motor	Trochoid pump	Pump motor
N10A	N8B	—	—	TOP-13AK	0.2kW 4P
15A	10B	—	—	TOP-208HB	0.4kW 4P
20A	15B	—	—	TOP-212HB	0.4kW 4P
30A	20B	—	—	TOP-216HB	0.75kW 4P
40A	30B	—	—		
50A	50B	TOP-212HB	0.75kW 4P	TOP-330H	2.2kW 6P
75A	75B				
100A	150B				
150A	100B	TOP-N350HVB-7 With relief valve		TOP-N350HVB-7 With relief valve	2.2kW 6P
200A	150B				

Table 7 Trochoid Pump Specification for **Cyclo portion**

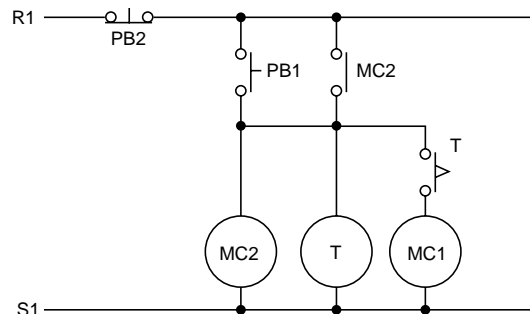
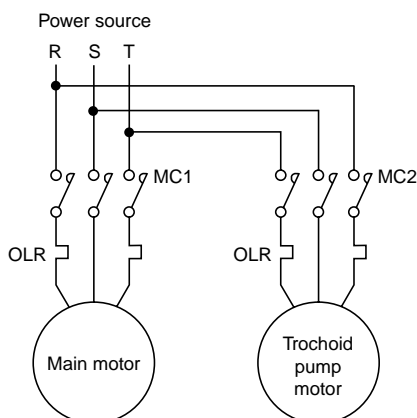
Cyclo frame size	Vertical type	
	Trochoid pump	Pump motor
6275	TOP-216HBVB-3 With relief valve	0.75kW 4P
6275DA	TOP-204HBVB-3 With relief valve	0.4kW 4P

Lubrication oil cooling device will be set separately for over 50A and 50B. Refer to "9. Lubricating Oil Cooling Device (page 28)."



a	Pressure gauge
b	Trochoid pump
c	Motor (For Trochoid pump)
d	Oil level gauge

Fig. 10 Trochoid Pump Construction



MC1 : Electromagnetic switch (For Main motor)
 MC2 : Electromagnetic switch (For Trochoid pump motor)
 PB1 : Push button switch (For Starting)
 PB2 : Push button switch (For Stopping)
 T : Timer (Approx. 30 sec. or more)

Fig. 11 Trochoid Pump Wiring Diagram

7. Operation

⚠ DANGER

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

⚠ CAUTION

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

- **Oil-lubricated models** are shipped without oil. Units must be filled with the proper amount of recommended oil prior to start-up.
- Never turn speed control handwheel when Beier Variator is not in operation.
If handwheel is turned when the unit is not in operation, this will exert undue force on internal parts which in turn may break disc and other parts.
- When starting under full load condition, it is easier to start on low speed range.
This is because Beier Variator can give a larger torque in low speed range.
- Cushion start is required when the moment of inertia of driven machine is big. Please consult us.

After the unit is installed, filled with oil and properly wired, check the following before operating:

- (1) Is the wiring correct ?
- (2) Is the unit properly coupled with the driven machine ?
- (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 top line of the oil gauge when the unit is at rest ?

After confirming these items without a load, gradually apply a load.

Check the items shown in Table 8.

Table 8 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 insufficient rigidity of the installation base generating excessive noise ? (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 variator 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 exceed the rated current shown on the rating plate ?

If any abnormality 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; loose clothing may become caught in these rotating parts and cause serious 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 facilities electrical codes, 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 becomes very hot during operation. Touching the unit with bare hands; may result in serious burns.
- 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 shield rotating parts; otherwise loose clothing may become caught in the unit and cause serious injury.
- Promptly identify and correct, according to instructions in this maintenance manual, any abnormalities observed during operation. Do not operate until abnormality is corrected.
- Change lubricant according to the maintenance manual instructions. Be sure to use factory recommended lubricant.
- Do not change lubricant during operation or immediately after stopping operation; otherwise, burns may result.
- Supply/discharge grease to/from the motor bearing according to the maintenance manual instructions. Avoid contact with rotating parts; otherwise, injury may result.
- Do not operate damaged gearmotors or reducers; otherwise, injury, fire, or damage to the equipment may result.
- We cannot assume any responsibility for damage or injury resulting from an unauthorized modification by a customer.
- Dispose of the gearmotor or 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 substance around the unit in order to prevent explosion or ignition.

- 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 skilled 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 9 to perform daily inspections.

Table 9 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 there excessive vibration ? 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 models. When the difference between the temperature of the casing surface and the ambient temperature is approx. 50°C, there will be no problem if there is no fluctuation.
Oil level (Oil-lubricated model)	At rest	Does the oil level reach the top line of the oil gauge ?
	In operation	When compared to the oil level at rest, is this level different ?
	When using the trochoid pump	Is the function of oil signal or flow gauge normal ? When the function is abnormal, stop the unit and inspect it ; otherwise inadequate oil will cause poor lubrication of reduction portion, broken pump and fill-up the oil pipe.
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 any abnormality is found during the daily inspection, take corrective measures listed in section 10, Troubleshooting (page30.) If the abnormality cannot be corrected, contact our nearest agent, distributor or sales office.

8-2) Confirmation of Lubrication Method

• Refer to the applicable items regarding maintenance. Improper maintenance may decrease unit life.

- (1) Refer to Table 10–12 to confirm the gear lubrication method for your unit.
- (2) Table 14 lists maintenance manual pages that can be referenced regarding lubrication maintenance.

Table 10 Standard Lubrication System, BEIER part

A Type BEIER VARIATOR	BEIER size	N02A	N05A	N1A	N2A	N3A	N5A	N8A	N10A	15A	20A	30A	40A	50A	75A	100A	150A	200A		
	Horizontal	Oil bath												Forced lubrication type						
	Vertical	Oil bath						Forced lubrication type						Forced lubrication type						
B Type BEIER VARIATOR	BEIER size	N02B	N05B	N1B	N2B	N3B	N5B	N8B	10B	15B	20B	30B	50B	75B	100B	150B				
	Horizontal	Oil bath											Forced lubrication type							
	Vertical	Oil bath						Forced lubrication type						Forced lubrication type						
D Type BEIER VARIATOR	BEIER size	N05D	N1D	N2D	N3D	N5D	N8D	N10D	<div style="background-color: #cccccc; width: 10px; height: 10px; display: inline-block;"></div> Lubricating oil cooling device is attached. Refer to page 28.											
	Horizontal	Oil bath																		
	Vertical	Oil bath																		

Table 11 Standard Lubrication System, **A Type and B Type BEIER-CYCLO Variator, CYCLO Part**

Single reduction	Frame size	6075	6095	6105	6125	6135	6145	6165	6175	6185	6195	6205	6215	6225	6235	6245	6255	6265	6275		
	Horizontal	Grease				Oil bath															
	Vertical	Grease				Oil bath			Plunger pump (Self-lubrication)												Forced lubrication type
Double reduction	Frame size	6125DB	6130DB 6135DB	6130DC 6135DC	6160DA 6165DA	6160DC 6165DC	6170DC 6175DC	6180DB 6185DB	6190DA 6195DA	6205DA 6205DB	6215DA 6215DB	6225DA 6225DB	6235DA 6235DB	6245DA 6245DB	6255DA 6255DB	6265DA	6275DA	Forced lubrication type			
	Horizontal	Grease				Oil bath															
	Vertical	Grease	Reduction ratio	Grease				-187	-210	-289	-522	-522									
				Plunger pump (Self-lubrication)																	
				210-	231-	319-	595-	649-													
Grease																					

Maintenance-free series

Table 12 Standard Lubrication System, **D Type BEIER-CYCLO Variator, CYCLO Part** (at standard input speed by Table 13)

Single reduction	Frame size	6095	6105	6125	6135	6145	6165	6175	6185	6195									
	Horizontal	Grease				Oil bath													
	Vertical	Grease				Oil bath			Plunger pump (Self-lubrication)										
Double reduction	Frame size	6125DB	6130DC 6135DC	6160DB 6165DB	6170DB 6175DB	6180DA 6185DA	6180DB 6185DB	6190DA 6195DA	6190DB 6195DB	6205DA 6205DB	6215DA 6215DB	6225DA 6225DB	6235DA 6235DB	6245DA 6245DB	6255DA	6265DA	6275DA	Forced lubrication type	
	Horizontal	Grease				Oil bath													
	Vertical	Grease	Reduction ratio	Grease				104	-	-165	-319	-377			-559				
				Plunger pump (Self-lubrication)															
				121-	104-	195-	377-	473-			649-								
Grease																			

Maintenance-free series

1. For models with trochoid pump, before start of Beier Variator or Beier-Cyclo Variator, start pump motor and make sure there is no abnormality in lubrication. Then start main motor. For this requirement, interlock power supply for main motor with pump motor and give pump motor a lead time of 30 to 60 seconds. Wire pump motor so that it will run in the specified direction.
2. Oil filter (Fig. 12) is equipped on piping of forced lubrication type. Turn a handle on the oil filter and take out clogging. At the beginning of operation, clean the filter once a day.
3. Discharge the sludge from drain plug at the bottom edge when the machine stops.

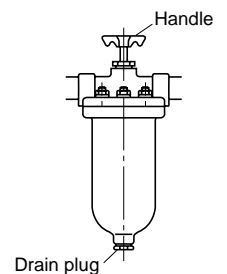


Fig. 12

Table 13 Standard input speed

A Type		BType		D Type	
Beier size	Standard input speed (r/min)	Beier size	Standard input speed (r/min)	Beier size	Standard input speed (r/min)
N02A-15A	1450/1750	N02B-10B	1450/1750	N05D-N10D	1450/1750
20A-40A	980/1165	15B-30B	980/1165		
50A-200A	720/870	50B-150B	720/870		

Table 14 Maintenance Manual Pages that can be Referenced Regarding Lubrication Maintenance

	Lubrication method		Pages where maintenance method is shown					
			Supply of oil/grease before initial operation after purchase	Oil/grease change period	Recommended oil/grease	Qty of oil/grease	Disposal of oil/grease	
Beier	Oil	Oil bath	Self-lubrication	Necessary	8-3 (1) P18	8-3 (2) P19	8-3 (3) P19	8-3 (4) (5) P20
		Trochoid pump lubrication						
Cyclo	Oil	Oil bath	Self-lubrication	Necessary	8-4 (1) P21	8-4 (2) P21	8-4 (3) P21	8-3 (4) (5) P21
		Plunger pump lubrication						
		Trochoid pump lubrication	Forced lubrication					
	Grease	Maintenance-free	Self-lubrication	Necessary	8-5 (1) P23	8-5 (1) P23	8-5 (3) P23	8-5 (4) P24
		Except for maintenance-free						
Variator Bearing	Grease		Self-lubrication	Necessary	8-6 (1) P25	8-6 (2) P25	8-6 (3) P25	8-6 (4) P25
Motor Bearing	Grease		Self-lubrication	Necessary	8-7 (1) P26	8-7 (2) P27	8-7 (1) P26	8-7 (3) P27

8-3) Oil Supply and Change for Beier

(1) Standard for lubricating oil change frequency

Table 15 **A Type and B Type BEIER Part**

	Time for lubricating oil change	Operating conditions	
Oil supply	At the time of purchase	_____	
Oil change	First time	After 500 hours	
	2nd onward	Every 6 months	10 hours/day
		Every 2500 hours	10 to 24 hours/day
	Every 1 to 3 months	Special conditions such as high temperatures, high humidity, activated gas, etc.	

Table 16 **D Type BEIER Part**

	Time for lubricating oil change	Remarks
Oil supply	At the time of purchase	_____
Oil change	Every 20,000 hours or every 4 to 5 years	Increased frequency of supply for use under severe operating conditions

(2) Recommended Lubricants

Be sure to use a lubricant recommended by our company.

Table 17 Recommended Lubricating Oil **for A Type and B type**

Ambient Temperature	Shell	Esso	Mobil
-10°C – 5°C	Shell Tellus Oil 46, 68	Nuto H 68	Mobil DTE 25, 26 (ISO VG46, 68)
0°C– 35°C	Shell Tellus Oil 100, C150	Teresso 100, 150	Mobil DTE Oil Extra Heavy (ISO VG150)
30°C – 50°C	Shell Tellus Oil C220, C320	Teresso 320	Mobil DTE Oil BB, AA (ISO VG220, 320)

Table 18 Traction oil designated **for D Type**

Ambient temperature	Idemitsu Kosan	Nippon Mitsubishi Oil
-10°C – 5°C	Daphne Alpha Drive P150	Diamond TD Oil 150

Always use correct lubrication oil for **D Type BEIER-CYCLO Variator**, which requires different lubrication oil for BEIER part and CYCLO part.

