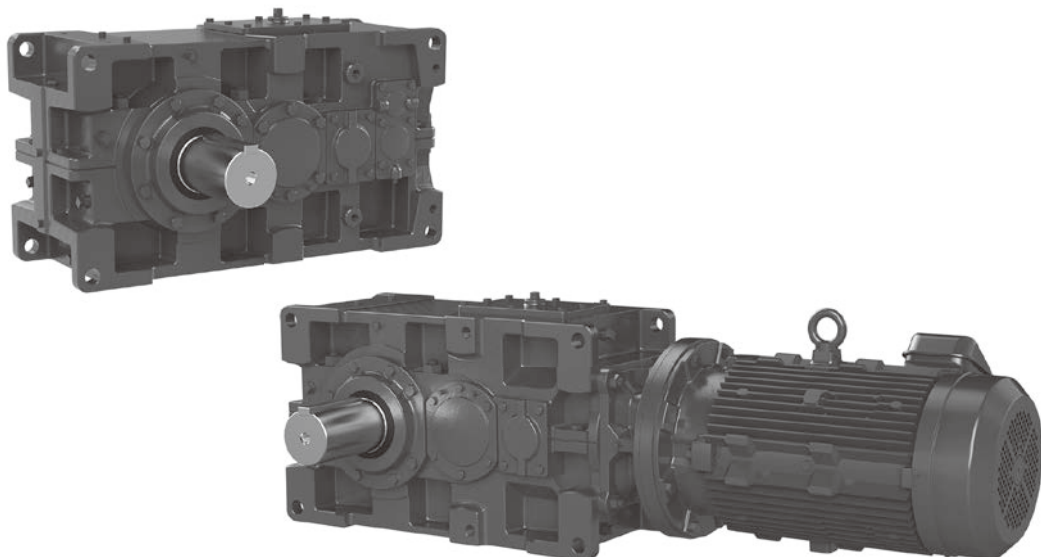


PARAMAX®

9000 Series



《CAUTION》

- These products should be handled, installed, and maintained by trained technicians. Carefully read the maintenance manual before use.
- Oil is removed from these products before shipment. Supply oil according to the maintenance manual before operation.
- A copy of this maintenance manual should be sent to the actual user.
- This maintenance manual should be kept by the user for future reference.

Introduction: Safety Precautions

- Carefully read this maintenance manual and all accompanying documents before use (installation, operation, maintenance, inspection, etc.). Thoroughly understand the machine, information about safety, and all precautions for correct operation.

After reading, 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 and/ or personal injury.

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



DANGER

- Transport, installation, plumbing, operation, maintenance, and inspections should be handled by properly trained technicians; otherwise, personal injury or damage to the machine may result.
- When using the equipment in conjunction with explosion proof motor, a technician with electrical expertise should supervise the transport, installation, plumbing, wiring, operation, maintenance and inspection of the equipment, so as to avoid a potentially hazardous situation that may result in electrical shock, fire, explosion, personal injury and/or damage to the equipment.
- When the unit is to be used in a system for human transport, a protecting device for human safety should be installed to prevent 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 falling; otherwise, personal injury, death, or damage to the equipment may result.
- Do not disassemble the drive unit or reducer during operation. Even if it is stopped, do not disassemble except dip stick, oil filling/drain port or inspection cover when input/output shaft of the reducer is connected to motor or driven machine: otherwise, personal injury, or damage to the equipment due to running out of control or falling by unmeshing gear and the like may result.



CAUTION

Please install loss prevention device such as oil pan to the machine which is vulnerable to oil especially (machine for food processing and machine for clean room, and so on) in case oil; otherwise, the product may fail because of oil leakage.

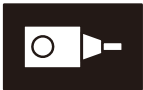

Introduction: Reading the Maintenance Manual, Table of Contents

This maintenance manual is common for “reducers”, “Drive units”.

Refer to the motor maintenance manual (Cat. No. MM1001E) for the handling of drive unit with a brake.

The symbols shown below appear in the upper right or left corner of each page to indicate the classification. Please read the applicable pages.

On **Common** pages, regarding only specific specification, symbols are applied to indicate the contents about it.

Specifications	Common to All Specifications	Reducer	Drive Unit
Mark	COMMON		

Contents

Introduction : Safety Precautions	1
Introduction : Reading the Maintenance Manual, Table of Contents	2
1. Inspection upon delivery	3
2. Storage	6
3. Transport	7
4. Installation	8
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6. Wiring	17
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1. Inspection Upon Delivery **COMMON**

⚠ CAUTION

- Unpack the unit after verifying that it is positioned right side up; otherwise, personal injury may result.
- Verify that the unit received matches your order. Installing an incorrect product may result in personal injury or damage to the equipment.
- Do not remove the nameplate.

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

- (1) Does the description on the nameplate match your order?
- (2) Was any part broken during transport?
- (3) Are all bolts and nuts tightened firmly?

1-1 How to Check the Nameplate

Please refer to sample nameplate below.

When making an inquiry, advise us of ①MODEL ②RATIO ③SERIAL NO.

(1) Gear Unit



① Type of Drive unit or Reducer
(see P4)

② Reduction ratio

• Input power and speed

③ Serial number

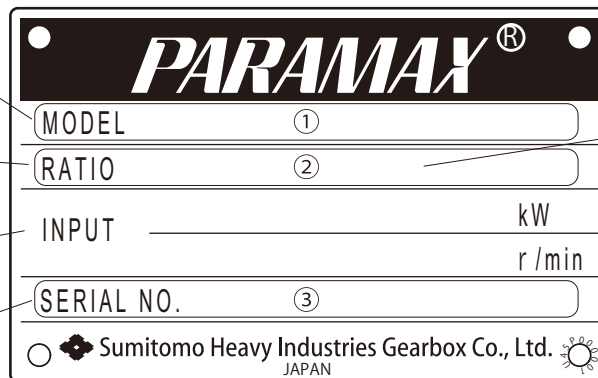


Fig.1-1 Nameplate of Gear Unit

(2) Motor Unit



• Motor capacity

• Motor characteristics

• Motor efficiency value

• IE code

• Power factor

• For motor with brake
Brake current value

3 PHASE INDUCTION MOTOR		TYPE	
kW	P	FRAME	
VOLTS		M. THERMAL	()
Hz		RATING	
M. AMP		B. THERMAL	
r/min		B. TORQUE	N·m
EFF.		JIS C 4213	
P. F.		S/N	
B. AMP			

Sumitomo Heavy Industries, Ltd. MS478W

• Motor nomenclature

• For motor with brake
Brake type

• For motor with brake
Brake torque

③ Serial number

Fig.1-2 Nameplate of Motor Unit

COMMON 1. Inspection Upon Delivery

1-2 Reducer, Drive Unit Nomenclature

Symbol meanings are shown below. Please confirm that the nomenclature matches the order.
In case of special type, it may not be shown below.

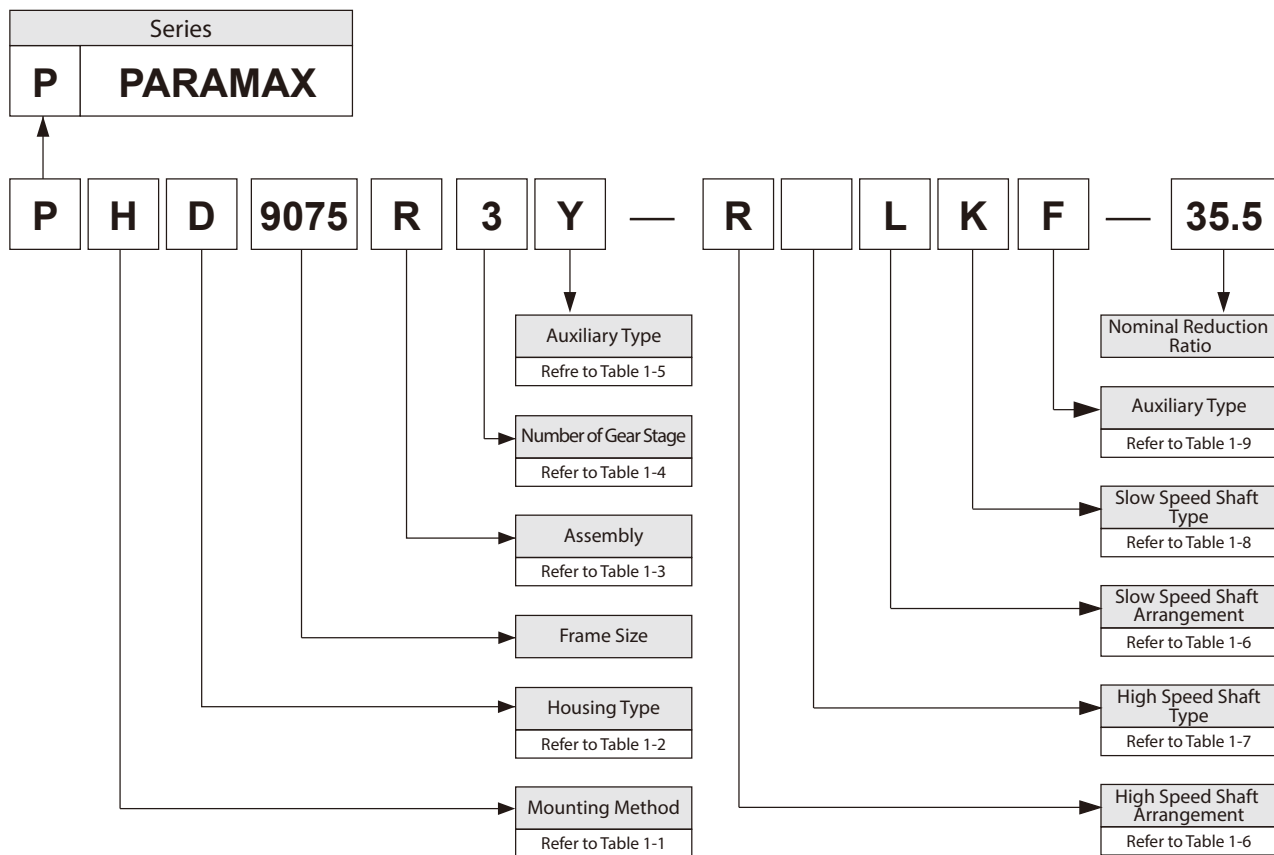


Table 1-1

Mounting Method	
H	Horizontal
V	Vertical
W	Upright
R	Upright Flipped Over

Table 1-2

Housing Type	
A	Mono-block housing
D	Split housing

Table 1-3

Assembly	
P	Parallel shafts
R	Right-angle shafts
Z	Special right-angle shaft

Table 1-4

Number of Gear Stages	
1	Single reduction
2	Double reduction
3	Triple reduction
4	Quadruple reduction

Table 1-5

Auxiliary Type	
Y	Inch shaft
A	Steel fabricated housing
YA	Steel fabricated housing + Inch shaft
F	Ductile iron housing
YF	Ductile iron housing + Inch shaft
W	Wall mount
R	Heavy radial load
K	Wall mount + Heavy radial load

Table 1-6

Position of Projected High/Slow Speed Shaft	
R	Right side viewed from high speed shaft
L	Left side viewed from high speed shaft
B	Both sides
D	Both sides (Reverse gear arrangement of B's)

* Projected high speed shaft of right angle shaft depends on the position of bevel gear.

Table 1-7

High Speed Shaft	
Blank	Solid shaft
M	With motor
Y	Hollow input shaft with flange (right angle shaft only)
J	With high speed adapter

Table 1-8

Slow Speed Shaft	
Blank	Solid shaft
K	Hollow output shaft key type
T	Hollow output shaft shrink disc type

Table 1-9

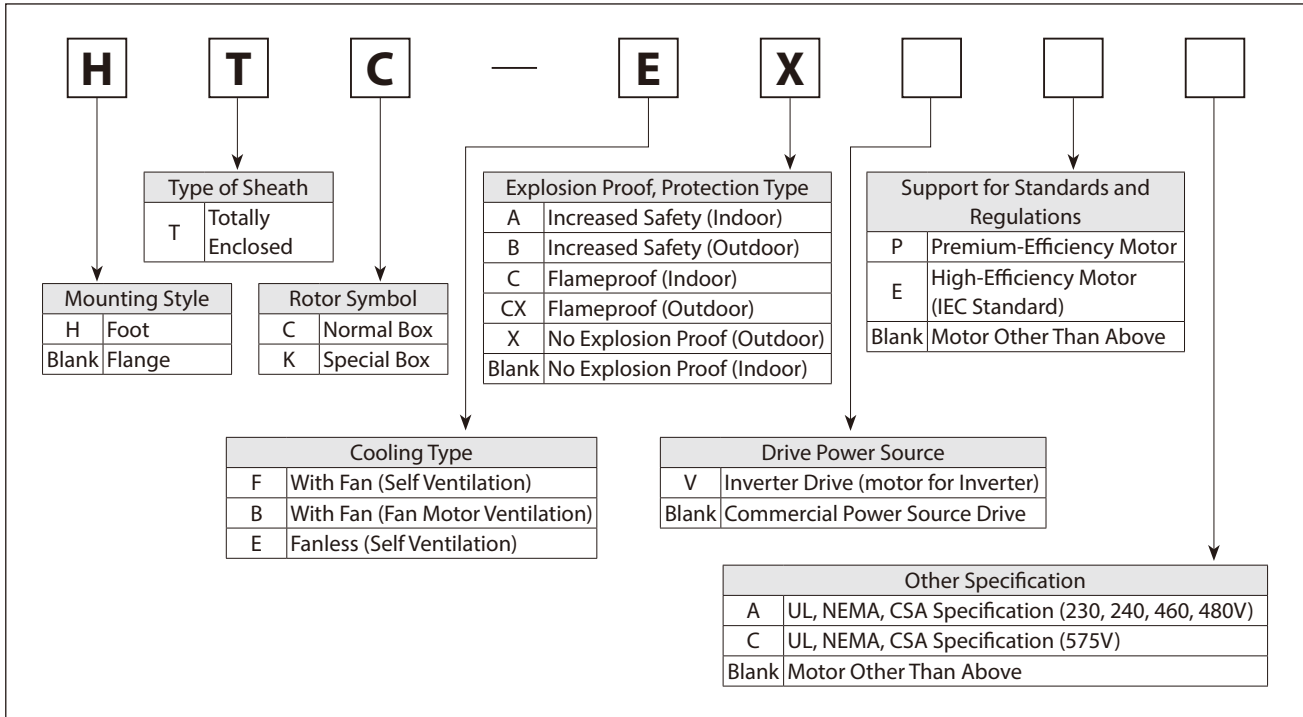
Auxiliary Type	
F	1 Radial fan
G	1 Radial fan (opposite side)
B	Backstop
FB	1 Radial fan + Backstop

1. Inspection Upon Delivery **COMMON**

1-3 Motor Nomenclature

Symbol meanings are shown below. Please confirm that the nomenclature matches the order.

When using another manufacturer's motor (There are some models made by other manufacturers.), follow the operation manual for that motor.



COMMON 2. Storage

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

2-1 Storage Location

Store the product indoors in a clean, dry location.

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

2-2 Storage Period

- The storage period should be within 6 months.
- Standard rustproof specifications
 - External rustproof Rust prevention oil is applied when shipping from the factory. Check rust conditions every 6 months after shipment. Reapply the rust prevention process, if necessary.
 - Internal rustproof Rustproof period 6 months
Store in an ordinary factory or warehouse in an environment where free of moisture, dust, extreme temperature changes, corrosive gas, etc.
- If the storage period exceeds 6 months or for export, adherence to special rust prevention specifications is required. Please consult factory.
- If the storage time is longer than one year, run the product for a few minutes under no load once every two to three months. Measure (see P18) and check the insulation resistance of the motor at that time.

