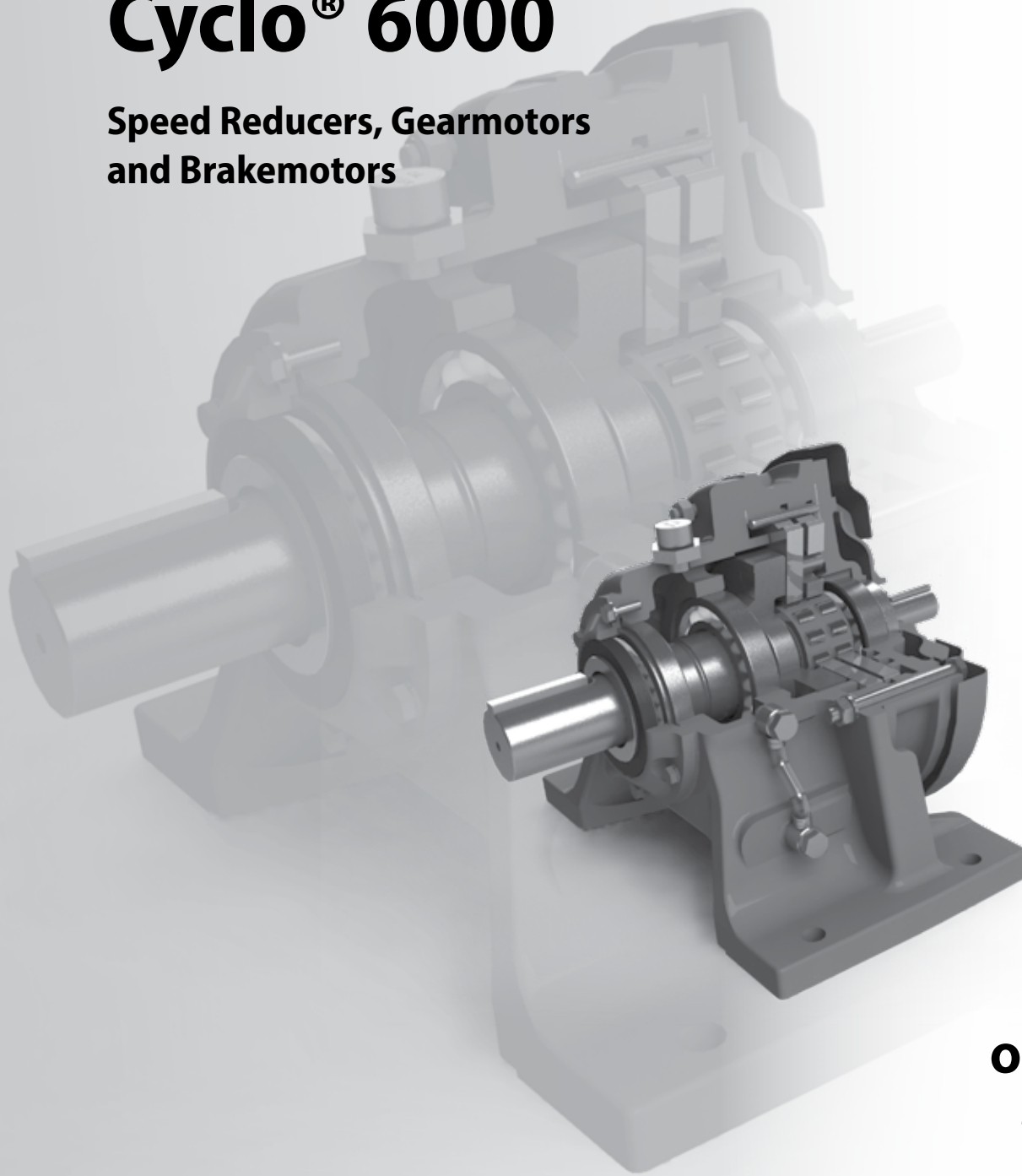


Cyclo[®] 6000

**Speed Reducers, Gearmotors
and Brakemotors**



Operation and Maintenance Manual

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Safety Symbols

- 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.



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



CAUTION
Improper handling may result in physical damage, serious personal injury.

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

Safety Precautions



- Transport, installation, plumbing, wiring, operation, maintenance, and inspections should be performed by trained technicians; otherwise, electric shock, personal injury, fire, or damage to the equipment may result.
- In the case of disassembly, assembly or overhaul of this device, contact the nearest authorized service station.
- 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; otherwise, explosion, ignition, electrical shock, personal injury, fire or damage to the equipment may result.
- When the unit is to be used in a system for human transport, a protecting device for human safety should be installed to prevent chances of accidents resulting in personal injury, death, or damage to the equipment due to running out of control or falling.
- When the unit is to be used for an elevator or lifter, install a safety protecting device on the elevator side to prevent it from falling; otherwise, personal injury, death, or damage to the equipment may result.

IMPORTANT NOTES



- Operate the unit only within its design and performance specifications; otherwise, injury or damage to the system may occur.
- Keep hands and all foreign objects from the internal moving parts of the unit; otherwise, injury or damage to the system may occur.
- Take damaged units off-line immediately and do not resume operation until properly repaired.
- Modifications or alterations of any kind to the unit will void the warranty and all subsequent claims.
- Do not remove the rating plate.

Disposal

Please refer to local, state, and federal regulations governing disposal of:

Steel Scrap:

- Housing (Ductile and Gray Cast Iron)
- Gears
- Shafts
- Bearings

Lubricants:

- Gear Oil
- Grease

1.INSPECTION UPON DELIVERY

1. Inspection Upon Delivery



- In order to avoid injury, **ensure that the unit is in a stable position** before unpacking.
- **Verify that the unit received matches your order.** Using the incorrect product may cause equipment damage or personal injury.
- **Do not** remove the nameplate from the unit.

Upon delivery, inspect the unit for damage that may have occurred during shipment. Notify the shipping company immediately if you find any damage. **Do not** install or operate a damaged unit.

Upon receipt of the reducer/gearmotor, verify that:

- The model number on the unit nameplate matches the purchase order.
- The unit was not damaged during shipping.
- All bolts and nuts are fully tightened.

Please consult your Sumitomo agent, distributor, or sales office if you find any defects or if you have any questions.

1.1 Reading the Nameplates

When contacting Sumitomo about this product, please be prepared to provide the following information from the nameplate:

- Serial Number.
- Model Number.
- Ratio

Metal Reducer Nameplate

Nominal Reduction Ratio

Unit Model Number

Unit Serial Number

Metal Gearmotor Nameplate

Unit Model Number

Unit Serial Number

Nominal Reduction Ratio

Non-Metallic Nameplate (when Cyclo® input is 613 or larger)

Unit Serial Number

Unit Model Number

Nominal Reduction Ratio

Unit Serial Number

Unit Model Number

Nominal Reduction Ratio

1. INSPECTION UPON DELIVERY

1.2 Checking Lubrication Method

Refer to “**8.2 Lubrication**” to confirm the lubrication method.



- Oil lubricated machines are shipped without oil.
- Before operating, make sure to fill the unit with approved oil (see “**Lubrication**” Section).

1. INSPECTION UPON DELIVERY

Notes

1. INSPECTION UPON DELIVERY

Type	Code
Horizontal ^[1]	H
Vertical ^[1]	V
Vertical Up ^[1]	W
Universal Direction ^[2]	N

Notes:
[1]: H, V, W, units cannot change orientation in the field.
[2]: Universal Direction (N) units are maintenance-free greased.

Type	Code
Foot	H
Flange	F
V-Flange	V

Motor Connection	Code
Integral Motor	M
C-Face Adapter	JM
Hollow Input Shaft	XM

	Code
Special	S
Standard	-

Modification (Special)

HP	1/8	1/4	1/3	1/2	3/4	1	1.5	2	3	4	5	7.5	10	15	20	25	30	40	50	60	75
Symbol	01	02	03	05	08	1	1H	2	3	4	5	8	10	15	20	25	30	40	50	60	75

Motor Capacity

4P

Note: For standard fractional motors (non inverter duty), no specification code suffix is required.

Shaft	Code
Metric JIS	-
Inch	Y
AGMA I	YA
AGMA II	YB
AGMA III	YC
Standard Metric DIN "G" (up to size 6125)	G
Standard Metric DIN "E" (up to size 6145)	E

Shaft Specification

	Code
With Brake	B
No Brake	

Brake

Frame Size
(Page 10, Table 1-1 to 1-3)

Nominal Ratio

C H H M

10

6165

YB

EP

29

Motor Capacity

Frame Size

Modification (Special Feature)

Input Connection

Mounting Style

Output Shaft Orientation

C = Ratios 6:1 and greater (Cyclo® Speed Reducer Product Code)
P = Ratios 3:1 and 5:1 (Cyclo® 6000 Planetary Product Code)

GEARMOTOR NOMENCLATURE

Example:

CHHM10 – 6165YB – EP - 29

C – Cyclo 6000

H – Horizontal O/P

H – Foot Mount

M – Gearmotor

6165 – Frame Size

Y – Inch Shaft, AGMA Class II

EP – Three Phase Motor Premium Efficiency

29 – Ratio

Specification Codes

Type	Suffix
AF Motor (Inverter Duty, 1/8 HP to 3/4 HP)	AV
Three-Phase Motor Premium Efficiency (1+ HP), IE3	EP
High Capacity Bearing	R1
High Capacity Bearings + Ductile Casing	R2
*DC Motor	DV
*CHH Type	
Oil Sight Mount Ceiling	H1
Oil Sight Mount Left Wall	H2
Oil Sight Mount Right Wall	H3
*Low Backlash	LB
*Single Phase Motor	SG
*Servo Motor	SV
*Torque Limiter	TL

*For technical information please contact customer service.
Note: When there are multiple suffices, sequence them alphabetically.
Ex.: EPTL

1. INSPECTION UPON DELIVERY

Type	Code
Horizontal	H
Vertical	V
Vertical Up (Solid Shaft)	W
Universal Direction	N

Type	Code
Foot	H
Flange	F
V-Flange	V

Input Connection	Code
None	-
C-Face Adapter	J
Hollow Input Shaft	X
Top Mount	P

	Code
Special	S
Standard	-

Frame Size (Page 10, Table 1-1 to 1-3)

Input Shaft	Suffix
Inch	Y
Metric DIN	G
Metric JIS	-

Type	Suffix
Torque Limiter	TL
High Capacity Bearing	R1
High Capacity Bearings + Ductile Casing	R2
Baseplate	BP
Shovel Base	SB
Top Mount	Center - Right PR Left PL
HH Type	Ceiling H1 Left Wall H2 Right Wall H3
Low Backlash	LB

Nominal Total Ratio

C

H

H

-

6

1

6

5

-

Y

-

2

9

Output Shaft Orientation

Mounting Style

Input Connection

Modification (Special Feature)

Frame Size

Shaft Specification

Reducer Specification

Ratio

C = Ratios 6:1 and greater (Cyclo® Speed Reducer Product Code)

P = Ratios 3:1 and 5:1 (Cyclo® 6000 Planetary Product Code)

REDUCER NOMENCLATURE

Example:

CHH – 6165Y – 29

C – Cyclo 6000
H – Horizontal O/P
H – Foot Mount
6165 – Frame Size
Y – Inch Shaft
29 – Ratio

1. INSPECTION UPON DELIVERY

Table 1-1: Single Stage Reduction Frame Sizes

Frame Size								
6060 6065	6090 6095	6110 6115	6130 6135	6160* 6165* 616H*	6180 6185	6205	6235	6265
6070 6075	6100* 6105*	6120* 6125*	6140* 6145*		6190 6195	6215	6245	6275
6080 6085	610H*	612H*	614H*	6170* 6175*		6225	6255	

Note *: Frame sizes available as Planetary (ratios 3 and 5).

Table 1-2: Double Stage Reduction Frame Sizes

Frame Size	Second Stage (Output Stage)	First Stage (Input Stage)	Frame Size	Second Stage (Output Stage)	First Stage (Input Stage)	Frame Size	Second Stage (Output Stage)	First Stage (Input Stage)	Frame Size	Second Stage (Output Stage)	First Stage (Input Stage)
6060DA 6065DA	6060 + 6060 6065 + 6065		6130DC 6135DC	6130 + 6100 6135 + 6105		6170DB 6175DB	6170 + 6100 6175 + 6105		6215DA 6215DB	6215 + 6135 6215 + 6165	
6070DA 6075DA	6070 + 6060 6075 + 6065		6140DA 6145DA	6140 + 6070 6145 + 6075		6170DC 6175DC	6170 + 6120 6175 + 6125		6225DA 6225DB	6225 + 6135 6225 + 6175	
6090DA 6095DA	6090 + 6070 6095 + 6075		6140DB 6145DB	6140 + 6090 6145 + 6095		6180DA 6185DA	6180 + 6100 6185 + 6105		6235DA 6235DB	6235 + 6165 6235 + 6185	
6100DA 6105DA	6100 + 6070 6105 + 6075		6140DC 6145DC	6140 + 6100 6145 + 6105		6180DB 6185DB	6180 + 6130 6185 + 6135		6245DA 6245DB	6245 + 6165 6245 + 6185	
6120DA 6125DA	6120 + 6070 6125 + 6075		6160DA 6165DA	6160 + 6090 6165 + 6095		6190DA 6195DA	6190 + 6120 6195 + 6125		6255DA 6255DB	6255 + 6175 6255 + 6195	
6120DB 6125DB	6120 + 6090 6125 + 6095		6160DB 6165DB	6160 + 6100 6165 + 6105		6190DB 6195DB	6190 + 6130 6195 + 6135		6265DA 6275DA	6265 + 6195 6275 + 6195	
6130DA 6135DA	6130 + 6070 6135 + 6075		6160DC 6165DC	6160 + 6120 6165 + 6125		6205DA	6205 + 6125				
6130DB 6135DB	6130 + 6090 6135 + 6095		6170DA 6175DA	6170 + 6090 6175 + 6095		6205DB	6205 + 6135				

1. INSPECTION UPON DELIVERY

Table 1-3: Triple Stage Reduction Frame Sizes

Frame Size	Third Stage (Output Stage)	Second Stage (Inter-mediate Stage)	First Stage (Input Stage)	Frame Size	Third Stage (Output Stage)	Second Stage (Inter-mediate Stage)	First Stage (Input Stage)	Frame Size	Third Stage (Output Stage)	Second Stage (Inter-mediate Stage)	First Stage (Input Stage)
6060TA 6065TA	6060 + 6065 +	6060 + 6065 +	6060 6065	6170TA 6175TA	6170 + 6175 +	6090 + 6095 +	6070 6075	6215TB 6215TC	6215 + 6215 +	6135 + 6135 +	6095 6105
6070TA 6075TA	6070 + 6075 +	6060 + 6065 +	6060 6065	6170TB 6175TB	6170 + 6175 +	6100 + 6105 +	6070 6075	6215TD 6215TE	6215 + 6215 +	6165 + 6165 +	6095 6105
6090TA 6095TA	6090 + 6095 +	6070 + 6075 +	6060 6065	6170TC 6175TC	6170 + 6175 +	6100 + 6105 +	6070 6075	6215TF 6225TA	6215 + 6225 +	6165 + 6135 +	6125 6075
6100TA 6105TA	6100 + 6105 +	6070 + 6075 +	6060 6065	6170TD 6175TD	6170 + 6175 +	6120 + 6125 +	6090 6095	6225TB 6225TC	6225 + 6225 +	6135 + 6135 +	6095 6105
6120TA 6125TA	6120 + 6125 +	6070 + 6075 +	6060 6065	6180TA 6185TA	6180 + 6185 +	6100 + 6105 +	6070 6075	6225TD 6225TE	6225 + 6225 +	6175 + 6175 +	6095 6105
6120TB 6125TB	6120 + 6125 +	6090 + 6095 +	6070 6075	6180TB 6185TB	6180 + 6185 +	6130 + 6135 +	6070 6075	6225TF 6235TA	6225 + 6235 +	6175 + 6165 +	6125 6095
6130TA 6135TA	6130 + 6135 +	6070 + 6075 +	6060 6065	6180TC 6185TC	6180 + 6185 +	6130 + 6135 +	6090 6095	6235TB 6235TC	6235 + 6235 +	6165 + 6165 +	6095 6105
6130TB 6135TB	6130 + 6135 +	6090 + 6095 +	6070 6075	6180TD 6185TD	6180 + 6185 +	6130 + 6135 +	6100 6105	6235TD 6235TE	6235 + 6235 +	6185 + 6185 +	6105 6135
6130TC 6135TC	6130 + 6135 +	6100 + 6105 +	6070 6075	6190TA 6195TA	6190 + 6195 +	6120 + 6125 +	6070 6075	6245TA 6245TB	6245 + 6245 +	6165 + 6165 +	6095 6105
6140TA 6145TA	6140 + 6145 +	6070 + 6075 +	6060 6065	6190TB 6195TB	6190 + 6195 +	6120 + 6125 +	6090 6095	6245TC 6245TD	6245 + 6245 +	6165 + 6185 +	6125 6185
6140TB 6145TB	6140 + 6145 +	6090 + 6095 +	6070 6075	6190TC 6195TC	6190 + 6195 +	6130 + 6135 +	6070 6075	6245TE 6255TA	6245 + 6255 +	6185 + 6175 +	6185 6095
6140TC 6145TC	6140 + 6145 +	6100 + 6105 +	6070 6075	6190TD 6195TD	6190 + 6195 +	6130 + 6135 +	6090 6095	6255TB 6255TC	6255 + 6255 +	6175 + 6175 +	6105 6125
6160TA 6165TA	6160 + 6165 +	6090 + 6095 +	6070 6075	6190TE 6195TE	6190 + 6195 +	6130 + 6135 +	6100 6105	6255TD 6255TE	6255 + 6255 +	6195 + 6195 +	6125 6135
6160TB 6165TB	6160 + 6165 +	6100 + 6105 +	6070 6075	6205TA 6205TB	6205 + 6205 +	6125 + 6125 +	6075 6095	6265TA 6265TB	6265 + 6265 +	6195 + 6195 +	6125 6135
6160TC 6165TC	6160 + 6165 +	6120 + 6125 +	6070 6075	6205TC 6205TD	6205 + 6205 +	6135 + 6135 +	6075 6095	6275TA 6275TB	6275 + 6275 +	6195 + 6195 +	6125 6135
6160TD 6165TD	6160 + 6165 +	6120 + 6125 +	6090 6095	6205TE 6215TA	6205 + 6215 +	6135 + 6135 +	6105 6075				

2. Storage

If this product is not for immediate use, note the following points when storing it.

2.1 Storage Location

Store the product indoors in a clean, dry location. Additionally, the unit should be sealed, wrapped in plastic and additionally packed with desiccant. Desiccant should be replaced periodically to keep the inside of the box dry. Use of color changing desiccant will aid in identifying when desiccant should be changed.



Do not store outdoors. Store in a location that is free of moisture, dust, extreme temperature changes, corrosive gases, etc.

2.2 Storage Period

The storage period should be within the recommendations for internal (**Table 2-1**) and external rust prevention below.

External Rust Prevention:

Rust prevention oil is applied when shipping from the factory. Check rust conditions every six months after shipment. Re-apply the rust preventive oil if necessary.

Table 2-1: Internal Rust Prevention

Lubrication	Grease Lubricated Machines	Oil Lubricated Machines
Rust prevention duration	12 months	6 months
Actions to be taken	No necessary actions to be taken.	Rotate input shaft until there is one complete revolution of output shaft every 3 months.

Please consult factory when the storage duration exceeds one year for grease lubricated units, six months for oil lubricated units, and/or if the unit is for export.

Please consult factory for long term storage practices.

2.3 Operation After Storage

Before operating the unit after an extended storage period, flush unit of rust preventative and ensure that non-metal parts, i.e., oil seals, o-rings, air breather, have not deteriorated. Non-metal parts may deteriorate easily from exposure to ambient conditions (i.e., extreme temperatures, UV rays). Replace deteriorated parts with new before unit start-up.

After starting the unit, verify that there is no abnormal noise, vibration, and/or temperature rise. Immediately stop the unit and call your local distributor, Original Equipment Manufacturer, or Sumitomo directly if you observe any abnormality.

3. Transport



Do not stand directly under a unit suspended by a crane or other lifting mechanism; otherwise, injury, or death may result.



- Care should be taken to not drop the unit.
- When a hanging bolt or hole is provided, be sure to use it. After mounting a unit to a machine, do not hoist the entire machine using the hanging bolt or hole; otherwise it may result on personal injury or damage to the equipment and/or lifting device.
- Before hoisting, refer to the rating plate, crate, outline drawing, catalog, etc., for the weight of the unit. Never hoist a unit that exceeds the rating of the crane or other mechanism being used to lift it; otherwise it may result on personal injury or damage to the equipment and/ or lifting device.
- When the products are lifted, use suitable lifting parts, and confirm which eye-bolts and nuts are not loose.
- Oil lubricated units should be handled dry (free of lubricant) before mounting, moving, and transporting. Handling the unit with lubricating oil inside the machine may cause oil to escape from the air vent.

4. Installation



- Do not use a standard unit in an explosive environment (which is likely to be filled with explosive gas or steam). Under such conditions, an explosion proof motor should be used; otherwise it may result on electric shock, personal injury, explosion, fire, or damage to the equipment.
- In the case of motors, use an explosion proof motor that meets the specific requirements for explosive environments (a location where gas or volatile vapor is present); otherwise it may result on explosion, ignition, electric shock, injury, fire, or equipment damage.
- When an explosion proof motor is driven by an inverter, and the inverter itself is not explosion proof, install the inverter in a place free from explosive gas; otherwise it may result on electric shock, personal injury, explosion, fire, or damage to the equipment.



- Do not use the products for purposes or conditions other than the ones specified on the nameplate or purchase order; otherwise it may result on electric shock, personal injury, or damage to the equipment.
- Do not place flammable objects around the gearmotor; otherwise it may result on fire.
- Do not place any object around the gearmotor or reducer 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 gearmotor or reducer; otherwise it may result on personal injury.
- Do not touch the shaft end of the gearmotor or reducer, inside keyways, or the edge of the motor cooling fan with bare hands; otherwise it may result in personal injury.
- When the unit is used in food processing applications, machines for cleanroom or applications in which the lubricant might contaminate manufactured or processed goods, install an oil pan or other device to protect from oil leakage due to breakdown or failure; otherwise oil leakage may contaminate manufactured or processed goods.
- Always drain oil lubricated models before mounting, moving, and transporting. Moving with lubricating oil in the machine may cause oil to escape from the air vent.

4.1 Installation Location

- Ambient Temperature:** 14°F to 104°F (–10°C to +40°C)
- Ambient Humidity:** 85% or less
- Altitude:** 3,280 ft (1,000 m) or less
- Atmosphere:** No corrosive or volatile gases, no steam, dust-free, well-ventilated area.
- Installation Location:** Indoor: Area with minimal dust, not in contact with water.
Outdoors: Unit should be protected from rain and strong winds.
Vibration: Maximum 1G

- 
- Please consult with factory when the installation conditions deviate from the ones specified above.
 - Drives built to specifications such as explosion proof can be used in the specified mounting environments. However, in regards of the connector to be used on the drive, implement measures based on the environment.
 - Mount in a location that enables easy operation, such as inspection and maintenance.
 - Mount on a sufficiently rigid base.

4.2 Mounting Angle

Table 4-1: Mounting Angle

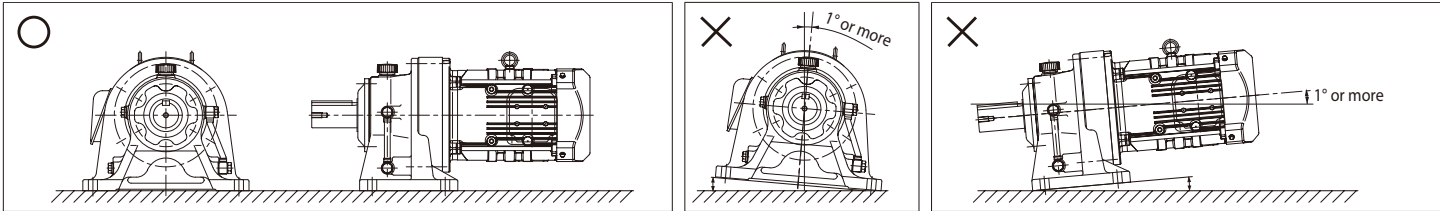
Grease Lubricated Units	Maintenance-Free	Universal Mounting
	Non Maintenance-Free	Depends on nomenclature (horizontal or vertical) as specified in nameplate.
Oil Lubricated Machines		Depends on nomenclature (horizontal or vertical) as specified in nameplate.

Note: Please consult factory for mounting angles that deviate from the ones specified in **Table 4-1**.
For units that are built to be mounted in a specific angle, they should not deviate from the specified mounting angle.

- 
- Do not remove the motor’s eye-bolt. In the rare case that it is removed, insert a bolt or other appropriate material into the screw hole to prevent water or other substances from entering the motor through the screw hole.

For the horizontal slow-speed shaft type (nomenclature starting in CH... or PH...), unit should be mounted as shown on **Figure 4-1**.

Figure 4-1: Mounting Angle (Example: Foot Mount Type)



4.3 Severe Loading Conditions

For loading conditions with extreme vibration or frequent starts/stops, it is recommended to use a mounting bolt class 8.8 (JIS B 1051) or greater. Additionally, a dowel pin should be used in foot mounted units.

4.4 Flange Type Assembly Points (Models: CNFM, CHFM, CNF, CHF, etc.).

1. Remove the fan cover if there is one installed (reducer frame size of 6160 or greater).
2. Remove the nut and bolt for ring gear housing. Take care when loosening the nut, as the bolt for ring gear housing may rotate together.
3. When the device is shipped, different size of nut from the one for ring gear housing may be assembled between nut for ring gear housing and flanged casing. Remove this nut, as it is used as a spacer for preventing damage to the faces of the nut for ring gear housing and flanged casing, as well as for covering non-threaded portion of bolt for ring gear housing.
4. Install the device to the driven machine, and tighten the nut and bolt for ring gear housing with the tightening torque shown in **Table 4-2**.

- 
- Disassembly prevention nuts are installed at 2 locations of the bolt for ring gear housing (opposing angles) to prevent disassembly of the reducer in case the bolt for ring gear housing is removed (**Figure 4-2**). Do not remove the disassembly prevention nuts. Removing them may result in the flanged casing, ring gear housing, internal cover, motor and other parts disassembling and falling off, and may cause injury.
 - Using only the disassembly prevention nuts with the nut for ring gear housing removed does not generate a sufficient level of torque. Do not use only the disassembly prevention nuts for ring gear housing for long periods of time, move them excessively or subject them to shock. Lubricant or grease may leak if there are gaps between any of the mating faces.
 - Tightening the nut for ring gear housing changes the axial force of the disassembly prevention nuts, and may result in them coming loose. To remove the CYCLO® Drive after temporarily assembling the device to the driven machine, check that the disassembly prevention nuts have not become loose.