- ① For operation in winter or at a relatively low ambient temperature, use lubricating oils with lower viscosity. In the case of **forced lubrication models**, a plunger pump or trochoid pump may cause cavitation and necessary amount of oil may not be supplied. In such a case, a burned main body may result.
- ② For **N02A and M02B** with small input capacity in particular, use of lower viscosity oils is recommended.
- ③ Table 19 shows selection standard for viscosity of lubricating oil.

Table 19 Selection Standard for Oil Viscosity **for A Type and B Type**

Min allowable viscosity	Above 20mm ² /s at oil temp, during operation		Viscosity to obtain the oil film needed for transmission of the load
Max allowable viscosity	Oil bath lubrication models	less than 4300mm ² /s	Viscosity that allows Variators to start
	Forced oil lubrication models	less than 2200mm ² /s	Viscosity that allows plunger pumps and trochoid pumps to start

- ④ To ensure smooth start, use lubricating oil whose pour point is at least 5-10°C lower than ambient temperature.
- ⑤ If ambient temperature varies over a wide range, use lubricating oil whose viscosity remains stable, or lubricating oil that will satisfy requirements in Notes ③ and ④ in high viscosity index.
- ⑥ When units are always used at an ambient temperature other than 0 to 40°C, consult with the factory because depending on models it may need to change some parts or preheat or cool lubricating oil.

(3) Oil Quantity

Table 20, 21 shows approx. quantity of oil. Be sure to check the oil level through the oil gauge.

Table 20 Amount of Lubricating Oil (lit.) **for A Type and B Type BEIER Part**

BEIER size		N02A N05A N1A	N02B N05B	N2A N3A	N1B N2B	N5A N8A	N3B N5B	N10A	N8B	15A	10B	20A	15B	30A 40A	20B 30B	50A 75A 100A	50B 75B	150A	100B	200A	150B
Horizontal	Basic model	0.7	1.8	3.7	4.3	11	10	20	56	85	95										
	With a gear reducer Built-in gear type	1.1	2.2	5.2	7.5	13	20	38	98	–	–										
Vertical	Basic model	1.4	4.1	7.6	6.5	12	13	23	56	85	95										
	With a gear reducer Built-in gear type	2.6	7.4	15	10	20	24	38	108	–	–										

Note: Regarding 50A—200A and 50B—150B, amounts in pipe and oil cooling device. Amounts of oil in the oil cooling device : 3.2 ℓ for 50A, 75A, 100A, 50B, and 75B, 6.7 ℓ for 150A and 100B, 13.5 ℓ for 200A and 150B.

Table 21 Amount of Lubricating Oil (lit.) **for D Type BEIER Part**

BEIER size	N05D	N1D	N2D	N3D	N5D	N8D	N10D
Horizontal	1.2	2.4	4.8	8.7			
Vertical	2.6	5.5	13.5	19.5			

(4) Oil Supply

- Be sure to fill with oil when the unit is not operating.
- When the viscosity of oil is high, it may take some time for the oil to settle. Be careful not to over-fill. (If oil is filled above the upper line, the temperature will rise due to the churning heat of the oil.)
- Use the lower red line on the oil gauge, as a guideline for the normal oil level during operation. (Immediately following commencement of operation, the oil level may fall below the lower red line, but should not be of particular concern, since the oil level will recover, as the oil viscosity falls due to the drive operation.)

Oil supply for Horizontal Type (Refer to Fig.13)

- ① Remove the oil filler plug.
- ② Fill oil through oil filler port while checking oil level by the oil gauge.
- ③ Fill oil in place on the oil gauge.
- ④ Replace the oil filler plug.

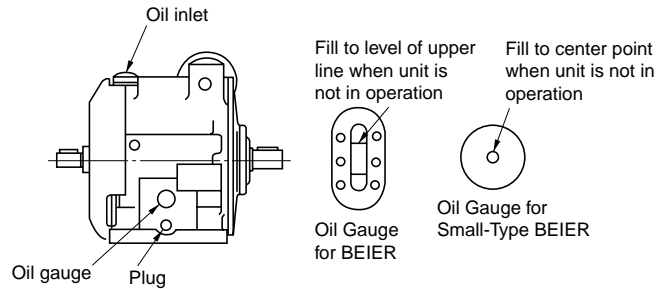


Fig.13

Oil supply for Vertical Type (Refer to Fig.14)

- ① Remove the oil filler plug.
- ② Fill oil through oil filler port while checking oil level by the oil gauge.
- ③ Fill oil in place on the oil gauge.
- ④ Replace the oil filler plug.

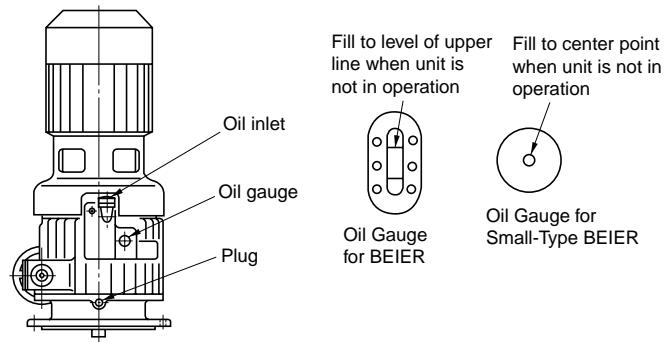


Fig.14

(5) Oil Discharge

Remove the drain plug shown in Fig.13, 14 to discharge oil

(6) Long-term Stoppage

Table 22 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, fill with 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 that the lubricant is free from deterioration that may have been caused by long-term stoppage.

8-4) Oil Supply and Change for Oil-lubricated CYCLO

(1) Oil Change Interval

Table 23 Interval

		Time for lubricating oil change	Operating conditions
Oil supply		At the time of purchase	_____
Oil change	First time	After 500 hours	_____
	2nd onward	Every 6 months	12 hours/day
		Every 2500 hours	12 to 24 hours/day
		Every 1 to 3 months	Special conditions such as high temperatures, high humidity, activated gas, etc.

(2) Recommended Lubricants

Be sure to use a lubricant recommended by our company.

Recommended lubrication oil is the same for BEIER part and CYCLO part of **A Type and B Type BEIER-CYCLO Variator**.

Use designated traction oil in Table 18 for BEIER part and use recommended lubrication oil for Cyclo in Table 24 for **D Type BEIER-CYCLO Variator**.

Always use correct lubrication oil for both D Type BEIER part and CYCLO part because using mixed or incorrect oil can affect performance and life significantly.

Table 24 Recommended Lubricating Oil For A Type and B Type BEIER-CYCLO Variator

Ambient Temperature	Shell	Esso	Mobil
-10°C – 5°C	Shell Tellus Oil 46, 68	Nuto H 68	Mobil DTE 25, 26 (ISO VG46, 68)
0°C – 35°C	Shell Tellus Oil 100, C150	Teresso 100, 150	Mobil DTE Oil Extra Heavy (ISO VG150)
30°C – 50°C	Shell Tellus Oil C220, C320	Teresso 320	Mobil DTE Oil BB, AA (ISO VG220, 320)

- ① For operation in winter or at a relatively low ambient temperature, use lubricating oils with lower viscosity.
- ② Table 25 shows selection standard for viscosity of lubricating oil.

Table 25 Selection Standard for the Oil Viscosity of CYCLO Part

Min allowable viscosity	Above 15mm/s at oil temp, during operation		Viscosity to obtain the oil film needed for transmission of the load
Max allowable viscosity	Oil bath lubrication models	less than 4300mm ² /s	Viscosity that allows CYCLO to start
	Forced oil lubrication models	less than 2200mm ² /s	Viscosity that allows plunger pumps and trochoid pumps to start

- ③ To ensure smooth start, use lubricating oil whose pour point is at least 5°C lower than ambient temperature.
- ④ If ambient temperature varies over a wide range, use lubricating oil whose viscosity remains stable or lubricating oil that will satisfy requirements in Notes ② and ③ in high viscosity index.
- ⑤ When units are always used at an ambient temperature other than 0 to 40°C, consult with the factory because depending on models it may need to change some parts or preheat or cool lubricating oil.

(3) Oil Quantity

Table 26 shows approx. quantity of oil. Be sure to check the oil level through the oil gauge.

Table 26 Amount of Lubricating Oil (lit.)

Single reduction	Frame size	6075	6095	6105	6125	6135	6145	6165	6175	6185	6195	6215	6225	6235	6245	6255	6265	6275			
	Horizontal	Grease					0.7	0.7	1.4	1.9	2.5	4.0	8.5	10	15	16	21	29	56		
Vertical	Grease					1.1	1.1	1.0	1.9	2.0	2.7	7.5	10	12	15	33	40	60			
Double reduction	Frame size	6125DB	6130DB 6135DB	6130DC 6135DC	6160DA 6165DA	6160DB 6165DB	6170DB 6175DB	6180DA 6185DA	6160DC 6165DC	6170DC 6175DC	6180DB 6185DB	6190DA 6195DA	6190DB 6195DB	6205DA 6205DB	6215DA 6215DB	6225DA 6225DB	6235DA 6235DB	6245DA 6245DB	6255DA 6255DB	6265DA	6275DB
	Horizontal	Grease							1.5	2.4	3.5	5.8	6.0	6.0	10	11	17	18	23	32	60
Vertical	Grease							1.0	1.9	2.0	2.7	2.7	11	14	18	23	29	33	40	60	

(4) Oil Supply

- Be sure to fill with oil when the unit is not operating.
- When the viscosity of oil is high, it may take some time for the oil to settle. Be careful not to over-fill. (If oil is filled above the upper line, the temperature will rise due to the churning heat of the oil.)
- Use the lower red line on the oil gauge, as a guideline for the normal oil level during operation. (Immediately following commencement of operation, the oil level may fall below the lower red line, but should not be of particular concern, since the oil level will recover, as the oil viscosity falls due to the drive operation.)

Oil supply for Horizontal Type (Refer to Fig.15)

- The standard location of the oil gauge on a horizontal unit is on the right side (viewed from the slow speed shaft side). However, since the oil gauge may be placed on either side, select the side most convenient for observation.

- ① Remove the oil filler plug.
- ② Fill oil through oil filler port while checking oil level by the oil gauge.
- ③ Fill oil the upper line on the oil gauge.
- ④ Replace the oil filler plug.

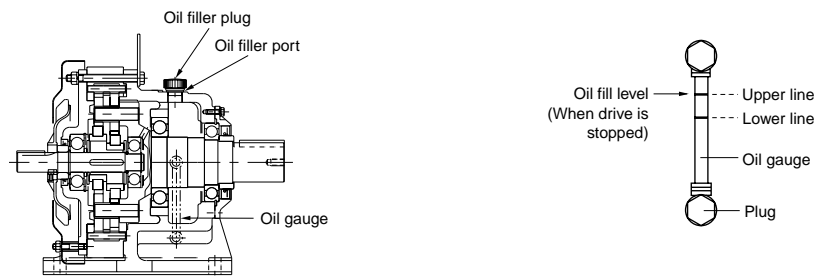


Fig. 15

Oil supply for Vertical Type (Refer to Fig.16)

- ① Remove the oil filler plug and, **except for sizes 6255 and 6265**, also remove the airvent.
- ② Fill oil through oil filler port while checking oil level by the oil gauge.
- ③ Fill oil the upper line on the oil gauge.
- ④ **Except for Sizes 6255 and 6265**, apply water proof sealing tape to threads of the air vent plug before re-installing.
- ⑤ Replace the oil filler plug.

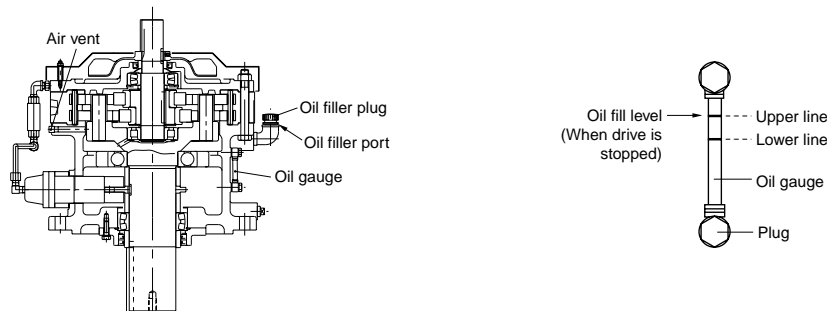


Fig. 16

(5) Oil Discharge

Remove the drain plug shown in Fig. 17 or the lower plug of oil gauge shown in Fig. 18 to discharge oil.