2-3 Operation After Storage

- Oil seals are affected by temperature, ultraviolet light and other ambient conditions and can easily degrade. After long storage period, inspect before operation, and replace any degraded seals with new seals.
- If the storage period exceeds 2 years, change the oil seal and grease before operation.
- At startup, check that there are no unusual noises, vibrations, temperature rises, or other symptoms. For models with brakes, check that brakes work properly.
If any abnormalities are found, immediately contact the nearest authorized maintenance shop.

 **DANGER**

- Do not step under a unit suspended by a crane or other lifting mechanism for transport; otherwise, injury or death may result.

 **CAUTION**

- Be careful not to drop the unit. When a hanging bolt or hole is provided, be sure to use it. After mounting a unit on a machine, do not hoist the entire machine by using the hanging bolt or hole; otherwise, personal injury or damage to the equipment and/ or lifting device may result.
- Before hoisting, refer to the nameplate, crate, outline drawing, catalog, etc. for the weight of the unit. Never hoist a unit that exceeds the load capacity of the crane or other mechanism being used to lift it; otherwise, personal injury or damage to the equipment and/ or lifting device may result.
- When the products are lifted, use suitable lifting parts, and confirm that eye-bolts and nuts are not loose.

COMMON 4. Installation

DANGER

- Do not use a standard unit in an explosive atmosphere (which is likely to be filled with explosive gas or steam). Under such conditions, an explosion proof motor should be used; otherwise, electric shock, personal injury, explosion fire, or damage to the equipment may result.
- In the case of an **explosion proof motor**, use a motor that has specifications that are appropriate for a dangerous location (a location where gas or volatile vapor is present); otherwise explosion, ignition, electric shock, injury, fire, or equipment damage may result.
- When a **flameproof motor is driven by an inverter**, install an inverter in a place free from explosive gas since the inverter itself is not explosion proof. Otherwise, electric shock, personal injury, explosion fire, or damage to the equipment may result.

CAUTION

- Do not use the products for purposes other than those shown on the nameplate or in the manufacturing specifications; otherwise, electric shock, personal injury, or damage to the equipment may result.
- Do not place flammable objects around the gearmotor; otherwise, fire may result.
- Do not place any object around the gearmotor or reducer that will hinder ventilation. Insufficient ventilation can cause excessive heat that may result in burns or fire.
- Do not step on or hang from the gearmotor or reducer; otherwise injury may result.
- 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, injury may result.
- Please install loss prevention device such as oil pan to the machine which is vulnerable to oil especially (machine for food processing and machine for clean room, and so on) in case oil; otherwise, the product may fail because of oil leakage.

4-1 Installation Location

Ambient temperature:	-10 to +40°C
Ambient humidity:	85%RH or less with no condensation
Altitude:	Maximum 1,000 m
Atmosphere:	No corrosive or volatile gases, no steam Dust-free, well-ventilated area.
Installation location:	Indoors (area with minimal dust, no contact with water)

- Mounting in conditions other than the above requires adherence to optional specifications. Please consult with us.
- Drives built according to special specifications, such as outdoor type, explosion proofing, etc. can be used in the specified mounting environments. However, concerning the connector to the machine used, implement measures based on the mounting environment.
- Mount in a location that enables easy operation, such as inspection and maintenance.
- Mount on a sufficiently rigid base.

4-2 Installation Angle

Install reducers on a level base. (Contact factory for installation on an inclined base)

When the unit is manufactured for inclined installation, do not install it at any angle other than the one specified.

For standard type, the installation angle shall be within limits shown in Fig. 4-1

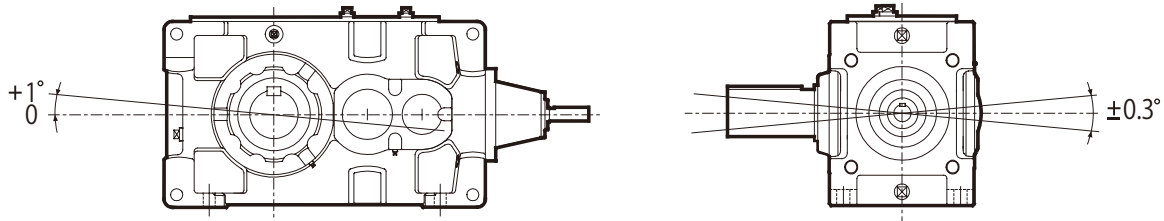


Fig. 4-1 The limits of the installation angle

4-3 Installation Method

- Install reducers on a sufficiently rigid base and use installation bolts corresponding to JIS strength class 10.9 or its equivalent.
- Use dowel pin when vibration or impact is high.
- Alignment for reducer with motor mounted on the base plate is done prior to shipment. However due to misalignment occurs during transport or condition of concrete base, re-align when install.
- The rust preventive oil is applied to input shaft, output shaft, key and installing surface. Remove by wash oil before installing. Do not use special solvent or sandpaper.

COMMON 4. Installation

4-4 Installation method for PARAMAX with fan (Parallel shaft)

⚠ CAUTION

- Be careful for injuries with sharp edges of keyways and parts.
- Keep accessories together to prevent losing during installation.
- Handle parts carefully to prevent damage. Avoid water and dust.

Reducer installation procedure

(1) Remove bolt [1] [2], and fan hood [3]. (Fig. 4-2)

You can install it in the state shown in Fig. 4-3, but if you cannot tighten the mounting bolts, perform (a) and (b) below.

(a) Remove bolt [4], and fan hood [5]. (fig. 4-3)

(b) Remove bolt [6], and fan rotor [7]. (Fig. 4-4)

(2) Install reducer to the installation surface with bolt [9]. (fig. 4-5)

In the case you have performed (a) and (b) above, conduct (c) and (d) below.

(c) Install fan rotor [7] to the fan hub [8]. with bolt [6].

(d) Install fan hood [5] to the reducer with bolt [4]. (Fig. 4-3)

(3) Install fan hood [3] to the reducer with bolt [1][2]. (Fig. 4-2).

See table 4-1 for bolt tightening torque of bolt [1], [2], [4], and [6].

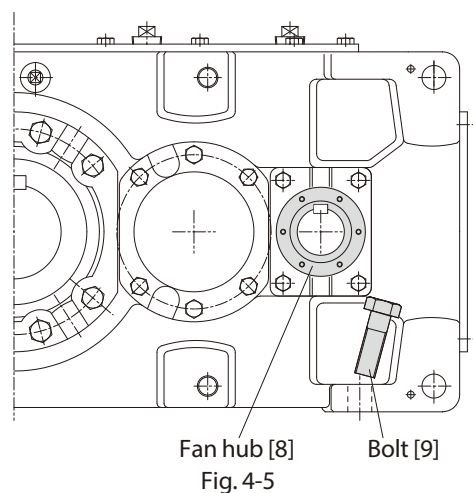
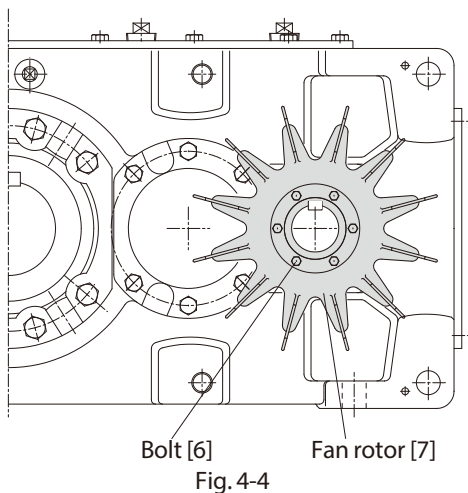
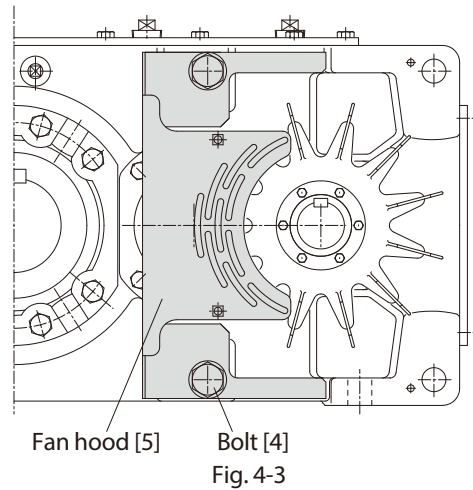
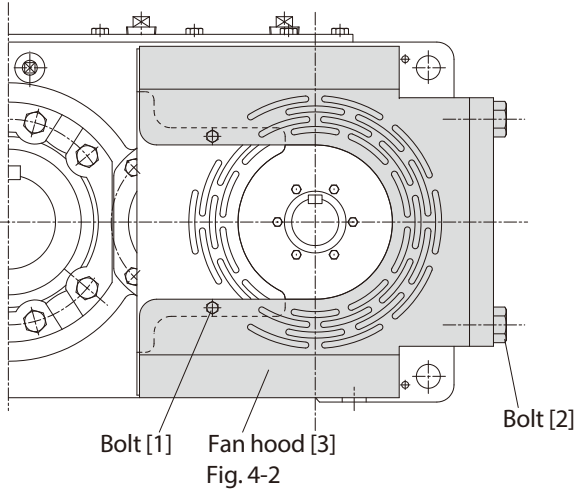


Table 4-1 Bolt Tightening Torque

Bolt Size	Tightening Torque N·m	
	Bolt [1][2][4]	Bolt [6]
M6	-	10.8
M8	11.3	-
M12	39.2	-
M16	97.4	-

Bolt Size	Tightening Torque N·m	
	Bolt [1][2][4]	Bolt [6]
M20	190	-
M24	328	-
M30	652	-
M36	1140	-

Torque tolerance: $\pm 10\%$

4-5 Ensuring the Air Inlet Gap and the Air Flow Passage for the Product with Fan

To ensure enough air flow from a fan rotor to the reducer efficiently, follow this instructions when installing.

(1) Ensure the Air Inlet Gap

For PARAMAX with a fan, make more than 15mm gap between a fan hood and a screen (ex. safety cover, fluid coupling). See Fig. 4-6, Fig. 4-7

When sufficient gap is not secured, the air intake become insufficient and the air volume decreases. However, this case does not apply when the safety cover is made of expanded metal and so on and has a structure that does not obstruct the air flow.

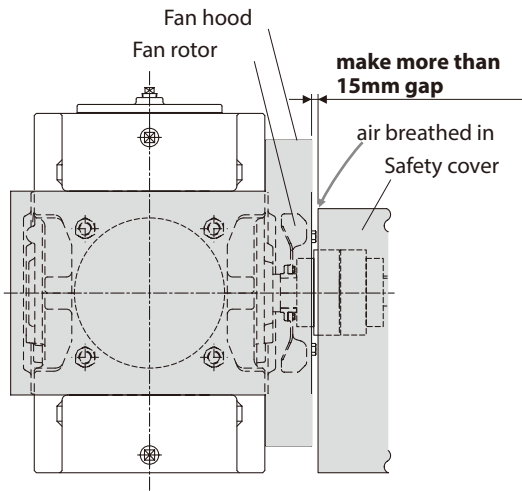


Fig. 4-6 gap between a fan hood and a safty cover

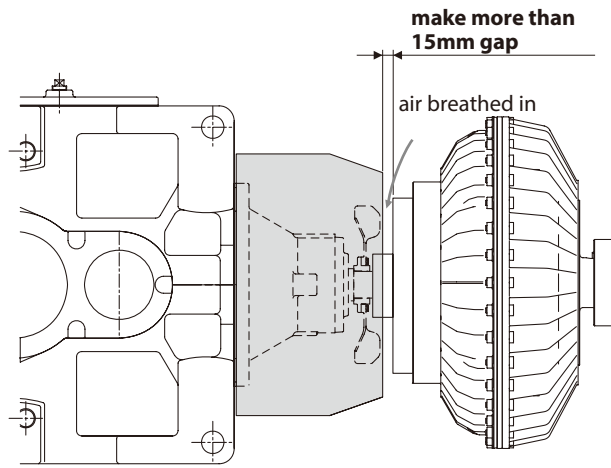


Fig. 4-7 gap between a fan hood and a fluid coupling

(2) Ensure the Air Flow Passage

For PARAMAX with a fan with vertical mount, right angle shaft (slow speed shaft direction: vertical upward or downward, high speed shaft direction: horizontal), make more than 10mm gap to flow the wind at lower part of the reducer (Fig. 4-8).

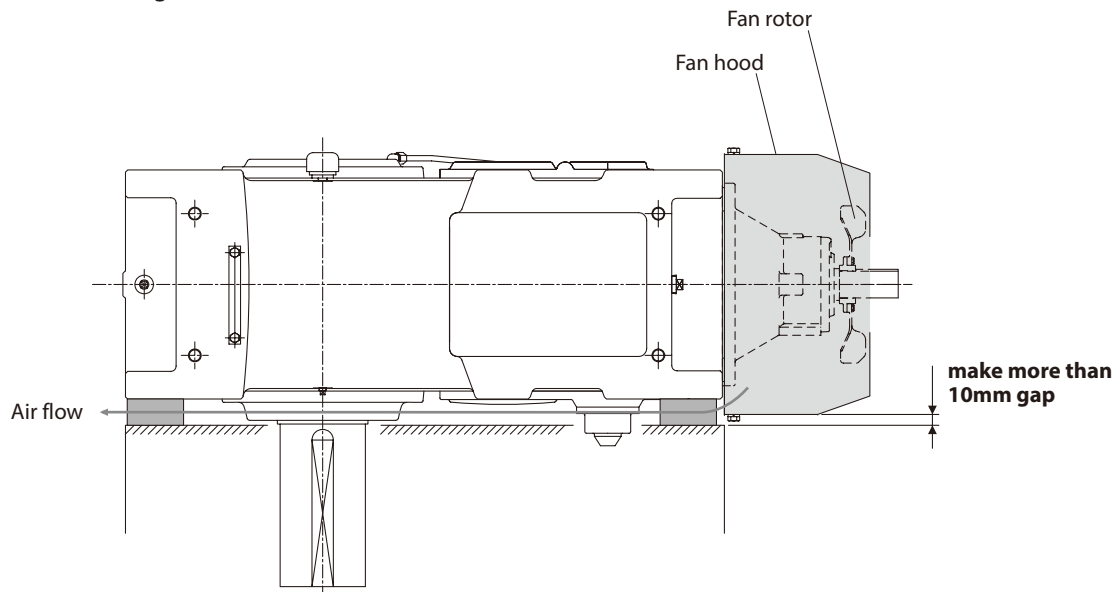


Fig. 4-8

⚠ CAUTION

- Confirm the rotation direction before coupling the unit with the driven machine. Incorrect rotation direction may cause personal injury or damage to the equipment.
- When operating the product alone (uncoupled), remove the key that is temporarily attached to the slow speed shaft; otherwise the key could fly off, and injury may result.
- Attach the cover to the rotating parts to avoid someone touching them; otherwise, injury may result.
- When coupling the product with another machine, check that the centering, the belt tension and parallelism of the pulleys are within the specified limits. When the unit is directly coupled with another machine, check that the direct coupling accuracy is within the specified limits. When a belt is used for coupling the unit with another machine, check the belt tension. Correctly tighten bolts on the pulley and coupling before operation; otherwise there is a risk of injury due to scattering the broken pieces or of damage to the products.

5-1 Mounting Connector

- When mounting Connector, do not apply impact or excessive axial load to the shaft. The bearing could be damaged, or the collar could come off.
- Shrinkage or shaft-end thread fit (see Fig. 5-1) is recommend.

(1) When using a coupling

The alignment accuracy (A, B, X) in figure 5-4 should be no more than that shown in Table 5-1.