4. INSTALLATION

Figure 4-2

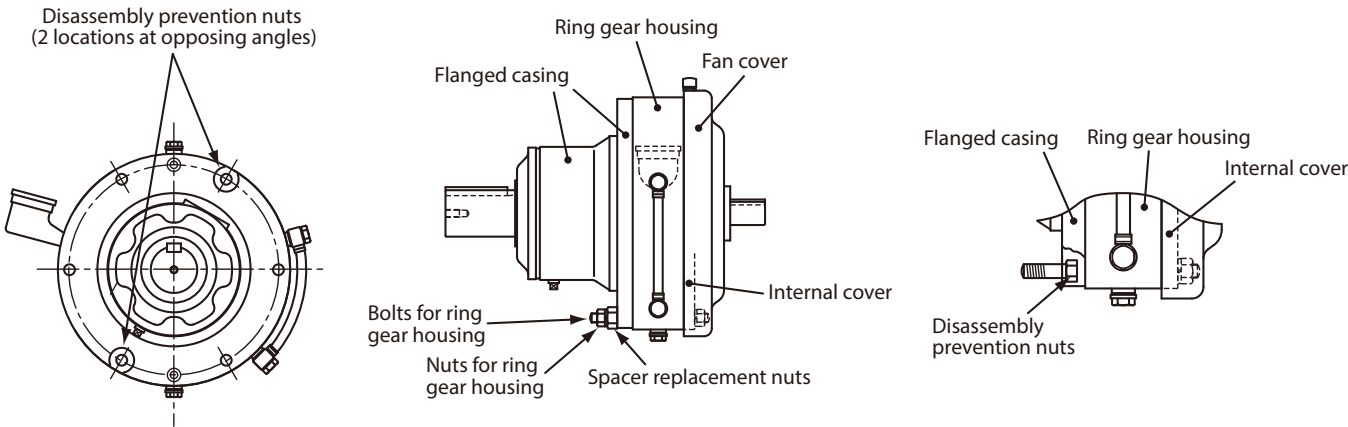


Table 4-2: Torque for Ring Gear Housing Bolts

Frame Size		Size	Tightening Torque (N-m)	Frame Size		Size	Tightening Torque (N-m)
1 Stage	2 Stages			1 Stage	2 Stages		
606X	606XDA	M6	11	617X	617XDA 617XDB 617XDC	M12	96
607X	607XDA			618X	618XDA 618XDB		
608X	-			619X	619XDA 619XDB		
609X	609XDA	M8	25	6205	6205DA 6205DB	M16	219
610X	610XDA			6215	6215DA 6215DB	M18	298
611X	-			6225	6225DA 6225DB	M20	475
612X	612XDA 612XDB			6235	6235DA 6235DB		
613X	613XDA 613XDB 613XDC	M10	55	6245	6245DA 6245DB	M24	794
614X	614XDA 614XDB 614XDC			6255	6255DA 6255DB		
616X	616XDA 616XDB 616XDC	M12	96	6265	6265DA	M30	1590

4. INSTALLATION

Notes:

1. “X” is for “0” or “5”.
2. If the mounting bolts are changed by the end user, tightening torque that suits the fasteners’ strength should be used.
3. The position of the disassembly prevention nuts and the shape of each part depend on the frame size.

4.5 Motor Mounting on Cyclo® Quill (Hollow) High-Speed Shaft Option

1. Remove oil, dirt and other contaminants from the motor shaft and Cyclo® hollow high speed shaft. The inner surface of the high speed shaft is treated with rust prevention oil before shipping.
2. Coat the motor shaft with molybdenum disulfide grease to prevent fretting.
3. Align the motor shaft key with the high speed hollow shaft keyway.
4. Depending on the motor combination, a spacer for preventing the key from falling out may be in a separate shipment. Before assembly, insert the spacer deep into the hole in the high speed shaft. Operation with uninserted spacer could result in the key falling out and damaging the shaft.
5. When assembling the motor and Cyclo® Drive, make sure that the centers of both shafts are aligned. Do not force the assembly if the shafts are slanted or misaligned or if the key is only partially engaged.
6. Fasten the motor and adapter plate (internal cover) using the motor mounting bolt. Tighten after confirming that the motor pilot is in contact with the adapter’s (or adapter’s plate) surface.
Important: If the bolt is tightened the motor pilot surface and adapter’s (or adapter’s plate) are not in contact, this will result in uneven tightening, causing damage to the internal bearing and other components.

4.6 Quill Bushing

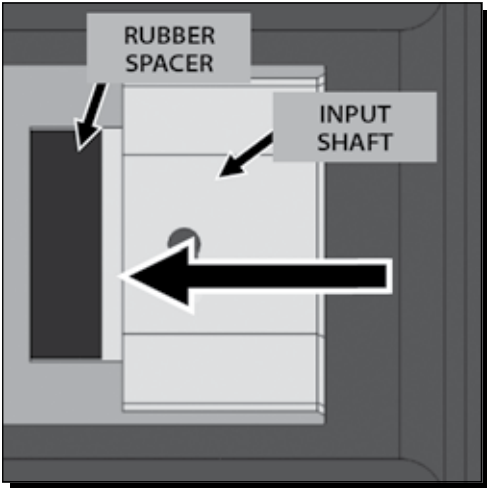
Installation Procedure

Quill bushing installation is described by steps 1-4.
Motor installation is described by steps 5-8.



Before beginning, check the part number and bore size on the bushing to make sure it matches the motor.

4. INSTALLATION



1
This step ONLY applies to the installation of quill bushing CMMR8527-C210. For all other bushings, start from step 2.

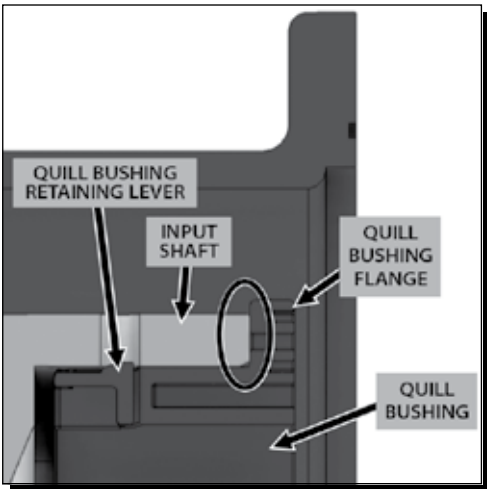
Insert the rubber spacer (CRPK6634-2) all the way into the deepest visible bore of the input shaft.



2
Align the quill bushing with the matching opening in the input shaft.

Fully insert the bushing into the shaft, firmly tapping the front face of bushing with a rubber mallet if necessary.

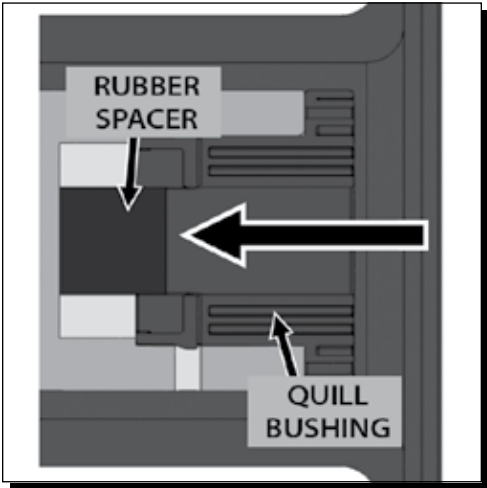
Ensure the bushing is straight before tapping with a mallet.



3
Using a feeler gauge, confirm that the quill bushing flange fully contacts the front face of the input shaft.

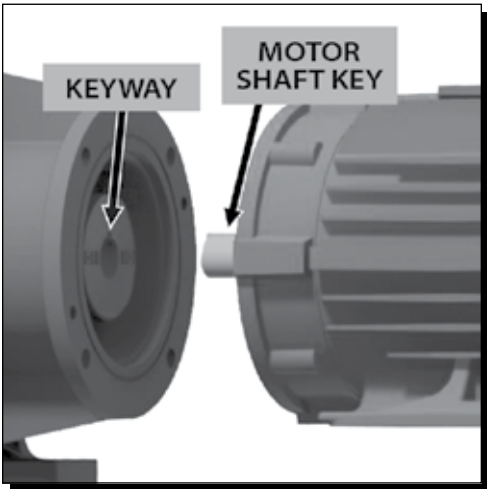
This ensures that the “quill bushing retaining levers” are captured in the two corresponding holes in the input shaft.

4. INSTALLATION

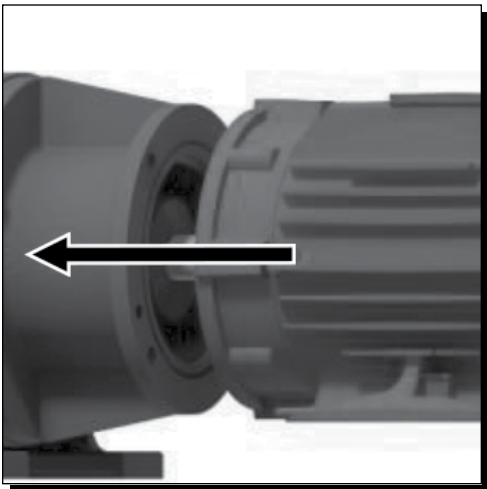


4
This step ONLY applies to the installation of quill bushing CMMR8527-B180 when used for a 612 Cyclo, and the installation of quill bushing CMMR8527-C180. For all other bushings, skip to step 5.

Insert the rubber spacer (CRPK6634-1 for CMMR8527-B180 or CRPK6634-3 for CMMR8527-C180) all the way into the bore of the quill bushing.



5
Use a crane or hoist to support the motor if necessary. Line up the motor shaft with the quill bushing bore, ensuring that the key and keyway are aligned.

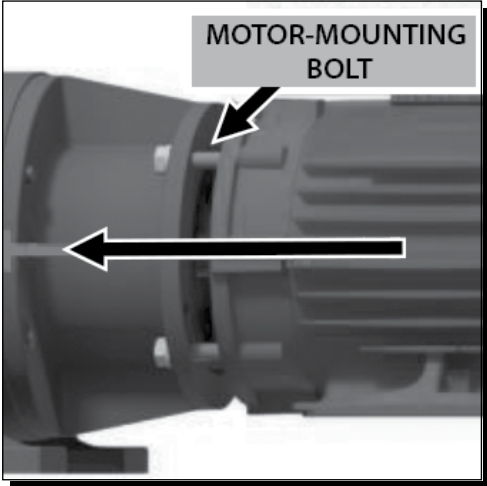


6
Insert the motor shaft into the quill bushing bore by hand and get it started.

Check the alignment of the motor shaft and quill bushing and then try to fully insert the motor shaft by hand.

If successful, proceed directly to step 8. If not, then continue to step 7.

4. INSTALLATION



7
Use the four motor-mounting bolts to pull the motor fully in.

Bolts with a longer length may be required to initially reach the tapped holes in the motor to accomplish this.



8
Torque the four motor-mounting bolts to the prescribed tightening torque.

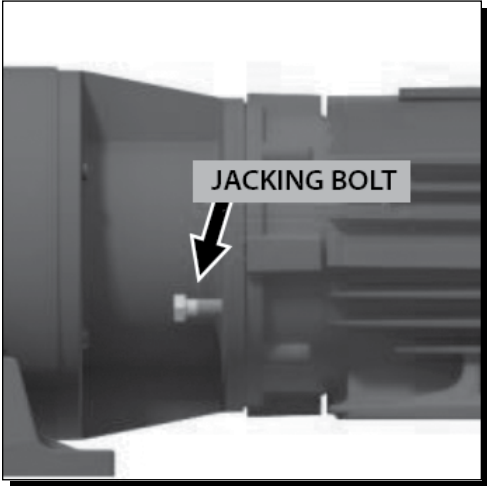
If the necessary tightening torque is unknown, the following values can be used for reference (assuming Grade 5 bolts):

3/8-16 Bolts (56C-145TC): 28 ft-lb
1/2-13 Bolts (182TC-256TC): 68 ft-lb

Removal Procedure

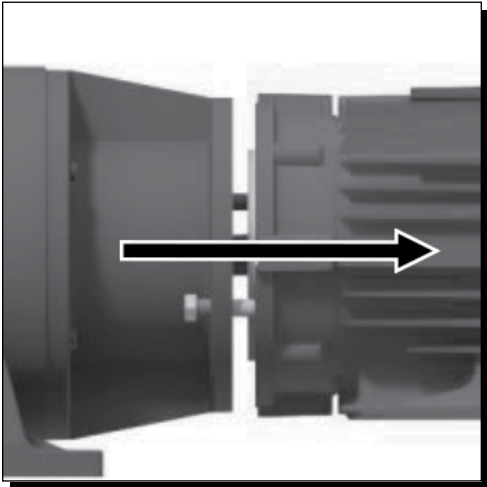
Motor removal is described by steps 1-3.
Quill bushing removal is described by steps 4-6.

4. INSTALLATION

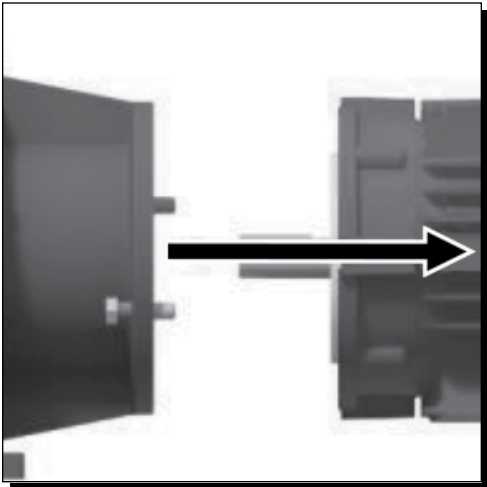


1
Support the motor with a crane or hoist if needed.

Unscrew the four motor mounting bolts and thread two of them into the jacking bolt tapped holes in the quill adapter, to use as jacking bolts.



2
Turn the two jacking bolts to separate the motor from the Cyclo unit.



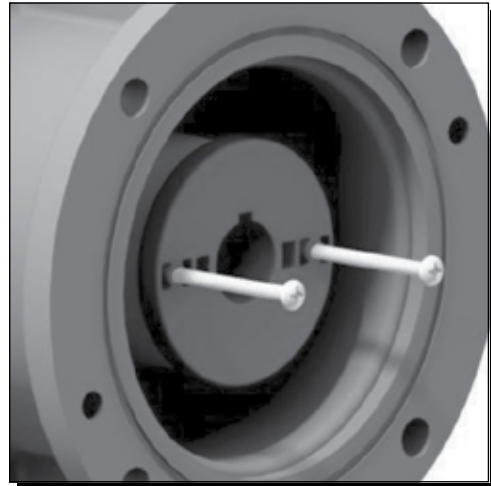
3
Fully remove the motor, using prybars and/or longer jacking bolts if needed.

The quill bushing may remain on the motor shaft and come out with the motor.

If so, then remove the bushing from the motor shaft with a bearing puller and proceed to step 6.

If it remains in the input shaft, continue to step 4.

4. INSTALLATION



4

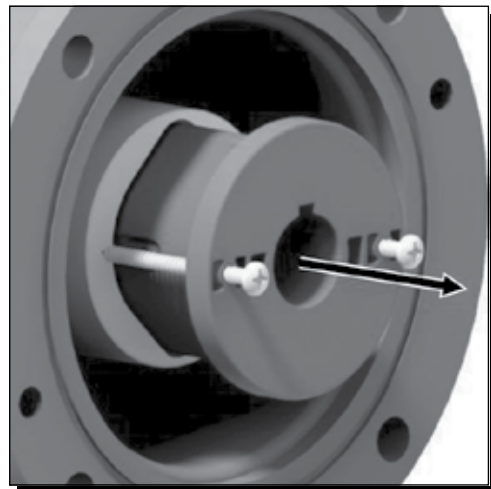
Insert two #8 screws into the holes on the front face of the quill bushing and screw them in until they contact the front face of the input shaft.

The preferred style of screw is ASME B18.6.3 Sheet Metal Screw (Type A), with a minimum length based on the bushing part number as follows:

CMMR8527-A###: 1"

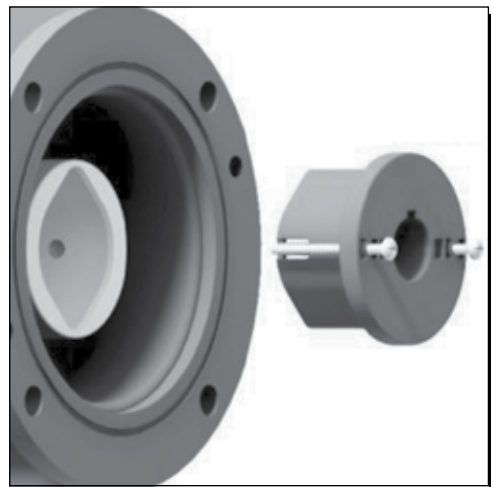
CMMR8527-B###: 1.75"

CMMR8527-C###: 2.5"



5

Turn the screws to extract the bushing from the input shaft.



6

Discard the quill bushing. It is not recommended to reuse the bushing.

4. INSTALLATION

Notes

5. Coupling to Driven Machine



- Confirm the rotation direction before coupling the unit to the driven machine. Incorrect rotation direction may cause personal injury or damage to the equipment.
- When operating the product alone (uncoupled), remove the key that is temporarily attached to the slow speed shaft; otherwise the key could fall off resulting in injury.
- Cover rotating parts; otherwise, it may result in injury.
- When loading the unit and the unit is coupled with pulleys, check that the centering, the belt tension and parallelism of the pulleys are within the specified limits. When the unit is directly coupled with the driven machine, check that the direct coupling accuracy is within the specified limits. When a belt is used for coupling the unit with the driven machine, check the belt tension. Correctly tighten bolts on the pulley and coupling before operation; otherwise, it may result injury or damaged equipment due to misalignment.

5.1 Check Direction of Rotation

For Gearmotor

Table 5-1 Shows the direction of slow speed shaft rotation when wiring is performed as on Pages 33 to 36.

Table 5-1: Slow Speed Shaft Rotation Direction (Gearmotor)

When wiring is performed as shown on Pages 33 to 36, the motor shaft rotates to the right as seen from the Low Speed Shaft side. In the following diagrams, arrows show the direction of slow speed shaft rotation in this case.		
Gear unit construction	Single and Triple Reduction	Double Reduction
Slow speed shaft rotation direction (seen from Low Speed Shaft side)		

For Reducer

Table 5-2: Slow Speed Shaft Rotation Direction (Reducer)

Gear Unit Construction	Single Reduction – Triple Reduction	Double Reduction
Slow speed shaft rotation direction	Rotates in opposite direction as the high speed shaft.	Rotates in same direction as the high speed shaft.

5.2 Mounting Connector

- When mounting a connector to the unit, do not apply impact or excessive radial and/or axial load to the shaft. The bearing could be damaged, or the collar could come off.
- Interference fit is recommended for slow-speed shafts.

(1) When Using a Coupling

The alignment accuracy (A, B, X) in Figure 5-1 should be no greater than that shown in Table 5-3.

Figure 5-1

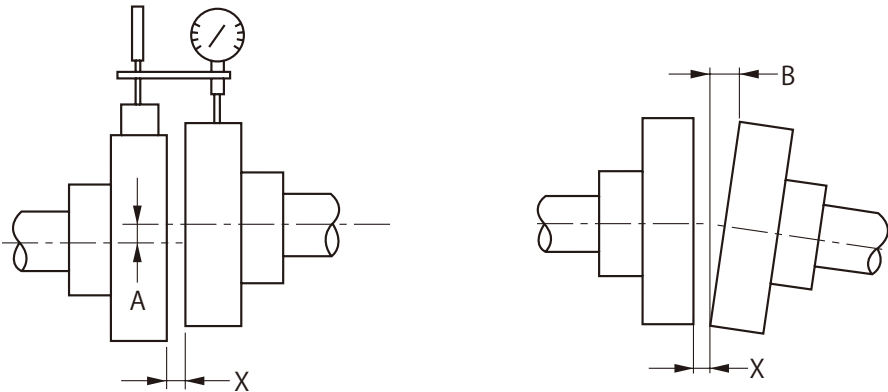


Table 5-3: Alignment Precision for Flexible Coupling

Allowable Tolerance A	0.1 mm or Manufacturer-Specified Value
Allowable Tolerance B	0.1 mm or Manufacturer-Specified Value
X	Manufacturer-Specified Value

5. COUPLING TO DRIVEN MACHINE

(2) When Using Chains, Sprockets, or Gears

- When using a chain, attach so that the chain tension angle is perpendicular to the shaft.
- Refer to the chain catalog or other reference for chain tension.
- Select a sprocket or gear pitch diameter that is at least three times the shaft diameter.
- The working load point of the sprocket or gear should go as close to the product as possible (See **Figure 5-2**).
It is recommended that the load point does not go beyond the center of the shaft's length.

(3) When Using a V Belt

- Over-tightening the V belt will damage the shaft and bearing. Refer to the V belt catalog or other reference for V belt tension.
- The parallelism, eccentricity β of the two pulleys should be within 20'. (See **Figure 5-3**)
- When using multiple V belts, use a matched set having the same length.

Figure 5-2

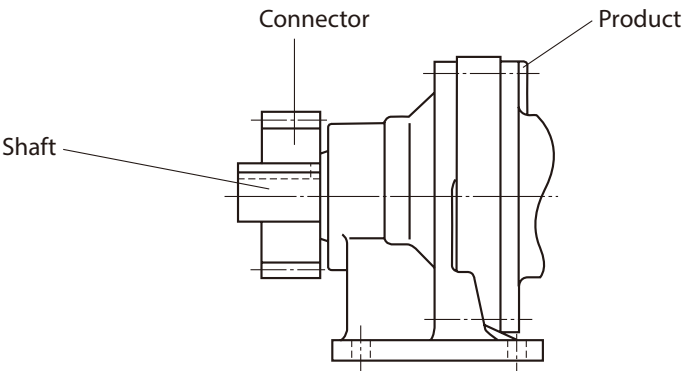
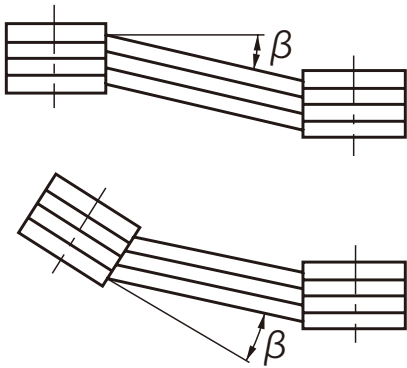


Figure 5-3

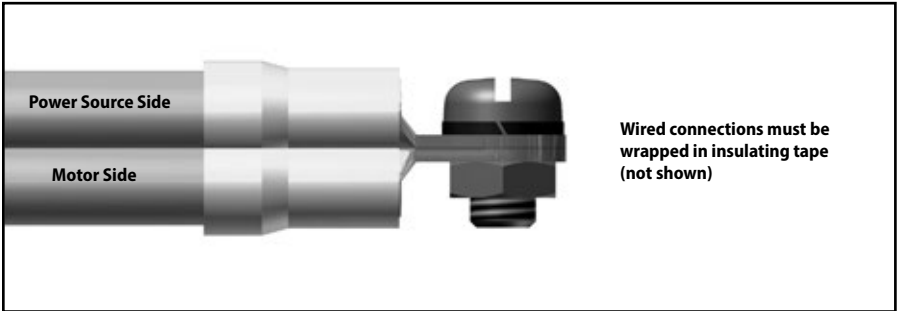


6. MOTOR WIRING

6. Motor Wiring

This section details wiring for standard Sumitomo three-phase motors and brakemotors. If using a motor manufactured by a company other than Sumitomo, please refer to that manufacturer's instruction manual for wiring, operating and maintenance details. When wiring motors into the power supply, Sumitomo recommends the use of terminal rings to facilitate the connection:

Figure 6-1. Terminal Ring Wiring Connection



- Do not handle the unit when cables are live. Be sure to turn-off the power; otherwise electric shock may result.
- Connect the power cables to the unit according to the connection diagram shown inside the terminal box or in the maintenance manual; otherwise electric shock or fire may result.
- Correctly ground the grounding bolt; otherwise electric shock may result.
- Keep all wiring and electrical parts dry and moisture free.
- Follow local electrical codes and regulations when wiring; otherwise burning, electrical shock, injury and/or fire may result.
- The motor is not equipped with an overload device. Sumitomo strongly recommends that another protective device (i.e.: ground fault interrupters, etc.), in addition to an overload device, be installed in order to prevent burning, electric shock, personal injury and/or fire.
- For single phase motors, exercise caution so as to not damage the vinyl cover of the starting capacitor, otherwise shock may result.
- For brakemotors, do not electrify a brake coil continuously when the motor is stopped otherwise the brake coil may burn and fire may result.



- For brakemotors, install the rectifier where the temperature is less than 140°F (60°C).
- Long wires cause the voltage to drop. Select cables with appropriate diameter so that the voltage drop will be less than 2%.
- After wiring the motor, check that the terminal box mounting bolts are tight.

6.1 Measuring Insulation Resistance

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



- Never touch the terminals when measuring insulation resistance otherwise electrical shock may occur.
- Measure the insulation resistance before wiring. Insulation resistance varies according to the motor voltage, insulation type, coil temperature, humidity, length of operation, test electrification time, etc.
- Under most conditions, the insulation resistance exceeds the value shown in this table:

Table 6-1: Insulation Resistance

Motor Voltage	Megohmmeter Voltage	Insulation Resistance
Electric motors of voltage no more than 600V	500V	Minimum 1 M(Ω)

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

6.2 Motor Protection



- Use a molded case circuit breaker for protection against short circuit.
- Use an overload protection device that protects the unit against voltage surges.

6.3 Motor Wiring Method

U.S. Standard Motors



- For additional information, please refer to the motor nameplate.
- Due to changes in design features, the wiring diagrams shown in this manual may not always agree with that on the motor.
Note: In such cases, wiring diagram found inside the conduit box of the motor should be used.

1

Based on motor power, determine if motor is **WYE** or **DELTA** type (see **Table 6-2**).

2

Wire the motor to the power source using the correct wiring type as shown on **Figures 6-2 to 6-5**.

Table 6-2: Typical 230/460V, Three-Phase Wiring Configuration by Motor Type

Motor HP (kW) x P	Standard		AF-Motor		EP/NA-Motor UL/CSA/CE
	Non CSA	CSA	Non CSA	CSA	
1/8 (0.1) x 4	WYE	WYE	WYE	WYE	WYE
1/4 (0.2) x 4					
1/3 (0.25) x 4					
1/2 (0.4) x 4					
3/4 (0.55) x 4					
1 (0.75) x 4					
1.5 (1.1) x 4					
2 (1.5) x 4	DELTA	DELTA	DELTA	DELTA	DELTA
3 (2.2) x 4					
5 (3.7) x 4					
7.5 (5.5) x 4					
10 (7.5) x 4					
15 (11) x 4					
20 (15) x 4					
25 (18.5) x 4					
30 (22) x 4					
40 (30) x 4					
50 (37) x 4					
60 (60) x 4					
75 (56) x 4					

Figure 6-2: Three-Phase WYE Connection Motor

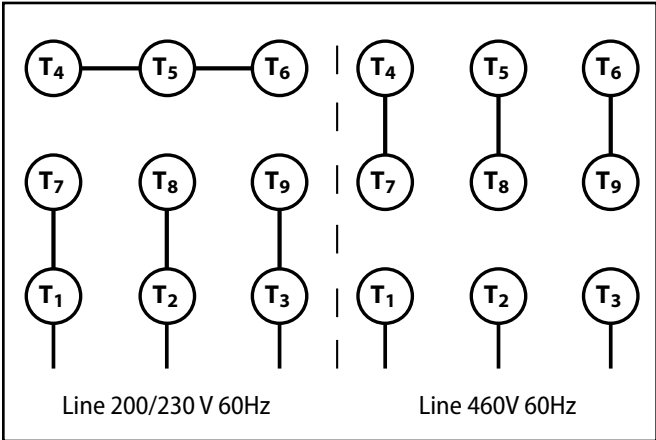


Figure 6-3: Three-Phase DELTA connection Motor

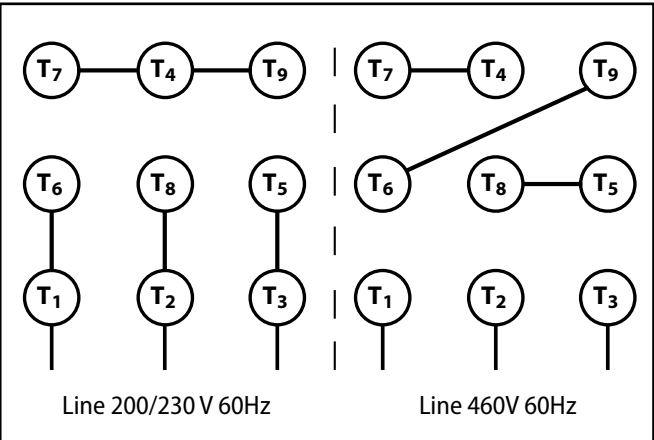


Figure 6-4: Three-Phase Motor, 575V, 60Hz

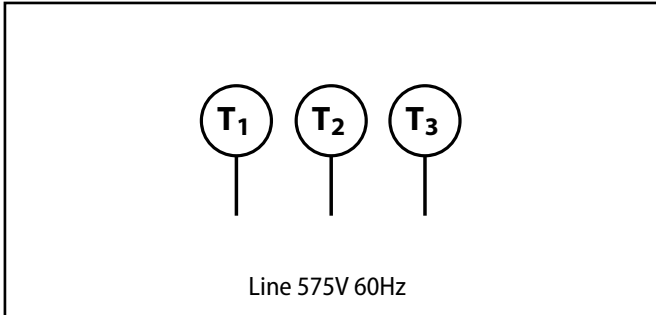
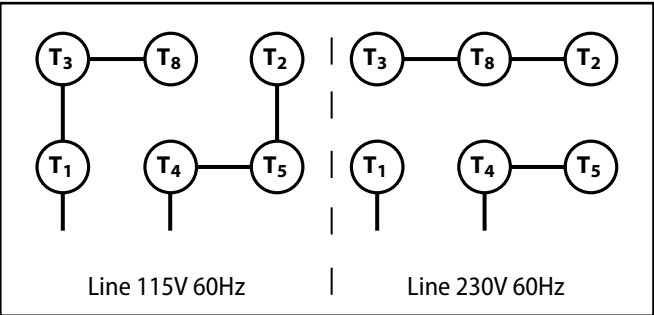


Figure 6-5: Single-Phase Motor, 115/230V, 60Hz



CE Motors



- For additional information, please refer to the motor nameplate.
- Due to changes in design features, the wiring diagrams shown in this manual may not always agree with that on the motor.
Note: In such cases, wiring diagram found inside the conduit box of the motor should be used.