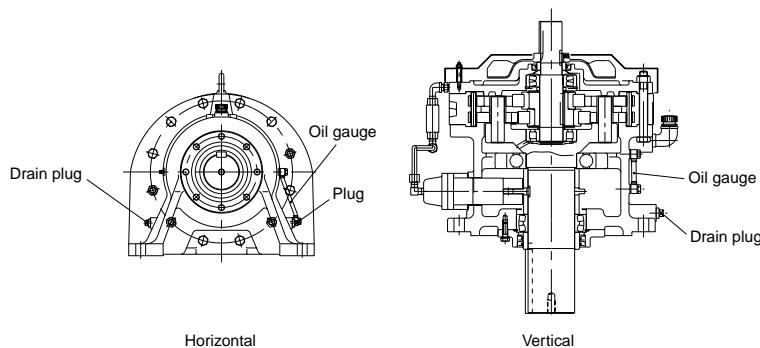


Fig. 17

Fig. 18

(6) Long-term Stoppage

Table 27 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, fill with 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 that the lubricant is free from deterioration that may have been caused by long-term stoppage.

8-5) Grease Replenishment and Change for **CYCLO Portion**

(1) Grease Replenishment/Change Interval

Table 28 Grease Supply/Change Intervals

Model	Grease supply/change interval
Maintenance-free series (<input type="checkbox"/> section in Table 11, 12 on page 17)	Long-life grease (ALVANIA GREASE RA) is supplied with these models, so operation can continue for extended periods. However, disassembly to change the grease after 20,000 hr or 3 to 5 years operation will ensure longer service life.
Grease-lubricated models other than maintenance-free	Refer to Tables 29 and 30 for supply and change of grease.

Table 29 Grease Replenishment Interval
(Excl. maintenance-free type)

Hours of operation	Replenishment interval	Remarks
10 hr max./day	3–6 months	Reduce the supply interval when the operating conditions are severe or the frame size is large.
10–24 hr/day	500–1,000 hr	

Table 30 Grease Change Interval
(Excl. maintenance-free type)

Change interval	Remarks
Every 20,000 hr or 3–5 years	Reduce the supply interval when the operating conditions are severe or the frame size is large.

(2) Recommended Grease

Table 31 Recommended Grease

Ambient temperature (°C)	Model		
	i) Maintenance-free series (<input type="checkbox"/> section in Table 11,12 on page 17)	ii) Other grease model	
	Shell	Cosmo Oil	Shell
-10~50	ALVANIA GREASE RA	COSMO GREASE DYNAMAX SH No.2	ALVANIA GREASE 2

• Do not use any grease other than those shown in Table 31.
 • Models ii) in Table 31 are filled with COSMO GREASE DYNAMAX SH No.2 before shipment from our factory.
 • The two kinds of grease for ii) in Table 31 may be mixed with each other.
 • When the ambient temperature continuously exceeds the range of 0~40°C, modifications are needed.

(3) Quantity of Grease

Table 32 shows the quantity of grease required when grease needs to be changed. Approximately 1/3~1/2 of the volume for the 1st stage reduction portion is appropriate when grease needs to be replenished.

Table 32 Qty of Grease

Single reduction	Frame size	606□	607□	608□	609□	610□	611□	612□													
	Reduction portion	Qty of grease (g)		25	25	65	90	140	200	330											
	Slow speed shaft bearing portion	Qty of grease (g)		35	35	70	100	100	90	120											
Double reduction	Frame size	606□DA	607□DA	609□DA	610□DA	612□DA	612□DB	613□DA	613□DB	613□DC	614□DA	614□DB	614□DC	616□DA	616□DB	616□DC	617□DA	617□DB	617□DC		
	1st stage (I/P side) reduction portion	Qty of grease (g)		25				90	25	90	140	25	90	140	90	140	330	90	140	330	
	2nd stage (O/P side) reduction portion	Qty of grease (g)		25	90	140	330	450					750			1000					
	2nd stage (O/P side) slow speed shaft bearing portion	Qty of grease (g)		35	35	100	100	120	300										500		
	Frame size	618□DA	618□DB	619□DA	619□DB	6205DA	6205DB	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB	6245DA	6245DB	6255DA	6255DB	6265DA			
1st stage (I/P side) reduction portion	Qty of grease (g)		140	450	330	450	330	450	750	450	1000	750	1100	750	1100	1000	1500	1500			
2nd stage (O/P side) reduction portion	Qty of grease (g)		1100		1500		1500		2000		2500		4000		4500		8000				
2nd stage (O/P side) slow speed shaft bearing portion	Qty of grease (g)		600		700		700		800		900		1000		1100		1300				

- : Maintenance-free Series
- Space/volume ratio : Ratio of grease to the volume of space
- 0, 5, or H is inserted in □.

(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 through the grease nipple in the inside cover section or motor connection cover.
- ③ Replace the grease discharge plug.

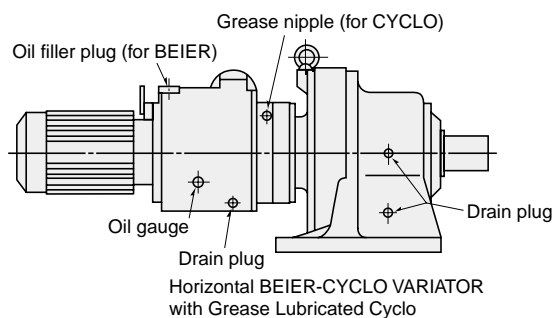


Fig. 19 Location of Grease Discharge Port

- Fill with grease during operation to ensure proper, uniform circulation.
- Fill with grease slowly.
- Grease supply exceeding the quantity shown in Table 32 will cause temperature rise from agitation heat or leakage of grease into BEIER part.
- Apply grease liberally to bearings (especially to eccentric bearings), pins, rollers, and toothed section of the cyclo discs. (Refer to 13-3. Drawing on page 36.)

8-6) Maintenance of Variator Bearing

- Maintenance of bearing is needed for **BEILER vertical A Type and B Type**.
- Replenish grease from grease nipple (Fig 30 on page 35.)

(1) Interval

Table 33 Interval

Hours of operation	Replenishment interval	Remarks
10 hr max./day	3–6 months	Reduce the supply interval when the operating conditions are severe or the frame size is large.
10–24 hr/day	500–1,000 hr	

(2) Recommended Grease

Table 34 Recommended Grease

Ambient temperature	Shell	Cosmo Oil
-10–50	ALVANIA GREASE RA	COSUMO GREASE DYNAMAX SH No.2

- Do not use any grease other than those shown in Table 34.

(3) Grease Quantity

Table 35 Amount of Grease to Be Replenished on Open Bearing

Frame size	Basic type BEIEL-CYCLO Variator			With built-in gear			
	For output shaft			For slow speed shaft			
	Bearing No.	Qty of grease (g)	Input shaft side		Output shaft side		
			Bearing No.	Qty of grease (g)	Bearing No.	Qty of grease (g)	
BEIER A and B Type (vertical)	N10A N8B	6208NR	5	—	—	—	—
	15A 10B	6310NR	20	NU312	30	6315Z	45
	20A 15B	6313NR	35	NU314	40	6317Z	55
	30A 20B 40A 30B	22217BK	25	NU317	55	6320Z	70
	50A 50B 75A 75B 100A	23024BK	35	—	—	—	—
	150A 100B 200A 150B	23128BNR	100	—	—	—	—

- Replenish the amount of grease in the table above to the bearings.
- Replenish grease at least every three years even if you use the unit with the intermittent operation.
- After a long suspension, replenish grease right after starting the operation.

(4) Supply and Discharge of Grease (Refer to Fig.30 Construction on page 35)

Replenish the new grease from the grease nipple during the operation.

(Replenishing grease while BEIER is nonoperational may cause insufficient grease exchange.)

- Excessive grease may cause temperature rise of the bearing or leakage of the grease.
- Do not extend the replenishing interval by supplying more than the prescribed amount of grease.
- Omitting to replenish grease at the start or periodically may result in abnormal abrasion, noise, and breakage of the bearing.



8-7) Maintenance of Motor Bearing

The maintenance for **Sumitomo standard 3-phase motor** is shown below.

(Refer to the respective instruction manuals for the **brakemotor**, **other companies' motor**, etc.) Bearing No. and maintenance methods also differ according to motor size. Before maintenance, check the bearing type on the rating plate and Table 36.

Table 36 Bearing Type

Bearing type	Motor frame size		Note
	Load side	Opposite side	
Shield bearing	Smaller than #225	Smaller than #250	No grease nipple
Open bearing	Bigger than #250	—	With grease nipple and discharge plug

Maintenance of **shield bearing**

Shield bearing is supplied with good lubricating grease in advance. Although grease replenishment is not necessary, exchange of bearing every 20,000 operational hours or once in 3-5 years in normal operating condition at the time of overhaul, enables more unfailling operation.

- Use CM class (clearance) bearing for the motor bearing.
- Use grease (Kyodo Yushi : Multemp SRL) lubricated bearing for the sealed motor bearing.
- Reduce the supply interval when the operating conditions are severe.

Grease replenishment for **open bearing**

(1) Grease Replenishment Intervals and Quantity

Check the bearing No. on the rating plate, refer to Table 37 and supply grease.

Table 37 Grease Replenishment Intervals and Quantity for Open Bearing

Bearing No.	Dimension (mm)			Initial q'ty (g)	Replenished q'ty (g)	Grease replenishment interval (h) for each rotation speed (r/min) of motor					
	I. D	O. D	W			750r/min	900r/min	1000r/min	1200r/min	1500r/min	1800r/min
6314	70	150	35	200	40	8500	7000	6000	5000	3500	2500
6315	75	160	37	230	45	8500	6500	6000	4500	3500	2500
6316	80	170	39	260	50	8000	6500	5500	4500	3000	2500
6317	85	180	41	300	55	7500	6000	5000	4000	3000	2000
6318	90	190	43	350	60	7000	5500	5000	4000	2500	2000
6319	95	200	45	400	65	7000	5500	4500	3500	2500	1500
6320	100	215	47	450	70	6500	5000	4500	3500	2000	1500
6321	105	225	49	500	75	6000	5000	4000	3000	2000	1500
6322	110	240	50	550	80	6000	4500	4000	3000	2000	1000
6324	120	260	55	700	100	5500	4000	3500	2500	1500	1000
6412	60	150	35	200	40	8500	7000	6000	5000	3500	3000
6413	65	160	37	230	45	8000	6500	6000	4500	3500	2500
6414	70	180	42	300	55	8000	6500	5500	4500	3000	2500
NU314	70	150	35	120	40	4000	3500	3000	2500	1500	1000
NU315	75	160	37	150	45	4000	3000	3000	2000	1500	1000
NU316	80	170	39	200	50	4000	3000	2500	2000	1500	1000
NU317	85	180	41	250	55	3500	3000	2500	2000	1500	1000
NU318	90	190	43	300	60	3500	2500	2500	2000	1000	1000
NU319	95	200	45	350	65	3500	2500	2000	1500	1000	
NU320	100	215	47	400	70	3000	2500	2000	1500	1000	
NU321	105	225	49	450	75	3000	2500	2000	1500	1000	
NU322	110	240	50	500	80	3000	2000	2000	1500	1000	
NU324	120	260	55	650	100	2500	2000	1500	1000		
21312	60	130	31	70	30	1500	1000	1000	800		

- "Initial q'ty" shows quantity of grease for disassembled and cleaned inside of the unit. Paint 1/3 of grease with the inner lace of bearing and replenish other with inside of the unit.
- "Replenished q'ty" shows quantity of grease for every replenishment.
- For intermittent operation, replenish grease every 3 years or less.
- For long-term stoppage replenish grease just after operating.



(2) Recommended Grease

Table 38 Recommended Grease

Ambient temperature °C	Open bearing	
	E, B Insulation	F Insulation
	Shell Oil	
-10~40	Alvania Grease 2	Darina Grease 2

- Do not use any grease other than those shown in Table 38.

(3) Grease Supply and Discharge (Refer to Fig.20)

- ① Remove the discharge plug, discharge old grease and add new grease while unit is operating.
(Grease replenishment at rest cause an insufficient grease change.)
- ② Replace the discharge plug after 10min operation.

- Excessive grease may cause temperature rise of bearing or leakage of grease.
- Exceeding the recommended amount of grease does not extend the replenishment interval.
- Don't neglect daily inspection; otherwise abnormal wear and noise from the motor, damage to the bearing may result.