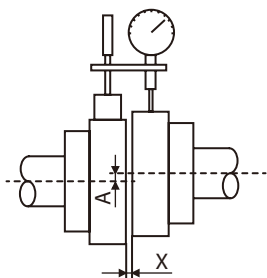


Fig. 5-2

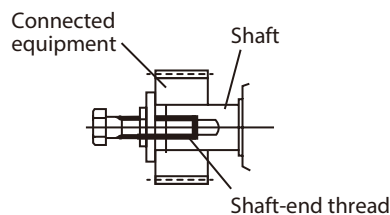
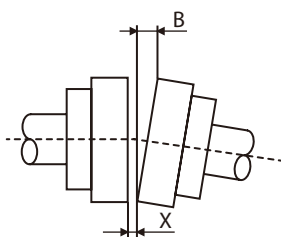


Fig. 5-1

Table 5-1 Alignment Precision for Flexible Coupling

Allowable Dimensional Error for A	0.05mm
Allowable Dimensional Error for B	0.05mm
Dimension for X	manufacturer-specified value

(2) When Using Chains, Sprockets, or Gears

- When using a chain, attach it so that the chain tension angle is perpendicular to the shaft.
 - Refer to the chain catalog or other reference for chain tension.
 - The pitch circle diameter of the sprocket and gear shall be more than three times of the shaft diameter.
 - The load point of the sprocket or gear should be nearer to the product than to center of the shaft.
- (See Figure 5-3)

(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 between the two pulleys should be within 20'. (See figure 5-4)
- When using multiple V belts, use the same V belts having the same circumferential length

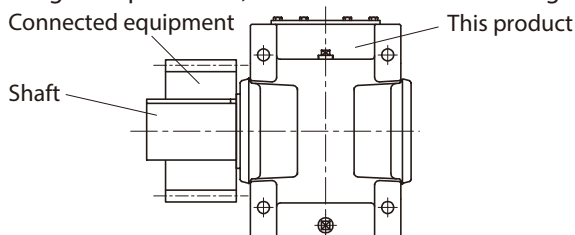


Fig. 5-3

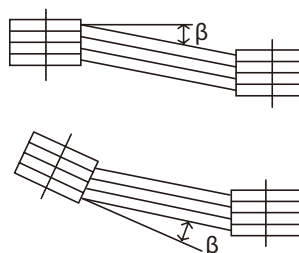


Fig. 5-4

5-2 Hollow Shaft, Shrink Disc Mount

(1) Shrink Disc Mount

A shrink disc is a mechanical shrink fit mechanism that tightens a locking bolt and mechanically shrink the hollow shaft of the reducer, and connects the driven shaft and the hollow shaft of the reducer by the frictional force generated between the shaft and the surface pressure.

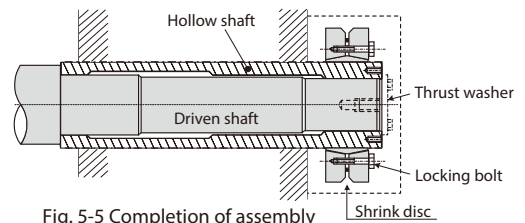


Fig. 5-5 Completion of assembly

(2) Preparation for mounting

1. Thoroughly degrease contact surface (a), (b), (c), and (d) between the inner diameter of the hollow shaft of the reducer and the outer diameter of the driven shaft.
2. Confirm that molybdenum disulfide grease has Applied on the outer diameter (e) of the hollow shaft, the inner diameter (f) of the shrink disc, the locking bolts and the surface (g) that the bolts contact. If the amount is too small, add more.
3. Apply molybdenum disulfide grease on surface (a) of the outer diameter of the driven shaft. Use "Molykote 321" or the equivalent. **Do not Apply grease on contact surface (b) and (d) between the inner diameter of the hollow shaft and the outer diameter of the driven shaft.**

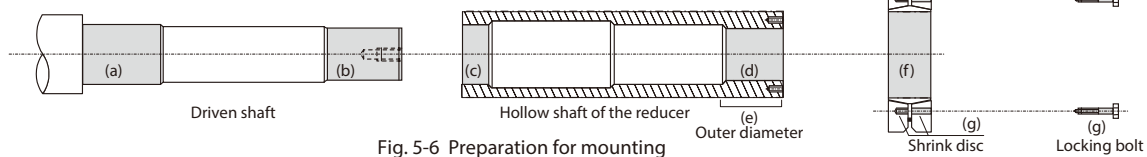


Fig. 5-6 Preparation for mounting

(3) Mounting procedure

1. Insert an O-ring. (Only size 9090 to 9115)
2. Mount the reducer on the driven shaft and screw nut until faces (h) and (i) make contact.
3. Set the shrink disc at dimensions LV from the end face of the hollow shaft (Refer to Table 5-2 on Page 15).
4. Tighten the locking bolts. Make sure that the surfaces of both plates of the shrink disc are parallel when tightening bolts. A short-handled spanner is suitable for tightening these bolts. After confirming that the shrink disc is set correctly, tighten the bolts with a wrench. Uniformly, tighten the locking bolts clockwise (not diagonally) while keeping both plates parallel. It is recommended to tighten Each bolt by 30 degrees each time.
5. Use a torque wrench to check the tightening torque of all locking bolts.
6. Finally, confirm again that both plates of the shrink disc are parallel.

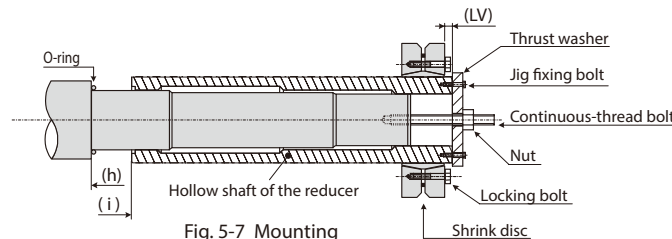


Fig. 5-7 Mounting

Note 1. Tighten the locking bolts at the specified torque TA(see Table 5-2 on Page 15).

2. For a vertical reducer, mount a thrust washer to prevent the reducer from moving when locking nut is loosened. (see Fig.5-5)
3. A high-tension bolt (JIS strength classification: 10.9 or 12.9) is used as a locking bolt. When replacing it, use one of bolt specified by the manufacturer.

(4) Removal procedure

1. Remove by following the above steps in reverse order.
Loosen the locking bolts a little each time so that the plates of the shrink disc do not tilt. If both plates tilt, do not remove the locking bolts; otherwise, the both plates may suddenly fly out of the reducer and cause injury. In such a situation, loosen all of the locking bolts a little and insert a wedge (the customer need to prepar) into both plates so that they become parallel.
2. Set thrust washer and hexagon head bolt. Turn the push bolt to remove the reducer from the driven shaft.

Note: The mounting/removal jig (parts with * in A of Fig.5-8) is optional. Order them as necessary.

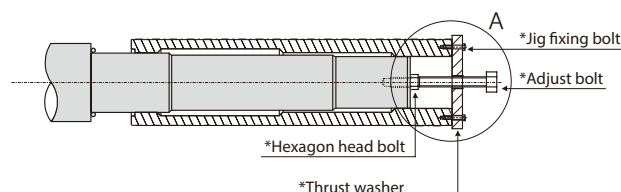


Fig.5-8 Removal

5-3 Hollow Shaft, Key Mount

■ Size 9015 to 9055

(1) Mounting procedure

The Hollow shaft bore is provided with retaining ring (d). Inside ring (d) is the essential component for mounting, securing, and removing the unit.

1. Apply molybdenum disulfide grease on the surface of the shaft (e).
2. Turn nut (b) insert the reducer into the driven shaft. Use ring (c) if necessary.

(2) Retaining

1. After mounting the reducer on the driven shaft, fix bolt (f). (Bolt (f) is not supplied with the unit.)
2. Attach protection cover (g).

(3) Removal Procedure

1. Remove ring (d), mount bolt (n), and reset ring (d). Turn bolt (J) to remove the reducer from the driven shaft. For bolt size, refer to Z of Table 5-3 on P16.

(4) Retaining in Special Cases

1. If the driven shaft has no stage when mounting as shown in Fig. 5-12, Use distance ring (h) to fix. (distance ring (h) is not supplied with the unit.) For distance ring dimension, refer to Table 5-3 on P16).

■ Size 9060 to 9085

(1) Mounting procedure

The Hollow shaft end is provided with thrust washer (d). Thrust washer (d) is the essential component for mounting, securing, and removing the unit.

1. Apply molybdenum disulfide grease on the surface of the shaft (e).
2. Turn nut (b) and insert the reducer into the driven shaft.

(2) Retaining

1. After mounting the reducer on the driven shaft, fix bolt (f). (Bolt (f) is not supplied with the unit.)
2. Attach protection cover (g).

(3) Removal Procedure

1. Remove thrust washer (d), mount bolt (n), and reset thrust washer (d). Attach bolt (J) to thrust washer (d), and turn bolt (J) to remove the reducer from the driven shaft. For bolt size, refer to Z of Table 5-3 on P16.

(4) Retaining in Special Cases

1. If the driven shaft has no stage when mounting, Use distance ring (h) to fix. (distance ring (h) is not supplied with the unit.) For distance ring dimension, refer to Table 5-3 on P16).

Note: Parts (a), (b), (c), (n), and (J) are optional. Order them as necessary.

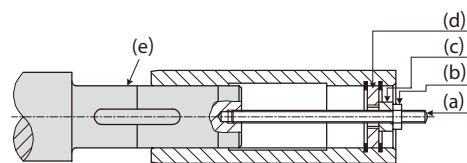


Fig. 5-9 Mounting Procedure

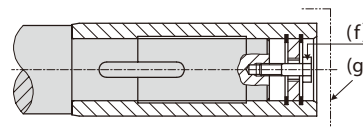


Fig. 5-10 Retaining

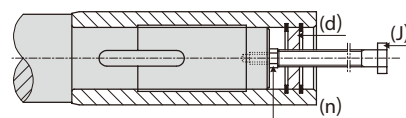


Fig. 5-11 Removal Procedure

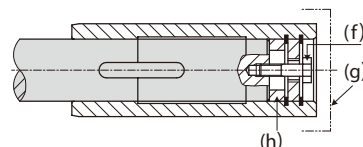


Fig. 5-12 Retaining in Special Cases

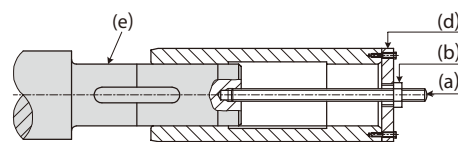


Fig. 5-13 Mounting Procedure

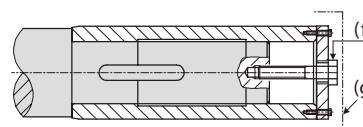


Fig. 5-14 Retaining

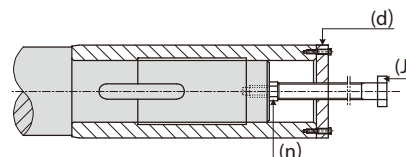


Fig. 5-15 Removal Procedure

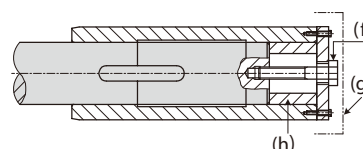


Fig. 5-16 Retaining in Special Cases

5-4 Torque Arm Mount (Optional)

The hollow shaft reducer need to be fixed by the torque arm to prevent the reducer from revolving by an opposite reaction force.

Fig. 5-17 shows the construction of a standard torque arm. Select a torque arm support with proper construction and strength, taking into consideration the reaction force of the reducer and the impact load.

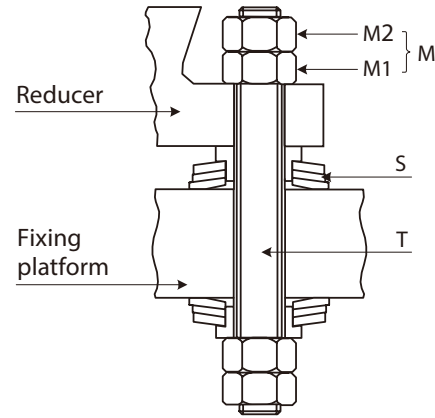


Fig. 5-17

- Note 1. The number of disc springs (S) differs according to the size of the reducer.
 2. Use bolt (T) and nut (M) classified as JIS strength class 8.8.
 3. Adjust nut (M1) to remove the gap in the torque arm.
 Tighten nut (M2) to prevent whirl stop.

5-5 Diameters Relating Hollow Shaft / Shrink Disk Mount

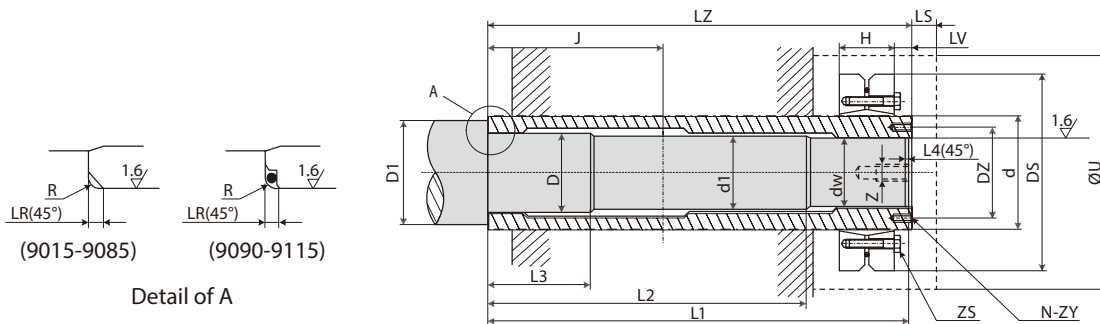


Fig.5-18 Diameters Relating Hollow Shaft, Driven shaft

Table 5-2. Shrink Disk Mount Diameters

Unit: mm

Size	Shrink Disc						Hollow Shaft							Driven Shaft										
	MODEL (Note 1)	d	Ds	H	ZS	TA N·m	J	LZ	LR	LV	N-ZY	DZ	LS	U	dw	d1	D h7	D1 min	L1	L2	L3	L4	R	Z (Thread Depth)
9015	TAS3091.4-080	80	145	38	M8	35	135	328	3	14	4-M6	70	15	159	60h6	61	63	78	325	240	80	3	2.5	M20 (30)
9025	TAS3081.-090	90	155	39	M8	35	145	358	3	14	4-M6	80	17	174	70h6	71	73	88	355	270	80	3	2.5	M20 (30)
9030	TAS3091.1-100	100	170	54	M10	59	160	393	3	14	4-M6	90	20	207	80h6	81	83	98	390	295	90	3	2.5	M20 (30)
9035	TAS3093.-110	110	185	60	M10	70	160	403	3	14	4-M6	97	20	237	85h6	86	88	103	400	295	90	3	2.5	M24 (35)
9040	TAS3081.-125	125	215	54	M10	70	180	448	3	20	4-M8	110	17	237	95h6	96	98	113	445	335	110	3	2.5	M24 (35)
9045	TAS3093.-140	140	230	74	M12	120	180	463	3	20	4-M10	124	17	277	105h6	106	108	123	460	355	110	3	2.5	M24 (35)
9050	TAS3093.-140	140	230	74	M12	120	200	503	3	22	4-M10	124	17	277	105h6	106	108	123	500	380	110	3	2.5	M24 (35)
9055	TAS3091.-165	165	290	88	M16	250	205	528	3	27	4-M12	146	17	307	120h6	121	123	138	525	385	120	3	2.5	M24 (35)
9060	TAS3091.-165	165	290	88	M16	250	230	583	4.5	27	4-M12	146	17	319	125h6	126	128	143	580	435	130	3	3	M24 (35)
9065	TAS3091.-175	175	300	88	M16	250	235	594	4.5	26	4-M12	157.5	21	349	140h6	141	143	158	589	450	130	5	3	M30 (45)
9070	TAS3081.-185	185	330	86	M16	290	260	644	4.5	26	4-M12	167	21	349	145h6	146	148	163	640	475	160	5	3	M30 (45)
9075	TAS3081.-200	200	350	86	M16	290	265	651	4.5	26	4-M12	177	21	379	155h6	156	158	173	646	475	160	5	3	M30 (45)
9080	TAS3081.-220	220	370	104	M16	290	285	714	4.5	26	4-M12	195	21	399	170g6	171	173	192	709	520	190	5	3	M30 (45)
9085	TAS3081.-240	240	405	109	M20	570	285	714	4.5	27	4-M12	210	21	429	180g6	181	183	198	709	520	190	5	3	M30 (45)
9090	TAS3081.-240	240	405	109	M20	570	350	844	6	27	6-M12	215	21	451	190g6	191	193	212	840	635	200	5	4.5	M36 (55)
9095	TAS3081.1-260	260	440	120	M20	535	350	859	6	27	6-M12	230	14	450	200g6	201	203	222	855	640	205	5	4.5	M36 (55)
9100	TAS3081.1-260	260	440	120	M20	535	390	934	6	27	6-M12	235	21	491	210g6	211	213	234	930	705	215	5	4.5	M36 (55)
9105	TAS3081.1-280	280	460	134	M20	535	390	949	6	27	6-M12	250	19	480	220g6	221	223	244	945	715	225	5	4.5	M36 (55)
9110	TAS3081.1-300	300	485	142	M20	535	420	1030	6	32	6-M16	270	15	551	240g6	241	243	263	1025	770	245	5	4.5	M36 (55)
9115	TAS3091.-320	320	520	184	M20	490	420	1065	6	32	6-M16	285	15	550	250g6	251	253	273	1060	785	245	5	4.5	M36 (55)

Note 1. Shrink disc (manufactured by SCHÄFER) type code.