1
Based on motor power, determine if motor is **WYE** or **DELTA** type (see **Table 6-3**).

2
Wire the motor to the power source using the correct wiring type as shown on **Figures 6-6** and **6-7**.

Figure 6-6: DELTA-WYE Connection Motor

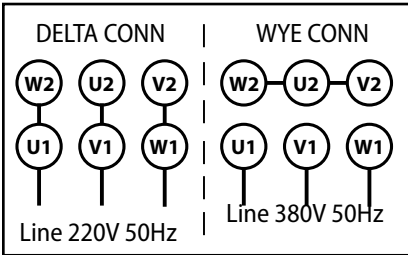
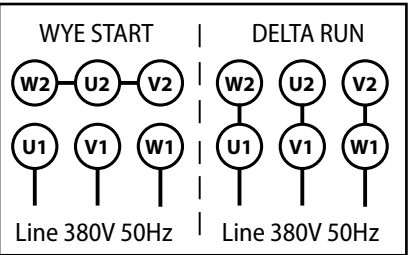


Figure 6-7: WYE-DELTA Start Connection Motor



Brake Wiring

Varistor Selection

For wiring of Fast Brake Action, Sumitomo recommends the use of a Varistor (VR). Refer to **Table 6-4** to assist in the selection of the appropriately sized Varistor.

Table 6-4: Varistor Specifications Table

Operating Voltage		190 - 230V	380-460V	575V
Varistor Rated Voltage Varistor Voltage		AC260-300V 430-470V	AC510V 820V	AC604V 1000V
Rated Watts	FB01A, 02A FB-05A FB-1D, 1E FB-2D, 3D, 1HE, 2E, 3E FB- 5B, 8B, 5E, 8E FB10B, 15B, 10B1, 15B1, 10E, 15E	Over 0.4W Over 0.4W Over 0.6W Over 1.5W Over 1.5W Over 1.5W Over 1.5W	Over 0.4W Over 0.4W Over 0.6W Over 1.5W Over 1.5W Over 1.5W Over 1.5W	Over 0.4W Over 0.4W Over 0.6W Over 1.5W Over 1.5W Over 1.5W Over 1.5W
	FB-20, 30			Over 1.5W

Table 6-3: Typical 220/380V, Three-Phase Wiring Configuration by Motor Type

MotorHP (kW) x P	Voltage Configuration	Wiring Configuration
1/8 (0.1) x 4 1/4 (0.2) x 4 1/3 (0.25) x 4 1/2 (0.4) x 4 3/4 (0.55) x 4 1 (0.75) x 4 1.5 (1.1) x 4 2 (1.5) x 4 3 (2.2) x 4 4 (3.0) x 4 5 (3.7) x 4	220/380V, 50Hz Three Phase	DELTA-WYE
7.5 (5.5) x 4 10 (7.5) x 4 15 (11) x 4 20 (15) x 4 25 (18.5) x 4 30 (22) x 4 40 (30) x 4	380V, 50Hz Three Phase	WYE-Start DELTA-Run

6.4 U.S. Standard and CSA Approved Motor Brake Wiring

The brake portion (if supplied) of the motor may be wired using one of the following methods.

Models FB-01A through FB-15B/FB-15E

Figure 6-8: Normal Brake Action, 230V, 575V

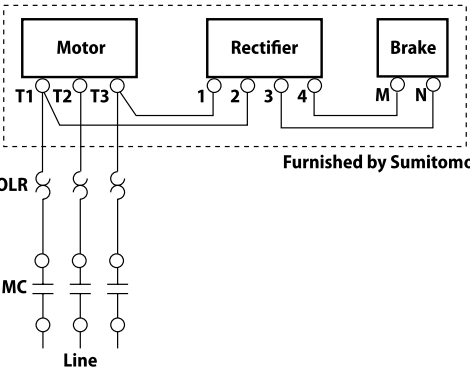


Figure 6-9: Fast Brake Action, 230V

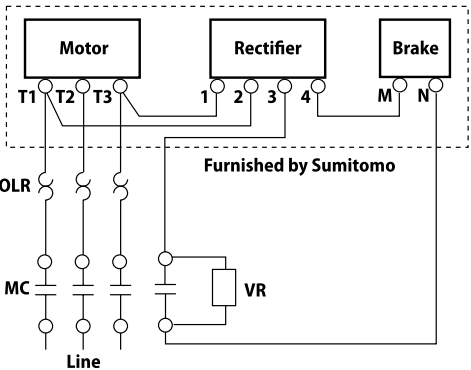


Figure 6-10: Normal Brake Action, 460V

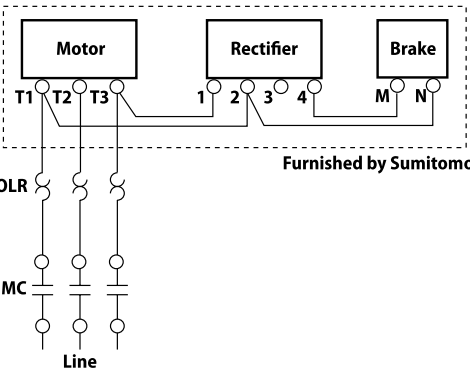
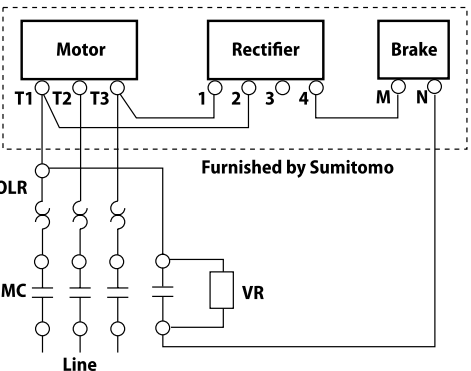


Figure 6-11: Fast Brake Action, 460V, 575V



- MC:** Electromagnetic Relay
MCB: Magnetic Circuit Breaker
OLR: Overload or Thermal Relay
VR: Varistor (protective device)^[1]

Note: [1] Refer to Varistor Specifications Table

6. MOTOR WIRING

Models FB-01A through FB-15B/FB-15E with Inverter

Figure 6-12: Normal Brake Action, 230V

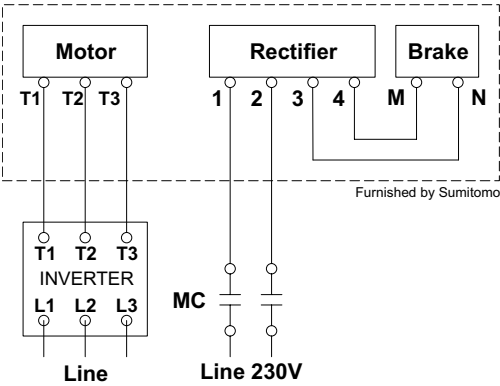
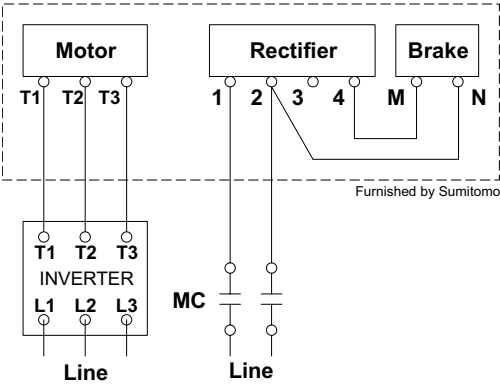
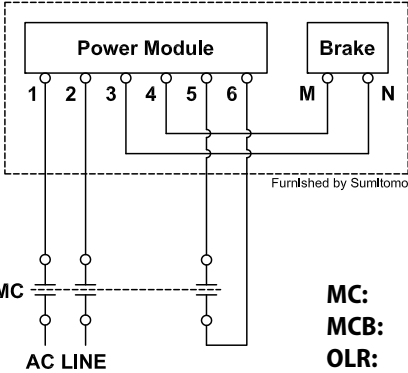


Figure 6-14: Normal Brake Action, 460V, 575V Brake



Models FB-20 / FB-30

Figure 6-16: FB-20 and FB-30 Brake Wiring, 480VAC or less



MC: Electromagnetic Relay
MCB: Magnetic Circuit Breaker
OLR: Overload or Thermal Relay
VR: Varistor (protective device)^[1]

Note: [1] Refer to Varistor Specifications Table

6. MOTOR WIRING

6.5 CE Motor Brake Wiring

Models FB-01A through FB-5B/FB-5E, 220/380V, 50Hz

Figure 6-18: Normal Brake Action, 220V Motor 220V Brake

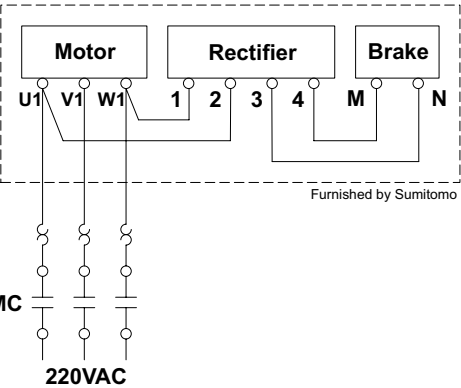


Figure 6-20: Normal Brake Action, 380V Motor, 220V Brake, Tapped

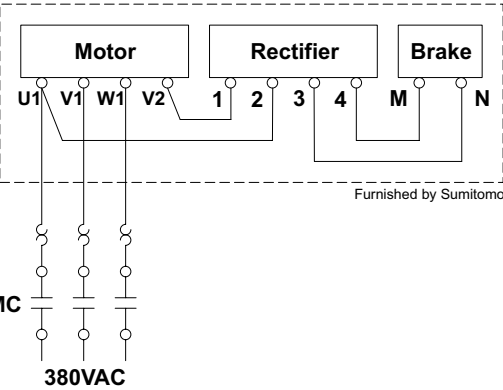
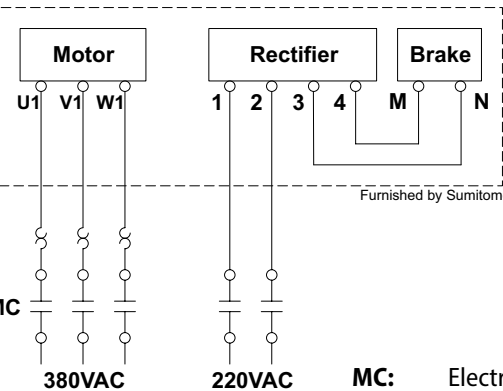


Figure 6-22: Normal Brake Action, 380V Motor, 220V Brake, Separated



MC: Electromagnetic Relay
MCB: Magnetic Circuit Breaker
OLR: Overload or Thermal Relay
VR: Varistor (protective device)^[1]

Note: [1] Refer to Varistor Specifications Table

Figure 6-19: Fast Brake Action, 220V Motor 220V Brake

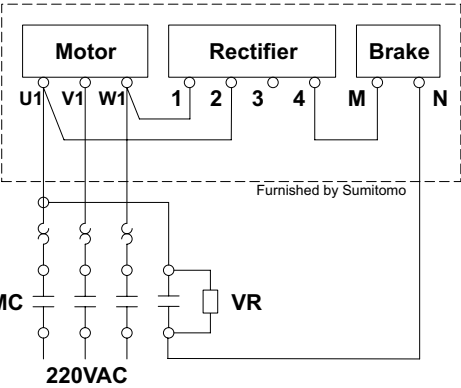


Figure 6-21: Fast Brake Action, 380V Motor, 220V Brake, Tapped

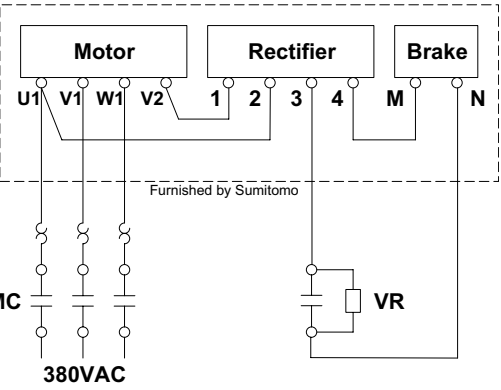
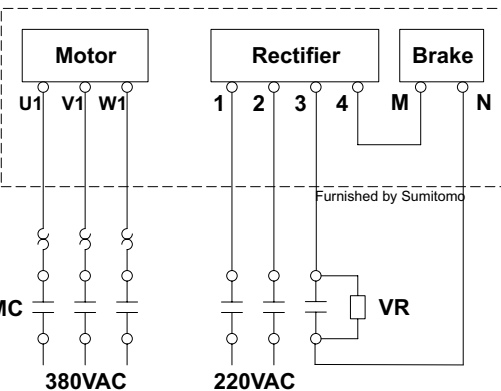
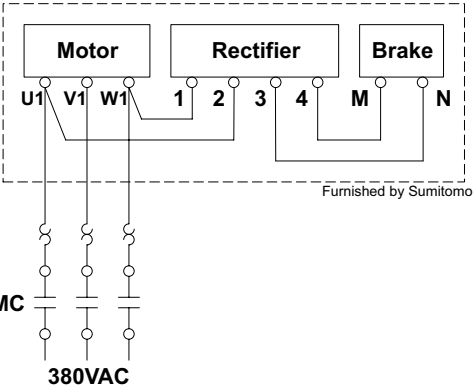


Figure 6-23: Fast Brake Action, 380V Motor, 220V Brake, Separated



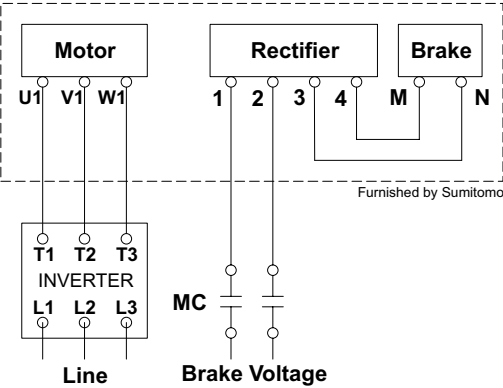
Models FB-8B/FB-8E through FB-15B/FB-5E

Figure 6-24: Normal Brake Action, 380V Motor, 380V Brake



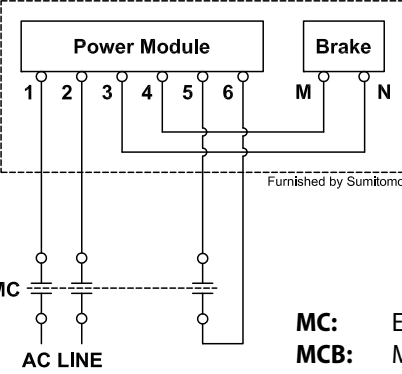
Models FB-01A through FB-15B/FB-15E with Inverter

Figure 6-26: Normal Brake Action



Models FB-20 / FB-30

Figure 6-28: FB-20 and FB-30 Brake Wiring, 480VAC or less



MC: Electromagnetic Relay
MCB: Magnetic Circuit Breaker
OLR: Overload or Thermal Relay
VR: Varistor (protective device)^[1]

Note: [1] Refer to Varistor Specifications Table

6.6 Brake Rectifiers and Power Modules

Table 6-6: Standard Brake Rectifiers

Brake Type	Motor HP (kW) x P	230V/460V Rectifier		575V Rectifier	
		Model Number	Part Number	Model Number	Part Number
FB-01A	1/8 (0.1) x 4	25FW-4FB3	EW107WW-01	10F-6FB3	EW104WW-01
FB-02A	1/4 (0.2) x 4 1/3 (0.25) x 4				
FB-05A	1/2 (0.4) x 4				
FB-1D, 1E	3/4 (0.55) x 4 1 (0.75) x 4				
FB-2D, 1HE, 2E	1.5 (1.1) x 4 2 (1.5) x 4				
FB-3D, 3E	3 (2.2) x 4				
FB-5B, 5E	5 (3.7) x 4				
FB-8B, 8E	7.5 (5.5) x 4				
FB-10B, 10B1, 10E	10 (7.5) x 4				
FB-15B, 15B1, 15E	15 (11) x 4				
FB-20	20 (15) x 4				
FB-30	25 (18.5) x 4 30 (22) x 4 40 (30) x 4				

Table 6-7: Brake Rectifiers for CE Motors

Brake Type	Motor HP (kW) x P	220V Rectifier		380V Rectifier	
		Model Number	Part Number	Model Number	Part Number
FB-01A	1/8 (0.1) x 4	10F-2FB2	MP983WW-01	Consult Factory	Consult Factory
FB-02A	1/4 (0.2) x 4 1/3 (0.25) x 4				
FB-05A	1/2 (0.4) x 4				
FB-1D, 1E	3/4 (0.55) x 4 1 (0.75) x 4				
FB-2D, 1HE, 2E	1.5 (1.1) x 4 2 (1.5) x 4				
FB-3D, 3E	3 (2.2) x 4				
FB-5B, 4E, 5E	4 (3.0) x 4 5 (3.7) x 4				
FB-8B, 8E	7.5 (5.5) x 4	Consult Factory	Consult Factory	05F-4FB2	MP985WW-01
FB-10B, 10B1, 10E	10 (7.5) x 4			15F-4FB1	EW397WW-01
FB-15B, 15B1, 15E	15 (11) x 4				

Table 6-8: Brake Power Modules

Brake Type	Motor HP (kW) x P	170 ~ 300VAC Module		380 ~ 480VAC Module	
		Model Number	Part Number	Model Number	Part Number
FB-20	20 (15) x 4	13SR-2	ES075WW-01	10SR-4	MQ003WW-01
FB-30	5 (18.5) x 4 30 (22) x 4 40 (30) x 4				

7. Operation



- Do not approach or touch rotating parts (slow speed shaft, etc.) during operation; otherwise loose clothing may became 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. Restoration 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 operate the machine while the brake is released by the manual brake release bolt; otherwise, falling, going out of control, or damage to the equipment may result.



- Do not put fingers or foreign objects into the opening of the products; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The products become 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 load rating; otherwise, personal injury, or damage to the equipment may result.

7.1 Items to Check Before Operation

After installation and wiring are completed, check the following items before operation.

- Is the wiring correct?
- Is the unit properly coupled with the driven machine?
- Are mounting bolts tightened firmly?
- Is the direction of rotation as required?
- Does the oil level in an oil-lubricated model reach the top red line of the oil gauge when the unit is at rest?

After confirming these items, operate without a load and gradually apply a load. Check the items shown in **Table 7-1**.

Table 7-1: Items to Check During Operation

Is abnormal sound or vibration generated?	• Is the housing deformed because the installation surface is not flat? • Is insufficient rigidity of the installation base generating resonance? • Is the shaft center aligned with the driven machine? • Is the vibration of the driven machine transmitted to the gearmotor or reducer?
Is the surface temperature abnormally high?	• Is the voltage rise or drop substantial? • Is the ambient temperature too high? • Does the current flowing to the gearmotor exceed the rated current shown on nameplate?

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

7.2 Brake Torque and Activation Delay Time

The table below shows standard specification brake types, their brake torque, and their relationship to brake activation delay time.

Table 7-2: Brake Torque and Activation Delay Time

Brake Type	Motor Type							Brake Activation Delay Time (sec)			
	3-Phase Motor	Premium Efficiency, 3-Phase Motor		AF Motor for Inverter		Premium Efficiency, 3-Phase Motor for Inverter	High Efficiency, 3-Phase Motor	Brake Torque (Dynamic Friction Torque) (N·m)	Normal Braking Circuit (Simultaneous Turn-Off Circuit)	Normal braking Circuit for Inverter (Simultaneous Turn-Off Circuit)	Quick Braking Circuit
		4P	4P	6P	4P	6P	4P				
FB-01A1	0.1	-	-	-	-	-	-	1.0	0.15 – 0.2	0.08 – 0.12	0.015 – 0.02
FB-02A1	0.2 0.25	-	-	0.1	-	-	-	2.0			
FB-05A1	0.4	-	-	0.2	-	-	0.2	4.0	0.1 – 0.15	0.03 – 0.07	0.01 – 0.015
FB-1D	0.55	-	-	0.4	-	-	0.4	7.5	0.2 – 0.3	0.1 – 0.15	0.01 – 0.02
FB-1E	-	0.75	-	-	-	0.75	-	7.5	0.25 – 0.45	0.15 – 0.25	0.01 – 0.03
FB-1HE	-	1.1	-	-	-	-	-	11	0.45 – 0.65	0.25 – 0.35	
FB-2E	-	1.5	-	-	-	1.5	-	15	0.35 – 0.55	0.15 – 0.25	
FB-3E	-	2.2	-	-	-	2.2	-	22	0.75 – 0.95	0.4 – 0.5	0.02 – 0.04
FB-4E	-	3.0	-	-	-	-	-	30	0.65 – 0.85	0.3 – 0.4	
FB-5E	-	3.7	-	-	-	3.7	-	40	1.1 – 1.3	0.4 – 0.5	
FB-8E	-	5.5	-	-	-	5.5	-	55	1.0 – 1.2	0.3 – 0.4	
FB-10E	-	7.5	-	-	-	7.5	-	80	1.8 – 2.0	0.6 – 0.7	
FB-15E	-	11	-	-	-	11	-	110	1.6 – 1.8	0.5 – 0.6	0.06 – 0.14
FB-20	-	15	-	-	-	15	-	150	-	-	
FB-30	-	-	15	-	-	-	-	220	-	-	0.03 – 0.11
	-	18.5	18.5	-	-	18.5	-	190			
	-	22	22	-	-	22	-	220			
	-	30	-	-	-	30	-	200			
ESB-250 ESB-250-2	-	-	-	30	18.5	-	-	212	-	-	0.065
	-	37	-	37	22	37	-	266			
	-	45	30	-	30	45	-	320			
	-	-	37	-	-	-	-	372			

Notes:

- 1. Brake type may differ depending on specification. Check the nameplate.
- 2. Brake torque will change according to operating environment, operating conditions, the condition of the friction surface, etc. In particular, brake torque may not be at the prescribed level for initial operation, and after a long period of inactivity. In such a case turn the brake on and off under as light load as possible to contact the brake's friction surfaces.
- 3. Brake activation delay time will change according to the brake's wiring circuit. Select the optimum circuit for the application.

8. Daily Inspection and Maintenance



- Do not handle the unit when cables are live. Be sure to turn off the power when operating on the unit; otherwise, electric shock may result.
- Do not approach or touch any rotating parts (slow speed shaft, etc.) during run-time maintenance or inspection of the unit; loose clothing may become caught in these rotating parts and cause serious injury or death.
- Customers must not disassemble or modify for explosion proof motors; otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- The lead-in condition of explosion proof motors, shall conform to the facilities electrical codes, extension regulations, and explosion- proofing guide, as well as the maintenance manual; Additionally, do not open the terminal box cover while operating. otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- Do not operate the machine while the brake is released by the manual brake release bolt; otherwise, falling, going out of control, or damage to the equipment may result.



- Do not put fingers or foreign objects into the opening of the products; otherwise, electric shock, injury, fire, or damage to the equipment may result.
- The products become very hot during operation. Touching the unit with bare hands may result in serious burns.
- Do not touch the terminals when measuring insulation resistance; otherwise, electric shock may result.
- Do not operate the unit without a safety cover (removed during inspection) in place to shield rotating parts; otherwise loose clothing may became caught in these rotating parts and cause serious injury or death.
- Promptly identify and correct, according to instructions in this maintenance manual, any abnormalities observed during operation. Do not operate until the cause for the abnormality is understood, and the abnormality is corrected.
- Change lubricant according to the maintenance manual instructions. Be sure to use factory approved lubricant.
- Only install, move, or transport oil-lubricated models with lubricating oil removed. Moving with lubricating oil in the machine may cause oil to escape from the air vent, etc.
- 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.

8. DAILY INSPECTION AND MAINTENANCE



- Do not operate damaged gearmotors or reducers; otherwise, injury, fire, or damage to the equipment may result.
- Sumitomo Machinery Corporation of America cannot assume any responsibility for damage or injury resulting from an unauthorized modification by a customer, as it is outside the scope of the warranty.
- Dispose of unit’s lubricant as general industrial waste.
- When measuring the insulation resistance of explosion proof motors, confirm that there is no gas or other vaporized explosive substance around the unit in order to prevent explosion or ignition.
- Changing brake linings requires experience. Consult with the nearest authorized service station.
- Brake torque will change with operation environment and conditions, the condition of the friction surface, and other factors. In particular, brake torque may not be at the prescribed level for initial operation, and after a long period of inactivity. In such a case turn the brake on and off under as light load as possible to contact the brake’s friction surfaces.

8.1 Daily Inspection

Make certain to carry out daily inspections in accordance with **Table 8-1**. Neglecting inspections is a source of trouble.

Table 8-1: Daily Inspection

Inspection Item		Inspection Detail
Current value		Is the current no greater than the rated value shown on the nameplate?
Noise		Are there unusual noises, or are there extreme changes in the noises?
Vibration		Is there abnormally large vibration? Are there extreme changes?
Surface Temperature		Is surface temperature unusually high? Has there been a sudden rise? Temperature rises during operation will differ according to model and type. However, the difference between the gear unit surface temperature and the environment temperature should be approximately 60°C. In this case, there is no particular problem if fluctuation is slight.
Oil Level (Oil Lubricated Machines)	At Rest	Is the oil level below the red line at the top of the oil gauge when the machine is at rest? If when at rest the oil level is below the top red mark, fill up to the mark with lubricating oil. Do not add while the machine is running.
	While Running	Is the oil level significantly different than the level during stable operation? The bottom red mark is an auxiliary mark serving as a guideline to check oil level while the machine is running.
	Plunger Pump/ Trochoid	Are the oil signal and flow gauge working properly? If the oil signal and flow gauge are not working properly it is a sign of improper reducer lubrication, due to factors including insufficient oil, pump damage, and plugged pipes. Immediately stop the machine and inspect.
Lubricant Contamination		Is the lubricating oil contaminated? To check for oil contamination, in addition to extracting oil while the machine it stopped, it is also possible to check using the oil gauge. If the oil gauge is contaminated, promptly change it.
Oil, Grease Leaks		Are oil or grease leaking from the gear unit? Are the oil seal sliding surfaces corroded?
Mounting Bolts		Are the mounting bolts loose?
Chain, V-Belt		Are the chain or V-belt loose?

If any abnormality is discovered during the daily inspection, take measures in accordance with “**9. Troubleshooting**” (**Pages 74 to 76**). If these actions do not remedy the issue, immediately contact the nearest authorized service station.

8. DAILY INSPECTION AND MAINTENANCE

8.2 Lubrication



Please look for the relevant items and make certain to do maintenance. Neglecting maintenance is a source of trouble.

Check **Tables 8-2 to 8-5** for the lubrication method employed by the gear unit of the model used.