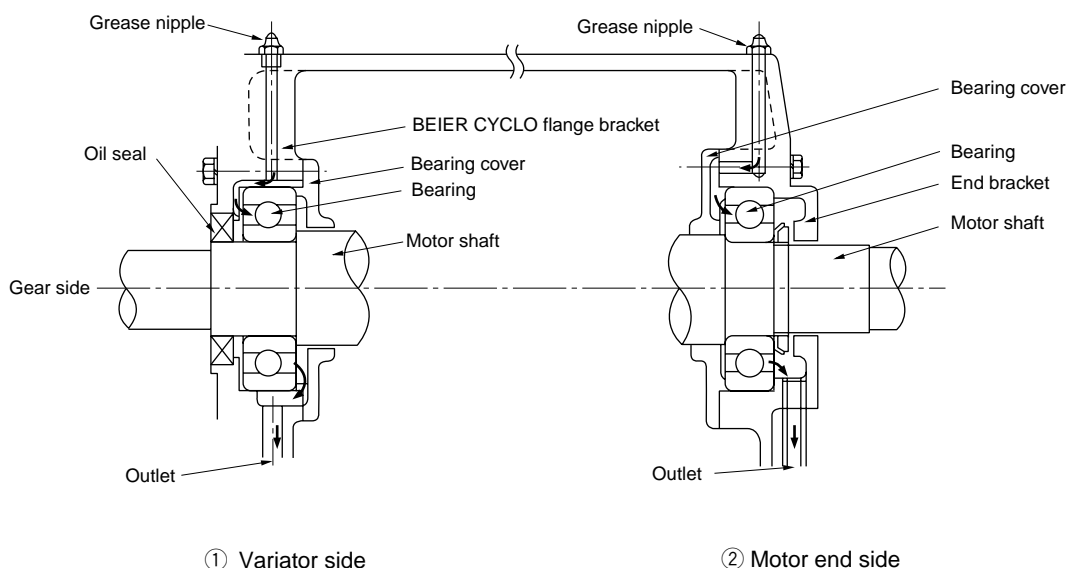


Fig. 20 Construction of Open Bearing in the Motor

Maintenance of V ring in **outdoor type motor**

Under aging phenomena or by abrasion, the V ring may become less water-proof.

Exchange the V ring once every three years under the normal operation. Refer to the dimension in Table 39 for V ring attaching dimension.

Table 39 V Ring Attaching Dimension

V Ring	Dimension B1	Remarks
V-10A-V-18A	4.5 mm	
V-20A-V-38A	6 mm	
V-40A-V-65A	7 mm	
V-70A-V-100A	9 mm	

- At exchange, apply a small amount of grease to the lip of the V ring.
- We recommend the V ring made by Forsheda.

9. Lubricating Oil Cooling Device

Lubrication oil cooling device is standard attachment to **Beier frame size 50A – 200A, 50B – 150B**.

9-1) Installation

- Install the horizontal-type Beier Variator horizontally, install the vertical-type Beier Variator vertically, and install the lubricating oil cooling device horizontally.
- Install this device as close as possible to the main body of the Beier Variator. If it is installed too far apart, the oil pump will suffer faulty suction and excessive noise, temperature, and insufficient lubrication will result.
- If air is sucked only halfway out of the suction side piping of the oil pump, the amount of oil will be reduced as a result of this insufficient suction, thereby causing excessive noise in the oil pump. For this reason, airtightness must be maintained.

- (1) Install this device within 0.5m in a vertical upward location, or within 1.5m in a vertical downward location, and within 3m horizontally from main body of the Beier Variator. Minimize pipe bands.
 - (2) The outline diagram shows both the Beier Variator and its lubricating oil cooling device. According to Fig. 21, install piping at the site along the broken lines. Use a gas pipe for the piping. Use a 1-1/2B to 2B gas pipe for the Beier Variator oil outlet, and use a 1B gas pipe for the oil inlet.
- Piping materials and pipe joints should be provided by the user since such piping will be installed at the site.

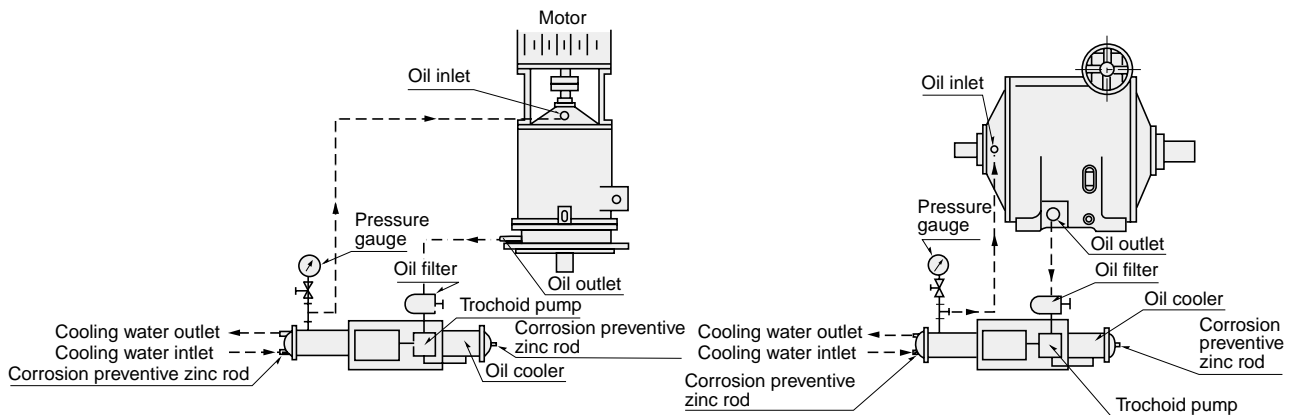


Fig. 21

9-2) Cooling Water

- For cooling water, use city water or industrial water.
- Table 39 gives a guideline for amount of cooling water supply. Adjust this amount depending on ambient temperature and operating conditions. It is desirable that Beier Variator be operated with its casing temperature kept within about 60°C.

9-3) Instructions on Starting

- Before starting the main body, be sure to start the oil pump of the lubricating oil cooling device and confirm lubrication. Allow 30 to 60 seconds lead time for the pump motor, and start the main motor only after the lubricating oil is circulating well. For the wiring, refer to the diagram on Fig. 11 page 14.

9-4) Daily Inspection and Maintenance of Oil Cooling Device

(1) Daily Inspection

Check the items below to evaluate whether cooling device is operating normally.

1. Is cooling water flowing normally?
2. Is oil circulating?
3. Is the temperature of BEIER case at 60°C or lower most of the time?

Table 40 Amount of Cooling Water Supply

Beier frame size		Amount of water supply (lit/min)
50A, 75A, 100A 50B, 75B	Horizontal Model	6-8
	Vertical Model	10-15
150A 200A 100B 150B		15-20

(2) Maintenance

(a) Filter cleaning

- (i) Clogged filter cartridge may cause the abnormal noise by oil suction shortage of the oil pump. Continuing the operation under this state may result in supplying shortage of the oil to the variator as well as breakdown of the oil pump, and may consequently bring the variator itself to burning and other problems.
- (ii) Since the filter cartridge is a laminate, you can easily clean the clogged cartridge by turning the handle at the upper end of the filter. Be sure to turn the handle once or more.
- (iii) At the initial operation, since it is easy to clog the cartridge, turn the handle once or more a day for cleaning the cartridge.
- (iv) At a standstill, drain the accumulated dust in the lower part of the filter from the drain plug at the lower end.

(b) Inspection and cleaning of the oil cooler (cf. Fig.22)

- (i) Maintenance and cleaning the oil cooler of the lubricating oil cooling device periodically. The interval depends on the condition of the lubricating oil or the quality of the cooling water. Be sure to conduct the periodical inspection every 3 to 6 months.
- (ii) You can check the cooling water by removing a bonnet in the U-turn side of the cooling water. For checking the lubricating oil, drain the oil from the oil drain plug.
- (iii) At that time, be sure to check the corrosion preventive zinc rod for wear. Replace the rod if it has been worn to less than half of its original length. You may have to replace it 3 to 6 months depending on the quality of the cooling water. (There are zinc rods at three places.)
- (iv) In winter when you stop the operation at the place where the cooling water freezes, surely drain the water every day. Even at the ambient temperature that the cooling water freezes, if you can keep the casing temperature of the variator between 40 to 45 degree, reduce the amount of the cooling water or stop supplying the cooling water.

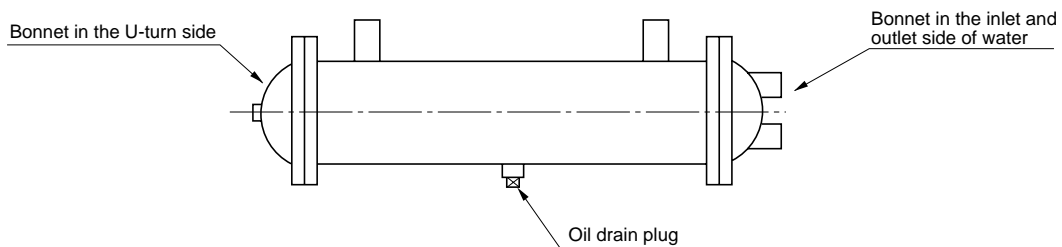



Fig. 22 Oil Cooler

10. Troubleshooting

If a problem occurs with the Beier variator, refer to Table 40 below and take the appropriate corrective action as soon as possible.

Table 40 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.	
		Protective device is engaged	Disengage protective device.	
		Load locking	Check the load and safety device.	
		Poor switch contact	Adjust the contact area.	
		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, contact, 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 Overload	Replace with specified switch. Decrease the load to the specified value.
		Fuse tripping	Insufficient capacity of fuse	Replace with specified fuse.
			Overload	Decrease the load to the specified value.
		The speed will not increase and the motor is overheating.	Voltage drop	Contact the electric power company.
			Overload	Decrease the load to the specified value.
			Short-circuited motor stator coil	Return the unit to factory for servicing.
	The motor stops.	The key is missing	Install a key.	
		The bearing is burned.	Replace the bearing.	
		Poor adjustment of protective device	Adjust the protective device.	
	The motor runs in the reverse direction.		Connection error	Change the connection.
	Fuse tripping		The outlet wire is short-circuited. Poor contact between motor and starter	Return the unit to factory for servicing. Complete the connection.
	Excessive temperature rise		Overload	Decrease the load to the specified value.
Voltage drop or rise			Contact the electric power company.	
The ambient temperature is high.			Improve the ventilation method.	
Damaged bearing			Return the unit to factory for servicing.	
Abnormal wear of gear or disc due to overloading			Return the unit to factory for servicing.	
Oil leakage	Leakage of oil/grease from input/output shaft section	Damaged oil seal	Replace the oil seal.	
	Leakage of oil/grease from the contact surfaces of case or cover	Loose bolts	Tighten bolts correctly.	
	Leakage of oil/grease into motor	Damaged oil seal	Return the unit to factory for servicing.	
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 or disc.	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 variator 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.	

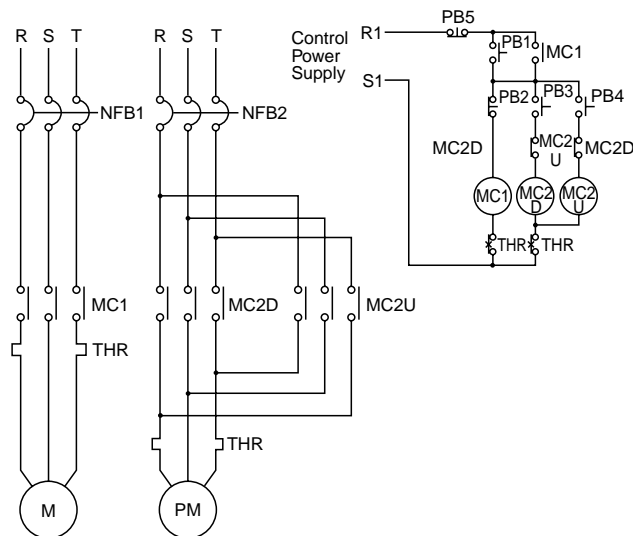
11. Remote Control Equipment (OPTION)

11-1) Speed Control Device

(1) Checking Wiring and Speed Control Operation

- An example of control circuit for pilot motor and push button is shown in Fig. 23 . To check the connection, start the main motor first. Then, confirm that the revolution speed of output shaft increases while depressing the speed increase button (PB4). Also confirm that the revolution speed of output shaft decreases while depressing the speed decrease button (PB3). If the operation is reversed, interchange two phases of power supply to the pilot motor (PM).
- When highest speed or lowest speed has been reached, check to confirm slip clutch is idling, thereby positively protecting both PM and speed change control device.

- There is a possibility of speed control failure if clutch is left slipping for 30 seconds or more while speed control operation is sustained at maximum or minimum speed. Do not fail to stop PM as soon as possible by releasing pushbutton for control. To prevent such problem, check change in rotation speed using electromagnetic tachometer while conducting speed control operation.
- For cases when clutch stays slipping because of the content of speed control, optional limit switch system is recommended.
- When stopping Beier Variator, never turn speed control handwheel. For Beier with remote control, connect power source of speed control pilot motor from the secondary side of power source of main motor.