2. For vertical reducer, mount a thrust washer to prevent the reducer from moving when locking bolt (ZS) is loosened.

3. Stepped point strength required for the driven shaft: $Re \geq 370N/mm^2$ (equivalent to JIS-S45C temperance)

COMMON 5. Coupling With Other Machines

5-6 Diameters Relating Hollow Shaft / Key Mount

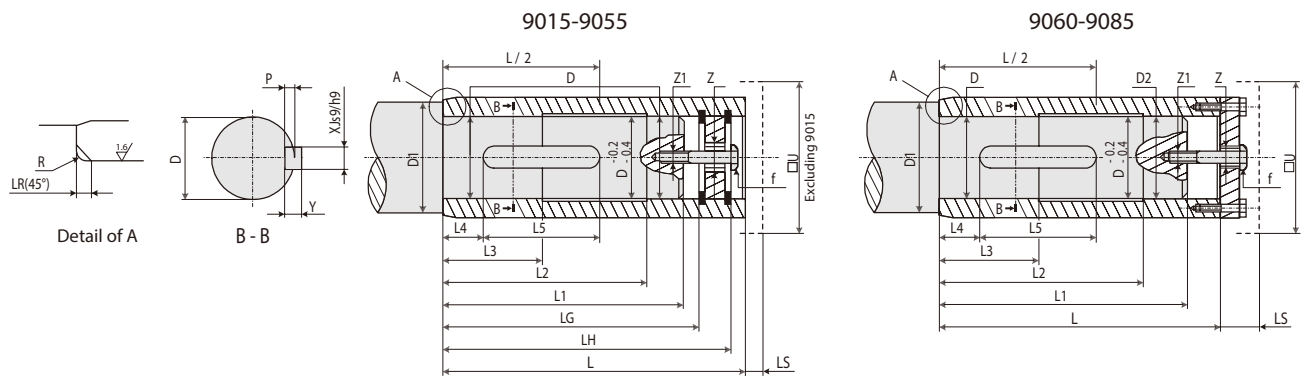


Fig. 5-19 Hollow shaft, Driven shaft

Table 5-3. Key Mount Diameters

Unit: mm

Size	Hollow Shaft							Driven Shaft											Locking Screw (f) Thread Size Body Length	Locking Distance Ring (h) Outer Diameter × Width		
	L	LG	LH	LR	Z	Safety Cover		D j6	D1 min	D2 j6	L1	L2	L3	L4	L5 min	X	Y	P			R	Z1 (Thread Depth)
9015	270	240	258	3	M24	7.5	Ø161	55	70		235	200	70	30	115	16	10	6	2.5	M20(30)	M20×50	Ø55×5
9025	300	265	286	3	M24	10	190	65	80		260	220	80	35	125	18	11	7	2.5	M20(30)	M20×50	Ø65×5
9030	330	290	314	3	M24	9.5	230	75	90		285	240	90	35	145	22	14	9	2.5	M20(30)	M20×55	Ø75×5
9035	330	290	315	3	M24	10	260	85	100		285	240	90	35	160	22	14	9	2.5	M20(30)	M20×55	Ø85×5
9040	360	314	340	3	M30	10	260	90	105		310	260	100	40	180	25	14	9	2.5	M24(35)	M24×60	Ø90×4
9045	370	316	348	3	M30	10	300	105	120		310	260	100	40	180	28	16	10	2.5	M24(35)	M24×65	Ø105×6
9050	410	356	388	3	M30	10	300	105	120		350	300	110	45	220	28	16	10	2.5	M24(35)	M24×65	Ø105×6
9055	410	356	388	3	M30	10	330	115	130		350	300	110	45	220	32	18	11	2.5	M24(35)	M24×65	Ø115×6
9060	470			4.5	M30	47	340	125	140	123	445	395	90	5	260	32	18	11	3	M24(35)	M24×80	Ø125×25
9065	480			4.5	M36	54	350	145	160	143	455	405	100	5	265	36	20	12	3	M30(45)	M30×90	Ø145×25
9070	530			4.5	M36	54	370	145	160	143	500	445	120	5	310	36	20	12	3	M30(45)	M30×100	Ø145×30
9075	530			4.5	M36	54	400	150	165	148	500	445	120	5	365	40	22	13	3	M30(45)	M30×100	Ø150×30
9080	570			4.5	M36	54	400	165	180	163	540	480	125	5	370	40	22	13	3	M30(45)	M30×100	Ø165×30
9085	570			4.5	M36	54	450	175	190	173	540	480	125	5	385	45	25	15	3	M30(45)	M30×100	Ø175×30

- Note 1. The key and keyway conform to JIS B 1301-1996 (ISO) "Sunk keys and keyways parallel keys (regular class)".
 2. Fixing bolts and distance rings are not attached. The customer need to prepare if necessary.
 3. Dimension from center of housing to shaft and is L/2.

When using another manufacturer's motor (There are some models made by other manufacturers.), follow the operation manual for that motor.

This manual shows wiring for motors with Japanese standard specifications. Please consult with us for motors with overseas specifications.

DANGER

- Do not handle the unit when cables are energized. Be sure to turn off the power when working on the unit; otherwise, electric shock may result.
- Connect a power cable to the unit according to the diagram shown inside the terminal box or in the maintenance manual; otherwise, electric shock or fire may result.
- Do not forcibly bend, pull, clamp or push the power cable and lead wires; otherwise, electric shock or fire may result.
- Correctly ground the grounding bolt; otherwise, electric shock may result.
- For **explosion proof motor**, the lead-in condition shall conform to the facility's regulations, electrical codes, and explosion proofing standard, as well as the maintenance manual; otherwise, electric shock, personal injury, explosion, fire, or damage to the equipment may result.

CAUTION

- When wiring, follow the domestic laws and standards; otherwise, burning, electric shock, injury, or fire may result.
- The motor is not equipped with a protection device. However, it is compulsory to install an over current protecting device according to the laws and standards. It is recommended to install other protective devices (earth leakage breaker, etc.), in addition to an over current protecting device in order to prevent burning, electric shock, injury, and fire.
- Never touch the terminals when measuring insulation resistance; otherwise, electric shock may result.
- When using a **star-delta starter**, use an electromagnetic switch on the primary side (3-contact point type); otherwise, fire may result.
- PWM inverters that use IGBT generate high-voltage surges at the motor terminals, which may degrade the insulation on the motor windings. Especially when the motor is in the 400V class with the long cable, a surge voltage over 1300V occurs. Therefore, in this case, install an LCR filter, output AC reactor, etc. between the inverter and motor to inhibit the surge voltage.
- When using a **motor with brake**, do not energize the brake coil when the motor is stopped; otherwise, coil burnout may result. Also, mistaken wiring could damage the rectifier.
- When using an **explosion proof motor driven by an inverter**, use one inverter for one motor. Use the approved inverter for the motor.
- When measuring the insulation resistance of an **explosion proof motor**, confirm that there is no gas or explosive vapor in the vicinity; otherwise, explosion or ignition may result.
- If ambient temperature exceeds 60°C, place the rectifier in a location where the temperature is 60°C or less. In this case, always protect the entire rectifier with a cover. However, ambient temperature conditions for standard units with and without brakes must be -10 to 40°C. (Manufacture with special specification is required for operation in an environment where ambient temperature exceeds 40°C.)
- Long cables cause large voltage drops. Select cables with appropriate diameter so that the voltage drop will be no greater than 2%.
- After wiring **outdoor types and explosion proof types**, check that mounting bolts for terminal box are not loose, and correctly attach the terminal box cover.



6. Wiring

6-1 Measuring Insulation Resistance

When measuring insulation resistance, always disconnect the control board and measure the motor alone.

Measure insulation resistance before wiring. Insulation resistance (R) is changed by a number of factors, including motor output, voltage, type of insulation, winding temperature, moisture, degree of fouling, hours used, and amount of time test voltage is applied. However, normally, it must be above the values in Table 6-1.

Table 6-1 Values for Insulation Resistance

Motor Voltage	Ohmmeter Voltage	Insulation Resistance (R)
Low-voltage motors of no more than 600V	500V	Minimum 1MΩ

Reference: JEC -2100 provides the following equation.

$$R \geq \frac{\text{Rated Voltage (V)}}{\text{Rated output power (kW)} + 1,000} \quad (\text{M}\Omega)$$

$$R \geq \frac{\text{Rated Voltage (V)} + (\text{RPM}/3)}{\text{Rated output power (kW)} + 2,000} + 0.5(\text{M}\Omega)$$

Low insulation resistance is a sign that there is an insulation failure. Do not apply power. Consult the nearest maintenance shop.

6-2 Coordination of System Protection

Use a wiring breaker for short circuit proofing.

Use an over current protecting device which operates when the currents exceed the rated current on the nameplate.

For **increased safety motor**, use an over current protecting device which operates in the locked rotor current on the nameplate within the allowable locking time.

6-3 Connecting the Power Cable

Connect the power cable and motor lead wire by joining pressure connection terminals as shown in figure 6-1.

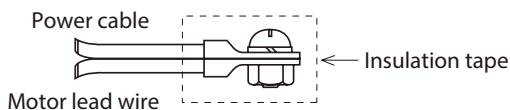
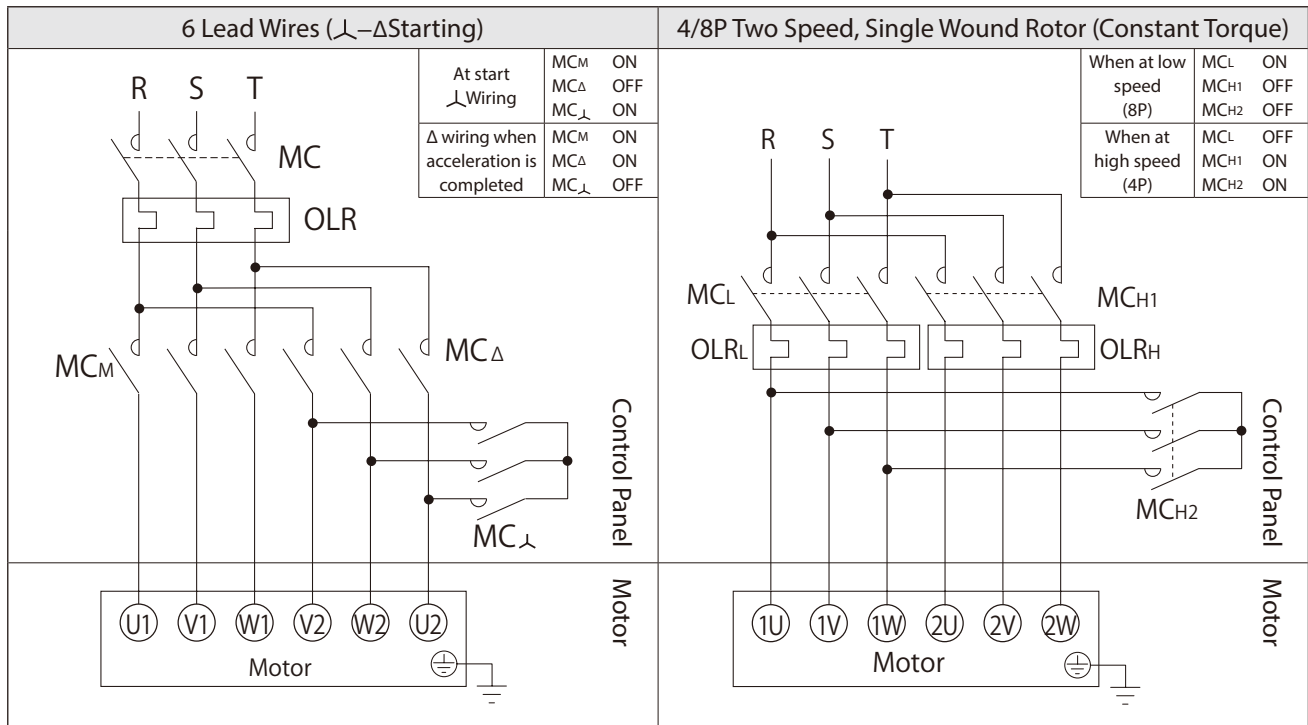
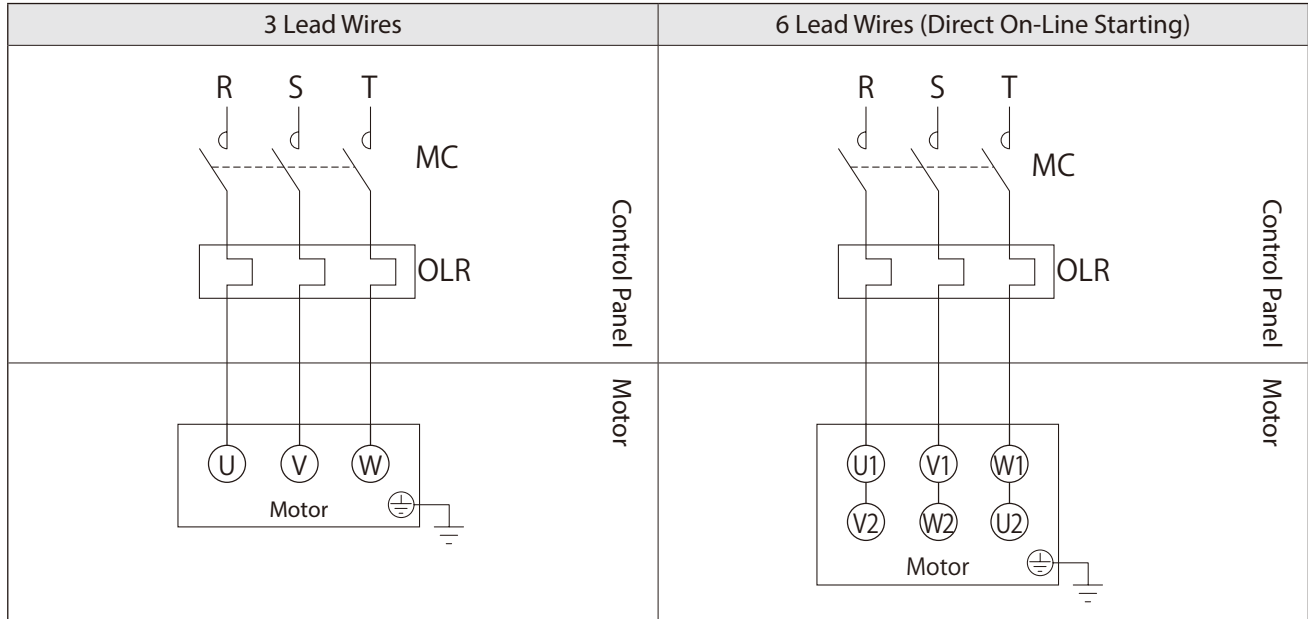


Figure 6-1

6. Wiring


In this section, motor wiring, standard specification for terminals, and symbols of lead wires are shown.