Table 8-2: Lubrication for Horizontal Mount Single Reduction

Frame Size	Reduction Ratio																		
	3	5	6	8	11	13	15	17	21	25	29	35	43	51	59	71	87	119	
6060, 6065	Grease																		
6070, 6075														59					
6080, 6085														87					
6090, 6095		Maintenance Free Grease																	
6100, 6105, 610H																			
6110, 6115																			
6120, 6125, 612H																			
6130, 6135																			
6140, 6145, 614H																			
6160, 6165, 616H																			
6170, 6175	Oil																		
6180, 6185																			
6190, 6195																			
6205																			
6215																			
6225																			
6235																			
6245																			
6255																			
6265																			
6275																			

Frame Size	Reduction Ratio																																
	104	121	143	165	195	231	273	319	377	473	559	649	731	841	1003	1015	1247	1479	1849	2065	2537	3045	3481	4437	5133	6177	7569						
6060DA, 6065DA																																	
6070DA, 6075DA																							2537										
6090DA, 6095DA																											5133						
6100DA, 6105DA												Maintenance Free Grease																					
6120DA, 6125DA																																	
6120DB, 6125DB																																	
6130DA, 6135DA																																	
6130DB, 6135DB																																	
6130DC, 6135DC																																	
6140DA, 6140DB, 6140DC																																	
6145DA, 6145DB, 6145DC																																	
6160DA, 6165DA																																	
6160DB, 6165DB																																	
6170DA, 6175DA																																	
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																																	
6275DA																																	

Frame Size	Reduction Ratio																			
	3	5	6	8	11	13	15	17	21	25	29	35	43	51	59	71	87	119		
6060, 6065	Grease		Maintenance Free Grease																	
6070, 6075														59						
6080, 6085																	87			
6090, 6095																				
6100, 6105																				
6110, 6115																				
6120, 6125																				
6130, 6135			Oil																	
6140, 6145																				
6160, 6165			Forced Oil																	
6170, 6175																				
6180, 6185																				
6190, 6195																				
6205																				
6215																				
6225																				
6235																				
6245																				
6255																				
6265																				
6275																				

Table 8-5: Lubrication for Vertical Mount Double Reduction

Frame Size	Reduction Ratio																													
	104	121	143	165	195	231	273	319	377	473	559	649	731	841	1003	1015	1247	1479	1849	2065	2537	3045	3481	4437	5133	6177	7569			
6060DA, 6065DA																														
6070DA, 6075DA																							2537							
6090DA, 6095DA																											5133			
6100DA, 6105DA	Maintenance Free Grease																													
6120DA, 6125DA																														
6120DB, 6125DB																														
6130DA, 6135DA																														
6130DB, 6135DB																														
6130DC, 6135DC																														
6140DA, 6140DB, 6140DC																														
6145DA, 6145DB, 6145DC																														
6160DA, 6165DA	Grease																													
6160DB, 6165DB																														
6170DA, 6175DA																														
6170DB, 6175DB																														
6180DA, 6185DA																														
6160DC, 6165DC												473																		
6170DC, 6175DC													841																	
6180DB, 6185DB														1015																
6190DA, 6195DA																			2065											
6190DB, 6195DB																														
6205DA, 6205DB																				1849										
6215DA, 6215DB	121																						2537							
6225DA, 6225DB																														
6235DA, 6235DB																														
6245DA, 6245DB																														
6255DA, 6255DB																														
6265DA																														
6275DA												377																		

Forced Lubrication For Vertical Units

Plunger Pump Lubrication

The plunger pump (**Figure 10-2, Part 40**) is automatically operated by a cam (**Figure 10-2, Part 47**) fitted on the slow speed shaft (**Figure 10-1, Part 1**). The number of pumping cam teeth required is in direct relation to the reduction ratio and frame size. Please consult the factory for input speeds other than standard.

Table 8-6: Plunger Pump Type

Small Size Pump		Large Size Pump	
Frame Size	Ratio	Frame Size	Ratio
6160,6165,6170,6175, 6180,6185,6190,6195	See Table 8-4	6205, 6215, 6225, 6235, 6245, 6255, 6265, 6275	See Table 8-4
6160DC, 6165DC, 6170DC, 6175DC, 6180DB, 6185DB, 6190DA, 6195DA, 6190DB, 6195DB	See Table 8-5	6205DA, 6205DB, 6215DA, 6215DB, 6225DA, 6225DB, 6235DA, 6235DB, 6245DA, 6245DB, 6255DA, 6255DB, 6265DA	See Table 8-5

Positive Displacement (Trochoid) Pump Lubrication

Forced oil lubrication is accomplished by using a positive displacement pump and motor that requires an additional electric power source. It is recommended that the main motor be interlocked with the pump motor to avoid operation without lubrication. The pump must be started 30 seconds or longer before the main motor is operated.

Table 8-7: Positive Displacement (Trochoid) Pump Type

Cyclo Drive			Trachoid Pump ^[1,2]									
Type	Frame Size	Reduction Ratio	Pump Type	Pump Motor	50 HZ				60 HZ			
					Flow		Max Pressure		Flow		Max Pressure	
					gal/min	l/min	psi	kgf/cm²	gal/min	l/min	psi	kgf/cm²
Vertical Shaft	6275	29, 43, 59, 87	TOP216HA-VB3	1 HP (0.75 kW) 4P	6.3	24.0	113.8	8	7.6	28.8	71.1	5.0
	6275DA	All	TOP204HA-VB3	1/2 HP (0.4 kW) 4P	1.6	6.0	227.6	16	1.9	7.2	163.6	11.5

Notes: [1] Consult the factory when using an inverter.
[2] A relief valve, pressure set at 42.7 psi (3 kgf/cm²), is a standard attachment on the trochoid pump.

8. DAILY INSPECTION AND MAINTENANCE

8.3 Oil Quantities and Oil Change for Oil Lubricated Units

8.3.1 Oil Change Interval

Table 8-8: Lubricating Oil Inspection and Change Intervals

	Change Interval		Operating Condition
Oil Supply	Time of Purchase		-
Oil Change	First Time	After 500 hours or 6 months, whichever comes first.	-
	2nd. and Subsequent Times	Every 5,000 hours, or every year, whichever comes first.	Indoors, etc. at 0 to 35 °C
		Every 2,500 hours, or every 6 months, whichever comes first.	Outdoors or hot locations, etc., where 0 to 35 °C cannot be maintained.

Note: Oil degrades more rapidly when ambient temperature is high or changes radically, and when corrosive gases are present. In such cases consult with the lubricating oil manufacturer.

8.3.2 Approved Lubricating Oils

Always use lubricating oils approved by Sumitomo Machine Corporation of America as shown in **Table 8-9**.

Table 8-9: Approved Oils

ExxonMobil:	Spartan EP	Shell Oil:	Omala S2 G	Kluber:	Kluberoil GEM1
ExxonMobil:	Mobilgear 600XP	Caltex:	Meropa	Idemitsu Oil:	Daphane Mechanic
ExxonMobil:	Mobil SHC Gear Hi-Shock 150	Castrol:	Alpha SP	BP Oil:	Energol GR-XP
Food Grade Oil:	Klübersynth UH1 6-460	Gulf Oil:	EP Lubricant HD	Total:	Carter EP

° F	14	32	50	68	86	104	122
° C	-10	0	10	20	30	40	50
ISO VG							
		68 (14 °F to 41 °F)					
			100/150 (32 °F to 95 °F)				
				220/320/460 (86 °F to 122 °F)			

Notes:

1. When using in winter or where the ambient temperature is relatively low, use an oil with a viscosity at the lower end of the range.
2. For allowable lubricating oil viscosity see **Table 8-10**. Use within this required viscosity range.

8. DAILY INSPECTION AND MAINTENANCE

3. For a smooth startup use oil with a pour point at least 5°C below ambient temperature.
4. If operating temperature changes within a wide range use a high viscosity index oil that meets requirements in Notes **2** and **3**.
5. Please consult factory if regularly operating outside the ambient temperature range of 0 to 40°C, as some parts of the mechanism may need to be changed, and lubricating oil might need to be preheated, or cooled.

Table 8-10: Allowable Oil Lubricant Viscosity

Minimum Allowable Viscosity	For oil temperature during operation, minimum 15mm²/S.		Viscosity that will obtain required film strength under load.
Maximum Allowable Viscosity	Oil Bath Lubricated Models	Maximum 4,300mm²/S	Viscosity at which Cyclo Drive can start.
	Force Feed Lubricated Models	Maximum 2,200mm²/S	Viscosity at which the plunger pump and motorized trochoid pump can start.

8.3.3 Oil Fill Quantities

Table 8-11: Oil Fill Quantities

Cyclo Horizontal Foot Mounted / Cyclo Horizotal V-Flange Mounted														
Size	613X	614X	616X	617X	618X	619X	6205	6215	6225	6235	6245	6255	6265	6275
US gal	0.18	0.18	0.37	0.50	0.66	1.1	1.5	2.2	2.6	4.0	4.2	5.5	7.7	14.8
liter	0.7	0.7	1.4	1.9	2.5	4	5.5	8.5	10	15	16	21	29	56
Size	616XDC	617XDC	618XDB	619XDA	619XDB	6205DA	6205DB	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB	6245DA
US gal	0.40	0.63	0.92	1.5	1.6	1.6	1.6	2.6	2.6	2.9	2.9	4.5	4.5	4.8
liter	1.5	2.4	3.5	5.8	6	6	6	10	10	11	11	17	17	18
Size	6245DB	6255DA	6255DB	6265DA	6275DA									
US gal	4.8	6.1	6.1	8.5	15.9									
liter	18	23	23	32	60									

Cyclo Vertical V-Flange Mounted														
Size	613X	614X	616X	617X	618X	619X	6205	6215	6225	6235	6245	6255	6265	6275
US gal	0.29	0.29	0.26	0.50	0.53	0.71	1.5	2.0	2.6	3.2	4.0	11.1	13.5	(15.9)
liter	1.1	1.1	1	1.9	2	2.7	5.7	7.5	10	12	15	42	51	(60)
Size	616XDC	617XDC	618XDB	619XDA	619XDB	6205DA	6205DB	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB	6245DA
US gal	0.26	0.50	0.53	0.71	0.71	2.9	2.9	3.7	3.7	4.8	4.8	6.1	6.1	7.7
liter	1	1.9	2	2.7	2.7	11	11	14	14	18	18	23	23	29
Size	6245DB	6255DA	6255DB	6265DA	6275DA									
US gal	7.7	11.1	11.1	13.5	(15.85)									
liter	29	42	42	51	(60.00)									

Cyclo Horizontal Flange Mounted														
Size	613X	614X	616X	617X	618X	619X	6205	6215	6225	6235	6245	6255	6265	6275
US gal	0.07	0.07	0.24	0.34	0.40	0.53	0.79	1.1	1.3	2.0	2.1	2.9	3.7	7.9
liter	0.25	0.25	0.9	1.3	1.5	2	3	4	5	7.5	8	11	14	30
Size	616XDC	617XDC	618XDB	619XDA	619XDB	6205DA	6205DB	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB	6245DA
US gal	0.26	0.53	0.61	1.0	1.1	1.1	1.1	1.5	1.5	1.6	1.6	2.5	2.5	2.6
liter	1	2	2.3	3.8	4	4	4	5.5	5.5	6	6	9.5	9.5	10
Size	6245DB	6255DA	6255DB	6265DA										
US gal	2.6	3.4	3.4	4.5										
liter	10	13	13	17										

X = 0 or 5 () = With Trochoid Pump

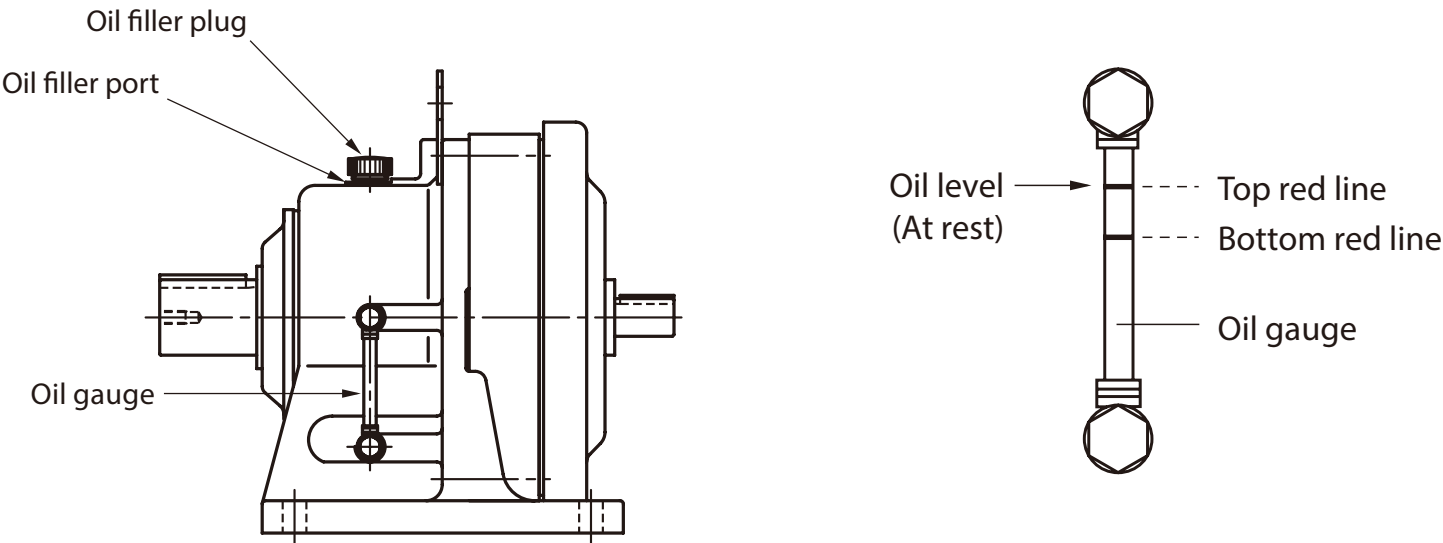
8.3.4 Oil Fill Procedure

Oil Fill Procedure for Horizontal Types

 For the horizontal type, the standard position for the oil gauge is to the right looking from the slow speed shaft (output shaft). However, it can be mounted on either the right or left side, so mount it where it is easy to see.

- 1. Remove the filler plug.
- 2. Pour oil into the oil filler port, keeping an eye on the oil gauge to check the oil level.
- 3. Confirm that the oil level is up to the top red line on the oil gauge.
- 4. Replace the filler plug.

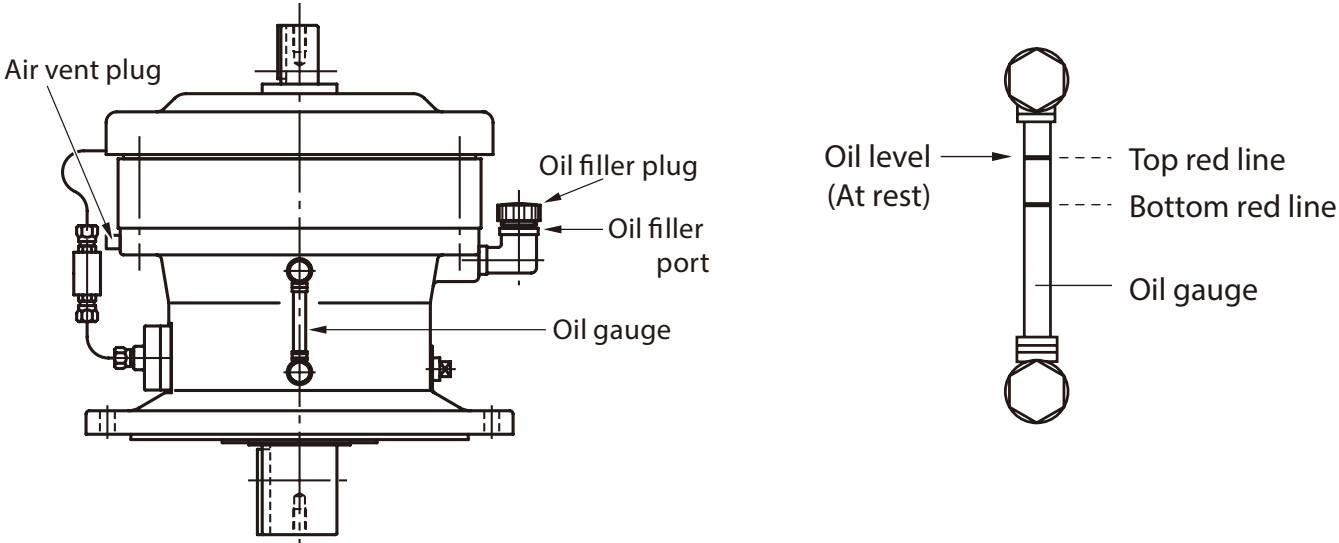
Figure 8-1: Horizontal Types



Oil Fill Procedure for Vertical Types

- 1. Remove the filler plug. For frame sizes other than models other than frame size 6255, 6265, remove the air vent plug to release air.
- 2. Pour oil into the oil filler port, keeping an eye on the oil gauge to check the oil level.
- 3. Confirm that the oil level is up to the top red line on the oil gauge.
- 4. For frame sizes other than models other than frame size 6255, 6265 wrap the air vent plug with sealing tape and install it.
- 5. Replace the filler plug.

Figure 8-2: Vertical Types



-  Only fill oil when the machine is stopped.
- It will take some time for high-viscosity oil to reach a uniform level. Be careful to not overfill. If oil is filled above the top red line, churning heat may raise the temperature.
- Use the lower red line of the oil gauge as a guideline for the oil level while the machine is running. It is normal for the oil level to drop below the bottom red line immediately after the machine starts. It will return when oil viscosity drops as the machine runs.
- For daily oil level management see **Table 8-1** on **Page 42**.

Oil Level Dimensions

Foot Mount Horizontal Type

Figure 8-3: Oil Level Dimensions Horizontal Types

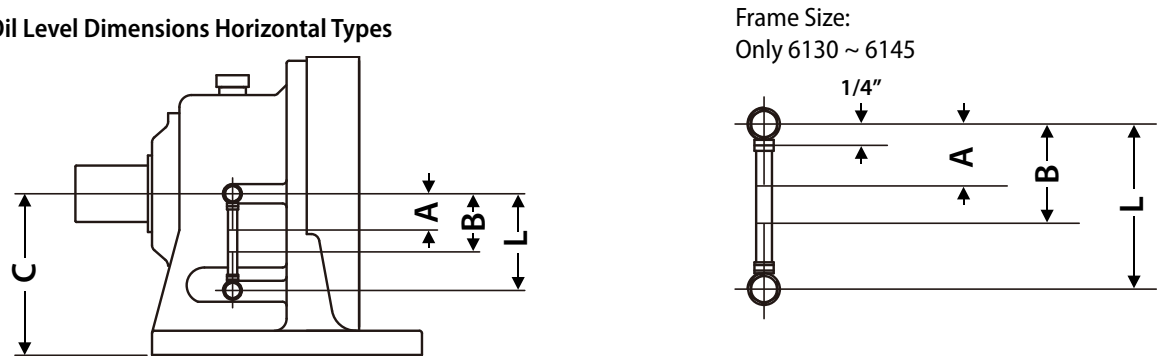


Table 8-12: Oil Level Dimensions Inches (Millimeters) Horizontal Types

Frame Size	A	B	C	L
6130, 6135, 6140, 6145	1.38 (35)	2.17 (55)	5.91 (150)	4.65 (118)
614H	1.38 (35)	2.17 (55)	6.3 (160)	4.65 (118)
6160, 6165	1.57 (40)	2.76 (70)	6.3 (160)	3.7 (94)
616H	1.57 (40)	2.76 (70)	7.87 (200)	3.7 (94)
6160DC, 6165DC	1.18 (30)	1.77 (45)	6.3 (160)	3.7 (94)
6170, 6175	1.97 (50)	3.35 (85)	7.87 (200)	4.96 (126)
6170DC, 6175DC	1.18 (30)	1.77 (45)	7.87 (200)	4.96 (126)
6180, 6185	2.17 (55)	3.94 (100)	8.66 (220)	5.91 (150)
6180DB, 6185DB	1.38 (35)	2.17 (55)	8.66 (220)	5.91 (150)
6190, 6195	2.26 (57)	3.25 (83)	9.84 (250)	6.61 (168)
6190DA, 6195DA	1.18 (30)	1.77 (45)	9.84 (250)	6.61 (168)
6190DB, 6195DB	1.38 (35)	2.18 (55)	9.84 (250)	6.61 (168)
6205	2.12 (54)	3.19 (81)	9.84 (250)	6.06 (154)
6205DA	1.26 (32)	1.93 (49)	9.84 (250)	6.06 (154)
6205DB	1.26 (32)	2.13 (54)	9.84 (250)	6.06 (154)
6215	2.05 (52)	3.03 (77)	10.43 (265)	6.85 (174)
6215DA	1.18 (30)	1.97 (50)	10.43 (265)	6.85 (174)
6215DB	1.57 (40)	2.76 (70)	10.43 (265)	6.85 (174)
6225	2.25 (57)	3.43 (87)	11.03 (280)	6.85 (174)
6225DA	1.26 (32)	2.05 (52)	11.03 (280)	6.85 (174)
6225DB	1.85 (47)	3.43 (87)	11.03 (280)	6.85 (174)
6235	2.48 (63)	3.47 (88)	11.81 (300)	7.64 (194)
6235DA	1.57 (40)	2.75 (70)	11.81 (300)	7.64 (194)
6235DB	1.97 (50)	3.35 (85)	11.81 (300)	7.64 (194)
6245	2.76 (70)	3.78 (96)	13.19 (335)	8.46 (215)
6245DA	1.65 (42)	2.72 (69)	13.19 (335)	8.46 (215)
6245DB	2 (51)	3.35 (85)	13.19 (335)	8.46 (215)
6255	3.19 (81)	4.17 (106)	14.76 (375)	9.02 (229)
6255DA	1.97 (50)	3.35 (85)	14.76 (375)	9.02 (229)
6255DB	2.05 (52)	3.23 (82)	14.76 (375)	9.02 (229)
6265	3.23 (82)	4.21 (107)	15.75 (400)	10.16 (258)
6265DA	2.28 (58)	3.27 (83)	15.75 (400)	10.16 (258)
6275	3.35 (85)	4.53 (115)	21.26 (540)	11.22 (285)
6275DA	2.26 (57)	3.25 (83)	21.26 (540)	11.22 (285)

Base Mount Vertical Type - Frame Size 6130 ~ 614H

Figure 8-4: Oil Level Dimensions Vertical Types 6130 ~ 614H

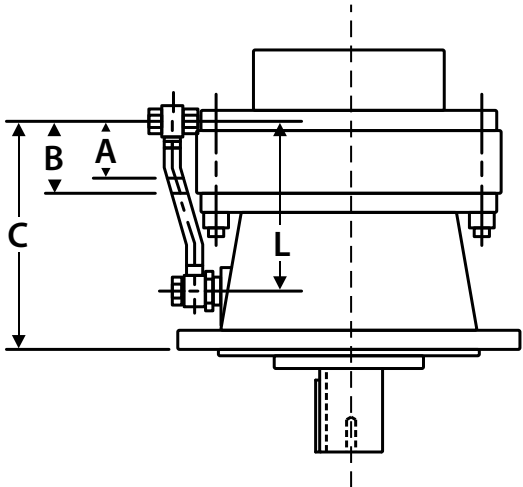


Table 8-13: Oil Level Dimensions Inches (Millimeters) Vertical Sizes 6130 ~ 614H

Frame Size	A	B	C	L
6130 ~ 614H	1.85 (47)	2.72 (69)	7.52 (191)	5.79 (151)

Base Mount Vertical Type - Frame Size 6160 ~ 6275

Figure 8-5: Oil Level Dimensions Vertical Types 6160 ~ 6275

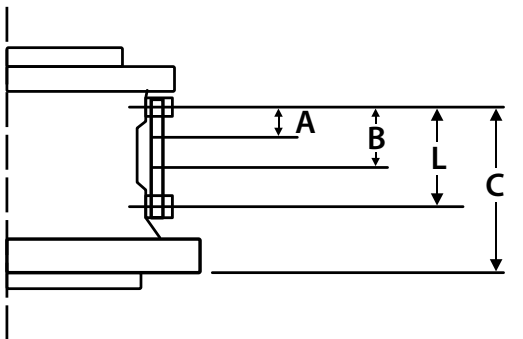


Table 8-14: Oil Level Dimensions Inches (Millimeters) Vertical Sizes 6160 ~ 6275

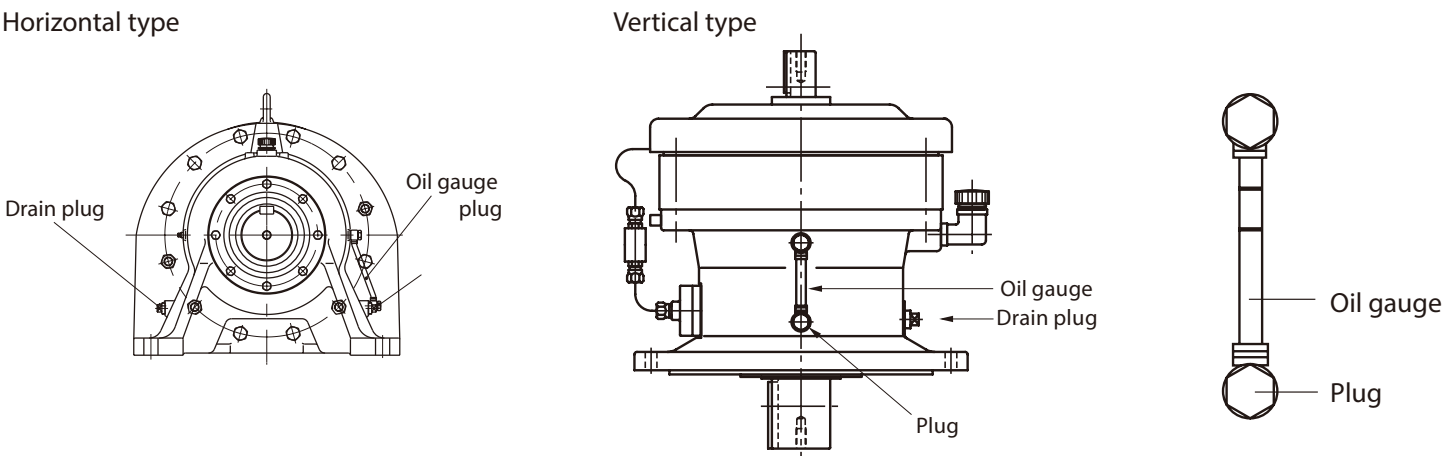
Frame Size	A	B	C	L
6160, 6165, 616H	1.02 (26)	1.42 (36)	4.68 (119)	2.72 (69)
6170, 6175	1.69 (43)	2.48 (63)	6.02 (153)	3.78 (96)
6180, 6185	1.93 (49)	2.72 (69)	6.81 (173)	4.25 (108)
6190, 6195	2.09 (53)	3.27 (83)	7.87 (200)	5.47 (139)
6205, 6215	1.46 (37)	2.05 (52)	7.09 (180)	3.54 (90)
6225	1.46 (37)	2.05 (52)	7.87 (200)	3.54 (90)
6235	1.46 (37)	2.05 (52)	7.72 (196)	3.54 (90)
6245	1.46 (37)	2.05 (52)	7.96 (202)	3.54 (90)
*6255	4.33 (110)	4.92 (125)	19.76 (502)	6.57 (167)
*6265	4.65 (118)	5.24 (133)	21.69 (551)	7.17 (182)
6275	1.97 (50)	2.76 (70)	13.39 (340)	5.51 (140)

***Note:** Oil level gauge is located on the Ring Gear Housing instead of V-Casing.

8.3.5 Draining Procedure

To drain the oil, remove the oil drain plug and the plug at the bottom of the oil gauge.

Figure 8-6: Oil Draining



8.3.6 Long Term Shutdown/Storage

Table 8-15: Long Term Shutdown/Storage

Period of Inactivity	Approximately 1 Month	Before shutdown/storage, change to new oil and run the machine for a few minutes.
	1 Month or More	Before shutdown/storage, flush, fill with rust preventing oil, and run for a few minutes under no load.

 When resuming operation after a long period of inactivity, change to new oil because the existing oil may have degraded.

8.4 Grease Replenishment for Grease Lubricated Units

8.4.1 Grease Replenishment Intervals

Table 8-16: Grease Replenishment and Change Intervals for Maintenance-Free Units

Condition	Interval
Replenishment	Not required
Change (Overhaul*)	Although these models are maintenance-free and can run for a long time without replenishment, overhauling after approximately 20,000 hours or 3 to 5 years will increase gearbox's usable life.

Note* Overhauling consists of disassembling the unit, replacing the seals and gaskets, cleaning the internal parts, and then re-packing the unit with designated grease.