- | | |
|---|--------------------------------|
| NFB : Auto Breaker | PB3 : Speed Decrease Button |
| MC1 : Electromagnetic Switch (Main Motor) | PB4 : Speed Increase Button |
| MC2D : Electromagnetic Switch (PM, Speed Decrease Side) | PB5 : Emergency Stop Button |
| MC2U : Electromagnetic Switch (PM, Speed Increase Side) | M : Main Motor |
| PB1 : Start Button | PM : Pilot Motor |
| PB2 : Stop Button | THR : Thermal Protection Relay |

Fig. 23 Connection Diagram

(2) Handling of the Pilot Motor (PM)

Both worm gear-type and Cyclo Drive-type pilot motors are available to match the different Beier types.

Table 42 Beier Type and Pilot Motor Type

	Worm gear motor type	Cyclo Drive type
A Type	N02A, N05A, N1A, N2A, N3A, N5A, N8A, N10A	15A, 20A, 30A, 40A, 50A, 75A, 100A, 150A, 200A
B Type	N02B, N05B, N1B, N2B, N3B, N5B, N8B	10B, 15B, 20B, 30B, 50B, 75B, 100B, 150B
D Type	N05D, N1D, N2D, N3D, N5D, N8D, N10D	

- Handling of the worm gear-type pilot motor (PM)

This pilot motor is a maintenance-free motor, which incorporates a ball clutch as a safety device.

To remove the pilot motor from the Beier main body, pull out the PM mounting bolts (3 bolts) first.

Then pull out the whole PM from the operating shaft. If it becomes necessary to change the manual speed, shut off the power of the pilot motor, and use a hexagon bar wrench (nominal 5) to turn part A.

- Never conduct operations while the Beier Variator is stopped.

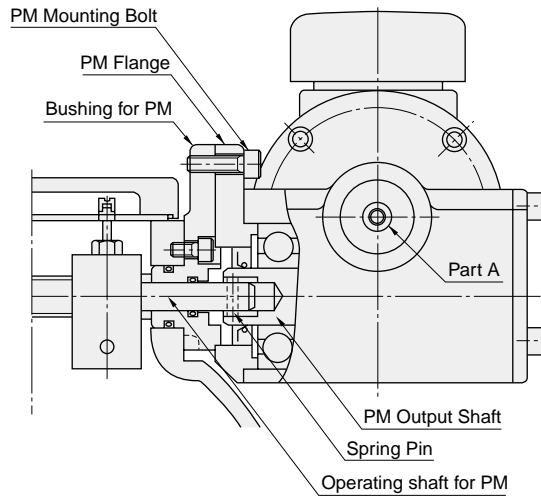


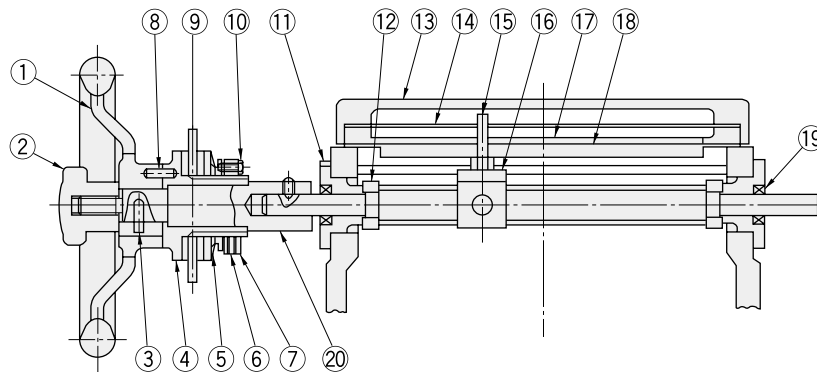
Fig. 24

· Setting torque of slip clutch for Cyclo Drive type

Torque of slip clutch has been set at the time of delivery by taking into consideration required moment of control shaft of Beier Variator, strength of inserted bush (mounting screws), etc. Therefore, no further adjustment is required except for special cases such as wear due to extended use. If need should arise to reestablish torque after delivery for some particular reason, proceed with the following steps referring to Fig. 25: Screw in adjusting nut ⑦ for full free length of spring ⑤ and set lock plug ⑥. Next, completely screw in adjusting bolt ⑩ into adjusting nut ⑦.

With these steps, required turning force should be obtained. If any fine adjustment is needed, this can be accomplished by sliding position of adjusting nut ⑦ back and forth.

· Slip clutch is designed to be used in dry condition. Therefore, take extra care to keep clutch free from splashes of water, oil, etc.



Part No.	Description	Q'ty	Part No.	Description	Q'ty	Part No.	Description	Q'ty	Part No.	Description	Q'ty
1	Handwheel	1	6	Lock plug	2	11	Bush	2	16	Shifting nut	1
2	Grip	1	7	Adjust nut	1	12	Spacer	2	17	Indicator Holder	1
3	Spring pin	1	8	Jaw clutch	2	13	Indicator plate	1	18	Gasket	2
4	Slip clutch	1	9	Chain wheel	1	14	Gasket	1	19	Oil seal	2
5	Spring	1-2	10	Adjust bolt	3	15	Pointer	1	20	Socket	1

Fig. 25

11-2) Speed indicators

Electromagnetic tachometer (for non explosion proof type).

- (1) Connect the lead wire of the Beier Variator electromagnetic sensor to the two tachometer terminals. When shield wire is used with digital tachometer, shield can be connected to the (-) side of sensor input. For analog tachometer, connection of shield is not necessary. (Assess whether or not to connect the shield wire since the noise intensity may become greater if unconnected.)

• Use a twisted shield wire measuring 0.5mm² or more for the wiring. Separate the shield wire from the power line. The connection distance must be no more than 100m.

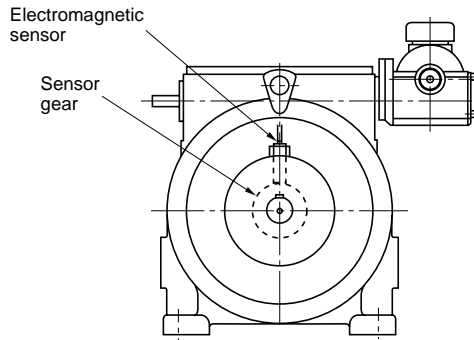
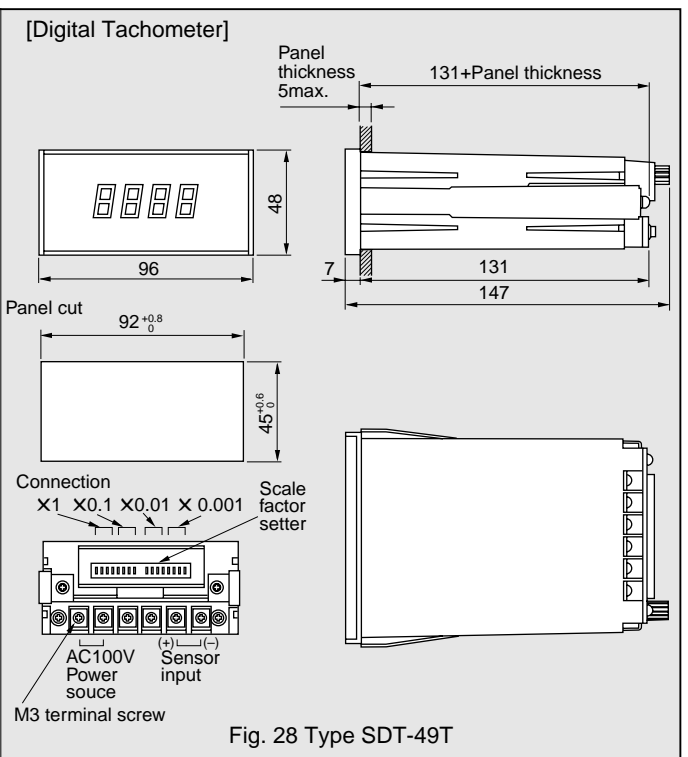
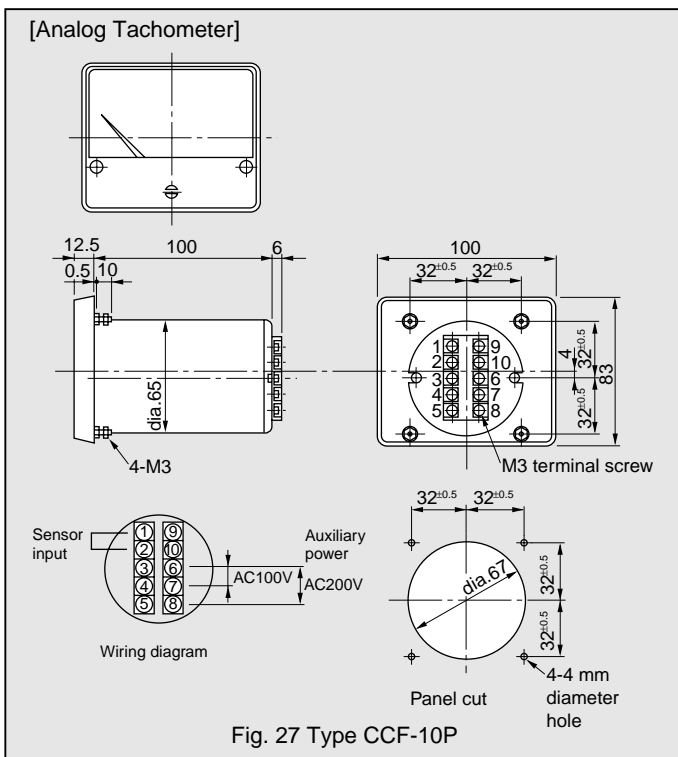


Fig. 26

- (2) Connect the auxiliary power source to the two tachometer terminals.
 Auxiliary power specification
 Analog tachometer : Common for AC100V 50/60Hz, AC200V 50/60Hz
 Digital tachometer : AC100V 50/60Hz
 This tachometer has graduated output revolutions.
- (3) For use of explosion proof type, refer to the Speed Setter SP-20D catalog.



11-3) Operating instructions

(1) Starting

- Change speed only after starting Variator. Never attempt to perform speed change operation when the unit is at a standstill.

To prevent such erroneous operation, it is recommended that power to pilot motor (PM) be obtained from secondary side of main motor power supply. (Refer to Fig. 23 on page 31)

(2) Speed change

Pilot motor (PM) will run and speed change will take place while pushbutton switch for speed change control is being pressed. When desired revolutions have been reached, release pushbutton switch to stop PM. Then Variator will run at a constant speed thereafter. To reverse PM (for instance, in order to switch from acceleration to deceleration), depress pushbutton again for desired operation after PM has come to a stop.

(3) Stopping

- Stopping main motor during speed change operation can break discs or cause other trouble. Therefore, before opening switch for main motor, disconnect speed change operation circuit without fail.

In this case, erroneous operation can be prevented by making connection as shown in Fig.23 on Page 31.

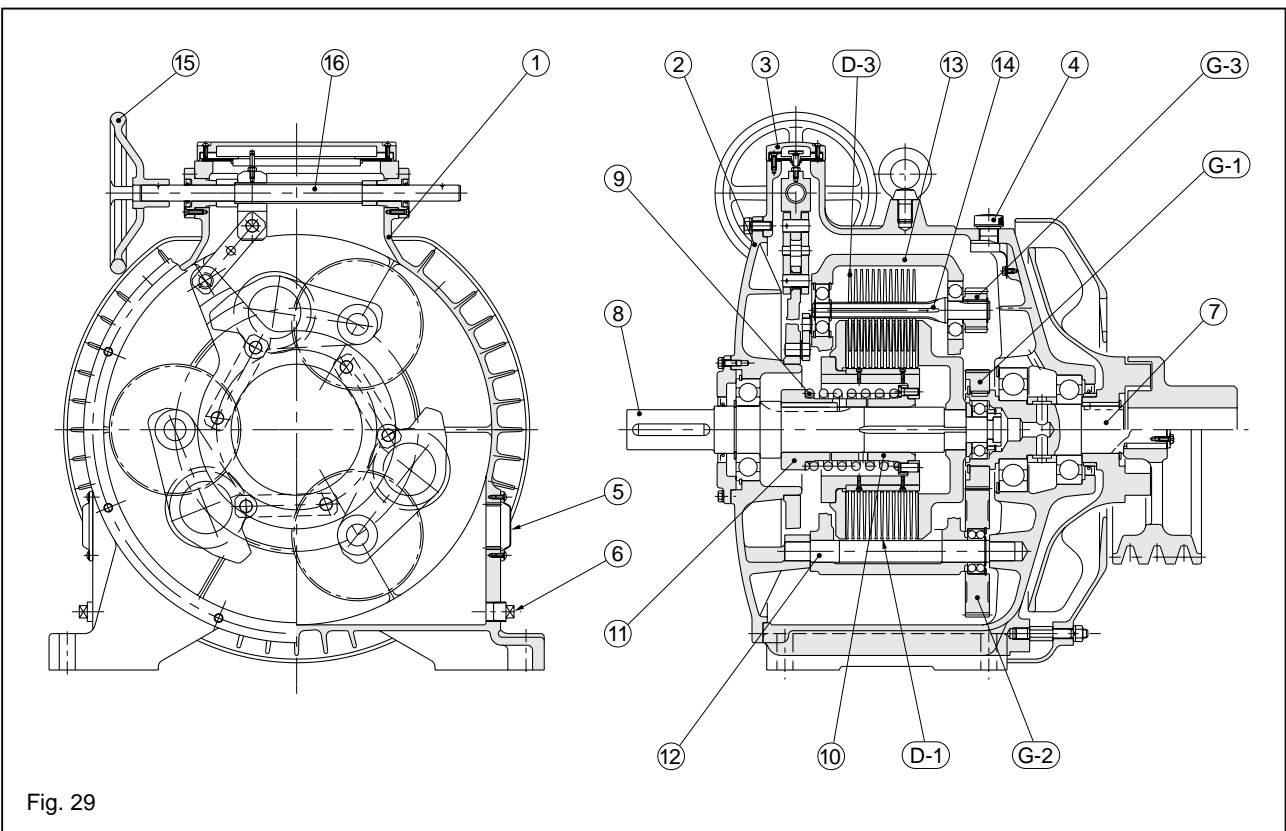
12. Speed Setter

Speed setter is automated control device that can control variator by rotation speed feedback system, which sets desired output rotation speed by digital switch or electronic signal DC4-20mA.