Without Brake 3-Phase Power Source



MC : Electromagnetic contactor

OLR : Over current protection device or thermal relay

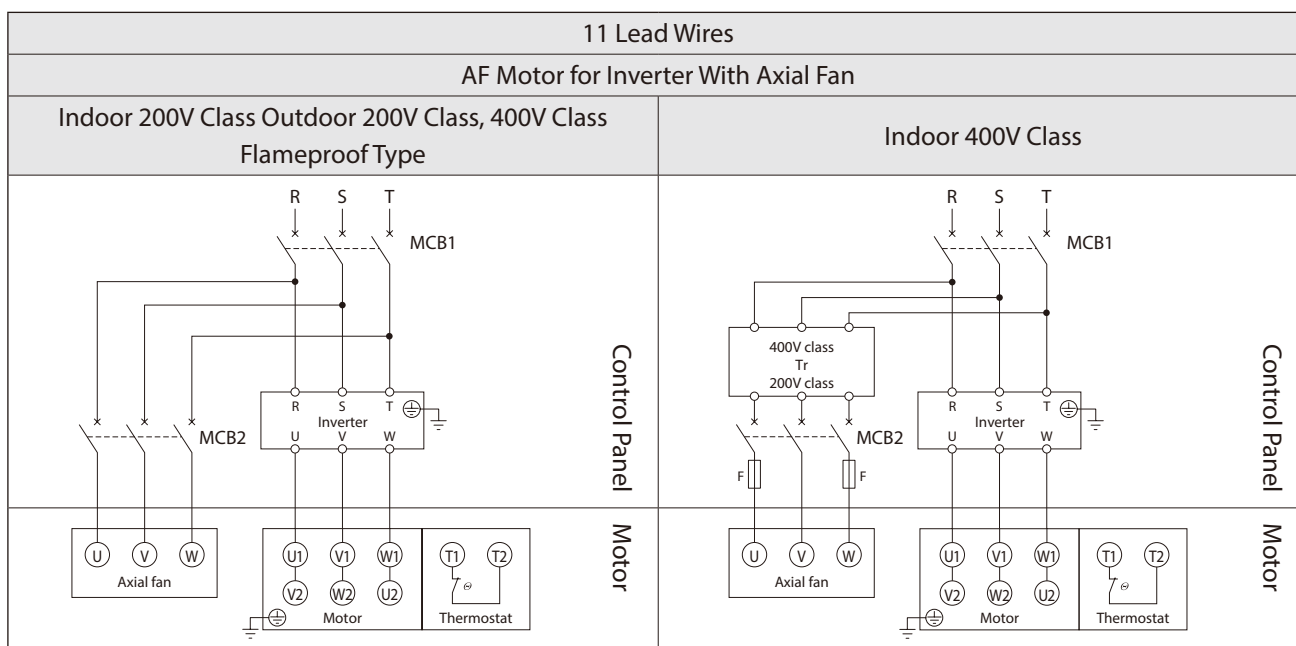
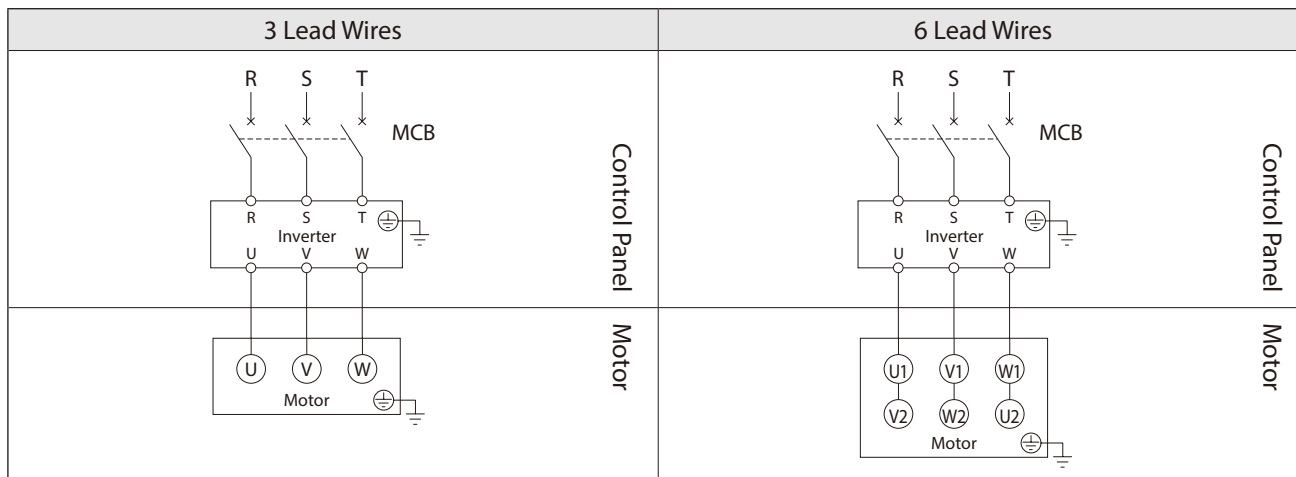
 Customer needs to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.



6. Wiring

Without Brake Inverter Drive



MCB : Miniature circuit breaker

Tr : Transformer capacity 250–300VA, Secondary voltage 200–220V

F : Fuse 3–5A

} Customer needs to prepare.

- This diagram shows cases for motors with standard Japanese domestic specifications. Please consult with us for motors with overseas specifications.
- When using inverter for 400V class 3-phase motor/high-efficiency 3-phase motor, the motor must be insulated.

In the case of **motor with axial fan (totally enclosed, fan motor ventilation type)**, note the following items.

- Also connect a power source to the axial fan.
- For an indoor 400V class (except flameproof type), the axial fan power source voltage will be 200V class. For the motor with special specifications, specifications may differ from the above.
- Connect the fan so that it rotates in the same direction as that shown on the nameplate for direction of rotation. (Normally, the air from the fan will blow in a direction from the anti-load side to the load side.)
- When the motor is shut down for a long period, also shut down the axial fan motor.
- Wire the mounted thermostat.
- Thermostat specification: Terminal symbols: T1, T2 or P1, P2
Operating temperature: 135°C (for thermal class 155 (F))
- Operating function: Normally closed (break contact)
Maximum current: DC 24V, 18A; AC 230V, 13A

DANGER

- Do not approach or touch rotating parts (slow speed shaft etc.) during operation; otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.
- When the power supply is interrupted, be sure to turn off the power switch; otherwise, 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.

CAUTION

- 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 remove the inspection cover while driving. Lubricating oil may blow out and cause burns.
- When rotating in reverse, be sure to stop it once and then start again; otherwise, damage to the unit may occur.
- 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 under more than rated load; otherwise, personal injury, or damage to the equipment may result.
- This product is shipped without lubricating oil, so be sure to fill the recommended lubricant oil before operation.
- In the case of long-term rust prevention, export rust prevention, and specifications filled with lubricating oil, the air release plug hole is plugged with a plug and shipped, so replace it with the attached air plug after installing the unit.
- For special piping specification, pipes are not installed to the unit when shipping as to prevent the damage to them during transportation, so be sure to pipe after installing the unit.

7-1 Items to Check Before Operation

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

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?
- Is the oil level at the stop in the specified position?

After confirming these items, perform leveling operation with a light load, and make sure that there is no abnormal vibration, sound, or temperature rise before performing the main operation. Check the items shown in Table 7-1.

7-2 Items to Check During Operation

Table 7-1 Items to Check During Operation

Does abnormal sound or vibration generate?	<ul style="list-style-type: none"> - 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?	<ul style="list-style-type: none"> - Does the voltage rise or drop substantially? - Is the ambient temperature too high? - Does the current value to the gearmotor exceed the rated current shown on the nameplate? - Is the oil level appropriate?

If any abnormalities are found, immediately stop operation and contact the nearest authorized maintenance shop.

COMMON 8. Daily Inspection and Maintenance

DANGER

- Do not handle the unit when cables are energized. Be sure to turn off the power when working on the unit; otherwise, electric shock may result.
- Do not approach or touch any rotating parts (slow speed shaft etc.) during maintenance or inspection while operating the unit; otherwise, loose clothing may become caught in these rotating parts and cause serious injury or death.
- When checking the tooth surface at the stop, make sure to stop the motor and driven unit rotation; otherwise, loose clothing may become caught in the gear meshing part and cause serious injury or death.
- Do not operate the unit without a safety cover (removed during inspection) ; otherwise, loose clothing may become caught in these rotating parts and cause serious injury or death.
- For **explosion proof motors**, customers must not disassemble or modify; otherwise, explosion, ignition, electric shock, or damage to the equipment may result.
- For **explosion proof motors**, the lead-in condition shall conform to the facility's regulations, electrical codes, and explosion proofing standard, 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.


CAUTION

- 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 becomes 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); otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.
- When any abnormality happens, observe the condition based on maintenance manual. Do not operate the unit until the cause is detected and repaired.
- Change lubricant according to the maintenance manual instructions. Be sure to use lubricant that we recommend.
- Do not change lubricant during operation or immediately after stopping operation; otherwise, burns may result.
- Supply/dischage grease to/from the motor bearing according to the maintenance manual instructions. Avoid contact with rotating parts; otherwise, injury may result.
- Do not remove the inspection cover while driving. Lubricating oil may blow out and cause burns.
- Do not operate damaged gearmotors or reducers; otherwise, injury, fire, or damage to the equipment may result.
- We cannot assume any responsibility for damage or injury resulting from an unauthorized modification by a customer, as it is outside the scope of the warranty.
- Dispose of products lubricant as general industrial waste.
- When measuring the insulation resistance of **explosion proof motors**, confirm that there is no gas or explosive vapor in the vicinity in order to prevent possible explosion or ignition.
- Changing brake linings requires experience. Consult with the nearest authorized maintenance shop.
- 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. Lack of 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 the surface temperature unusually high (higher than 90°C)? Is there a sudden rise? (Temperature rises during operation will differ according to model and type. However, there is no particular problem if fluctuation is slight if the surface temperature of gear is approximately 80°C)
Oil level		Does the oil level decrease? (Check it with a dipstick or oil gauge while the machine stops.)
Lubrication	for electric pump model	Is the function of oil signal or flow gauge normal? If their function is abnormal, which means lubrication failure due to inadequate oil, broken pump or clogging pipe, so stop the unit and inspect it.
Oil, grease leaks		Does oil or grease leak through oil seal?
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 "10. Troubleshooting"(P31, 32). If these actions do not solve the issue, immediately contact the nearest authorized maintenance shop.

8. Daily Inspection and Maintenance COMMON

⚠ DANGER

- For equipment with a motorized oil pump, run the pump prior to starting the reducer. Start motor of reducer after lubricant has circulated through the bearings; otherwise, the damage to the equipment may result.

8-2 Check the Lubrication Method

- Please look for the relevant items and make certain to do maintenance. Neglecting maintenance is a source of trouble.
- Table 8-3 on P24 shows the description part of the maintenance method for each lubrication method.
- Refer to Table 8-4 on P24 for the standard input speed.
- In order to check the circulation of lubricating oil, install a flow switch or flow site and stop the reducer when there is an abnormality.
- Lubrication method may differs from Table 8-3 depending on specification. Check the manufacturing specification for details.

Table 8-2 Lubrication method for each gear type (when driving at standard input speed) Contact us when the input speed is different from the standard one.

		Size	9015	9025	9030	9035	9040	9045	9050	9055	9060	9065	9070	9075	9080	9085				
Right Angle Shaft	2-Stage	Horizontal	Oil bath						Oil splash				*	*						
		Vertical	Shaft driven oil pump																	
		Upright	Oil bath + grease						Oil splash				*	*						
	3-Stage	Horizontal	-	-	Oil bath						Oil splash									
		Vertical	-	-	Shaft driven oil pump															
		Upright	-	-	Oil bath + grease						Oil splash									
	4-Stage	Horizontal	-	-	-	-	Oil bath				Oil splash									
		Vertical	-	-	-	-	Shaft driven oil pump													
		Upright	-	-	-	-	Oil bath + grease				Oil splash									
Parallel Shaft	2-Stage	Horizontal	Oil bath						Oil splash											
		Vertical	Shaft driven oil pump																	
		Upright	Oil bath						Oil splash											
	3-Stage	Horizontal	Oil bath						Oil splash											
		Vertical	Shaft driven oil pump																	
		Upright	Oil bath						Oil splash											
	4-Stage	Horizontal	-	-	Oil bath						Oil splash									
		Vertical	-	-	Shaft driven oil pump															
		Upright	-	-	Oil bath						Oil splash									
Right Angle Shaft	2-Stage	Horizontal	-	*	-	*	-	*	-	-	-	-	-	-	-	-				
		Vertical	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
		Upright	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	3-Stage	Horizontal	Oil splash		*	*	*	*	*	*	*	*	*	*	*	*				
		Vertical	Shaft driven oil pump		Electric pump						-	-	-	-	-	-				
		Upright	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	4-Stage	Horizontal	Oil bath						Oil splash				*	*	*					
		Vertical	Shaft driven oil pump																	
		Upright	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	Parallel Shaft	2-Stage	Horizontal	Oil splash		*	*	*	*	-	-	-	-	-	-	-				
			Vertical	Electric pump																
			Upright	-	-	-	-	-	-	-	-	-	-	-	-	-				
3-Stage		Horizontal	Oil splash						*	*	*	*	*							
		Vertical	Electric pump																	
		Upright	-	-	-	-	-	-	-	-	-	-	-	-	-					
4-Stage		Horizontal	Oil splash																	
		Vertical	Shaft driven oil pump						Electric pump		-	-	-	-	-	-				
		Upright	-	-	-	-	-	-	-	-	-	-	-	-	-					
Special Right-angle Shaft	3-Stage	Horizontal	Oil bath + grease						-											
		Upright	Oil bath						-											
	4-Stage	Horizontal	-	-	Oil bath + grease				-											
		Upright	-	-	Oil bath				-											
	Size	9025	9030	9040	9050	9060														

* : For continuous operation, oil splash lubrication or electric pump lubrication is applied according to the input speed.

COMMON 8. Daily Inspection and Maintenance

Table 8-3 Maintenance manual pages that can be referenced regarding lubrication maintenance.