Table 8-17: Grease Replenishment and Change Intervals for Non-Maintenance-Free Units

Condition	Operation Time	Interval	Special Considerations
Replenishment	Less than 10 Hours Per Day	Once Every 3 – 6 Months	Shorten the replenishment interval when the operating conditions are outside standard ambient conditions (see Section 4.1 Installation Location) and/or for frame sizes 6205 or larger.
	10 – 24 Hours Per Day	Once Every 500 – 1,000 Hours	
Change (Overhaul*)	All	Overhauling after approximately 20,000 hours or 3 to 5 years will increase gearbox's usable life.	

Note* Overhauling consists of disassembling the unit, replacing the seals and gaskets, cleaning the internal parts, and then re-packing the unit with designated grease.

8.4.2 Approved Greases

Grease lubricated units are shipped with grease from factory.

Table 8-18: Approved Greases

Frame Size	Ambient Temperature		Planetary	Cycloid Discs
	°F	°C	(NLGI Grade 0)	(NLGI Grade 2)
606X to 612X	14 to 122	-10 to 50	Shell Gadus S2 V220 (610X, 612X to 617X)	Mobil Unirex N2 Ultrachem Omnilube FGM-2 (FG)
613X to 616X				Shell Gadus S2 V220
617X to 626X				

Notes:

- For double reduction units, standard grease is Mobil Unirex N2 NLGI Grade 2, except for frame sizes 6215DB, 6225DB, 6235DA/DB, 6245DA/DB, 6255DA/DB, 6265DA, and 6275DA, which standard grease is Shell Gadus S2 V220 NLGI Grade 2.
- For triple reduction units, standard grease is Mobil Unirex N2 NLGI Grade 2.
- "X" in frame size can be "0" or "5".
- Only use grease listed in **Table 8-18**.
- The maintenance method will differ according to product although the same grease is used.
- Please consult factory when regularly used in an ambient temperature outside 32 °F to 104 °F (0 °C to 40 °C) range
- FG = Food Grade Grease. Considered non-standard and non-maintenance-free grease. Available upon customer's request.

8.4.3 Grease Replenishment Quantities

Table 8-19a: Grease Replenishment Quantities for Normally Maintenance-Free Speed Reducers

Frame Size	6060 6065	6070 6075	6080 6085	6090 6095	6100 6105	6110 6115	6120 6125	6060DA 6065DA	6070DA 6075DA	6090DA 6095DA	6100DA 6105DA	6120DA 6125DA	6120DB 6125DB
Oz	0.3 - 0.5	0.3 - 0.5	0.5 - 0.7	0.7 - 1.1	1.4 - 2.1	2.3 - 3.4	3.0 - 4.4	0.3 - 0.5	0.3 - 0.5	0.3 - 0.5	0.3 - 0.5	0.3 - 0.5	0.7 - 1.1
(g)	(9 - 13)	(9 - 13)	(14 - 20)	(20 - 30)	(40 - 60)	(70 - 100)	(90 - 130)	(9 - 13)	(9 - 13)	(9 - 13)	(9 - 13)	(9 - 13)	(20 - 30)

NOTE: Units considered as maintenance-free will require grease replenishment when operating at ambient conditions outside standard (refer to **Section 4.1**) or for applications which require specialty greases (i.e., food grade applications).

Table 8-19b: Grease Replenishment Quantities for Normally Oil-Lubricated Speed Reducers

Frame Size	6130 6135 6140 6145 614H	6160 6165 616H	6170 6175	6180 6185	6190 6195	6205	6215	6225	6235	6245	6255	6265
Oz	5.3 - 8	8.9 - 13.3	11.8 - 17.7	13.0 - 19.2	17.7 - 26.5	17.7 - 26.5	23.5 - 35.3	29.4 - 44.1	48 - 71	52.9 - 79.4	70.6 - 105.8	94.1 - 141.1
(g)	(150 - 225)	(250 - 380)	(340 - 500)	(370 - 550)	(500 - 750)	(500 - 750)	(670 - 1,000)	(840 - 1,250)	(1,340 - 2,000)	(1,500 - 2,2500)	(2,000 - 3,000)	(2,670 - 4,000)

NOTE: Normally oil-lubricated units can be grease lubricated, either per customer’s request or application’s demand. Consult factory when grease lubrication is required for normally oil lubricated units.

Table 8-19c: Grease Replenishment Quantities for Non-Maintenance-Free Speed Reducers

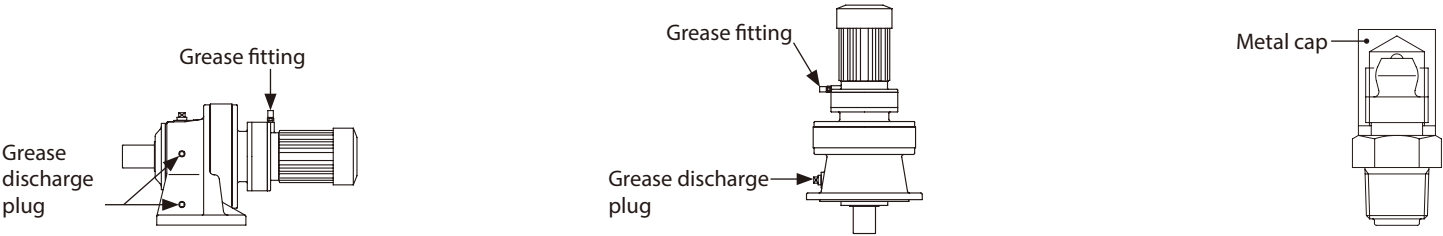
Frame Size	6130DA 6135DA	6130DB 6135DB	6130DC 6135DC	6140DA 6145DA	6140DB 6145DB	6140DC 6145DC	6160DA 6165DA	6160DB 6165DB	6160DC 6165DC	6170DA 6175DA	6170DB 6175DB	6170DC 6175DC
Oz	0.3 - 0.5	0.7 - 1.1	1.4 - 2.1	0.3 - 0.5	0.7 - 1.1	1.4 - 2.1	0.7 - 1.1	1.4 - 2.1	3.0 - 4.4	0.7 - 1.1	1.4 - 2.1	3.0 - 4.4
(g)	(8.5 - 12.5)	(20 - 30)	(40 - 60)	(8.5 - 12.5)	(20 - 30)	(40 - 60)	(20 - 30)	(40 - 60)	(85 - 125)	(20 - 30)	(40 - 60)	(85 - 125)
Frame Size	6180DA 6185DA	6180DB 6185DB	6190DA 6195DA	6190DB 6195DB	6205DA	6205DB	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB
Oz	1.4 - 2.1	5.3 - 8	3.9 - 5.8	5.3 - 8	3.9 - 5.8	5.3 - 8	5.3 - 8	8.9 - 13.3	5.3 - 8	11.8 - 17.7	8.9 - 13.3	13.0 - 19.2
(g)	(40 - 60)	(150 - 225)	(110 - 165)	(150 - 225)	(110 - 165)	(150 - 225)	(150 - 225)	(250 - 375)	(150 - 225)	(335 - 500)	(250 - 375)	(370 - 550)
Frame Size	6245DA	6245DB	6255DA	6255DB	6265DA							
Oz	8.9 - 13.3	13.0 - 19.2	11.8 - 17.7	17.7 - 26.5	17.7 - 26.5							
(g)	(250 - 375)	(370 - 550)	(335 - 500)	(500 - 750)	(500 - 750)							

8.4.4 Grease Fill and Purge Procedures

Grease Replenishment Procedure for Grease Lubricated Models (Excluding Maintenance-Free Grease Lubricated Models)

1. Remove the grease discharge plug from the casing.
2. Use a grease gun to replenish through the grease fittings for the internal cover and the motor flange bracket, using the quantities of grease shown on **Page 56, Table 8-19** as guidelines. If a grease fitting has a metal cap, remove the cap before replenishing. After replenishing replace the metal cap.
Note: Grease fitting is normally installed on the high speed end shield (for reducers) or motor flange (for gearmotors). In the event there is additional piping in between the grease fitting and high speed end shield/motor flange, consider replenishing up to 50% additional grease for the first time replenishment only..
3. Replace the grease discharge plug.

Figure 8-7: Location of Grease Fill and Discharge Ports



- Grease while the unit is running to improve grease distribution.
- In addition to being used for discharging grease, the grease discharge plug also functions as a pressure vent when replenishing grease. Make sure to remove when replenishing.
- Replenish grease slowly.
- Replenishing more than the quantity shown in **Table 8-19** may cause agitation heat, which raises the temperature, and may cause grease to leak into the motor unit.
- Grease may ooze out of the grease fitting after starting the machine. In such a case replace the grease fitting with one that has a metal cap.
- Be careful when handling the metal cap for the grease fitting as dropping it from a high place is dangerous.
- Contact the nearest authorized service station when change or overhaul is required for grease lubricated units.

8. DAILY INSPECTION AND MAINTENANCE

8.5 Unit Maintenance

- Although it will depend on operation conditions, overhauling after approximately 20,000 hours or 3 to 5 years will further increase lifetime. Contact the nearest authorized service station regarding overhaul.
- Oil seals have a lifetime. During long use natural degradation and frictional wear will reduce effectiveness. Reducer operating conditions and ambient environment will cause lifetime to widely vary. Given normal operation, (uniform load, running 10 hours per day, normal temperature) as a guideline it is recommended to change them every 1 to 3 years. If the sliding surfaces of oil seals or V-rings show signs of wear or corrosion, replace them with new ones. Because sliding surfaces for oil seals are made of carbon steel, take on-going rust prevention measures regularly not to spread rust on them by applying rustproof oil and so on, if there are exposed surfaces of steel.
- If stop and start are frequent, mounting bolts (or nuts) and ring gear housing fastening bolts (or nuts) may come loose. Periodically check for looseness as this is a source of miss-alignment, oil leakages, and load unbalance.

8. DAILY INSPECTION AND MAINTENANCE

8.6 Brake Maintenance and Inspection



- Do not handle the unit when cables are live. Be sure to turn off the power when operating on the unit; otherwise, electric shock may result.
- When using for lifting, do not release the brake while a load is suspended; otherwise it could fall, causing an accident.
- Do not operate the machine while the brake is released by the manual brake release bolt; otherwise, falling, going out of control, or damage to the equipment may result.
- Before operation, turn power on and off to check brake action; otherwise falling or running out of control could occur.
- Do not bring water or lubricant in contact with the brake. Brake torque degradation could cause falling or running out of control.



- Avoid replenishing with a large quantity to extend the replenishment interval , as overfilling could result in overheating the bearing, grease leakage, and other problems.
- Please maintain the unit properly. Neglecting replenishment when resuming operation, or periodic replenishment when the unit is operating could lead to abnormal wear, bearing noise, bearing burnout, and other problems.

Important!

Given normal operation conditions, brake mechanical lifetime is quite long at 2 million times (1 million times for FB-30, ESB-250 and ESB-250-2). These conditions include the moment of inertia for the load being no greater than the moment of inertia for the brakemotor. However, please periodically inspect the brake gap (G).

The brake lining wears after long hours of running time, making it impossible for the brake to release. When 2 million times is exceeded (1 million times for FB-30, ESB-250 and ESB-250-2), wear and damage to mechanical parts may cause dropping or overdrive problems.

8.7 Brake Construction and Gap Inspection and Adjustment

- The brake is spring activated (power-off type).
- The brake lining wears after long hours of operating the brake, making it impossible for the brake to release. Therefore, please periodically inspect the brake gap (G).
- Adjust the gap if the gap is close to the limit during inspection.
- In FB-1E – FB-4E, a shock absorber is inserted between the stationary core and the armature plate to reduce the noise that results from the braking action.
- When inspecting, be careful that the gap gauge, other measuring tool or anything else does not damage the shock absorber or cause it to fall out.
- There is danger that if the shock absorber is damaged or falls out, brake noise will increase and the brake will not function properly.

Brake Models FB-01A1, FB-02A1, and FB-05A1

1. Standard Brakemotor Specifications

Table 8-20 lists the standard specifications for Models FB-01A1, FB-02A1, and FB-05A1.

Table 8-20: FB-01A1, FB-02A1, and FB-05A1 Standard Specifications

Brake Model	Motor Capacity		Standard Braking Torque ft - lbs (<i>N - m</i>)	Braking Delay Time (sec)			Brake Work Capacity		
	HP x 4P	kW x 4P		Normal Braking Action		Fast Braking Action	Allowable E ₀ (J/min)	Gap Adjust (x 10 ⁷ J)	Total E ₁ (x 10 ⁷ J)
				Standard Wiring	Inverter Wiring ^[1]				
FB-01A1	1/8	0.1	0.7 (1.0)	0.15 ~ 0.2	0.08 ~ 0.12	0.015 ~ 0.02	1080	2.6	6.7
FB-02A1	1/8 ~ 1/3	0.1 ~ 0.25	1.4 (2.0)						
FB-05A1	1/4 ~ 1/2	0.2 ~ 0.4	2.9 (4.0)	0.1 ~ 0.15	0.03 ~ 0.07	0.01 ~ 0.015			

Notes:

Above table applies to standard brake specification under standard brake torque. Special brakes may perform differently from those shown. Initial brake torque may be lower than specified brake torque. If this is the case, under light load start and stop the motor to wear-in the braking surface. To improve performance for positioning accuracy or lifting applications, consider using fast braking action circuit. If the brake is operated at a rate greater than the Allowable Brake Work Capacity, E0, the brake performance may degrade or become inoperable.

[1] Also applies to wiring where brake is powered separately from the motor leads.

2. Construction and Operating Principles

a) Construction

Figure 8-9 illustrates the construction of the brake. The restraining screw (14) fastens the brake shoe (5) and spacer (15) onto the stationary core (1). The armature plate (3) is kept from rotation by the restraining screw (14) but moves axially by electromagnetic attraction and the tension of the pressure spring (2). The brake lining (4) is fitted to the hub (7) which is secured to the motor shaft with a key. The solenoid coil (17) is energized via a rectifier provided within the conduit box.

Figure 8-9: FB-01A1, FB-02A1, FB-05A1 Models

No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Armature Plate*
4	Brake Lining*
5	Brake Shoe*
6	Leaf Spring*
7	Hub*
8	C-type Retaining Ring
9	Cover
10	Set Screw (TEFC model only)
11	V-Ring
12	Fan (TEFC model only)
13	Waterproof Cover
14	Restraining Screw*
15	Spacer*
16	Waterproof Seal
17	Solenoid Coil*
18	Motor Shaft
19	Fan Side Bearing

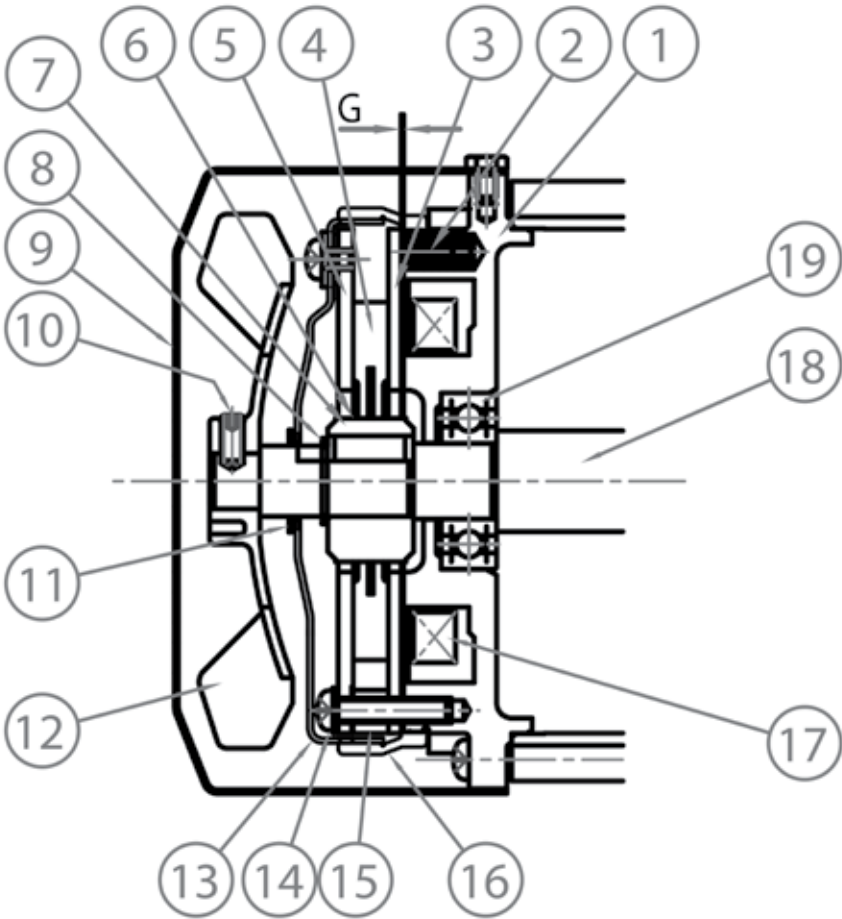
* These parts are included in a complete brake kit.

b) Operating Principles

The brake is a (fail safe type) spring actuated type brake, which will release the brake mechanism when the solenoid coil is energized and which will engage when the coil is de-energized.

When power is applied to the unit, the solenoid coil and the electric motor will energize, and the energized coil attracts the armature plate (3) against the tension of the pressure spring (2). As a result, the brake lining (4) will disengage, and the motor begins to run.

When the power is disconnected, the solenoid coil and the electric motor is de-energized. This causes the pressure spring (2) to actuate the armature plate (3) which in turn presses the brake lining (4) against the brake shoe (5) and brings the motor to a quick stop.



8. DAILY INSPECTION AND MAINTENANCE

3. Inspection

a) At regular intervals, check that:

- the unit is operating normally.
- the brake lining is not excessively worn (or gap G is normal).
- all the mounting screws are securely tightened.

b) Manual Brake Release Procedure

FB-01A1, FB-02A1, and FB-05A1 brakemotors are equipped with a one touch release mechanism. To manually release the brake with power to the unit turned off, pull the brake release lever up and out from its holder and push it forward towards the reducer. Releasing the lever will re-engage the brake.

4. Gap Inspection

The brake lining will wear after the unit has been used for a long period of time. Regularly check that gap G (Figure 8-9) is at an acceptable value. If the gap G become too large, the solenoid coil may fail to pull in the armature plate and hence cannot release the brake, resulting in the unit remaining in a continuously braked condition. Follow these steps to inspect the brake gap:

- Remove cover (9).
- Remove fan (12) by loosening set screw (10) (models FB-02A1 and FB-05A1).
- Remove waterproof seal (16).
- Insert a gap gage into the space between stationary core (1) and armature plate (3). Measure the gap size at three appropriate circumferential points.
- The gap needs to be adjusted if the values are close to the allowable limit listed in Table 8-21.

Table 8-21: Brake Gap Size

Brake Type	Gap value G, in. (mm)	
	Spec. value	Allowable limit
FB-01A1	0.008 - 0.014 (0.20 - 0.35)	0.02 (0.5)
FB-02A1		
FB-05A1		

8. DAILY INSPECTION AND MAINTENANCE

5. Gap Adjustment

If the brake lining is so heavily worn that gap adjustment is required, follow these steps:

- Remove cover (9).
- Remove fan (12) by loosening set screw (10) (models FB-02A1 and FB-05A1).
- Remove waterproof seal (16).
- Loosen restraining bolts (14), rotate the brake shoe completely counterclockwise, and re-tighten the restraining bolts (14). After tightening the restraining bolts, measure the gap G to verify that it falls within the specification value and the allowable limit shown in Table 8-20. (This procedure reduces the gap approximately 0.012 inch (0.30 mm).)
- Check for brake performance by turning system power on and off a few times.
- Reinstall waterproof seal (16) and fan (12).
- Replace cover (9).

Brake Models FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, and FB-3E

1. Standard Brakemotor Specifications

Table 8-22 lists the standard specifications for Models FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, and FB-3E.

Table 8-22: FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, and FB-3E Standard Specifications

Brake Model	Motor Capacity		Standard Braking Torque ft - lbs (<i>N - m</i>)	Braking Delay Time (sec)			Brake Work Capacity		
				Normal Braking Action		Fast Braking Action	Allowable E ₀ (J/min)	Gap Adjust (x 10 ⁷ J)	Total E ₁ (x 10 ⁷ J)
	Standard Wiring	Inverter Wiring ^[1]							
FB-1D	1/2 ~ 3/4	0.4 ~ 0.55	5.8 (7.5)	0.2 ~ 0.3	0.1 ~ 0.15	0.01 ~ 0.02	1620	7.0	33.1
FB-2D	3/4	0.55	11 (15)				2580	6.8	29.5
FB-1E	1	0.75	5.5 (7.5)	0.25 ~ 0.45	0.15 ~ 0.25	0.01 ~ 0.03	2580	11.6	38.7
FB-1HE	1.5	1.1	8.0 (11)	0.45 ~ 0.65	0.25 ~ 0.35		3360	20.8	46.3
FB-2E	2	1.5	11 (15)	0.35 ~ 0.55	0.15 ~ 0.25				
FB-3E	3	2.2	16 (22)	0.75 ~ 0.95	0.4 ~ 0.5	0.02 ~ 0.04	5720	26.3	105.3

Notes:

Above table applies to standard brake specification under standard brake torque. Special brakes may perform differently from those shown. Initial brake torque may be lower than specified brake torque. If this is the case, under light load start and stop the motor to wear-in the braking surface. To improve performance for positioning accuracy or lifting applications, consider using fast braking action circuit. If the brake is operated at a rate greater than the Allowable Brake Work Capacity, E0, the brake performance may degrade or become inoperable.

[1] Also applies to wiring where brake is powered separately from the motor leads.

2. Construction and Operating Principles

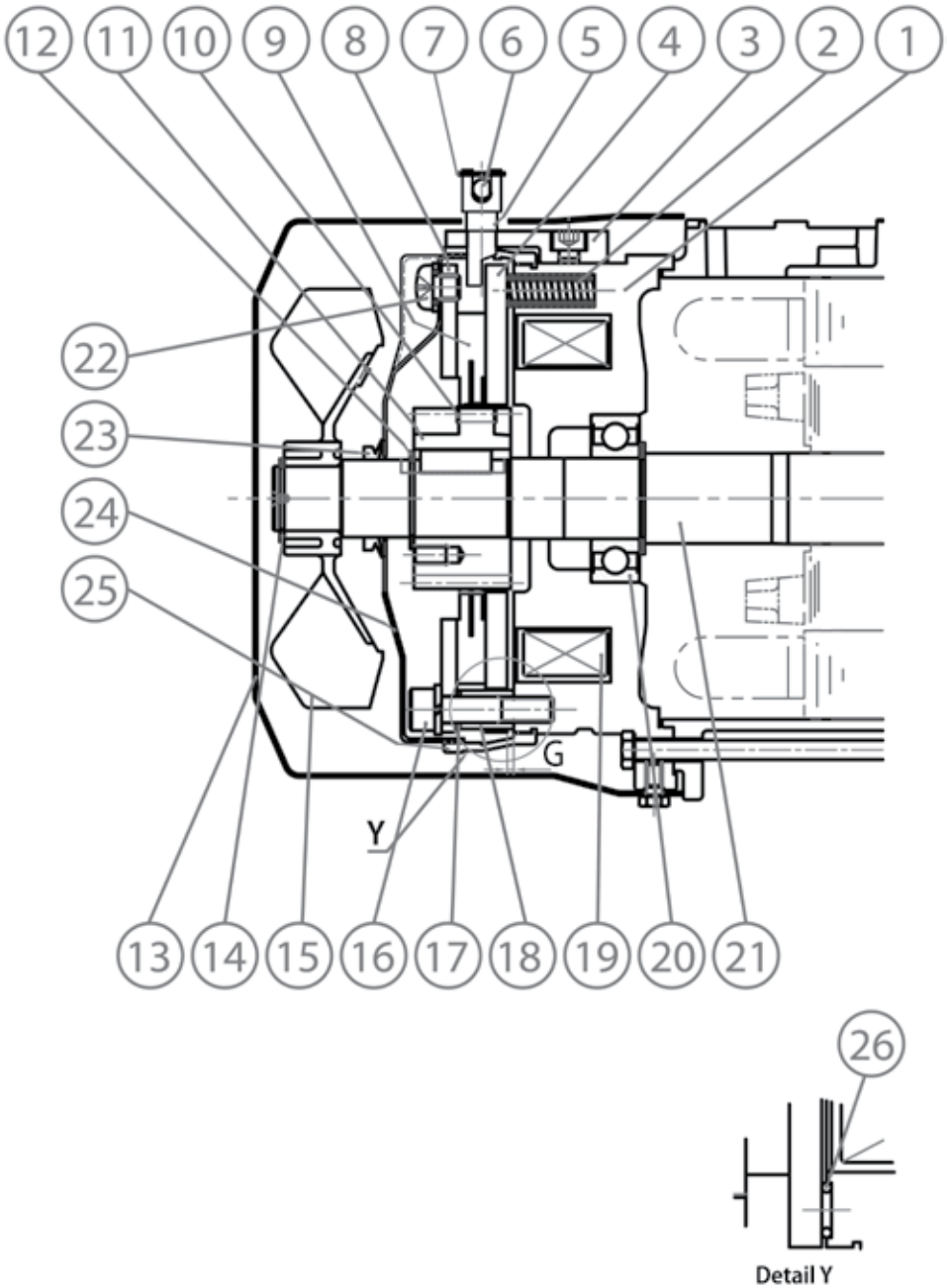
a) Construction

Figure 8-10 illustrates the construction of the brake. The restraining bolt (16) fastens the brake shoe (8), gap adjusting shims (17) and spacer (18) onto the stationary core (1). The armature plate (4) is kept from rotation by the restraining bolt (16) but moves axially by electromagnetic attraction and the tension of the pressure spring (2). The brake lining (9) is fitted to the hub (11) which is secured to the motor shaft with a key. The solenoid coil (19) is energized via a rectifier provided within the terminal box.

Figure 8-10: FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E, and FB-3E Models (E-Series Shown)

No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Brake Release Support
4	Armature*
5	Shifting Pin
6	Brake Release Lever
7	Retaining Clip
8	Brake Shoe*
9	Brake Lining*
10	Leaf Spring*
11	Hub*
12	C-type Retaining Ring
13	Cover
14	Retaining Ring
15	Fan
16	Restraining Bolt*
17	Gap Adjusting Shims*
18	Spacer*
19	Solenoid Coil*
20	Fan Side Bearing
21	Motor Shaft
22	Attachment Screw
23	V-Ring
24	Waterproof Cover
25	Waterproof Seal
26	Shock Absorber*

* These parts are included in a complete brake kit.



b) Operating Principles

The brake is a (fail safe type) spring actuated type brake, which will release the brake mechanism when the solenoid coil is energized and which will engage when the coil is de-energized.

When power is applied to the unit, the solenoid coil and the electric motor will energize, and the energized coil attracts the armature plate (4) against the tension of the pressure spring (2). As a result, the brake lining (9) will disengage, and the motor begins to run.

When the power is disconnected, the solenoid coil and the electric motor are not energized. This causes the pressure spring (2) to actuate the armature plate (4) which in turn presses the brake lining (9) against the brake shoe (8) and brings the motor to a quick stop.

3. Inspection

a) At regular intervals, check that:

- the unit is operating normally.
- the brake lining is not excessively worn (or gap G is normal).
- all the mounting screws are securely tightened.

b) Manual Brake Release Procedure

FB-1D, FB-2D, FB-1E, FB-1HE, FB-2E and FB-3E brakemotors are equipped with a one touch release mechanism. To manually release the brake with power to the unit turned off, pull the brake release lever up and out from its holder and push it forward towards the reducer. Releasing the lever will re-engage the brake.

4. Gap Inspection

The brake lining will wear after the unit has been used for a long period of time. Regularly check that gap G (**Figure 8-10**) is at an acceptable value. If the gap G become too large, the solenoid coil may fail to pull in the armature plate and hence cannot release the brake, resulting in the unit remaining in a continuously braked condition. Follow these steps to inspect the brake gap:

- Remove shifting pin (5) and brake release lever (6).
- Remove cover (13).
- Remove fan (15) by removing retaining ring (14).
- Remove waterproof seal (25).
- Insert a gap gage into the space between stationary core (1) and armature plate (4). Measure the gap size at three appropriate circumferential points.
- Check for brake performance by turning system power on and off a few times.
- The gap needs to be adjusted if the values are close to the allowable limit listed in **Table 8-23**.