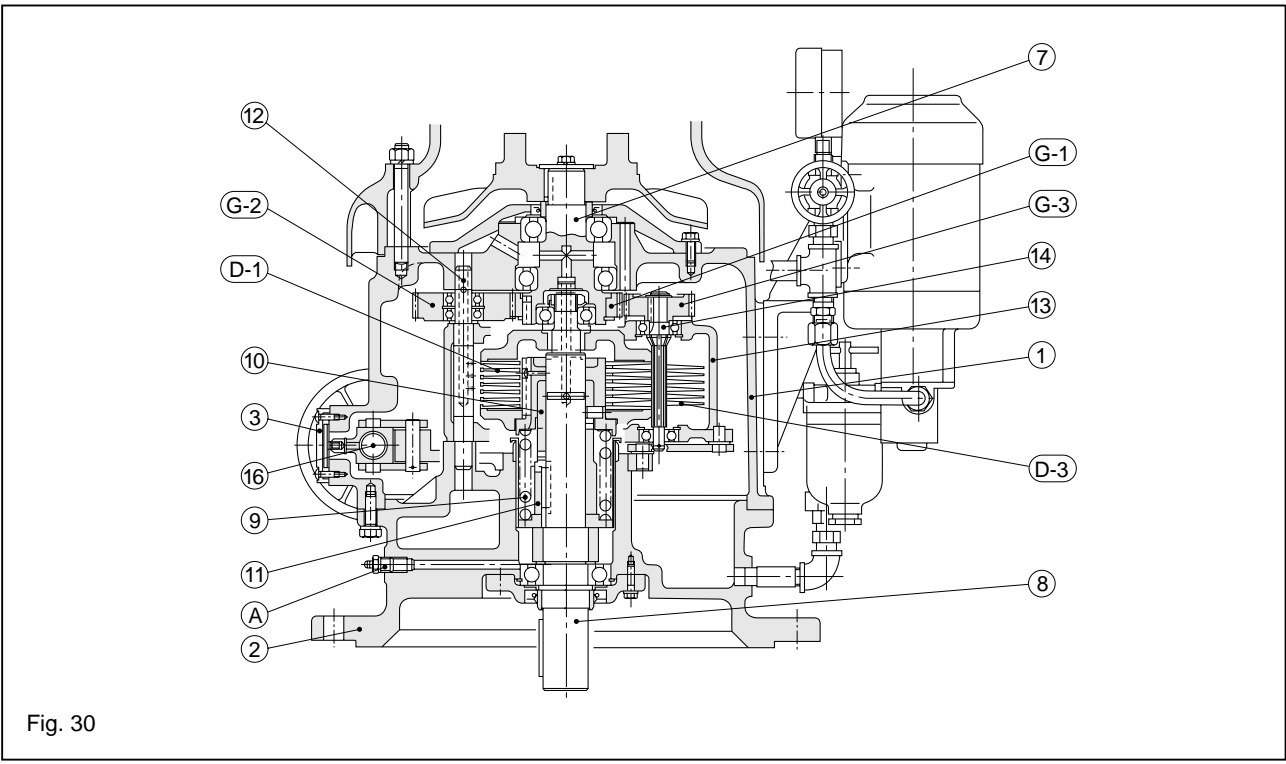
Refer to Speed Setter SP-20D Operating Manual for handling instructions.

13. Construction

13-1) Basic A and B Type BEIER VARIATOR (Horizontal)



13-2) Basic A and B Type BEIER VARIATOR (Vertical)



Ⓐ Frame sizes equipped with grease nipple are shown on page 25.

13-3) BEIER-CYCLO VARIATOR

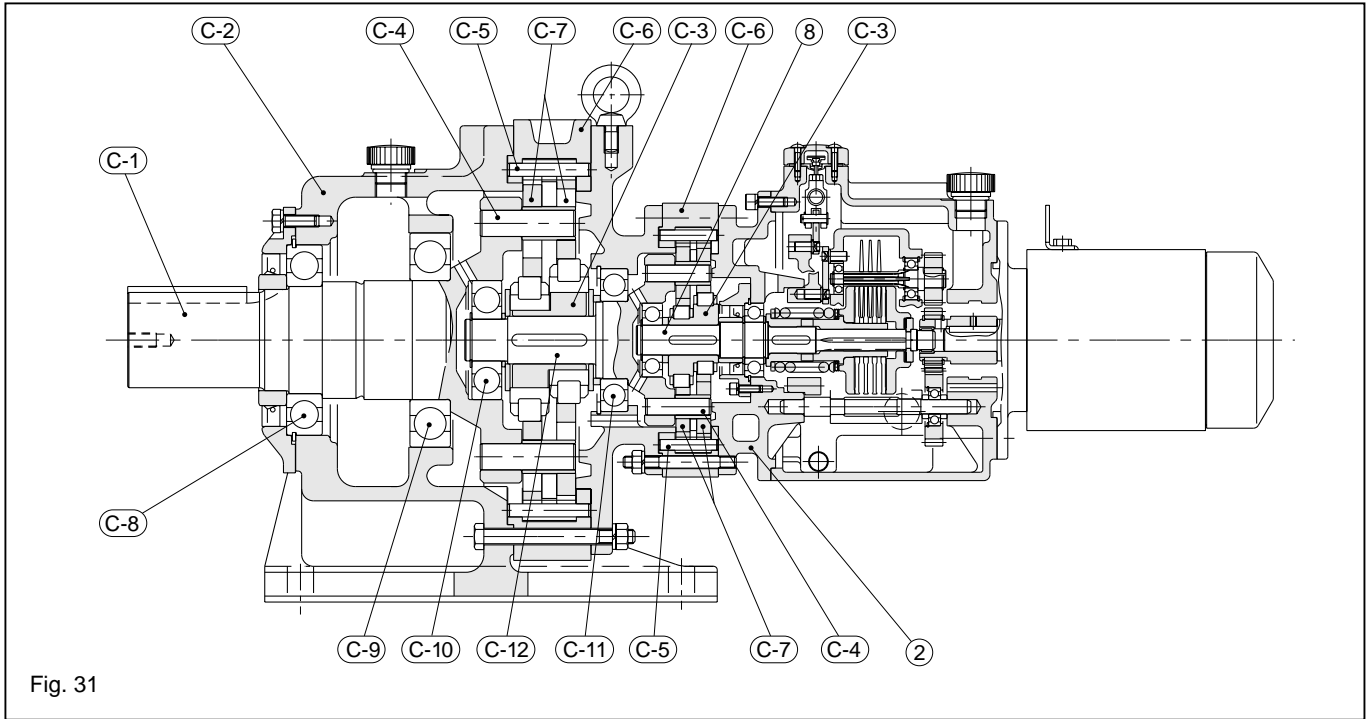


Fig. 31

Main Parts

Part No.	Description	Part No.	Description	Part No.	Description	Part No.	Description
1	Casing	10	Face cam I	D-1	Flange disc	C-5	Ring gear housing pin
2	Cover (Flange cover in Fig. 31)	11	Face cam II	D-3	Cone disc	C-6	Ring gear housing
3	Indicator plate	12	Swing shaft	G-1	Input shaft gear	C-7	Cycloid disc
4	Oil filler plug	13	Bracket (arm)	G-2	Idler gear	C-8	Slow speed shaft bearing A
5	Oil gauge	14	Spline shaft	G-3	Spline shaft gear	C-9	Slow speed shaft bearing B
6	Drain plug	15	Hand wheel	C-1	Slow speed shaft	C-10	Intermediate shaft bearing A
7	Input shaft	16	Shifting screw	C-2	Horizontal casing	C-11	Intermediate shaft bearing B
8	Output shaft (high speed shaft in Fig. 31)			C-3	Eccentric	C-12	Intermediate shaft
9	Spring			C-4	Slow speed shaft pin		

13-4) D Type BEIER VARIATOR (Horizontal)

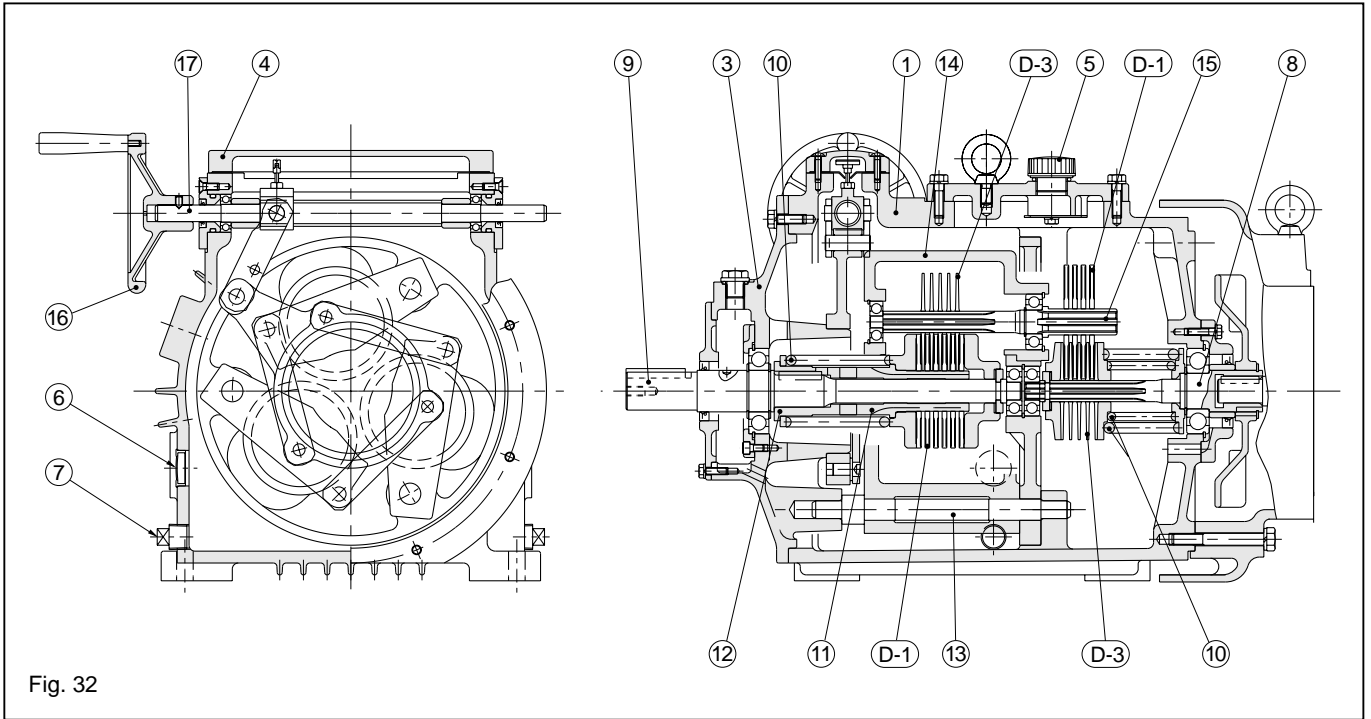


Fig. 32

Main Parts

Part No.	Description	Part No.	Description	Part No.	Description	Part No.	Description
1	Casing	6	Oil gauge	11	Face cam I	16	Hand wheel
2	Base	7	Drain plug	12	Face cam II	17	Shifting screw
3	Cover	8	Input shaft	13	Swing shaft	D-1	Flange disc
4	Indicator plate	9	Output shaft	14	Bracket (arm)	D-3	Cone disc
5	Oil filler plug	10	Spring	15	Spline shaft		