	Lubrication Method		Supply of Oil/ Grease Before Initial Operation After Purchase	Pages Where Maintenance Method Is Shown				
				Oil/Grease Change Period	Recommended Oil/Grease	Disposal of Oil/ Grease	Parts	
Gear	Oil	Oil bath	Self-lubrication	Necessary (Unnecessary for grease)	8-3 (1) (2) P25	8-3 (3) P25	8-3 (5) (6) P26	8-5 P29
		Oil bath + grease						
		Oil splash lubrication						
		Shaft driven pump lubrication						
		Electric pump lubrication	Forced lubrication					
Motor	Grease	-	Self-lubrication	Unnecessary	8-4 (2) P28	8-4 (3) P29	8-4 (4) P29	8-5 P29

Table 8-4 Standard speed table

Assembly		Size	Input Speed r/min																							
			750				1000				1500				1800											
Right Angle Shaft	2-Stage	Horizontal	9015 - 9075																							
			9080 - 9085																							
			9095																							
		9105 - 9115																								
		Vertical	9015 - 9075																							
			9080 - 9085																							
	9105 - 9085																									
	Upright	9030 - 9095																								
		9100 - 9115																								
		9030 - 9095																								
	9100 - 9115																									
4-Stage	Horizontal	9040 - 9115																								
		9040 - 9115																								
		9040 - 9085																								
Parallel Shaft	2-Stage	Horizontal	9015 - 9095																							
			9100 - 9105																							
			9110 - 9115																							
		Vertical	9015 - 9095																							
			9100 - 9105																							
			9110 - 9115																							
	Upright	9015 - 9085																								
		9015 - 9115																								
		9015 - 9115																								
	4-Stage	Horizontal	9030 - 9115																							
			9030 - 9115																							
			9030 - 9085																							

- Note 1. The ranges except shaded areas show the standard input speed.
 2. Consult us for the ranges exceed the shading areas and the ranges in this table.
 3. Consult us for standard input speed of reducer 9118-9136.

8. Daily Inspection and Maintenance **COMMON**

8-3 Lubrication Maintenance

(1) Oil Change Interval

Table 8-5 Oil Change Interval

Oil filling	Interval		Usage Conditions
	At purchasing		—
Oil change	1st time	After 500 hours or 6 months, whichever comes first	—
	2nd time	After 2500 hours or 6 months, whichever comes first	—
	3rd time or later	Every 5000 hours or one year, whichever comes first	Oil temperature is below 70°C
		Every 2500 hours or half year, whichever comes first	Oil temperature is 70°C or higher

- Please consult oil manufacturer when atmosphere contains corrosive gas or where ambient temperature changes dramatically.

(2) Grease Interval

Table 8-6 Grease Interval

Interval	Input speed
Every 1500 hrs	750 r/min or slower
Every 1000 hrs	750 r/min to 1800 r/min

- The grease lubricated models are packed with grease prior to shipment and attached grease nipple and grease discharge plug. Please check the number of grease nipples and their positions carefully.
- For requirement of grease lubrication, refer to Table 8-2 on P23.
- For the place grease fitting and discharge plug, refer to Figure 8-3 to 8-5 on P27.

(3) Lubricant selection

Refer to Table 8-7 to select appropriate oil viscosity. Table 8-8 shows recommended lubricants.

Table 8-7 Oil Viscosity

Application or Operation Pattern	Output Speed		Ambient Temperature °C		
			-10 to 15	0 to 30	10 to 50
Continuous Operation	100 r/min or faster	ISO* AGMA	VG68 2EP	VG150 4EP	VG220 5EP
	100 r/min or slower	ISO* AGMA	VG100 3EP	VG220 5EP	VG320 6EP
For Crane	All rotation speed	ISO* AGMA	VG68 2EP	VG150 4EP	VG220 5EP

* : Viscosity at ISO 40°C (mm²/s)

Table 8-8 Recommended Lubricant

	Viscosity Classification (ISO) mm ² /s (40°C)	AGMA	BP	Castrol			Chevron	TEXACO	Mobil			Shell		Total
				Alpha SP 68	Optigear BM 68	Tribol 1100/68			Gear Compounds EP 68	Meropa WM 68	-	Mobilgear 600XP 68	Shell Omala S2 G 68	
Gear Oil	VG68	2EP	Energol GR-XP 68	Alpha SP 68	Optigear BM 68	Tribol 1100/68	Gear Compounds EP 68	Meropa WM 68	-	Mobilgear 600XP 68	Shell Omala S2 G 68	Shell Omala S2 GX 68	CARTER EP 68	
	VG100	3EP	Energol GR-XP 100	Alpha SP 100	Optigear BM 100	Tribol 1100/100	Gear Compounds EP 100	Meropa WM 100	-	Mobilgear 600XP 100	Shell Omala S2 G 100	Shell Omala S2 GX 100	CARTER EP 100	
	VG150	4EP	Energol GR-XP 150	Alpha SP 150	Optigear BM 150	Tribol 1100/150	Gear Compounds EP 150	Meropa WM 150	Spartan EP 150	Mobilgear 600XP 150	Shell Omala S2 G 150	Shell Omala S2 GX 150	CARTER EP 150	
	VG220	5EP	Energol GR-XP 220	Alpha SP 220	Optigear BM 220	Tribol 1100/220	Gear Compounds EP 220	Meropa WM 220	Spartan EP 220	Mobilgear 600XP 220	Shell Omala S2 G 220	Shell Omala S2 GX 220	CARTER EP 220	
	VG320	6EP	Energol GR-XP 320	Alpha SP 320	Optigear BM 320	Tribol 1100/320	Gear Compounds EP 320	Meropa WM 320	Spartan EP 320	Mobilgear 600XP 320	Shell Omala S2 G 320	Shell Omala S2 GX 320	CARTER EP 320	
Bearing Grease			Energrease LS-EP2	Spheerol AP 3	Olista Longtime 3 EP	Tribol 3020/1000-2	Duralith Grease 68	Multifak EP 2	Beacon EP2	Mobilplex 48	Shell Gadus S2 V 220 2		MULTIS EP2	

COMMON 8. Daily Inspection and Maintenance

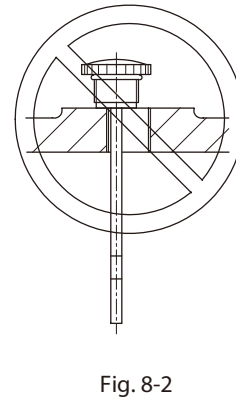
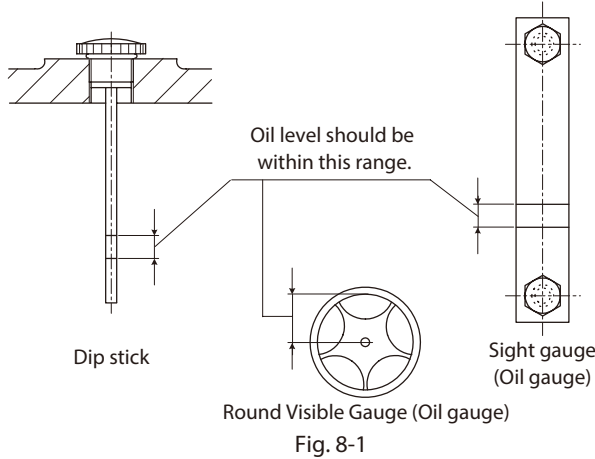
(4) Oil Quantity

An estimated oil quantity for standard specifications is shown in "12. Oil quantity" (P36). Use a dipstick or visible oil gauge to check the oil level even after filling with indicated oil quantity.

(5) Fill/Drain oil

Supply oil through the filling port on top of the main unit. Check the oil level with a dipstick or visible oil gauge. (Fig. 8-1).

Screw the dipstick to its deepest position to check the oil level; otherwise, the measured oil level will be incorrect. (Fig. 8-2).



Prevent bolt, washer, dust, water or other foreign object from entering during oil-filling process.

If the oil level is lower than the range, the unit will not be lubricated sufficiently.

If the oil level is higher than the range, deterioration of the oil is accelerated due to oil temperature rise.

Remove drain plug located lower part of the unit to drain when lubricant is still warm.

For the model with air breather, remove the air breather at the time of filling and discharging oil leads to smooth operation.

(6) Fill/Drain Grease

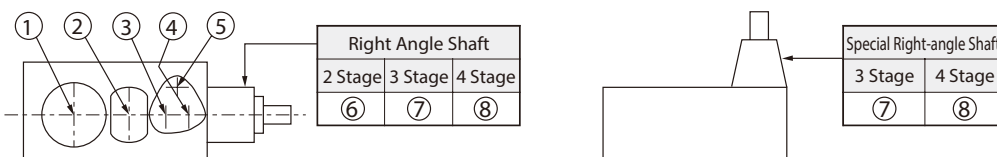
1. Some bearings need to be greased. Verify the number and locations of the grease fittings.

2. Grease is supplied before shipment. For grease supply after starting operation, supply necessary amount according to the following table depending on the input speed: every 1500 hours for 750 r/min or lower and every 1000 hours for 750 r/min to 1800 r/min. Do not exceed the recommended amount of grease.

Table 8-9 Amount of Grease

Unit : g

Location \ Size	9015	9025	9030	9035	9040	9045	9050	9055	9060	9065	9070	9075	9080	9085	9090	9095	9100	9105	9110	9115
①	30	30	30	40	40	50	70	100	100	150	150	150	150	200	200	200	200	200	200	200
②	10	10	30	30	30	30	50	50	50	50	70	70	70	70	100	100	150	150	200	200
③	10	10	20	20	20	20	20	20	30	30	40	40	50	50	70	70	70	70	100	100
④	10	10	20	20	20	20	20	20	30	30	40	40	40	40	50	50	50	50	50	50
⑤	-	-	10	10	10	10	10	10	10	10	20	20	20	20	30	30	30	30	30	30
⑥	20	20	20	20	40	40	40	40	60	60	100	100	100	100	-	150	-	150	-	200
⑦	-	-	20	20	20	20	30	30	40	40	40	40	60	60	100	100	100	100	100	100
⑧	-	-	-	-	20	20	20	20	20	20	30	30	40	40	60	60	60	60	60	60



- Supply grease during operation in order to apply the grease evenly.
- Supply grease slowly.
- When new grease is supplied, the grease that was left over is mixed with the lubricant; it does not affect the performance of lubricant if changing lubricant regularly.

8. Daily Inspection and Maintenance **COMMON**

(7) Positions of grease fitting and discharge plug

Please remove the grease plug before applying grease.
Grease does not necessarily come out from the grease drain plug.
Please remove it if it comes out.
Please reattach the drain plug after greasing.

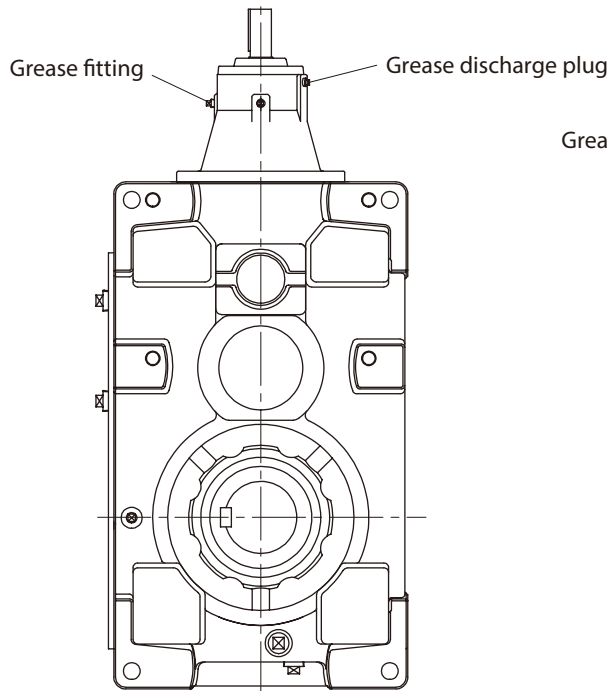


Fig.8-3 Reducer upright mount

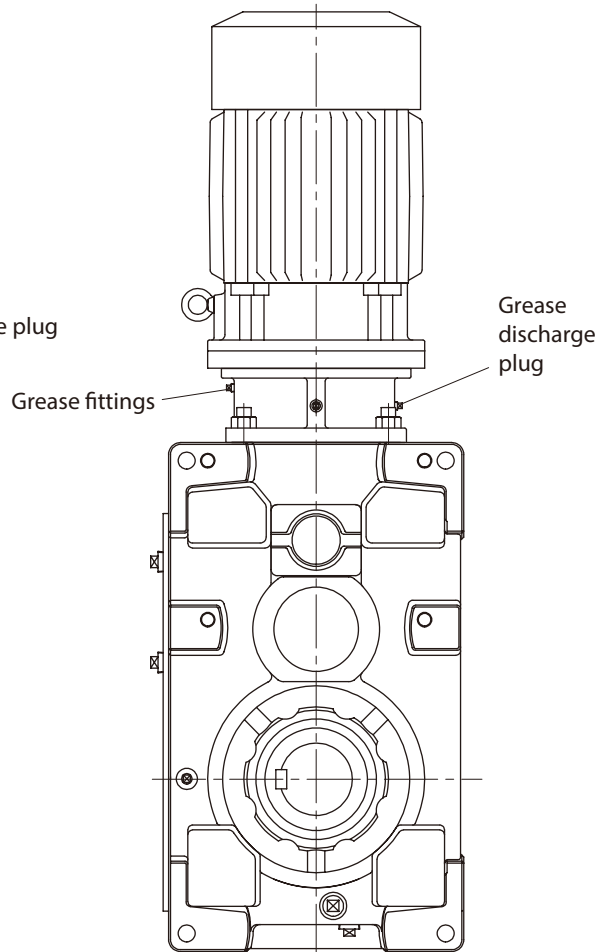


Fig.8-4 Drive unit upright mount

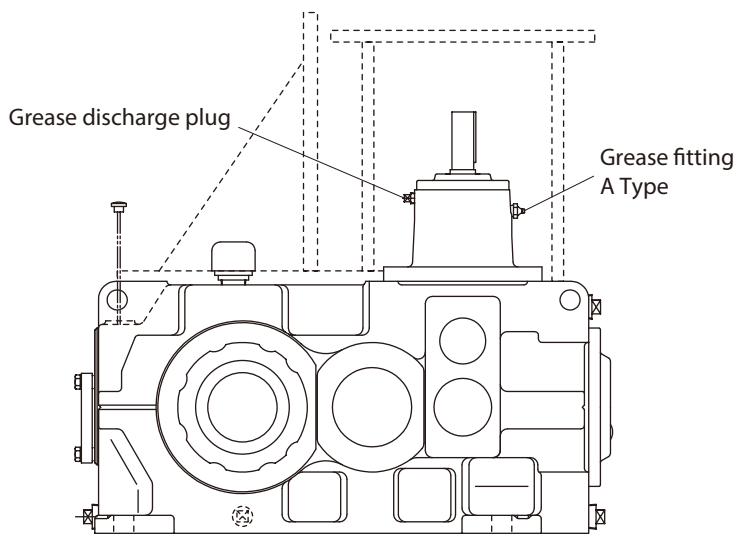


Fig.8-5 Special right-angle shaft



8. Daily Inspection and Maintenance

8-4 Maintenance of motor bearing

- Bearing types and maintenance methods vary according to the frame sizes of the unit.
Choose the proper maintenance method by checking the nameplate and the bearing type in Table 8-10.
- When using another manufacturer's motor (There are some models made by other manufacturers.), follow the operation manual for that motor.

Table 8-10 Bearing type

Bearing Type	Applicable Motor (Frame Size)		Remarks
	Loading side	Opposite of Loading Side	
Sealed Bearing	225 or smaller	All	No construction for supplying and draining grease
Open Bearing	250	–	With grease fitting and drain plug

(1) Maintenance of sealed bearing

Maintenance with disassembly every 3 to 5 years or every 20,000 hrs increase lifetime.
About maintenance with disassembly, inquire to the nearest maintenance shop.

(2) Maintenance of open bearing

Checking the bearing number in the nameplate, replenish grease in according to Table 8-11.