8. DAILY INSPECTION AND MAINTENANCE

Table 8-23: Brake Gap Size

Brake Type	Gap value G, in. (mm)		
	Spec. value	Allowable limit	Gap Adjustment Shim Thickness
FB-1D, FB-2D	0.012 - 0.016 (0.3 - 0.4)	0.024 (0.6)	0.008 - 0.01 (0.2 - 0.25)
FB-1E	0.01 - 0.014 (0.25 - 0.35)	0.024 (0.6)	0.008 - 0.01 (0.2 - 0.25)
FB-1HE, FB-2E	0.01 - 0.014 (0.25 - 0.35)	0.029 (0.75)	0.014 - 0.018 (0.35 - 0.45)
FB-3E	0.01 - 0.014 (0.25 - 0.35)	0.033 (0.85)	0.018 - 0.022 (0.45 - 0.55)

5. Gap Adjustment

If the brake lining is so heavily worn that gap adjustment is required, follow these steps:

- a. Remove shifting pins (5) and brake release lever (6).
- b. Remove the cover (13). Remove fan (15) by removing retaining ring (14). Remove V-Ring (23) waterproof seal (25) and waterproof cover (24).
- c. Measure the gap size to confirm the deviation from the specification value. The minimum adjustable setting is no less than the thickness of the Gap Adjusting Shim shown in Table 8-23.
- d. Loosen the restraining bolt (16) and remove parts (16), (8), (17), and (18) as a set. Be careful not to remove only the bolt (16) and lose the shims (17).
- e. Decrease the number of shims in use according to the degree of wear (Note: Retain the removed shims for use during the brake lining replacement procedure). Reassemble parts (16), (8), (17) and (18) as a set.
- f. Once reassembled, check gap G. If the gap size is still too large, adjust the number of shims again.
- g. After completing the gap adjustment, turn the system power on and off a few times to check the brake performance.
- h. Replace waterproof cover (24), waterproof seal (25), V-Ring (23), fan (15), retaining ring (14), cover (13), shifting pins (5), and brake release lever (6).

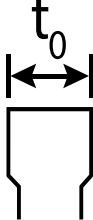
8. DAILY INSPECTION AND MAINTENANCE

6. Brake Lining Replacement

Follow these steps to replace the brake lining when its thickness has reached the allowable limit shown in Table 8-24, or when sleeve adjustment is no longer an effective means of gap adjustment:

- a. Remove shifting pins (5) and brake release lever (6).
- b. Remove the cover (13). Remove fan (15) by retaining ring (14). Remove V-Ring (23) waterproof seal (25) and waterproof cover (24).
- c. Loosen the restraining bolt (16) and remove parts (16), (17), (18) and (8) as a set.
- d. Remove the brake lining (9), taking care to prevent the leaf spring (10) from coming off.
- e. Install the new brake lining, taking care not to damage or remove the leaf spring (10). Ensure that the lining moves smoothly along the hub (11).
- f. Replace any gap adjusting shims removed and retained from previous gap adjustments. Then reinstall parts (16), (17), (18) and (8) as a set.
- g. Measure gap G. Read just if the gap is not within the specification value range.
- h. Turn the system power on and off a few times to check the brake performance. If no abnormalities are detected, replace waterproof cover (24), waterproof seal (25), V-Ring (23), fan (15), retaining ring (14), cover (13), shifting pins (5) and brake release lever (6).

Table 8-24: Brake Lining Size

Brake Type	Brake Lining Dimension	Initial Thickness t ₀ , in (mm)	Allowable Thickness t ₀ , in (mm)
FB-1D		0.276 (7.0)	0.236 (6.0)
FB-2D, FB-1E		0.347 (8.8)	0.307 (7.8)
FB-1HE, FB-2E, FB-3D		0.354 (9.0)	0.315 (8.0)
FB-3E		0.398 (10.4)	0.331 (8.4)

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Brake Models FB-5E, FB-8E, FB-10E, and FB-15E

1. Standard Brakemotor Specifications

Table 8-25 lists the standard specifications for Models FB-5E, FB-8E, FB-10E, and FB-15E.

Table 8-25: FB-5E, FB-8E, FB-10E, and FB-15E Standard Specifications

Brake Model	Motor Capacity		Standard Braking Torque ft - lbs (<i>N - m</i>)	Braking Delay Time (sec)			Brake Work Capacity		
	HP x 4P	kW x 4P		Normal Braking Action		Fast Braking Action	Allowable E ₀ (J/min)	Gap Adjust (x 10 ⁷ J)	Total E ₁ (x 10 ⁷ J)
				Standard Wiring	Inverter Wiring ^[1]				
FB-5E	5	3.7	30 (40)	1.1 ~ 1.3	0.4 ~ 0.5	0.02 ~ 0.04	6900	57.4	382.8
FB-8E	7.5	5.5	40 (55)	1.0 ~ 1.2	0.3 ~ 0.4				
FB-10E	10	7.5	59 (80)	1.8 ~ 2.0	0.6 ~ 0.7		10800	110.2	551.1
FB-15E	15	11	80 (110)	1.6 ~ 1.8	0.5 ~ 0.6				

Notes:
Above table applies to standard brake specification under standard brake torque. Special brakes may perform differently from those shown. Initial brake torque may be lower than specified brake torque. If this is the case, under light load start and stop the motor to wear-in the braking surface. To improve performance for positioning accuracy or lifting applications, consider using fast braking action circuit. If the brake is operated at a rate greater than the Allowable Brake Work Capacity, E0, the brake performance may degrade or become inoperable.

[1] Also applies to wiring where brake is powered separately from the motor leads.

2. Construction and Operating Principles

a) Construction

Figures 8-11 and 8-12 illustrate the construction of the brake. Among the brake parts, the stationary core (1), solenoid coil (20), and stud bolt (19) constitute an integral subassembly unit. The stud bolt (19) keeps the armature plate (4) from rotating, but the plate moves axially by electromagnetic attraction and the tension of the pressure spring (2). The adjusting washer (18) and spring washer (17) hold the brake shoe (8) against the nut (16) at all times. The brake lining (9) is fit to the hub (11), which is secured to the motor shaft with a key.

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Figure 8-11: FB-5E and 8E Models

No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Brake Release Support
4	Armature*
5	Shifting Pin
6	Brake Release Lever
7	Retaining Clip
8	Brake Shoe*
9	Brake Lining*
10	Leaf Spring*
11	Hub*
12	C-type Retaining Ring
13	Cover
14	C-type Retaining Ring
15	Fan
16	Gap Adjusting Nut*
17	Spring Washer
18	Adjusting Washer*
19	Stud Bolt*
20	Solenoid Coil*
21	Fan Side Bearing
22	Motor Shaft
23	Attachment Screw
24	V-Ring
25	Waterproof Cover
26	Waterproof Seal

* These parts are included in a complete brake kit.

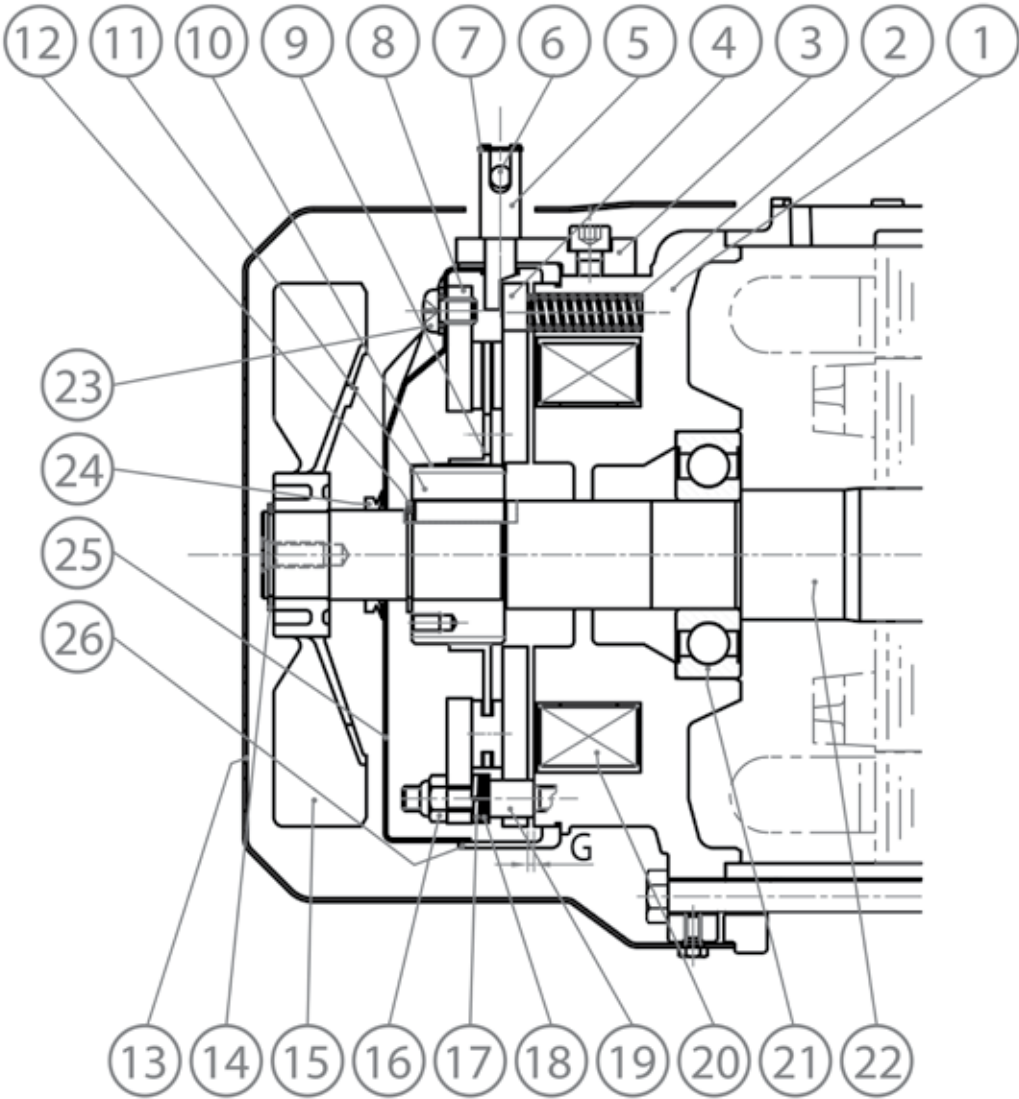


Figure 8-12: FB-10E and 15E Models

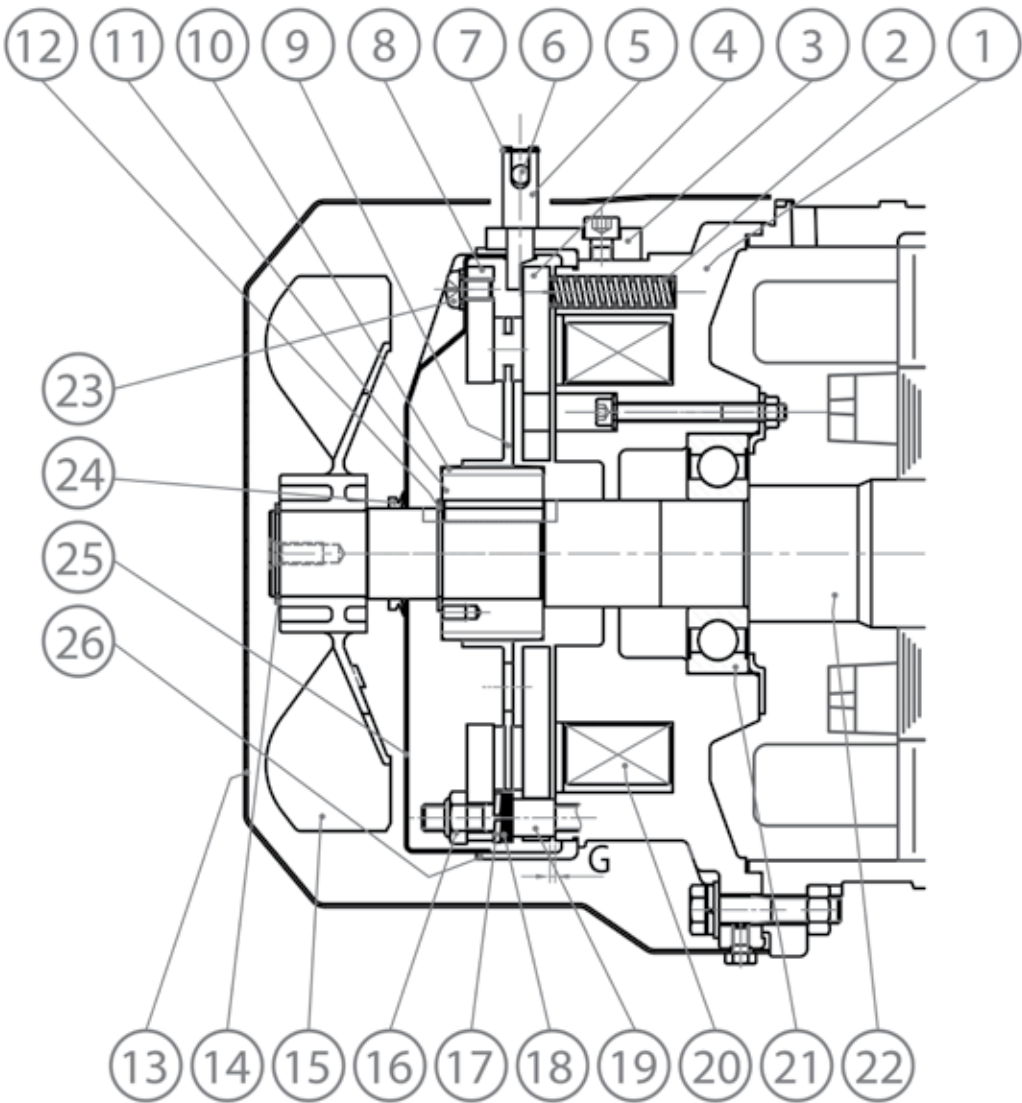
No.	Part Name
1	Stationary Core*
2	Pressure Spring*
3	Brake Release Support
4	Armature*
5	Shifting Pin
6	Brake Release Lever
7	Retaining Clip
8	Brake Shoe*
9	Brake Lining*
10	Leaf Spring*
11	Hub*
12	C-type Retaining Ring
13	Cover
14	C-type Retaining Ring
15	Fan
16	Gap Adjusting Nut*
17	Spring Washer
18	Adjusting Washer*
19	Stud Bolt*
20	Solenoid Coil*
21	Fan Side Bearing
22	Motor Shaft
23	Attachment Screw
24	V-Ring
25	Waterproof Cover
26	Waterproof Seal

* These parts are included in a complete brake kit.

b) Operating Principles

The brake is a (fail safe type) spring actuated type brake, that releases the brake mechanism when the solenoid coil is energized and engages when the coil is de-energized.

When power is applied to the unit, the solenoid coil and the electric motor become energized and the energized coil attracts the armature plate (4) against the tension of the pressure spring (2). As a result, the brake lining (9) will disengages, and the motor begins to run.



When the power is disconnected, the solenoid coil and the electric motor are not energized. This causes the pressure spring (2) to actuate the armature plate (4) which in turn presses the brake lining (9) against the brake shoe (8) and brings the motor to a quick stop.

3. Inspection

a) At regular intervals, check that:

- the unit is operating normally.
- the brake lining is not excessively worn (or gap G is normal).
- all the mounting screws are securely tightened.

b) Manual Brake Release Procedure

FB-5E, FB-8E, FB-10E, and FB-15E brakemotors are equipped with a one-touch release mechanism. To manually release the brake with power to the unit turned off, pull the brake release lever out from its holder and push it forward toward the reducer. Releasing the lever will re-engage the brake.

4. Gap Inspection

The brake lining will wear after the unit has been used for a long period of time. Regularly check that gap G (Figure 8-11 and 8-12) is at an acceptable value. If the gap G become too large, the solenoid coil may fail to pull in the armature plate and hence cannot release the brake, resulting in the unit remaining in a continuously braked condition. Follow these steps to inspect the brake gap:

- Remove shifting pin (5) and brake release lever (6).
- Remove cover (13).
- Remove fan (15) by removing retaining ring (14).
- Remove waterproof seal (26).
- Insert a gap gage into the space between stationary core (1) and armature plate (4). Measure the gap size at three appropriate circumferential points.
- Check for brake performance by turning system power on and off a few times.
- The gap needs to be adjusted if the values are close to the allowable limit listed in Table 8-26.

Table 8-26: Brake Gap Size

Brake Type	Gap value G, in. (mm)	
	Spec. value	Allowable limit
FB-5E, FB-8E	0.014 - 0.017 (0.35 - 0.45)	0.040 (1.0)
FB-10E, FB-15E		0.047 (1.2)

8. DAILY INSPECTION AND MAINTENANCE

5. Gap Adjustment

If the brake lining is so heavily worn that gap adjustment is required, follow these steps:

- a. Remove shifting pins (5) and brake release lever (6).
- b. Remove the cover (13). Remove fan (15) by removing retaining ring (14). Remove V-Ring (24) waterproof seal (26) and waterproof cover (25).
- c. Insert a gap gage into the space between the stationary core (1) and armature plate (4) and rotate the nut (16) at the tip of the stud bolt (19) clockwise until the gap measures an appropriate size. If the gap is too large to adjust by this procedure, decrease the number of adjusting washers (18) in use. Evenly adjust the three nuts (16) until the gaps at the three circumferential points are equal and fall within the specification range shown in Table 8-26.
- d. After completing the gap adjustment, turn the system power on and off a few times to check the brake performance.
- e. Replace waterproof cover (25), waterproof seal (26), V-Ring (24), fan (15), retaining ring (14), cover (13), shifting pins (5), and brake release lever (6).

6. Brake Lining Replacement

Follow these steps to replace the brake lining when its thickness has reached the allowable limit shown in Table 8-27, or when sleeve adjustment is no longer an effective means of gap adjustment:

- a. Remove shifting pins (5) and brake release lever (6).
- b. Remove the cover (13). Remove fan (15) by retaining ring (14). Remove V-Ring (24) waterproof seal (26) and waterproof cover (25).
- c. Remove all three nuts (16)
- d. Remove the brake shoe (8) and take out the brake lining (9).
- e. Fix the leaf spring (10) as shown in Figure 8-13.
- f. Apply a small amount of grease along the spline of the new brake lining (9), taking care not to apply any to the wear surface.
- g. Fit the new brake lining (9) onto the hub (11) and check that it moves smoothly. Remove any excess grease.
- h. After reassembling the brake, measure gap G. If the gap is out of the specification range, adjust by rotating the gap adjusting nut (16).
- i. Turn the system power on and off a few times to check the brake performance. If no abnormalities are detected, replace the fan (15), retaining ring (14) and cover (13).
- j. Measure gap G. Readjust if the gap is not within the specification value range.
- k. Turn the system power on and off a few times to check the brake performance. If no abnormalities are detected, replace waterproof cover (25), waterproof seal (26), V-Ring (24), fan (15), retaining ring (14), cover (13), shifting pins (5) and brake release lever (6).

8. DAILY INSPECTION AND MAINTENANCE

Table 8-27: Brake Lining Size

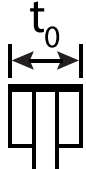
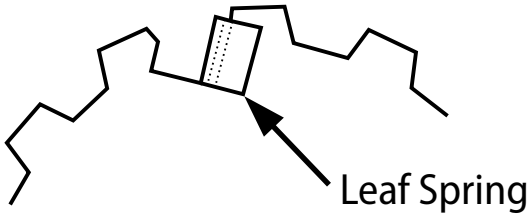
Brake Type	Brake Lining Dimension	Initial Thickness t ₀ ,in (mm)	Allowable Thickness t ₀ ,in (mm)
FB-5E, FB-8E		0.276 (7.0)	0.236 (6.0)
FB-10E, FB-15E		0.398 (10.4)	0.331 (8.4)

Figure 8-13: Leaf Spring



9. Troubleshooting

9.1 Reducer Troubleshooting

Problem with the Reducer		Possible Causes	Suggested Remedy
Runs Hot	Overloading	Load exceeds capacity of the reducer.	Check the rated capacity of the reducer, replace with unit of sufficient capacity or reduce the load.
	Improper lubrication	Insufficient lubricant.	Check lubricant level and increase to recommended level.
		Excessive lubricant.	Check lubricant level and reduce to recommended level.
		Incorrect lubricant.	Flush old lubricant from the unit and refill with correct recommended lubricant.
Vibration or Noise	Loose foundation bolts	Weak mounting structure.	Inspect mounting of reducer. Tighten loose bolts and/or reinforce mounting & structure.
		Loose hold-down bolts.	Tighten bolts.
	Worn reduction components	Load exceeds capacity of reducer.	If Cycloid discs are damaged, disassemble the Cyclo® portion and replace discs. Re-check the rated capacity of the unit.
	Bearing failure	Insufficient lubricant.	If bearings in Cyclo® portion are damaged, replace the affected bearings. Clean & flush the reducer and fill with the correct type and quantity of lubricant.
		Load exceeds capacity of reducer.	Check the rated capacity of the reducer. Replace with unit of sufficient capacity or reduce the driven load.
	Insufficient lubricant	Insufficient lubricant.	Check lubricant level and adjust to recommended level.
	Damaged Cyclo® pins and rollers	Load exceeds capacity of reducer.	Disassemble Cyclo® portion of reducer and replace ring gear housing pins and rollers. Check load on reducer.
Output Shaft Does Not Turn	Motor shaft broken	Load exceeds capacity of reducer or repetitive shock loading.	Replace broken shaft. Check rated capacity of reducer.
	Key missing or sheared off on input shaft		Replace key.
	Eccentric bearing broken	Insufficient lubricant.	Replace the Eccentric Bearing in the Cyclo® portion. Flush and refill the unit with the recommended lubricant.
	Motor does not turn	Motor.	Refer to the “Motor” portion of this Troubleshooting guide.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tightening coupling.
Oil Leakage	Worn seals	Caused by dirt or grit entering the seal area.	Replace the oil seals.
	Leakage into motor	Excessive lubricant.	Check the lubricant level and adjust to the recommended level.
		Air breather clogged.	Clean or replace element, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as other than designed mounting angle.	Mount the unit in its designed mounting angle.

9.2 Motor Troubleshooting

Problem with the Motor		Possible Causes	Suggested Remedy
Load Is Disconnected But Motor Does Not Rotate	Makes a “groaning” sound	Faulty switch contact	Adjust the contact
		Blown fuse	Replace fuse
		One phase wire of the power supply open	Rewire connection
		Stator coil open	Repair by rewinding or replacing the stator assembly
		Stator and rotor touching due to bearing housing wear	Replace the bearing and bracket
	Starts in either direction when turned by hand	Three-phase is operating as singlephase	Consult the power source with a voltmeter
	Doesn’t make any noise	Stator coil open	Repair by rewinding or replacing stator assembly
		External power failure	Contact the local power company
		Open connection wire Faulty Switch contact Faulty Starter contact	Check the source wiring Adjust the contacts
Rotates With The Load Disconnected But:	Rotates in the wrong direction	Connection error	Change any two of the three-phase source connections
	Fuse blows	Shorted lead wire	Replace fuse and rewire short
	Speed does not increase	Faulty starter contact	Replace or adjust starter contact
	Makes a “groaning” sound	Overcurrent/Overheating due to Rotor and Stator touching	Repair by rewinding or replacing stator assembly
		Overcurrent due to one phase of Stator Coil shorted	Replace the stator winding
	Makes a highpitched “metallic” noise	Faulty bearing	Replace the bearing
Rotates When The Load Is Disconnected But When The Load Is Connected:	Switch overheats	Insufficient switch capacity	Replace with switch having the rated capacity
		Overload	Decrease load to the rated value
	Fuse blows	Insufficient fuse capacity	Replace with fuse having the rated capacity
	Overheats	Overload	Decrease load to rated value
		Voltage drop	Consult with local power company
	Speed suddenly drops	Voltage drop	Consult with local power company
		Overload	Decrease load to rated value
	Stops	Bearing damaged by overheating	Replace the bearings

9.3 Brake Troubleshooting

Problem with the Brake	Possible Causes	Suggested Remedy
Gap Cannot Be Set To Spec. Value	Brake lining wear is too great.	Reduce the number of gap adjusting washers.
Brake Fails To Operate	Release lever still engaged.	Disengage and lock lever in holder.
	Improper adjustment after reassembly.	Adjust again.
Brake Slips (Braking Time Is Too Long)	Not wired tor fast action.	Wire tor fast action.
	Varistor failed.	Replace Varistor.
	Foreign matter entrapped in brake lining Oil on lining surface.	Remove foreign matter and take preventive action. Wipe lining surface with dry cloth.
	Worn brake lining.	Adjust brake gap or replace lining.
	Uneven brake gap.	Adjust evenly.
	Excessive load.	Decrease load or use larger brake.
Rotor fails to turn	Faulty electric circuit.	Check circuit.
	Blown fuse.	Replace fuse.
	Only single phase available from three phase power supply.	Measure power supply voltage and check tor defective circuit.
	Protective device has tripped.	Eliminate cause and reset.
	Damaged or burned motor winding.	Repair or replace.
	Rust on brake friction surface.	Clean brake (lining).
	Gap needs adjustment.	Readjust gap.
	Burned bearing.	Replace.
	Overload.	Check and troubleshoot load and safety device.
Abnormal Noise	Foreign material inside the brakemotor.	Check inside and remove.
	Damaged bearing.	Replace.
	Worn brake lining.	Adjust brake gap or replace lining.
	Hub leaf spring is off or damaged.	Replace.
	Burned solenoid coil.	Replace.
	Damaged rectifier.	Replace.
Trouble Under Loaded Condition	Voltage drop.	Raise voltage to rated level.
	Overload.	Reduce the load or oversize the brakemotor.
	Improper protective device setting.	Adjust protective device.