13-5) D Type BEIER VARIATOR (Vertical)

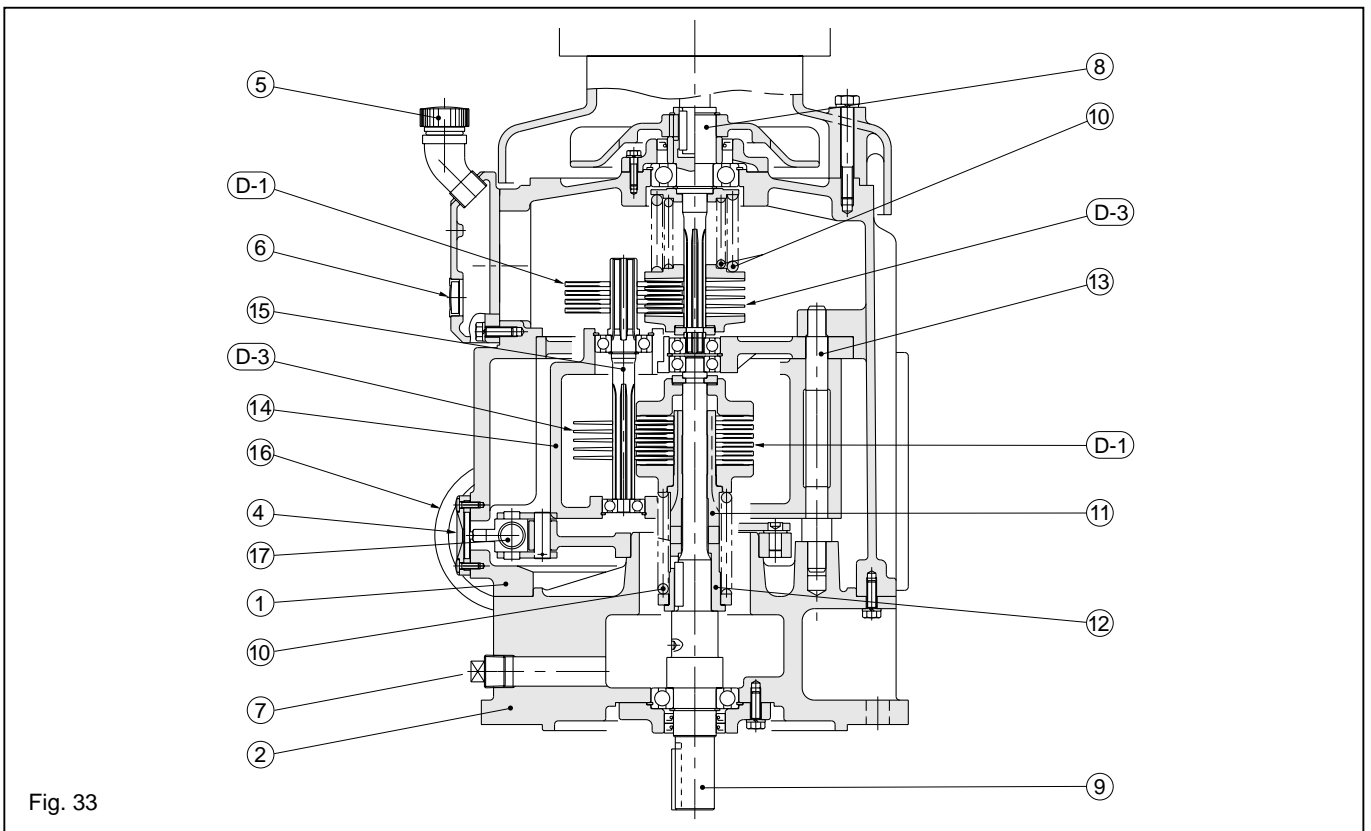


Fig. 33



13-6) Motor

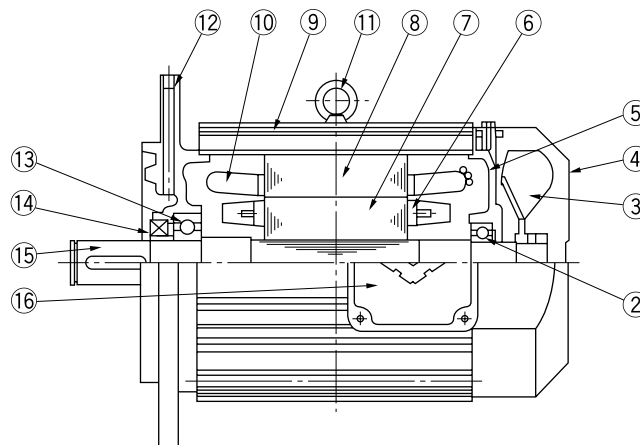


Fig 34 Example of Construction of 80–112M Frame

Main Parts

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 seal
3	Fan	9	Stator frame	15	Motor shaft
4	Fan cover	10	Stator windings	16	Conduit box
5	End bracket	11	Eyebolt		
6	Rotor conductor short circuit ring	12	Flange bracket		

14. Oil Seal list

Table 43 Oil Seal List

Type	Common				Basic Type		Gear Recuction Type		BEIER-CYCLO VARIATOR							
	For input shaft		For shifting screw		For output shaft		For slow speed shaft		CYCLO		For high speed shaft		For low speed shaft			
	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Type	Nominal No.	Q'ty	Nominal No.	Q'ty			
A & B Type BEIER VARIATOR (Horizontal)	N02A N05A N1A	N02B N05B	S25408 For free input shaft type only	1	P10A-O-ring (10 14 2.4) P18-O-ring (18 22 2.4) G10204	2 2 2	S26428	1	S25408	1	6075 6095 6105 6125	S22325 S25356	2 2	D30478 D507212 D659013 D659013	1 1 1 1	
	N2A N3A	N1B N2B	S35508 For free input shaft type only	1	P10A-O-ring (10 14 2.4) P18-O-ring (18 22 2.4) G10204	2 2 2	S385811	1	S355511	1	6125 6130, 6135 6145 6160, 6165	S385811 S45629	1 1	D658812 D8511013	1 1	
	N5A N8A	N3B N5B	S45629	1	P14-O-ring (14 18 2.4) S14246	2 2	S507010	1	S457014	1	6160, 6165 6170, 6175 6180, 6185	S45629 S50689	1 1	D8511013 D9513015 D11014515	1 1 1	
	N10A	N8B	S45629	1	S17306	2	S507212	1	S608212	1	6170, 6175 6180, 6185 6190, 6195	S50689 S60759 S608212	1 1 1	D9513015 D11014515 D12015516	1 1 1	
	15A	10B	S628512	1	S17306	2	S558514	1	S709212	1	6180, 6185 6190, 6195	S659012	1	D11014515 D12015516	1 1	
	20A	15B	S8511013	1	S17306	2	S609014	1	S8511013	1	6215 6225	S8511013 S8010010	1 1	D13016014 D14517514	1 1	
	30A 40A	20B 30B	S10012513	1	S22388	2	S659012	1	S10012513	1	-	-	-	-	-	-
	50A 75A 100A	50B 75B	S11014014	1	S254010	2	S11014014	1	S12515514	1	-	-	-	-	-	-
	150A 200A	100B 150B	S11014014	1	S355511	2	S14017014	1	-	-	-	-	-	-	-	-
	A & B Type BEIER VARIATOR (Vertical)	N05A N1A	N05B	-	-	P10A-O-ring (10 14 2.4) P18-O-ring (18 22 2.4) G10204	2 2 2	S26428 G26426	1 1	S32458	2	6095 6105 6125	S22325 S25356	2 2	D507212 D659013	1 1
N2A N3A		N1B N2B	-	-	P10A-O-ring (10 14 2.4) P18-O-ring (18 22 2.4) G10204	2 2 2	S40587	2	S385811	2	6125 6130, 6135 6145 6160, 6165	S38588 S45629	2 2	D659013 D658812	1 2	
N5A N8A		N3B N5B	S45629	1	P14-O-ring (14 18 2.4) S14246	2 2	S40587	2	S456812	2	6160, 6165 6170, 6175 6180, 6185	S45629 S50689	2 2	D8511013 D9513015 D11014515	2 2 2	
N10A		N8B	S45629	1	S17306	2	S507212	2	S608212	2	-	-	-	-	-	
15A		10B	S628512	1	S17306	2	S558514	1	S8511013	1	-	-	-	-	-	
20A		15B	S8511013	1	S17306	2	S609014	1	S10513514	1	-	-	-	-	-	
30A 40A		20B 30B	S11012513	1	S22388	2	S659012	1	S11014014	1	-	-	-	-	-	
50A 75A 100A		50B 75B	S11014014	1	S254010	2	S10513514	1	-	-	-	-	-	-	-	
150A 200A		100B 150B	S11014014	1	S355511	2	S14017014	1	-	-	-	-	-	-	-	
D Type BEIER VARIATOR (Horizontal)		N05D N1D		S25458	1	P10A-O-ring (10 14 2.4) P18-O-ring (18 22 2.4) G10204	2 2 2	S26428	1	-	-	6095 6105 6125	S26428	1	D507212 D659013	1 1
	N2D N3D		S35508	1	P10A-O-ring (10 14 2.4) P22-O-ring (22 26 2.4) G10257	2 2 2	S32528	1	-	-	6130, 6135 6145 6160, 6165	S38588	1	D658812 D8511013	1 1	
	N5D N8D		S45629	1	P14-O-ring (14 18 2.4) P26-O-ring (26 32 3.5) S14246	2 2 2	S35508	1	-	-	6160, 6165 6170, 6175 6180, 6185	S45629	1	D8511013 D9513015 D11014515	1 1 1	
	N10D		S55729	1	2017-O-ring (17 21 2.4) P29-O-ring (29 35 3.5) S17306	2 2 2	S45629	1	-	-	6170, 6175 6180, 6185 6190, 6195	S527512	1	D9513015 D11014515 D12015516	1 1 1	
	D Type BEIER VARIATOR (Vertical)	N1D		S25458	1	P10A-O-ring (10 14 2.4) P18-O-ring (18 22 2.4) G10204	2 2 2	S25458	2	-	-	6095 6105 6125	S26428	2	D507212 D659013	1 1
N2D N3D			S35508	1	P10A-O-ring (10 14 2.4) P22-O-ring (22 26 2.4) G10257	2 2 2	S305512	2	-	-	6130, 6135 6145 6160, 6165	S38588	2	D658812 D8511013	2 2	
N5D N8D			S45629	1	P14-O-ring (14 18 2.4) P26-O-ring (26 32 3.5) S14246	2 2 2	S35508	2	-	-	6160, 6065 6170, 6175 6180, 6185	S45629	2	D8511013 D9513015 D11014515	2 2 2	
N10D			S55729	1	2017-O-ring (17 21 2.4) P29-O-ring (29 35 3.5) S17306	2 2 2	S45629	2	-	-	6170, 6175 6180, 6185 6190, 6195	S527512	2	D9513015 D11014515 D12015516	2 2 2	