Table 8-11 Grease maintenance schedule and Replenishing quantity of open bearing

Bearing No.	Replenishing Quantit (g)	Replenishing Time (Interval (h) Corresponding to Rotation Speed r/min)					
		750r/min	900r/min	1000r/min	1200r/min	1500r/min	1800r/min
6316	50	8000	6500	5500	4500	3000	2500
6317	55	7500	6000	5000	4000	3000	2000
6318	60	7000	5500	5000	4000	2500	2000
6319	65	7000	5500	4500	3500	2500	1500
6321	75	6000	5000	4000	3000	2000	1500
NU314	40	4000	3500	3000	2500	1500	1000
NU315	45	4000	3000	3000	2000	1500	1000
NU316	50	4000	3000	2500	2000	1500	1000
NU317	55	3500	3000	2500	2000	1500	1000
NU318	60	3500	2500	2500	2000	1000	1000
21312	30	1500	1000	1000	800	–	–

- Replenishing quantity indicates grease amount poured into the bearing every interval.
- Even though the bearing run with interval, replenish grease at least every 3 years.
- Replenish grease right after starting operation after a long period of Inactivity.

(3) Recommended grease for open bearing

Table 8-12 Recommended grease

Ambient temperature °C	Open Bearing	
	Thermal class 130 (B)	Thermal Class 155(F)
	Mobil	Shell
-10 to 40	UNIREX N2	Shell Stamina Grease RL2

Use greases listed in table 8-12 only.

(4) Open bearing grease maintenance procedure

refer to Fig.8-6 Construction of open bearing.

1. Drain used grease from drain plug and replenish new grease from grease fitting during operation.
(Replenishing during non-operation may cause insufficient replenishing of grease amount)
2. After supplying grease, operate it for 10 min and then tighten the plug of drain port.

- Fill with indicated amount of grease only; otherwise, over heating and grease leakage may result.
- Exceeding the recommended amount of grease does not extend the replenishment interval.
- Do not forget to replenish at start-up and periodically during operation; otherwise, abnormal abrasion, noise and overheating may result.

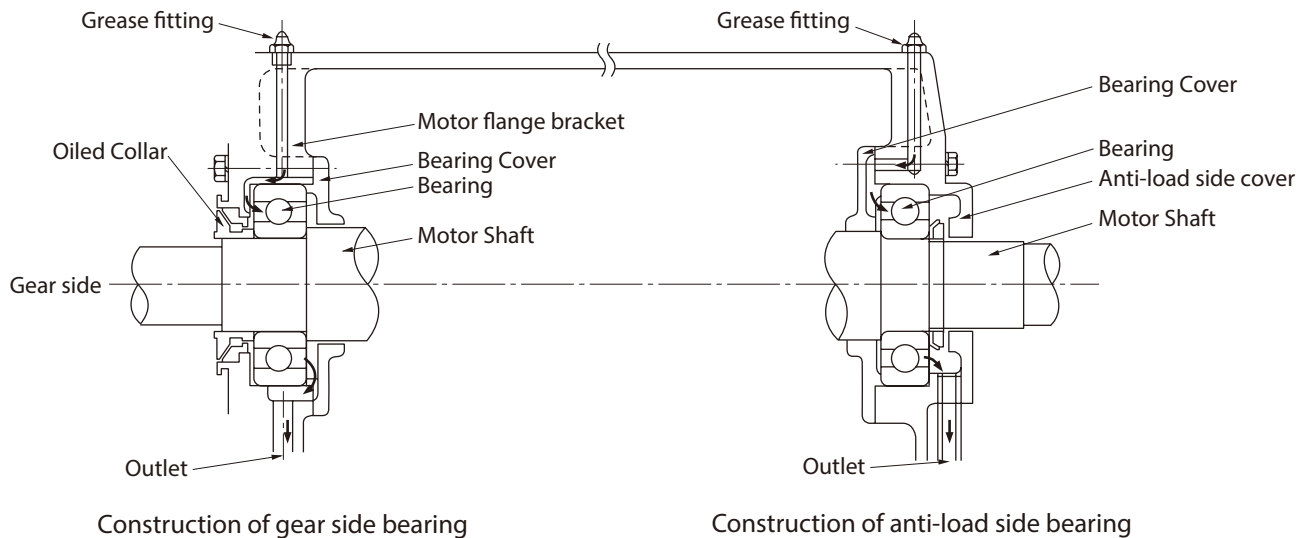


Fig. 8-6 Construction of open bearing

8-5 Parts Maintenance

Although it depends on operation conditions, maintenance with disassembly after approximately 3 to 5 years increase lifetime. Contact the nearest authorized maintenance shop regarding maintenance with disassembly.

Replacement parts

- Bearing, oil seal, nilos ring, collar, key, shim, packing, retaining ring, visible gauge or air breather
- Check and replace if the shaft or gear is damaged
- Check other parts (including special application) when required



9. Disassembly / reassembly

⚠ CAUTION

Repair, disassembly, and reassembly should be handled by properly technicians; otherwise, the system may be Damaged.

- Keep hands and all foreign objects from keyway and other sharp edges of parts; otherwise, injury may occur.
- Disassemble them at a clean, dry location.
- Keep accessory parts like screws in the box to prevent loss.
- Carefully handle parts to prevent damage.

9-1 Disassembling / assembling of gear and motor

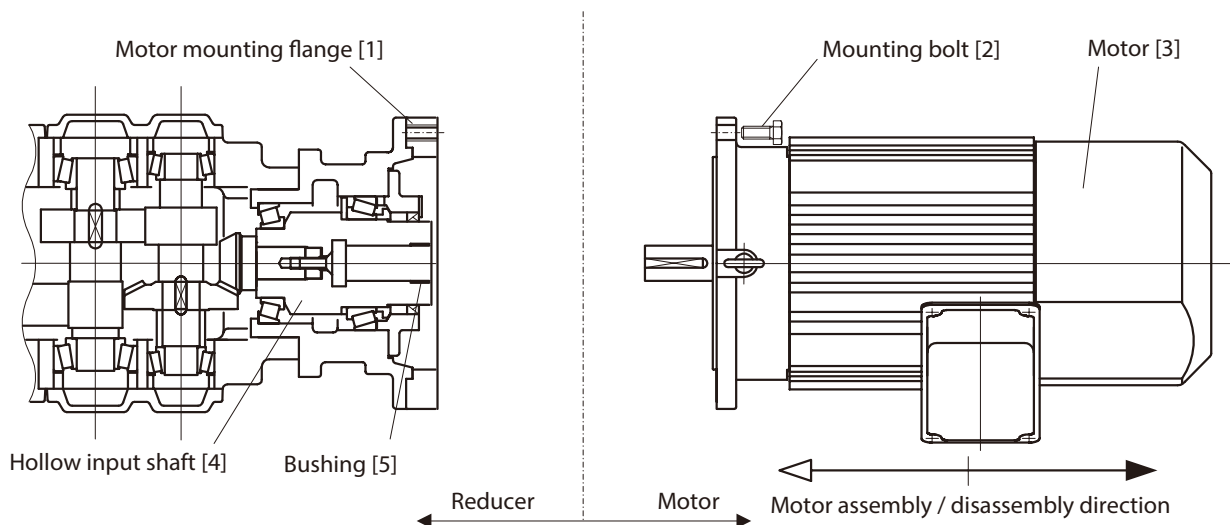


Fig. 9-1

Disassembling procedure

- (1) Remove mounting bolts [2].
- (2) Separate motor [3] from gear reducer.

Carefully handle them not to touch the edge of key and the output shaft end of bushing [5] and motor [3]; otherwise, coating of bushing [5] may be come off.

Assembling procedure

- (1) Install gear part to where motor [3] would be easily mounted..
- (2) Carefully slide motor [3] into position in the gear reducer.
- (3) Adjust phases of motor [3]'s output shaft key and of hollow input shaft [4]'s keyway.
- (4) Apply grease t output shaft of motor [3] and insert it into hollow input shaft [4] s lowly.
Carefully handle them not to touch the edge of key and the output shaft end of bushing [5]. and motor [3]; otherwise, coating of bushing [5] may be come off.
- (5) Check whether motor [3] is properly inserted and tighten installation bolt [2] to fix motor [3] with flange for motor.

9-2 Disassembling / Assembling of motor

Please pay particular attention to followings when motor's disassembled or assembled

- (1) Carefully handle bearing and winding not to be adhered with dust and liquid.
- (2) Apply a little bit amount of adhesive to outer diameter of bearing in the case of overloading usage such as large loading fluctuations and vibration (Recommended adhesive: Loctite 242 or 271).
- (3) After removing old non-drying liquid gasket, apply new one.
- (4) Make sure that there are no abnormalities by rotating with hands before the trial run.


10. Troubleshooting **COMMON**

⚠ CAUTION

- Identify any abnormalities during operation and take appropriate corrective action outlined in this maintenance manual. Do not operate the unit until corrective action has been taken.



If any abnormal condition occurs, refer to Table 10-1, 10-2 and promptly take appropriate measures.
If these actions do not solve the issue, immediately contact the nearest authorized maintenance shop.

Table 10-1 Troubleshooting

Problem		Cause	Correction
The motor will not operate under no load 		Power failure	Contact the electric power company.
		Defective electric circuit	Check the circuit.
		Blown fuse	Replace the fuse.
		Protective device is operating	Fix the problem and recover.
		Load locking	Check the load and safety device.
		Poor switch contact	Adjust the contact unit.
		Motor stator coil disconnect	Confer with authorized maintenance shop.
		Bearing damage	Confer with authorized maintenance shop.
		3-phase is functioning as single-phase	Check the power supply with a voltmeter. Check the motor, transformer coil, contactor, fuse, etc. and repair or replace them.
The motor rotates without a load but the slow speed shaft does not rotate		Damage to gear/shaft due to overload	Confer with authorized maintenance shop.
The output shaft turns without a load When a load is applied	The switch overheats	Insufficient switch capacity	Replace with specified fuse.
		Overload	Decrease the load to the specified value.
	Fuse tripping	Insufficient fuse capacity	Replace with specified fuse.
		Overload	Decrease the load to the specified value.
	The speed will not increase and the motor is overheating	Voltage drop	Contact the electric power company.
		Overload	Decrease the load to the specified value.
	It stops	Short-circuited motor stator coil	Confer with authorized maintenance shop.
		The key is not inserted	Insert key.
		Bearing burnout	Confer with authorized maintenance shop.
	The motor runs in the reverse direction		Poor adjustment of protection device
The motor runs in the reverse direction		Wiring error	Change the connection.
Fuse tripping		The lead wire is short circuited.	Confer with authorized maintenance shop.
		Poor contact between motor and starter	Make good connection.
Excessive temperature rise		Overload	Decrease the load to the specified value.
		Voltage drop or rise	Contact the electric power company.
		The ambient temperature is high	Improve the ventilation method.
		Damaged bearing	Confer with authorized maintenance shop.
		Damage to gear/bearing due to overload	Confer with authorized maintenance shop.
Oil leakage	Oil leaks from the slow/high speed shaft.	Damage to oil seal	Confer with authorized maintenance shop.
		Scratches or abrasion on the shaft where the sealing lip touches	Confer with authorized maintenance shop.
	Oil leaks from the split line of housing.	Loose bolt	Tighten the bolt to proper torque.
	Leakage of oil/grease into motor	Damage to oil seals, or slinger collar	Confer with authorized maintenance shop.
Excessive oil supply		Remove oil.	

COMMON 10. Troubleshooting

Table 10-2 Troubleshooting

Problem		Cause	Correction
Abnormal motor sounds		Gear, shaft, bearing damage	Confer with authorized maintenance shop.
		Warping of housing because the installation surface is not flat	Make the installation base flat or make adjustment using liners, etc.
		Resonance due to insufficient rigidity of installation base	Reinforce the installation base to increase rigidity.
		Misalignment of shaft with driven machine	Align the shaft centers.
		Transmission of vibration from the driven machine	Individually operate the products to check the source of the sound.
Abnormal motor sounds 		Foreign objects have entered	Confer with authorized maintenance shop.
		Bearing damage	Confer with authorized maintenance shop.
 Tripping Inverter	Overcurrent shut-of	Sudden speed changes	Increase the time for speed changes.
		Extreme load fluctuation	Decrease load fluctuation.
	Overcurrent due to ground fault	Ground fault on out side	Take measures to prevent ground fault.
	Direct current overcurrent	Short on output side	Take measures to prevent short. Inspect wiring.
	Regenerative overvoltage shut-of	Sudden speed reduction	Increase the time for speed reduction. Decrease brake frequency.
Thermal operation	Overload	Overload	



11-1 Reducer construction

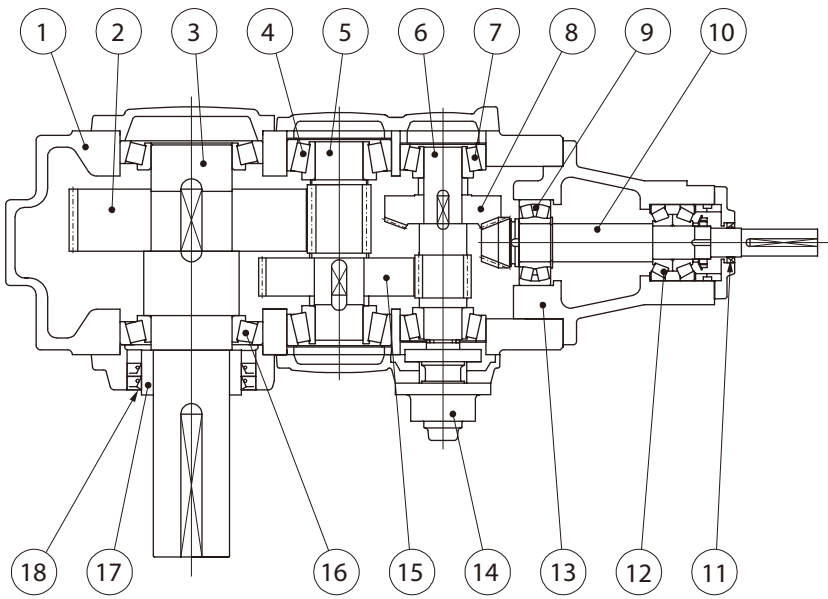


Fig.11-1 Right angle shaft triple reduction reducer construction

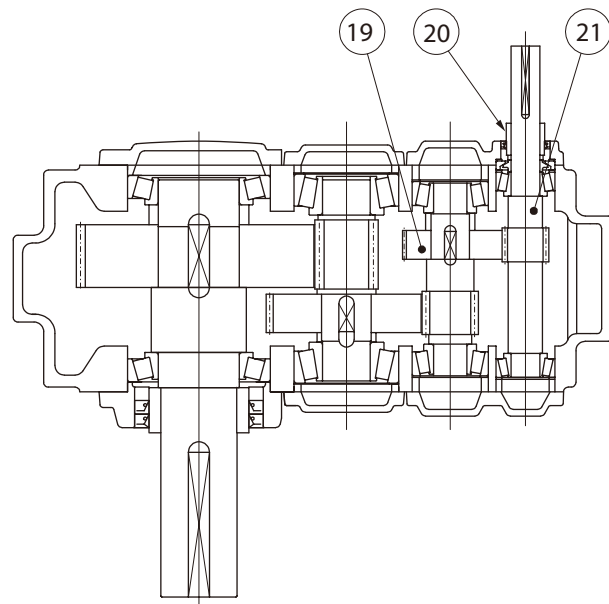


Fig.11-2 Parallel shaft triple reduction reducer construction

Table 11-1 Main Parts

Ref. No.	Part name	Ref. No.	Part name	Ref. No.	Part name
1	Housing	9	Spherical roller bearing	17	Collar
2	Helical gear	10	Bevel pinion shaft	18	Oil seal
3	Slow speed shaft	11	Oil seal	19	Helical gear
4	Taper roller bearing	12	Taper roller bearing	20	Collar
5	Helical pinion shaft	13	Bearing housing	21	Helical pinion shaft
6	Helical pinion shaft	14	Oil pump		
7	Taper roller bearing	15	Helical gear		
8	Bevel gear	16	Taper roller bearing		