Notes

10. Construction Drawings

10.1 Gear Unit Construction Drawings (1 & 2 Stage Reduction)

Figure 10-1: Type CHH (Horizontal, Reducer),
1 Stage Reduction (Example: Frame size 6175)

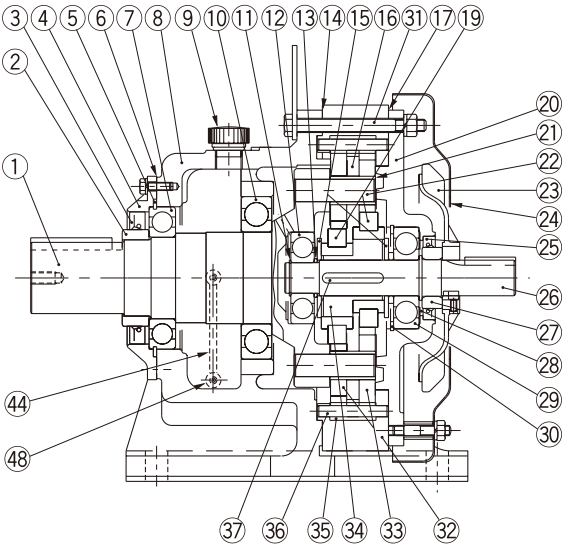


Figure 10-3 Type CHM (Horizontal, Gearmotor),
1 Stage Reduction (Example: Frame size 6225)

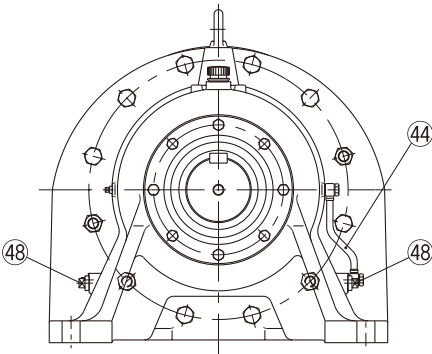


Figure 10-4: Type CNHM (Horizontal, Gearmotor),
1 Stage Reduction (Example: Frame size 6095)

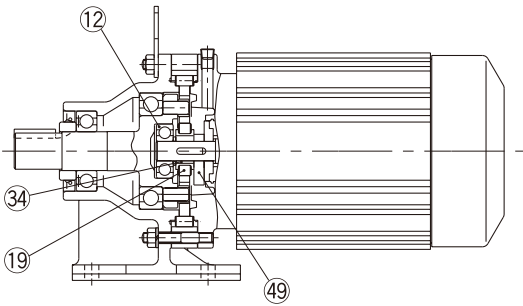


Figure 10-6: Type CHHM (Horizontal, Gearmotor),
2 Stage Reduction (Example: Frame size 6185DA)

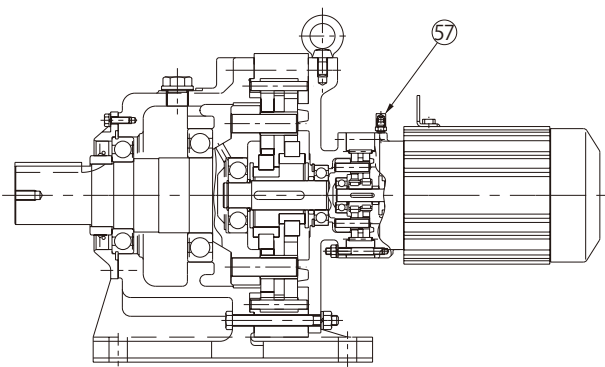


Figure 10-8: Type CHHM (Horizontal, Gearmotor),
2 Stage Reduction (Example: Frame size 6225DB)

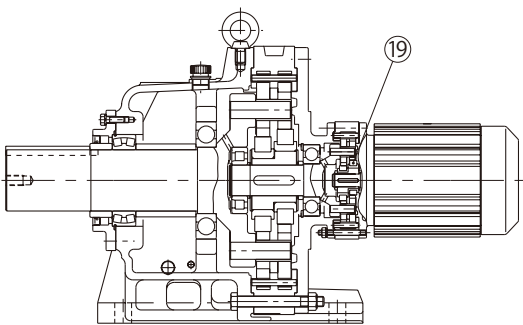


Figure 10-5: Type CNH (Horizontal, Reducer),
1 Stage Reduction (Example: Frame size 6105)

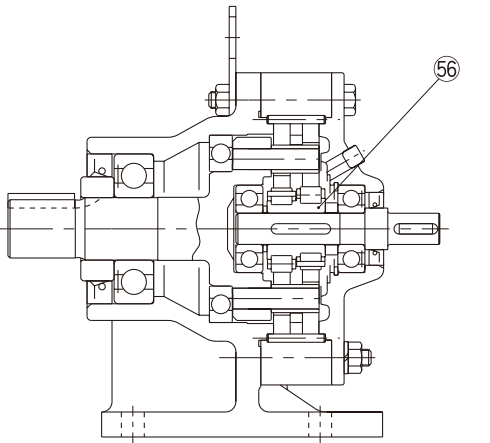


Figure 10-7: Type CHH (Horizontal, Reducer),
2 Stage Reduction (Example: Frame size 6185DB)

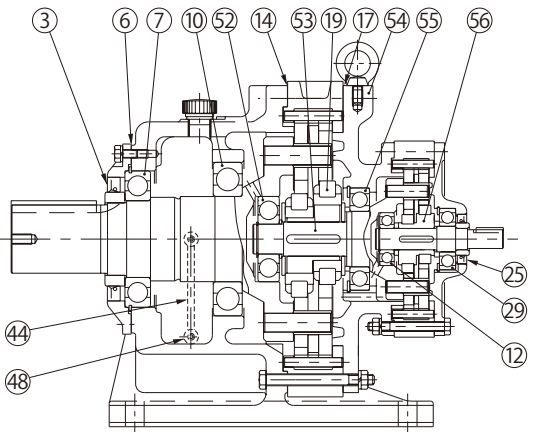
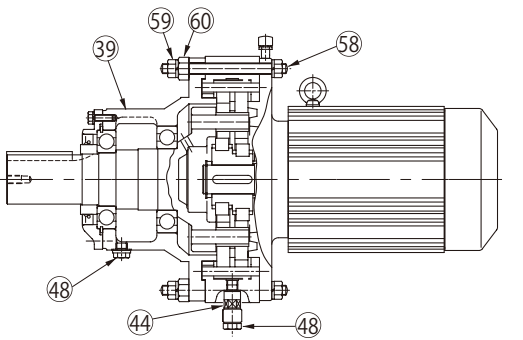


Figure 10-9: Type CHF (Horizontal, Gearmotor),
1 Stage Reduction (Example: Frame size 6165)



10. CONSTRUCTION DRAWINGS

Figure 10-10:
Type CVVM (Vertical, Gearmotor),
1 Stage Reduction
(Example: Frame size 6145)

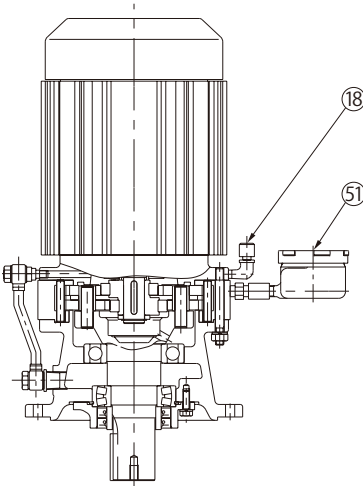


Figure 10-11:
Type CVV (Vertical, Gearmotor),
2 Stage Reduction
(Example: Frame size 6135DA)

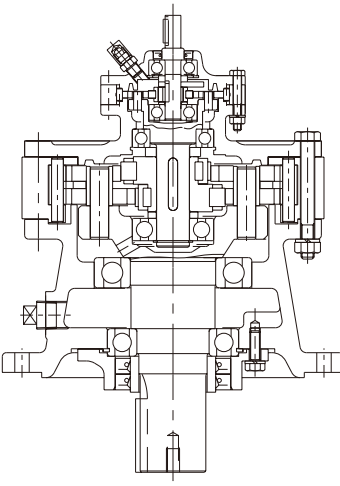


Figure 10-12:
Type CVVM (Vertical, Gearmotor),
2 Stage Reduction
(Example: Frame size 6225DA)

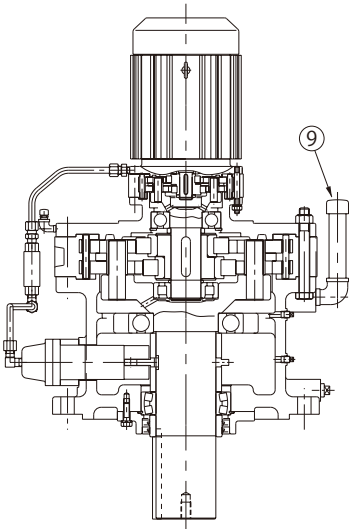


Table10-1: Gear Unit, Principal Parts 1 Stage Reduction, 2 Stage Reduction

Item No.	Ref. No.	Description	Item No.	Ref. No.	Description	Item No.	Ref. No.	Description
1	1-01	Slow Speed Shaft (SS)	21	1-06	SSS Roller	41	28	Air Vent
2	1-04H	Collar	22	1-01	SSS pin	42	41	Oil Signal
3	18	Oil Seal	23	9	Cooling Fan	43	58	Oil Slinger
4	25	Oil Seal Housing	24	10	Fan Cover	44	29	Oil Level Gauge
5	3-11	Retaining Ring	25	19	Oil Seal	45	46	Drain Plug
6	6	Gasket A	26	(3-01)	High Speed Shaft (HSS)	46	59	Spacer Ring
7	1-02	Bearing A	27	3-13	Collar	47	40	Pump Cam
8	26	Horizontal Casing	28	3-08	Spacer Ring	48	46	Drain Plug
9	28	Oil Filler Plug	29	3-03	Bearing D	49	3-06	Balance Weight
10	1-03	Bearing B	30	3-11	Retaining Ring	50	57	Eye Bolt
11	3-10	Retaining Ring for Shaft	31	13	Upper Bolt	51	28	Oil Fill Cup
12	3-02	Bearing C	32	2-01	Ring Gear Housing (RGH)	52	5-02	Bearing F
13	3-07	Spacer Ring	33	2-04	Cycloid Discs	53	5-01	Intermediate Shaft
14	6	Gasket B	34	3-04	Eccentric Cam	54	55	Intermediate Cover
15	3-07	Spacer	35	2-03	Ring Gear Roller	55	5-03	Bearing G
16	2-05	Spacer Ring	36	2-02	Ring Gear Pin	56	5-04	Eccentric Cam
17	6	Gasket C	37	1-05	Key	57	15	Grease Fitting (w/Cap)
18	28	Air Vent	38	25	Oil Seal Housing	58	13	RGH Bolts (Flange Type)
19	3-04	Eccentric Cam Bearing	39	26	Flanged Casing	59	13	Disassembly Prevention Nut (Flange Type)
20	8	High Speed End Shield	40	42	Plunger Pump	60	13	Spacer Replacement Nut (Flange Type)

10. CONSTRUCTION DRAWINGS

10.2 Bearings

Figure 10-13: Slow Speed and High Speed Shaft

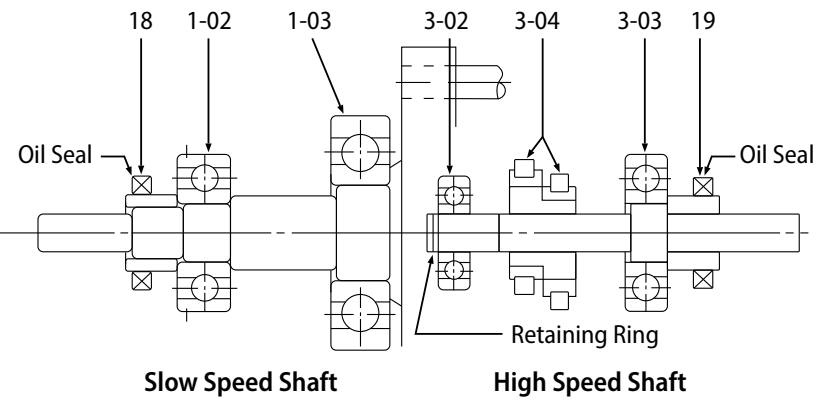


Table 10-2: Slow Speed Shaft Bearing

Frame Size		Slow Speed Shaft	
Single Reduction	Double Reduction	Bearing A Part #1-02	Bearing B Part #1-03
6060, 6065	6060DA, 6065DA	6204Z	6909
6070, 6075	6070DA, 6075DA	6204Z	6909
6080, 6085	-	6305Z	6009
6090, 6095	6090DA, 6095DA	6306Z	16011
6100, 6105, 610H	6100DA, 6105DA	6306Z	16011
6110, 6115	-	6307Z	6011
6120, 6125, 612H	6120DA, 6125DA, 6120DB, 6125DB	6308Z	6013
6130, 6135	6130DA, 6135DA, 6130DB, 6135DB, 6130DC, 6135DC	6211NR	6213
6140, 6145, 614H	6140DA, 6145DA, 6140DB, 6145DB, 6140DC, 6145DC	22211EXNR	6213
6160, 6165	6160DA, 6165DA, 6160DB, 6165DB, 6160DC, 6165DC	3TM-6213NR ^[1]	6215 ^[1]
6170, 6175	6170DA, 6175DA, 6170DB, 6175DB, 6170DC, 6175DC	6216NR ^[1]	6218 ^[1]
6180, 6185	6180DA, 6185DA, 6180DB, 6185DB	6218NR ^[1]	6220 ^[1]
6190, 6195	6190DA, 6195DA, 6190DB, 6195DB	6221NR ^[1]	6026 ^[1]
6205	6205DA, 6205DB	22220BNRC2	6222C2
6215	6215DA, 6215DB	23022BNRC2	6224C2
6225	6225DA, 6225DB	23024BNRC2	6226C2
6235	6235DA, 6235DB	23026BNRC2	NUP228C2
6245	6245DA, 6245DB	23028BNRC2	NUP230C2
6255	6255DA, 6255DB	23032BNRC2	NUP234C2
6265	6265DA	23034BNRC2	NUP236C2
6275	6275DA	23136BNXR	6340

Note [1]:
For grease lubricated models, a sealed bearing should be used, which changes the following letters in the part number to those shown in bold:
NR (Std.) - **ZNR**; NXR - **ZNXR**; None - add **Z**.

10. CONSTRUCTION DRAWINGS

Table 10-3: High Speed Shaft Bearing

Frame Size		High Speed Shaft			
Single Reduction	Double Reduction	Bearing C Part #3-02	Bearing D Part #3-03	Eccentric Part #3-04	Qty.
6060, 6065	6060DA, 6065DA, 6070DA, 6075DA	6301	6301Z	607YXX	1
6070, 6075	6090DA, 6095DA, 6100DA, 6105DA, 6120DA, 6125DA, 6130DA, 6135DA, 6140DA, 6145DA	6301	6301Z	607YXX	1
6080, 6085	-	6301SH	6302Z	6004RSH2ZZC3	1
6090, 6095	6120DB, 6125DB, 6130DB, 6135DB, 6140DB, 6145DB, 6160DA, 6165DA, 6170DA, 6175DA	6302RSH2	6302Z	Refer to Table 10-5	1
6100, 6105, 610H	6130DC, 6135DC, 6140DC, 6145DC, 6160DB, 6165DB, 6170DB, 6175DB, 6180DA, 6185DA	6302RSH2	6302Z		
6110, 6115	-	6302RSH2	6302Z	611YSS, 611GSS	2
6120, 6125, 612H	6160DC, 6165DC, 6170DC, 6175DC , 6190DA, 6195DA, 6205DA	6304	6305Z	Refer to Table 10-5	1
6130, 6135	6180DB, 6185DB, 6190DB, 6195DB, 6205DB, 6215DA, 6225DA	6305	6306		
6140, 6145, 614H	-	6305R	6306		
6160, 6165, 616H	6215DB, 6235DA, 6245DA	6307R	6308		
6170, 6175	6225DB, 6255DA	6406	6407	617YSX	2
6180, 6185	6235DB, 6245DB	6407	6409	618YSX	2
6190, 6195	6255DB, 6265DA, 6275DA	6408	6411	619YSX	2
6205	-	NJ310EV7	21311V1	620GXX	2
6215	-	NJ311EV16	21311V1	621GXX	2
6225	-	NJ312EV11	21312V1	622GXX	2
6235	-	NJ313EV11	21314V1	623GXX	2
6245	-	NJ314EV7	21315V1	624GXX	2
6255	-	NJ316EV1	21318V1	625GXX	2
6265	-	NJ317EV1	21318V1	626GXX	2
6275	-	NJ417	22222BL1	627GXX	2

10. CONSTRUCTION DRAWINGS

Figure 10-14: Motor Shaft

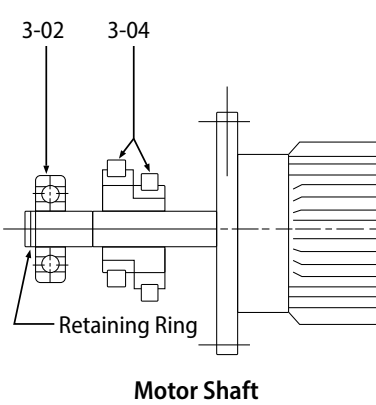


Table 10-4: Motor Shaft Bearing

Frame Size		Motor Shaft			
Single Reduction	Double Reduction	Bearing C Part #3-02	Bearing D Part #3-03	Eccentric Part #3-04	Qty.
6060, 6065	6060DA, 6065DA, 6070DA, 6075DA	6301	6301Z	607YXX	1
6070, 6075	6090DA, 6095DA, 6100DA, 6105DA, 6120DA, 6125DA, 6130DA, 6135DA, 6140DA, 6145DA	6301	6301Z	607YXX	1
6080, 6085	-	6301SH	6302Z	6004RSH2ZZC3	1
6090, 6095	6120DB, 6125DB, 6130DB, 6135DB, 6140DB, 6145DB, 6160DA, 6165DA, 6170DA, 6175DA	6302RSH2	6302Z	Refer to Table 10-5	1
6100, 6105, 610H	6130DC, 6135DC, 6140DC, 6145DC, 6160DB, 6165DB, 6170DB, 6175DB, 6180DA, 6185DA	6302RSH2	6302Z		
6110, 6115	-	6302RSH2	6302Z	611YSS, 611GSS	2
6120, 6125, 612H	6160DC, 6165DC, 6170DC, 6175DC , 6190DA, 6195DA, 6205DA	Bearing 3-02 is not used in these unit sizes	6305Z	Refer to Table 10-5	1
6130, 6135	6180DB, 6185DB, 6190DB, 6195DB, 6205DB, 6215DA, 6225DA		6306		
6140, 6145, 614H	-		6306		
6160, 6165, 616H	6215DB, 6235DA, 6245DA		6308		
6170, 6175	6255DA, 6255DB		6407	617YSX	2
6180, 6185	6235DB, 6245DB		6409	618YSX	2
6190, 6195	6255DB, 6265DA, 6275DA		6411	619YSX	2
6205	-		21311V1	620GXX	2
6215	-		21311V1	621GXX	2
6225	-		21312V1	622GXX	2
6235	-		21314V1	623GXX	2
6245	-		21315V1	624GXX	2
6255	-		21318V1	625GXX	2
6265	-		21318V1	626GXX	2
6275	-		22222BL1	627GXX	2

Figure 10-15: Eccentric Bearing

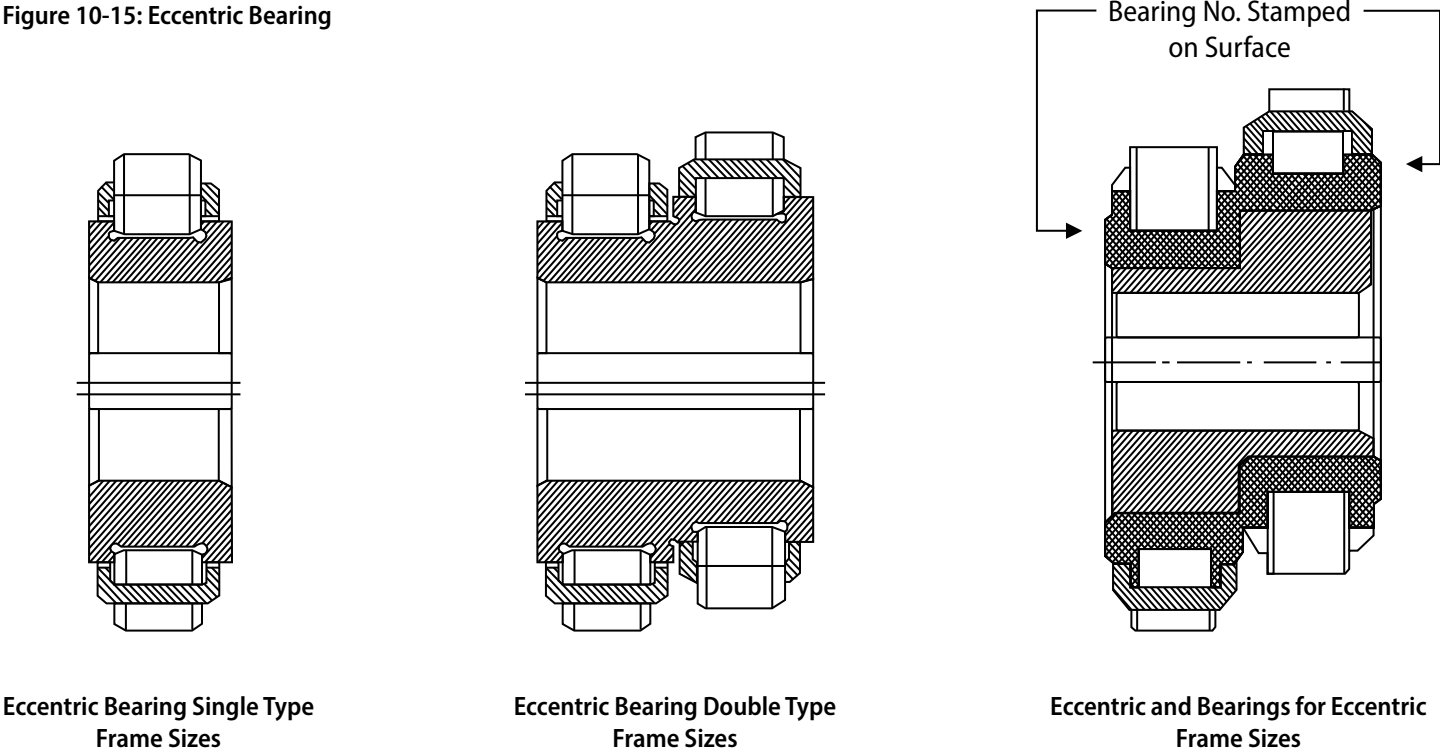
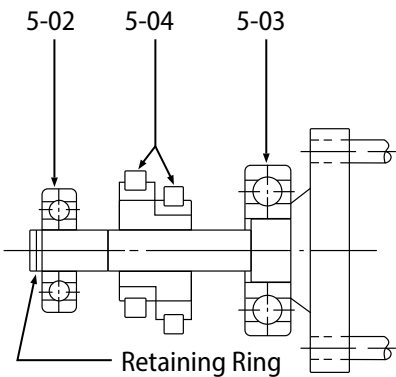


Table 10-5: Eccentric Bearing

Frame Size						
High Speed Shaft, Motor Shaft Part #3-04	6090, 6095	6100, 6105	6120, 6125	6130, 6135	6140, 6145	6160, 6165
Intermediate Shaft Part #5-04	6090DA 6095DA	6100DA 6105DA	6120DA, 6125DA 6120DB, 6125DB	6130DA, 6135DA 6130DB, 6135DB 6130DC, 6135DC	6140DA, 6145DA 6140DB, 6145DB 6140DC, 6145DC	6160DA, 6165DA 6160DB, 6165DB 6160DC, 6165DC
Reduction Ratio						
6	60906YRX	6100608YRX	6120608YRX	61406-11YSX	61406-11YSX	6160608YRX2
8	60908-15YSX	6100608YRX	6120608YRX	61406-11YSX	61406-11YSX	6160608YRX2
11	60908-15YSX	61011-15YRX	6121115YSX	61406-11YSX	61406-11YSX	61611-15YSX
13	60908-15YSX	61011-15YRX	6121317YSX	61413-17YSX	61413-17YSX	61611-15YSX
15	60908-15YSX	61011-15YRX	6121115YSX	61413-17YSX	61413-17YSX	61611-15YSX
17	60917YSX	61017YSX	6121317YSX	61413-17YSX	61413-17YSX	61617-25YSX
21	60921YSX	61021YRX	61221YRX	6142125YSX	6142125YSX	61617-25YSX
25	6092529YSX	6102529YRX	6122529YSX	6142125YSX	6142125YSX	61617-25YSX
29	6092529YSX	6102529YRX	6122529YSX	6142935YSX	6142935YSX	6162935YSX
35	60935YSX	61035YRX	61235YRX	6142935YSX	6142935YSX	6162935YSX
43	60943YSX	61043YSX	61243YSX	61443-59YSX	61443-59YSX	6164351YSX
51	60951YRX	61051YRX	6125159YSX	61443-59YSX	61443-59YSX	6164351YSX
59	60959YSX	61059YRX	6125159YSX	61443-59YSX	61443-59YSX	61659YSX
71	60971YRX	61071YRX	6127187YSX	6147187YSX	6147187YSX	61671YRX2
87	60987YSX	61087YRX	6127187YSX	6147187YSX	6147187YSX	61687YSX
119	609119YSX	610119YSX	-	-	-	-

10. CONSTRUCTION DRAWINGS

Figure 10-16: Intermediate Shaft



Intermediate Shaft
(For Double Reduction Units)

Table 10-6: Intermediate Shaft Bearing

Frame Size	Intermediate Shaft				Frame Size	Intermediate Shaft			
	Bearing F Part #5-02	Bearing G Part #5-03	Eccentric Bearing Part #5-04	Qty.		Bearing F Part #5-02	Bearing G Part #5-03	Eccentric Bearing Part #5-04	Qty.
6060DA, 6065DA	6301	6909	607YXX	1	6180DA, 6185DA	6407	6208	618YSX	2
6070DA, 6075DA	6301	6909	607YXX	1	6180DB, 6185DB	6407	6213	618YSX	2
6090DA, 6095DA	6302RSH2	6007	Refer to Table 10-5	1	6190DA, 6195DA	6408	6210	619YSX	2
6100DA, 6105DA	6302RSH2	6007			6190DB, 6195DB	6408	6213	619YSX	2
6120DA, 6125DA	6304	6007			6205DA	NJ310EV9	6210	620GXX	2
6120DB, 6125DB	6304	6205			6205DB	NJ310EV9	6310	620GXX	2
6130DA, 6135DA	6305	6007			6215DA, 6215DB	NJ311EV23	6311	621GXX	2
6130DB, 6135DB	6305	6206			6225DA, 6225DB	NJ312EV14	6313	622GXX	2
6130DC, 6135DC	6305	6206			6235DA, 6235DB	NJ313EV16	6314	623GXX	2
6140DA, 6145DA	6305	6007			6245DA	NJ314EV9	6315	624GXX	2
6140DB, 6145DB	6305	6206			6245DB	NJ314EV9	6316	624GXX	2
6140DC, 6145DC	6305	6206			6255DA, 6255DB	NJ316EV3	6318	625GXX	2
6160DA, 6165DA	6307R	6207			6265DA	NJ317EV2	6320	626GXX	2
6160DB, 6165DB					6275DA	NJ417	22220RH	627GXX	2
6160DC, 6165DC	6307R	6208							
6170DA, 6175DA	6406	6207	617YSX	2					
6170DB, 6175DB									
6170DC, 6175DC	6406	6208	617YSX	2					

10. CONSTRUCTION DRAWINGS

Table 10-7: Oil Seals

Frame Size	Slow Speed Shaft (Part #3)				High Speed Shaft (Part #25)		
	Type ^[1]	Dimension (mm)	Quantity		Type ^[1]	Dimension (mm)	Quantity
		(I.D. x O.D. x W)	Horizontal Shaft	Vertical Shaft		(I.D. x O.D. x W)	
6060, 6065	D	30 x 47 x 8	1	1	S	17 x 30 x 6	1
6070, 6075	D	30 x 47 x 8	1	1	S	17 x 30 x 6	1
6080, 6085	D	45 x 62 x 9	1	1	S	17 x 30 x 6	1
6090, 6095	D	50 x 72 x 12	1	1	S	20 x 35 x 7	1
6100, 6105	D	50 x 72 x 12	1	1	S	20 x 35 x 7	1
6110, 6115	D	55 x 80 x 12	1	1	S	20 x 35 x 7	1
6120, 6125	D	65 x 90 x 13	1	1	D	32 x 52 x 8	1
6130, 6135	D	68 x 88 x 12	1	2	D	38 x 58 x 11	1
6140, 6145	D	65 x 88 x 12	1	2	D	38 x 58 x 11	1
6160, 6165	D	85 x 110 x 13	1	2	D	55 x 78 x 12	1
6170, 6175	D	95 x 130 x 15	1	2	D	60 x 82 x 12	1
6180, 6185	D	110 x 145 x 15	1	2	D	65 x 88 x 12	1
6190, 6195	D	120 x 155 x 16	1	2	S	70 x 88 x 10	1
6205	D	120 x 155 x 16	1	2	S	70 x 88 x 10	1
6215	D	130 x 160 x 14	1	2	S	75 x 100 x 13	1
6225	D	145 x 175 x 14	1	2	S	75 x 100 x 13	1
6235	D	160 x 190 x 16	1	2	S	85 x 110 x 13	1
6245	D	170 x 200 x 16	1	2	S	95 x 120 x 13	1
6255	D	190 x 225 x 16	1	2	S	110 x 140 x 14	1
6265	D	200 x 240 x 20	1	2	S	110 x 140 x 14	1
6275	D	230 x 270 x 20	1	2	S	120 x 150 x 14	1

Note [1]:
S indicates single lip seal.
D indicates double lip seal.