15. Bearing list

Table 44 Bearing list

Type	Common								Basic Type		Gear Reduction Type							
	For input shaft		For spline shaft		For swing shaft gear		For output shaft (input side)		For output shaft		For driven shaft		For intermediate shaft		For low speed shaft			
	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty		
A & B Type BEIER VARIATOR (Horizontal)	N02A N05A N1A	N02B N05B	6003 For free input shaft type only	2	HK0509T2 HK0910	3 3	-	-	AXK1105 AS1105	1 2	6203NR	1	6203NR	1	6201 6202	1 1	6305 6305LL	1 1
	N2A N3A	N1B N2B	6305NR 6305 For free input shaft type only	1 1	629 6202	3 3	6201	3	AXK1107 AS1107 6202	1 2 1	6206NR	1	6206NR	1	6203	2	6307ZZ	2
	N5A N8A	N3B N5B	6307NR 6209	1 1	6300 6203	3 3	6202	6	6302	1	6207NR	1	6207NR	1	NJ305 NJ306	1 1	6309 NJ306	1 1
	N10A	N8B	6307NR 6210	1 1	6300 6203	3 3	6202	6	6304	1	6208NR	1	6209NR	1	6308 6309	1	6312 NJ308	1 1
	15A	10B	6210NR 6212	1 1	6303 6305	3 3	6204	6	6305	1	6211NR	1	6211NR	1	6208 NJ308	1 1	6313 NJ310EV3	1 1
	20A	15B	6213NR 6213	1 1	6303 6403	3 3	6006	6	6306	1	6212NR	1	6312NR	1	6309 NJ310EV3	1 1	6412 NJ312	1 1
	30A 40A	20B 30B	6314 6316	1 1	6404 6405	3 3	3206	3	6307	1	6313NR	1	6313NR	1	6212 NJ312	1 1	6416 NF315	1 1
	50A 75A 100A	50B 75B	6318ZNR 6322	1 1	6405 6406	3ea. 4ea. 6ea.	6207	6 8 12	51115 51124 22310	1 1 1	23122BNR	1	23122BNR	1	6318 NJ318	1 1	NJ319 23124 ★(NJ321) ★(23126)	1 1 (1) (1)
	150A 200A	100B 150B	23122BNR NF226	1 1	6405 6406	8 8	6207	16	51124 51136 21315	1 1 1	23128BNR	1	23128BNR	1	-	-	-	-
	A & B Type BEIER VARIATOR (Vertical)	N05A N1A	N05B	-	-	HK0509T2 HK0910	3 3	-	-	AXK1105 AS1105	1 2	6203NR	1	6203NR	1	6201 6202	1 1	6305 6305ZZ
N2A N3A		N1B N2B	-	-	629 6202	3 3	6201	3	AXK1107 AS1107 6202	1 2 1	6206NR	1	6206NR	1	6203	2	6307	2
N5A N8A		N3B M5B	6307ZZNR 6209	1 1	6300 6203	3 3	6202	6	6302	1	6207NR	1	6207NR	1	NJ305 NJ306	1 1	6309 NJ306	1 1
N10A		N8B	6307NR 6210	1 1	6300 6203	3 3	6202	6	6304	1	6208NR	1	6209NR	1	6308 6309	1	6312 NJ308	1 1
15A		10B	6210NR 6212Z	1 1	6303 6305	3 3	6204	6	6305	1	6310NR	1	6211NR	1	6310 NJ309	1 1	6315Z NU312	1 1
20A		15B	6213NR 6213Z	1 1	6303 6403	3 3	6006	6	6306	1	6313NR	1	6312NR	1	6312 NF211	1 1	6317Z NU314	1 1
30A 40A		20B 30B	6314Z 6316Z	1 1	6404 6405	3 3	3206	3	6307Z	1	22217BK +AH317	1	6313NR	1	6313 NJ213	1 1	6320Z NU317	1 1
50A 75A 100A		50B 75B	6318ZNR 6322ZZ	1 1	6405 6406	3ea. 4ea. 6ea.	6207	6 8 12	51115 51124 22310	1 1 1	23024BK +AH3024	1	-	-	-	-	-	-
150A 200A		100B 150B	23122BNR NF226	1 1	6405 6406	8 8	6207	16	51124 51136 21315	1 1 1	23128BNR	1	-	-	-	-	-	-
D Type BEIER VARIATOR (Horizontal)		N05D N1D		6205NR 629	1 1	-	-	-	-	629	1	6204NR	1	-	-	-	-	-
	N2D N3D		6007NR 6300	1 1	6202	3	-	-	6300	1	6205NR	1	-	-	-	-	-	-
	N5D N8D		6306NR 6302	1 1	6204 6300	3 3	-	-	6302	1	6207NR	1	-	-	-	-	-	-
	N10D		6208NR 6203 AXK1108	1 1 1	6204 6202	3 3	-	-	6203 AXK1110	1 1	6209NR	1	-	-	-	-	-	-
D Type BEIER VARIATOR (Vertical)	N1D		6205NR 629	1 1	-	-	-	-	629	1	6205NR	1	-	-	-	-	-	-
	N2D N3D		6007NR 6300	1 1	6202	3	-	-	6300	1	6206NR	1	-	-	-	-	-	-
	N5D N8D		6306NR 6302	1 1	6204 6300	3 3	-	-	6302	1	6207NR	1	-	-	-	-	-	-
	N10D		6208NR 6203 AXK1108	1 1 1	6204 6202	3 3	-	-	6203 AXK1110	1 1	6209NR	1	-	-	-	-	-	-

Table 45 Bearing List

BEIER-CYCLO VARIATOR								
CYCLO frame size	For high speed shaft		End of high speed shaft		Slow speed shaft A		Slow speed shaft B	
	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty	Nominal No.	Q'ty
6075			6301	1	6204Z	1	6909	1
6095	6203NR	1	6302RSH2	1	6306Z	1	16011	1
6105			6302RSH2	1	6306Z	1	16011	11
6125	6203NR	1	6304	1	6308Z	1	6013	1
6125			6304	1	6308Z	1	6013	1
6130, 6135	6206NR	1	6305	1	6211NR	1	6213	1
6145			6305R	1	22211EXNR	1	6213	1
6160, 6165	6207NR	1	6307R	1	*3TM-6213NR	1	*6215	1
6160, 6165			6307R	1	*3TM-6213NR	1	*6215	1
6170, 6175	6207NR	1	6406	1	*6216NR	1	*6218	1
6180, 6185			6308NR	1	6407	1	*6218NR	1
6170, 6175	6308NR	1	6406	1	*6216NR	1	*6218	1
6180, 6185			6309NR	1	6407	1	*6218NR	1
6180, 6185	6309NR	1	6408	1	*6221NR	1	*6026	1
6190, 6195			6310NR	1	6407	1	*6218NR	1
6180, 6185	6310NR	1	6408	1	*6221NR	1	*6026	1
6190, 6195			6312NR	1	NJ311EV16	1	23022BNRC2	1
6215	6312NR	1	NJ312EV11	1	23024BNRC2	1	6226C2	1
6225			-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
6095	6203NR	1	6302RSH2	1	6306Z	1	16011	1
6105			6302RSH2	1	6306Z	1	16011	1
6125	6203NR	1	6304	1	6308Z	1	6013	1
6125			6304	1	6308Z	1	6013	1
6130, 6135	6206NR	1	6305	1	6211NR	1	6213	1
6145			6305R	1	22211EXNR	1	6213	1
6160, 6165	6207NR	1	6307R	1	*3TM-6213NR	1	*6215	1
6160, 6165			6307R	1	*3TM-6213NR	1	*6215	1
6170, 6175	6207NR	1	6406	1	*6216NR	1	*6218	1
6180, 6185			6308NR	1	6407	1	*6218NR	1
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
6095	6204NR	1	6302RSH2	1	6306Z	1	16011	1
6105			6302RSH2	1	6306Z	1	16011	1
6125	6204NR	1	6304	1	6308Z	1	6013	1
6130, 6135			6305	1	6211NR	1	6213	1
6145	6205NR	1	6305R	1	22211EXNR	1	6213	1
6160, 6165			6305NR	1	6307R	1	*3TM-6213NR	1
6160, 6165	6207NR	1	6307R	1	*3TM-6213NR	1	*6215	1
6170, 6175			6307NR	1	6406	1	*6216NR	1
6180, 6185	6307NR	1	6407	1	*6218NR	1	*6220	1
6170, 6175			6209NR	1	6406	1	*6216NR	1
6180, 6185	6209NR	1	6407	1	*6218NR	1	*6220	1
6190, 6195			6309NR	1	6408	1	6221NR	1
6095	6204NR	1	6302RSH2	1	6306Z	1	16011	1
6105			6302RSH2	1	6306Z	1	16011	1
6125	6204NR	1	6304	1	6308Z	1	6013	1
6130, 6135			6205NR	1	6305	1	6211NR	1
6145	6205NR	1	6305R	1	22211EXNR	1	6213	1
6160, 6165			6305NR	1	6307R	1	*3TM-6213NR	1
6160, 6165	6207NR	1	6307R	1	*3TM-6213NR	1	*6215	1
6170, 6175			6305NR	1	6307R	1	*3TM-6213NR	1
6170, 6175	6307NR	1	6406	1	*6216NR	1	*6218	1
6180, 6185			6307NR	1	6407	1	*6218NR	1
6170, 6175	6209NR	1	6406	1	*6216NR	1	*6218	1
6180, 6185			6209NR	1	6407	1	*6218NR	1
6180, 6185	6209NR	1	6407	1	*6218NR	1	*6220	1
6190, 6195			6309NR	1	6408	1	6221NR	1

Notes

- Bearings used on each unit of variator include bearing shown in "Common" column and those shown in each type column (Basic, Gear reduction, and BEIER-CYCLO columns).
EX : BHHM-N8A Common + Basic
 (BHH-N8A)
 GVFBMN3B-G30 Common + Gear reduction
 (BVF-N3B)
 CHHBMN2D-4160 Common + BEIER-CYCLO
 (BHH-N2D)
(for details of type code, refer to catalogs.)
- For types shown in Table 46, bearing is also used in control shaft section.
- For bearing marked ★ in table, bearing in parentheses may sometimes be used depending upon reduction ratio.
- For models whose CYCLO reducer column is blank, they are models where BEIER and CYCLO are connected by means of coupling. Therefore, refer to description of each model for further details.
- For the grease-lubricated models, the bearings marked *** are of the single-shielded type. To specify their ID codes, change the last digits of the codes provided in the table as follows: NR → ZNR; NXR → ZNXR and no letters → Z.

Table 46 Bearing for Control Shaft

Frame size	Nominal No.	Q'ty
150A 200A 100B 150B	6207	2
N2D N3D	6000	2
N5D N8D	6002	2
N10D	6003	2

Table 47 Bearing for Eccentric of CYCLO DRIVE

Frame size	Nominal No.	Q'ty	Frame size	Nominal No.	Q'ty
6075	607YXX	1	6190, 6195	619YSX	2
6095	Eccentric bearing shown in table 46 is used.	1	6205	620GXX	2
6105			6215	621GXX	2
6125			6225	622GXX	2
6130, 6135			6235	623GXX	2
6145			6245	624GXX	2
6160, 6165			6255	625GXX	2
6170, 6175	617YSX	2	6265	626GXX	2
6180, 6185	618YSX	2	6275	627GXX	2

Table 48 Eccentric Bearing

Reduction ratio	Frame size		
	6095	6105	6125
6	60906YRX	6100608YRX	6120608YRX
8	60908-15YSX	6100608YRX	6120608YRX
11	60908-15YSX	61011-15YRX	6121115YSX
13	60908-15YSX	61011-15YRX	6121317YSX
15	60908-15YSX	61011-15YRX	6121115YSX
17	60917YSX	61017YSX	6121317YSX
21	60921YSX	61021YRX	61221YRX
25	6092529YSX	6102529YRX	6122529YSX
29	6092529YSX	6102529YRX	6122529YSX
35	60935YSX	61035YRX	61235YRX
43	60943YSX	61043YSX	61243YSX
51	60951YRX	61051YRX	6125159YRX
59	60959YSX	61059YRX	6125159YRX
71	60971YRX	61071YRX	6127187YRX
87	60987YSX	61087YRX	6127187YRX

Reduction ratio	Frame size		
	6130, 6135	6145	6160, 6165
6	61406-11YSX	61406-11YSX	6160608YRX2
8	61406-11YSX	61406-11YSX	6160608YRX2
11	61406-11YSX	61406-11YSX	61611-15YSX
13	61413-17YSX	61413-17YSX	61611-15YSX
15	61413-17YSX	61413-17YSX	61611-15YSX
17	61413-17YSX	61413-17YSX	61617-25YSX
21	6142125YSX	6142125YSX	61617-25YSX
25	6142125YSX	6142125YSX	61617-25YSX
29	6142935YSX	6142935YSX	6162935YSX
35	6142935YSX	6142935YSX	6162935YSX
43	61443-59YSX	61443-59YSX	6164351YSX
51	61443-59YSX	61443-59YSX	6164351YSX
59	61443-59YSX	61443-59YSX	61659YSX
71	6147187YSX	6147187YSX	61671YRX2
87	6147187YSX	6147187YSX	61687YSX

16. Disc and Spine Shaft List

Table 49

Frame size		Cone disc		Flange disc				Spline shaft
				I		II		
N02A N05A	N02B	3		–		2		3
N1A	N05B	6		1		2		3
N2A	N1B	6		1		2		3
N3A	N2B	9		2		2		3
N5A	N3B	12		3		2		3
N8A	N5B	15		4		2		3
N10A	N8B	18		5		2		3
15A	10B	24		7		2		3
20A	15B	27		8		2		3
30A	20B	33		10		2		3
40A	30B	36		11		2		3
50A		27		8		2		3
75A	50B	36		8		2		4
100A	75B	60		9		2		6
150A	100B	72		8		2		8
200A	150B	88		10		2		8
N05D		3	6	6	1	–	2	3
N1D		3	9	6	2	–	2	3
N2D		3	6	6	1	–	2	3
N3D		4	9	9	2	–	2	3
N5D		4	12	9	3	–	2	3
N8D		5	15	12	4	–	2	3
N10D		5	18	12	5	–	2	3

Note: For D Type (N05D–N10D), left side shows quantity of discs on 1st stage and right side quantity of discs on 2nd stage.

17. Warranty

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

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

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