10. CONSTRUCTION DRAWINGS

10.3 Motor

Figure 10-17: Direct-Coupled Motor for Cyclo® Drive
(Sealed Bearing, Oil Seal Structure) (Example: N-100L 2.2kW 4P)

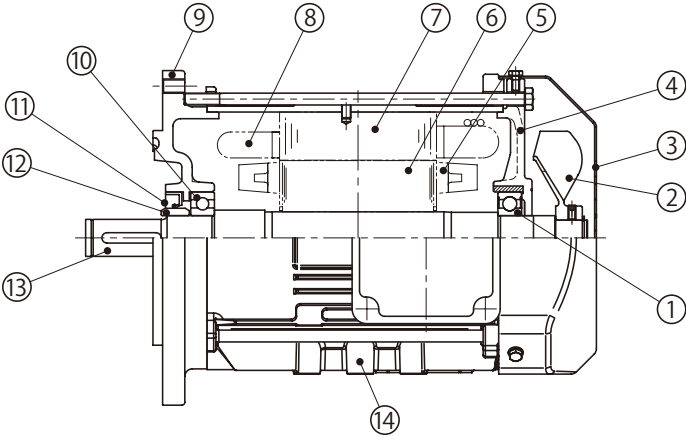


Figure 10-18: Direct-Coupled Motor for Cyclo® Drive
(Sealed Bearing, Slinger Collar Structure) (Example: N-100L 2.2kW 4P)

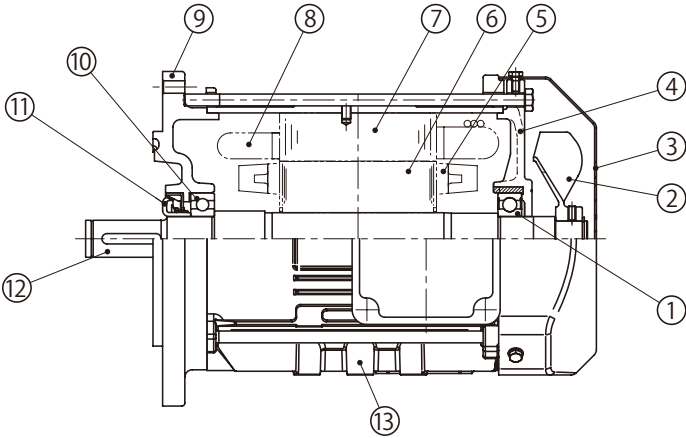


Table10-8: Principal Parts of Motor

Code	Part Name
1	Anti-Load Side Motor Shaft Bearing
2	Fan
3	Fan Cover
4	Anti-Load Side Cover
5	Rotor Conductor
6	Rotor Core
7	Stator Core
8	Stator Windings
9	Motor Flange Bracket
10	Load Side Motor Shaft Bearing
11	Oil Seal
12	Oil Seal Collar
13	Motor Shaft
14	Frame

Table10-9: Principal Parts of Motor

Code	Part Name
1	Anti-Load Side Motor Shaft Bearing
2	Fan
3	Fan Cover
4	Anti-Load Side Cover
5	Rotor Conductor
6	Rotor Core
7	Stator Core
8	Stator Windings
9	Motor Flange Bracket
10	Load Side Motor Shaft Bearing
11	Slinger Collar
12	Motor Shaft
13	Frame

11. CYCLO® ASSEMBLY / DISASSEMBLY

11. Cyclo® Assembly / Disassembly

11.1 Disassembly

Cyclo® Reducers/Gearmotors are designed to provide maximum ease when disassembling and reassembling; they require no special maintenance skills. During the process, please refer to **Table 10-1** and **Figures 10-1 to 10-12** for component identification.

The following procedures and precautions are recommended at time of disassembly and assembly:

- Perform work in a safe area free of dust and humidity, and use your proper personal protective equipment (PPE).
- Use a soft or plastic hammer when required. Take care not to damage parts, i.e., coil, bearings, seals, etc.
- Inspect all components and replace as necessary.
- Be extremely careful when handling Cyclo® discs and spacer ring for discs.

1

Remove the complete Cyclo® Reducer/gearmotor from the driven machine.

2

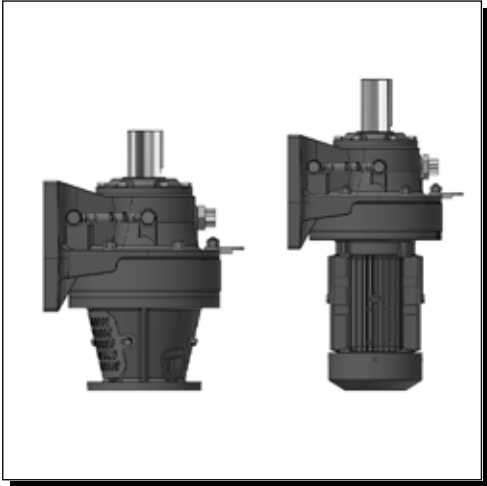
For oil lubricated units, remove the plug at the bottom of the oil gauge to drain all oil from the unit. Refer to **Section 8.3.5 Draining Procedure**.



3

For reducers with free input shaft equipped with a cooling fan, remove the cooling fan cover and fan.

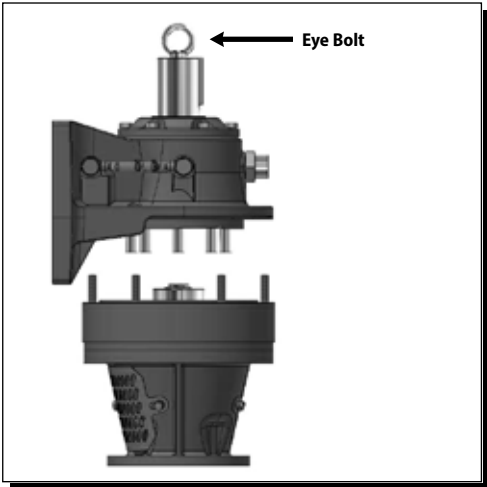
11. CYCLO® ASSEMBLY / DISASSEMBLY



- 4
- Stand the unit on a solid base with its high speed shaft side down.
- If the reducer has C-Face adaptor and coupling, remove the motor and coupling before following the procedure outlined above.
- As a final step, remove the adaptor and cooling fan.
- For gearmotor units, place Cyclo® gearmotor vertically with slow speed shaft upward.

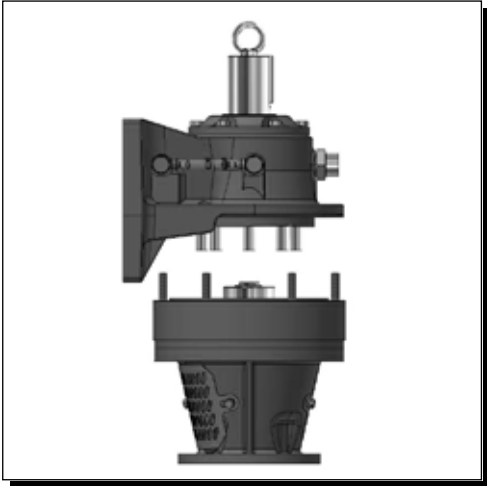


- 5
- Remove the through bolts for the high speed end shield and ring gear housing.

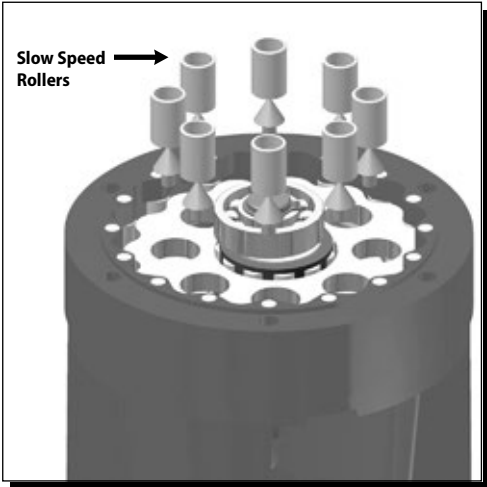


- 6
- To lift the slow speed side, attach an eyebolt to the tapped hole at the end of the slow speed shaft and use a hoist or chain block.

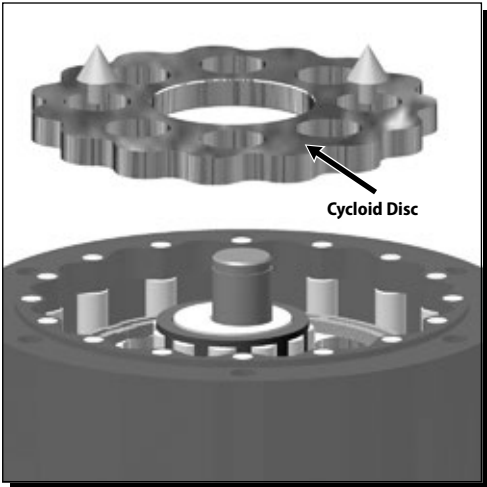
11. CYCLO® ASSEMBLY / DISASSEMBLY



- 7
- Lift the slow speed side, thus separating the unit into two parts so that the inner mechanism can be removed.
- If the unit will not separate easily, gently drive a wedge between ring gear housing and slow speed shaft casing.
- NOTE:** If this produces a burr, be sure to remove it before reassembly.

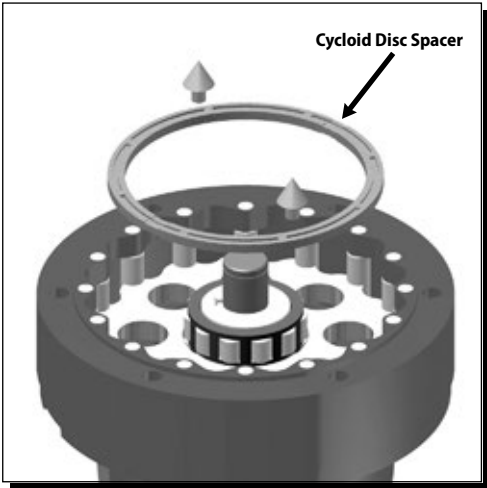


- 8
- Take out the slow speed shaft rollers.
- Check the slow speed shaft pins (22) to see whether any rollers have adhered to them.

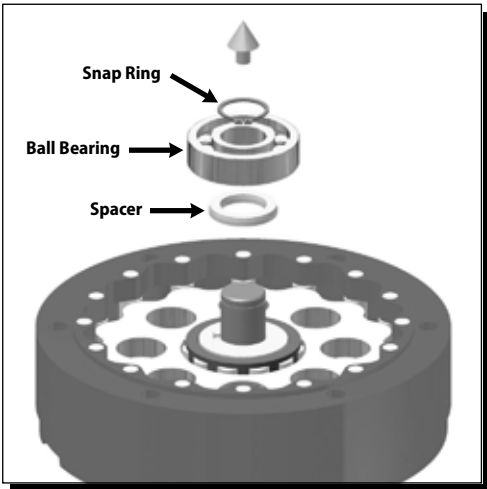


- 9
- Using both hands, lift out the top cycloid disc (33) on the slow speed side.
-  The cycloid disc is made from heat-treated bearing steel and the spacer ring is cast iron. Take care not to strike them together while handling.

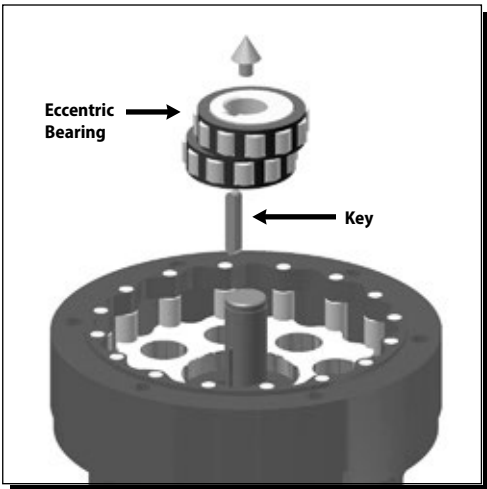
11. CYCLO® ASSEMBLY / DISASSEMBLY



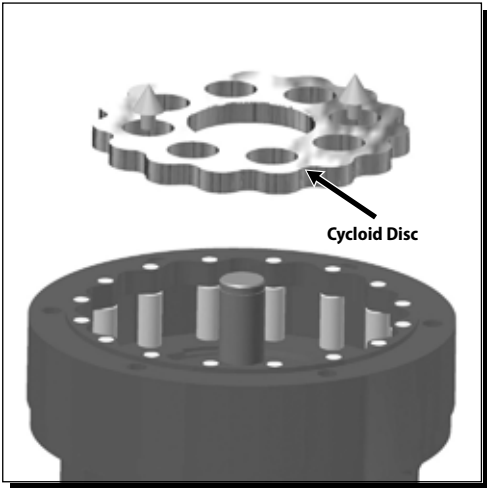
10
Remove the spacer ring (16).



11
The eccentric bearing can be removed from the Input shaft (reducer) or motor shaft (garmotor) after taking out the retaining ring and spacer.
Note: In certain sizes, the eccentric bearings are roller bearings without a retainer. Remove bearings of the top disc before proceeding with the next step.



11. CYCLO® ASSEMBLY / DISASSEMBLY



12
Take out the second disc located on the high speed shaft/motor side.
Also remove second disc bearings and eccentric bearing with inner bearing raceway if required.



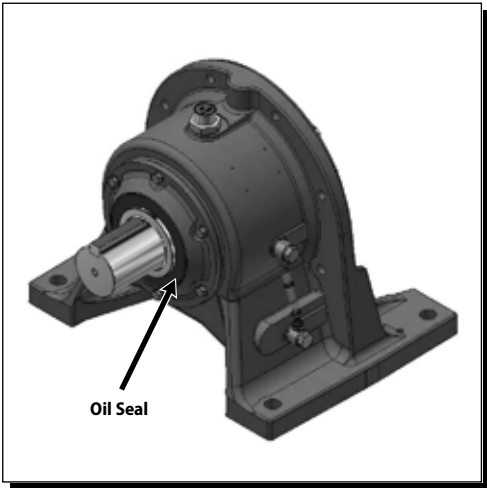
13
Remove the ring gear housing (32).

In most cases, the above instructions cover complete disassembly. In ordinary cases, however, only the removal of the cycloid discs and the eccentric bearing should suffice.

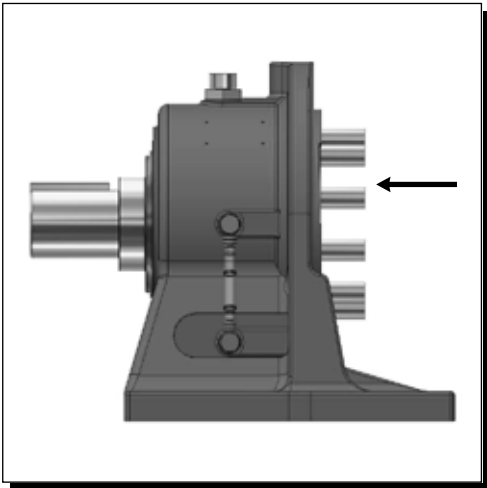
11. CYCLO® ASSEMBLY / DISASSEMBLY

11.2 Output Casing Subassembly

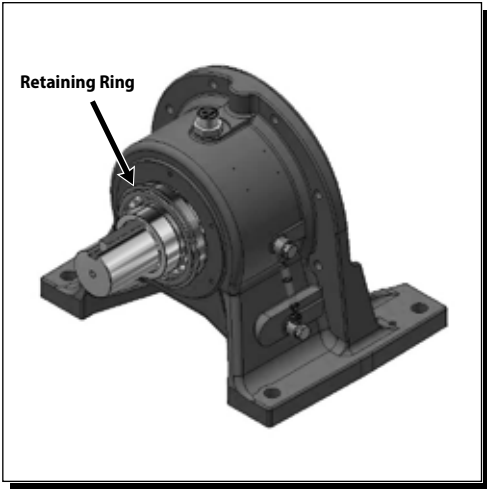
In the event that the slow speed shaft should be removed from the output casing assembly, please follow these steps to remove the slow speed shaft (1) with its bearings from the output casing (8 or 39, depending on Cyclo configuration).



- 1
Remove oil seal (3) and oil seal housing.

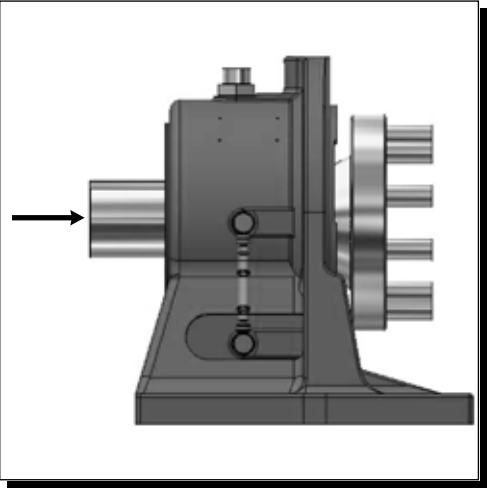


- 2
With a wooden or hard rubber mallet, tap the inner end of the slow speed shaft to expose the retaining ring from the outer raceway of the bearing.
- Note:** Retaining ring is part of bearing A (5).
-  Make sure to avoid hitting the SSS pins (22) and Bearing C's (12) raceway. Failure to do so may compromise re-assembly of the unit.



- 3
Remove the retaining ring (5).

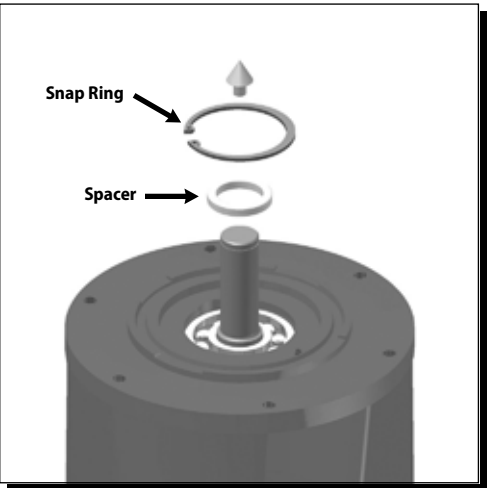
11. CYCLO® ASSEMBLY / DISASSEMBLY



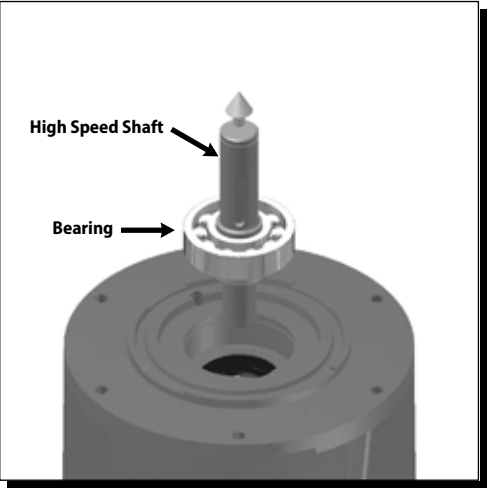
- 4
Rap the outer end of the slow speed shaft with a wooden or hard rubber mallet, and remove it from the casing.

11.3 High Speed End Shield Subassembly

Cyclo® reducers, in the event that the high speed end shield subassembly needs to be disassembled:



- 1
The high speed shaft (26) with bearings is removed from the high speed shaft end shield (20) by tapping the shaft end after first taking off the retaining ring (11).



11.4 Assembly

Cyclo® Reducers/Gearmotors are reassembled by reversing the disassembly procedure. Care must be taken to exclude dust or foreign matter from the moving parts, and to ensure that gaskets are properly placed to make the assembly oil-tight.

The following procedures and precautions are recommended at time of disassembly and assembly:

- 1. Set the ring gear housing and insert the ring gear pins and rollers; then test-rotate the pins and rollers by hand. Apply grease liberally to the ring gear pins and rollers before they are inserted in grease lubricated reducers/gearmotors.
- 2. Cycloid discs are a matched pair. Each carries the same number stamped on one side of the disc.
- 3. Set the cycloid disc with the stamped number face up.
- 4. Insert the spacer (15) and then insert the eccentric with bearings by tapping with a wooden or hard rubber mallet (See Step 11 of Section 11.1).
- 5. Insert the other spacer and the inner bearing raceway. Secure them with the retaining ring (See Step 11 of Section 11.1).
- 6. Set the spacer ring in place.
- 7. Insert top disc in such a way that the mark is 180° opposed to the mark on the bottom disc.
- 8. Insert slow speed shaft rollers (See Step 8 of Section 11.1).
- 9. Put the slow speed shaft pins into the rollers (See Step 7 of Section 11.1).

The above instructions are for eccentric bearings with retainer. Following are the instructions suggested for roller bearings without retainer:

- (a) First insert the eccentric bearing with inner raceways of bearings by tapping with a wooden or hard rubber mallet.
- (b) Apply grease to the raceway of the eccentric on the disc. Fix the rollers and set disc in place.
- (c) Insert the spacer ring and set second disc in such a way that mark is 180° opposed to mark on the bottom disc.

11.5 Eccentric Bearing Replacement Precautions

The eccentric bearings are specially designed for installation on Cyclo® reducers/gearmotors. They are special roller bearings without outer raceways (refer to Tables 10-3, 10-4 and 10-5).

It is necessary to insert replacement bearings with numbered surfaces of the inner raceways facing towards the slow speed shaft. **Note:** The incorrect insertion of the bearings (i.e., insertion of bearings with numbered surfaces inside) causes trouble.

11.6 Disassembly and Assembly of Sizes 6060-6095

Small sizes 6060-6095 have a single disc system, so they differ in construction from larger sizes in the following ways:

- 1. A balance weight (49) is provided in lieu of the two-disc system.
- 2. The balance weight must be positioned exactly 180° as opposed to that of the eccentric.
- 3. There are no end plates on either side of the eccentric. In all other respects, they have exactly the same construction as the larger sizes. Follow the instructions given under “Disassembly and Assembly”.

Disassembly of Output Side (6060-612H)

- 1. With casing supported, tap output shaft until it’s disengaged from casing.
- 2. Remove bearing “A” (7) by using pulling tool.
- 3. Replace all bearings, gaskets and seals when reassembling.

Assembly of Output Side (6060-612H)

- 1. Assemble the “B” bearing (10) on the slow speed shaft (1). Heating of “B” bearing is recommended for easier assembly.
Note: Do not exceed temperature of 200°F (~ 93 °C).
- 2. Assemble the casing (8 or 39, depending on Cyclo configuration) over the slow speed shaft, being sure to maintain “X”.
- 3. Carefully tap bearing “A” (7) onto the slow speed shaft until the bearing is flush with the shoulder of the casing.
- 4. Place the collar (2) onto the slow speed shaft. Heating the collar is recommended for easier assembly.
- 5. Insert the oil seal (3), lip in, into the casing.

Note: Measure for dimension “X” preferably in 3 places to ensure proper spacing.

Figure 11-9: “X” Dimension

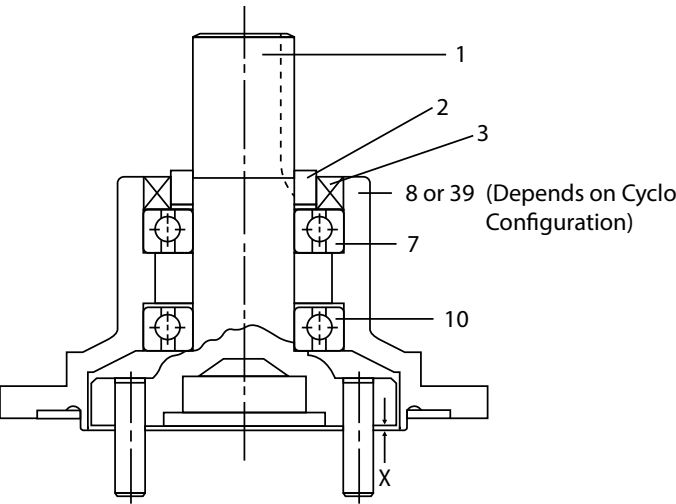


Table11-1: “X” Dimension

Frame Size	Dimension (mm)	Tolerance (mm)	Dimension (inch)	Tolerance (inch)
6060, 6065	1.2	± 0.178	0.046	± 0.007
6070, 6075 6080, 6085	1.1	± 0.178	0.042	± 0.007
6090, 6095	1.2	± 0.178	0.046	± 0.007
6100, 6105 610H	1.2	± 0.178	0.046	± 0.007
6110, 6115 6120, 6125 612H	1.1	± 0.178	0.042	± 0.007

A. Grease Quantities for Unit Overhaul

Table A-1a: Grease Change (Overhaul) Quantities for Maintenance-Free Speed Reducers oz. (g)

Frame Size	606X	607X	608X	609X	610X	611X	612X	606XDA	607XDA	609XDA	610XDA	612XDA	612XDB
Speed Reduction Mechanism (1st stage)	0.9 (25)	0.9 (25)	1.4 (40)	2.1 (60)	4.2 (120)	6.7 (190)	8.8 (250)	0.9 (25)	0.9 (25)	0.9 (25)	0.9 (25)	0.9 (25)	2.1 (60)
Speed Reduction Mechanism (2nd stage)								0.9 (25)	0.9 (25)	2.1 (60)	4.2 (120)	8.8 (250)	8.8 (250)
Slow Speed Shaft Bearing	0.5 (15)	0.5 (15)	0.9 (25)	1.1 (30)	1.1 (30)	1.6 (45)	1.9 (55)	0.5 (15)	0.5 (15)	1.1 (30)	1.1 (30)	1.9 (55)	1.9 (55)

X = 0 or 5

Table A-1b: Grease Change (Overhaul) Quantities for Non-Maintenance-Free Speed Reducers oz. (g)

Frame Size	613XDA	613XDB	613XDC	614XDA	614XDB	614XDC	616XDA	616XDB	616XDC	617XDA	617XDB	617XDC
Speed Reduction Mechanism (1st stage)	0.9 (25)	2.1 (60)	4.2 (120)	0.9 (25)	2.1 (60)	4.2 (120)	2.1 (60)	4.2 (120)	8.8 (250)	2.1 (60)	4.2 (120)	8.8 (250)
Speed Reduction Mechanism (2nd stage)	15.9 (450)	15.9 (450)	15.9 (450)	15.9 (450)	15.9 (450)	15.9 (450)	26.5 (750)	26.5 (750)	26.5 (750)	35.3 (1000)	35.3 (1000)	35.3 (1000)
Slow Speed Shaft Bearing	10.6 (300)	10.6 (300)	10.6 (300)	10.6 (300)	10.6 (300)	10.6 (300)	10.6 (300)	10.6 (300)	10.6 (300)	17.6 (500)	17.6 (500)	17.6 (500)
Frame Size	618XDA	618XDB	619XDA	619XDB	6205DA	6205DB	6215DA	6215DB	6225DA	6225DB	6235DA	6235DB
Speed Reduction Mechanism (1st stage)	4.2 (120)	15.9 (450)	11.6 (330)	15.9 (450)	11.6 (330)	15.9 (450)	15.9 (450)	26.5 (750)	15.9 (450)	35.3 (1000)	26.5 (750)	38.8 (1100)
Speed Reduction Mechanism (2nd stage)	38.8 (1100)	38.8 (1100)	52.9 (1500)	52.9 (1500)	52.9 (1500)	52.9 (1500)	70.5 (2000)	70.5 (2000)	88.2 (2500)	88.2 (2500)	141.1 (4000)	141.1 (4000)
Slow Speed Shaft Bearing	21.2 (600)	21.2 (600)	24.7 (700)	24.7 (700)	24.7 (700)	24.7 (700)	28.2 (800)	28.2 (800)	31.7 (900)	31.7 (900)	35.3 (1000)	35.3 (1000)
Frame Size	6245DA	6245DB	6255DA	6255DB	6265DA							
Speed Reduction Mechanism (1st stage)	26.5 (750)	38.8 (1100)	35.3 (1000)	52.9 (1500)	52.9 (1500)							
Speed Reduction Mechanism (2nd stage)	158.7 (4500)	158.7 (4500)	211.6 (6000)	211.6 (6000)	282.2 (8000)							
Slow Speed Shaft Bearing	38.8 (1100)	38.8 (1100)	42.3 (1200)	42.3 (1200)	45.9 (1300)							

X = 0 or 5

Table A-1c: Grease Change (Overhaul) Quantities for Normally Oil-Lubricated Speed Reducers Supplied With Grease.

Frame Size	6130 6135 6140 6145	6160 6165	6170 6175	6180 6185	6190 6195	6215	6225	6235	6245	6255	6265
Speed Reduction Mechanism	15.9 (450)	26.5 (750)	35.3 (1000)	36.8 (1100)	52.9 (1500)	70.5 (2000)	88.2 (2500)	141.1 (4000)	158.7 (4500)	211.6 (6000)	282.2 (8000)
Slow Speed Shaft Bearing	10.6 (300)	10.6 (300)	17.6 (500)	21.2 (600)	24.7 (700)	28.2 (800)	31.7 (900)	35.3 (1000)	36.8 (1100)	42.3 (1200)	45.9 (1300)

NOTE: Grease fill quantities in Table A-1c are used when a unit that is normally oil-lubricated is supplied with grease.

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