11. Construction Drawings

11-2 Drive unit construction

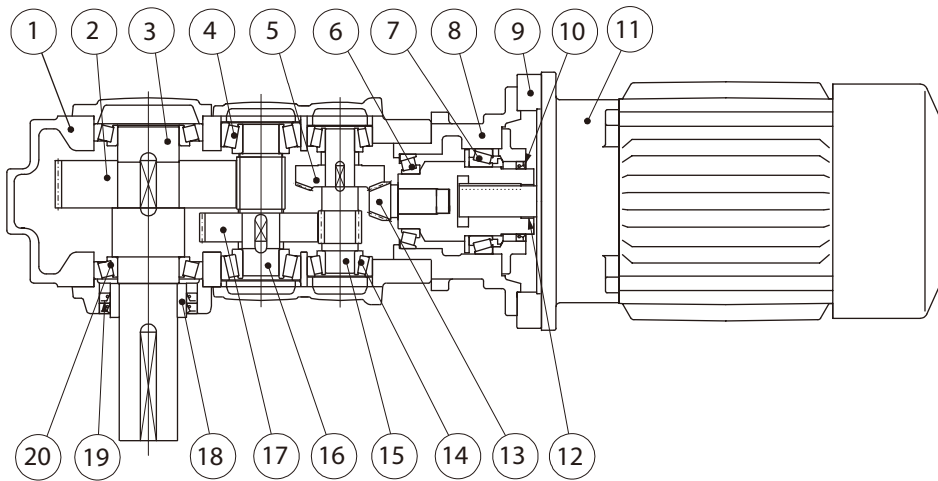


Fig.11-3 Right angle shaft triple reduction drive unit construction

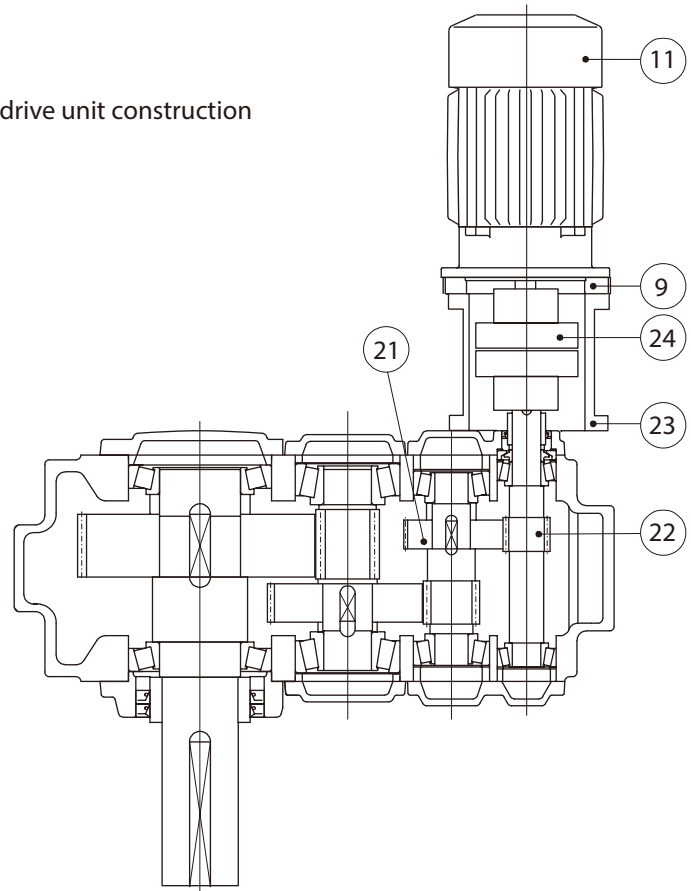


Fig.11-2 Parallel shaft triple reduction drive unit construction

Table 11-2 Main Parts

Ref. No.	Part name	Ref. No.	Part name	Ref. No.	Part name
1	Housing	9	Motor mounting flange	17	Helical gear
2	Helical gear	10	Oil seal	18	Collar
3	Slow speed shaft	11	Motor	19	Oil seal
4	Taper roller bearing	12	Bushing	20	Tapar roller bearing
5	Bevel gear	13	Bevel pinion shaft	21	Helical gear
6	Taper roller bearing	14	Taper roller bearing	22	Helical pinion shaft
7	Taper roller bearing	15	Helical pinion shaft	23	Motor adaptor
8	Bearing housing	16	Helical pinion shaft	24	Coupling



11-3 Construction drawing of motor

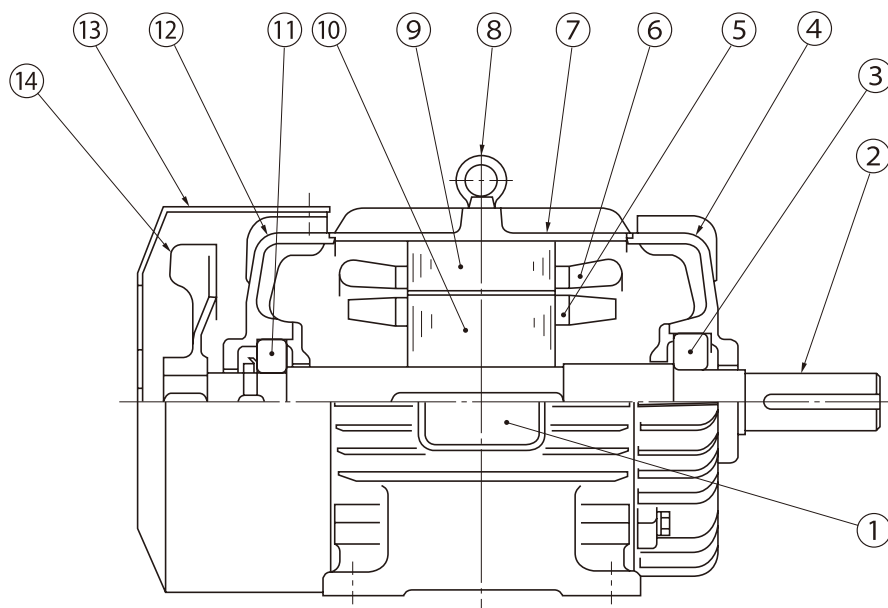


Fig.11-5 Construction of totally enclosed fan cooled squirrel-cage motor

Table 11-3 Main Parts

Ref. No.	Part name	Ref. No.	Part name	Ref. No.	Part name
1	Terminal box	6	Stator winding	11	Bearing outboard
2	Motor shaft	7	Stator frame	12	Bracket outboard
3	Bearing inboard	8	Eyebolt	13	Fan cover
4	Bracket inboard	9	Stator core	14	Fan
5	Rotor conductor short circuit ring	10	Rotor core		

COMMON 12. Oil quantity

12-1 Oil quantity

Table 12-1 Oil quantity

Unit: Liter

Size	Horizontal						Vertical						Upright					
	Right angle shaft			Parallel shaft			Right angle shaft			Parallel shaft			Right angle shaft			Parallel shaft		
	2 stage	3 stage	4 stage	2 stage	3 stage	4 stage	2 stage	3 stage	4 stage	2 stage	3 stage	4 stage	2 stage	3 stage	4 stage	2 stage	3 stage	4 stage
9015	5	-	-	5	5	-	5	-	-	5	6	-	7	-	-	9	11	-
9025	7	-	-	7	8	-	7	-	-	7	8	-	11	-	-	13	15	-
9030	10	10	-	10	10	14	7	9	-	9	10	10	14	16	-	16	20	20
9035	12	12	-	12	13	17	9	12	-	12	14	14	19	21	-	22	25	25
9040	16	16	19	16	19	25	19	18	18	18	18	17	24	29	35	29	35	35
9045	18	18	21	18	21	28	23	22	22	22	22	21	30	36	43	36	43	43
9050	21	21	24	21	24	32	20	21	24	22	25	23	31	35	46	36	45	46
9055	28	28	29	28	29	40	26	30	34	31	35	33	45	46	59	47	59	59
9060	25	29	38	25	33	37	*	28	36	25	28	32	44	56	68	53	68	69
9065	34	33	43	34	38	42	*	35	45	32	35	40	56	65	85	67	85	86
9070	37	45	57	38	49	56	*	46	54	39	44	53	65	83	107	84	106	108
9075	46	52	67	47	59	67	*	59	68	49	56	67	87	100	122	100	120	122
9080	53	60	73	54	64	73	*	60	69	54	57	65	90	115	128	109	130	130
9085	67	75	90	68	80	90	*	80	94	71	79	89	126	144	174	137	176	175
9090	-	120	150	120	120	150	-	120	120	90	90	110	-	-	-	-	-	-
9095	100	155	180	140	155	180	-	145	155	120	120	140	-	-	-	-	-	-
9100	-	180	210	170	180	220	-	170	180	140	140	170	-	-	-	-	-	-
9105	150	220	255	205	225	260	-	210	220	175	175	210	-	-	-	-	-	-
9110	-	250	300	240	260	300	-	230	250	200	200	240	-	-	-	-	-	-
9115	200	310	360	290	325	365	-	290	315	255	255	295	-	-	-	-	-	-
9118	-	350	390	-	350	390	-	-	-	-	-	-	-	-	-	-	-	-
9121	-	460	540	-	470	530	-	-	-	-	-	-	-	-	-	-	-	-
9126	-	460	530	-	470	520	-	-	-	-	-	-	-	-	-	-	-	-
9128	-	350	460	-	390	450	-	-	-	-	-	-	-	-	-	-	-	-
9131	-	510	680	-	550	650	-	-	-	-	-	-	-	-	-	-	-	-
9136	-	500	660	-	540	640	-	-	-	-	-	-	-	-	-	-	-	-

* : Refer to the Table 12-2.

Table 12-2

Size	Ratio		Ratio	
	6.3-9	10-18	8-11.2	12.5-22.4
9060	25	25	-	-
9065	-	-	32	32
9070	35	41	-	-
9075	-	-	47	54
9080	46	55	-	-
9085	-	-	58	68

13. Oil fill and drain plug locations **COMMON**

13-1 Horizontal

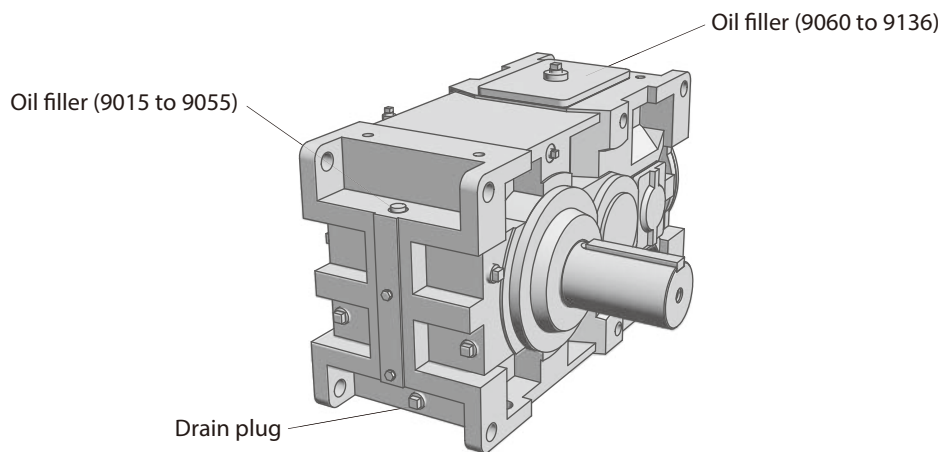


Fig. 13-1

13-2 Vertical

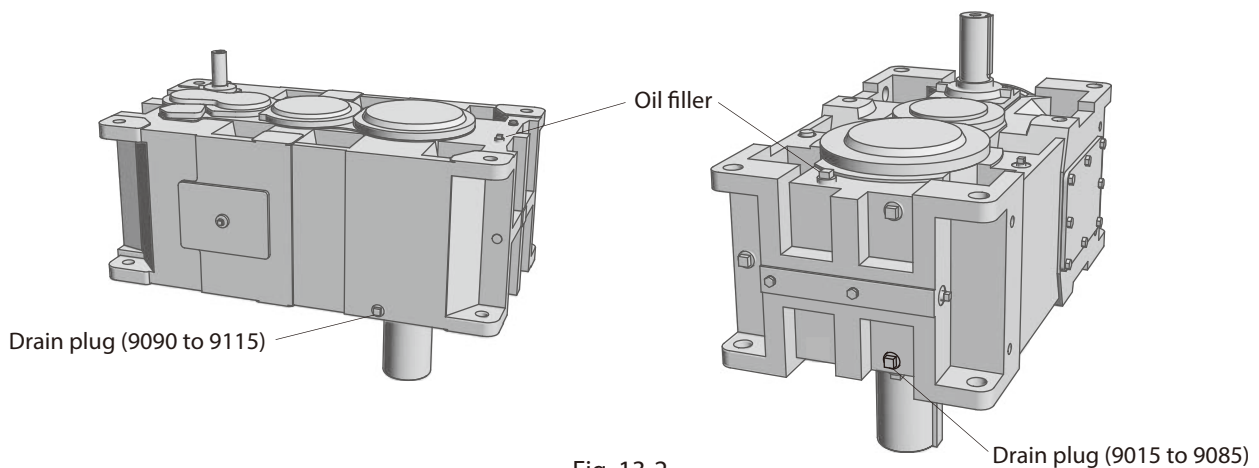


Fig. 13-2

13-2 Upright

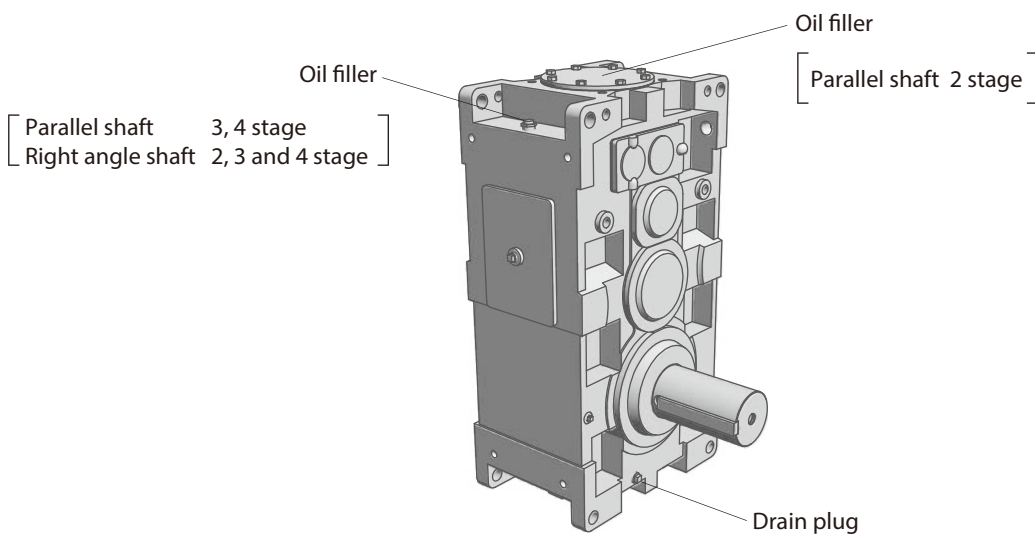


Fig. 13-3

COMMON 13. Oil fill and drain plug locations

13-4 Special right-angle shaft horizontal

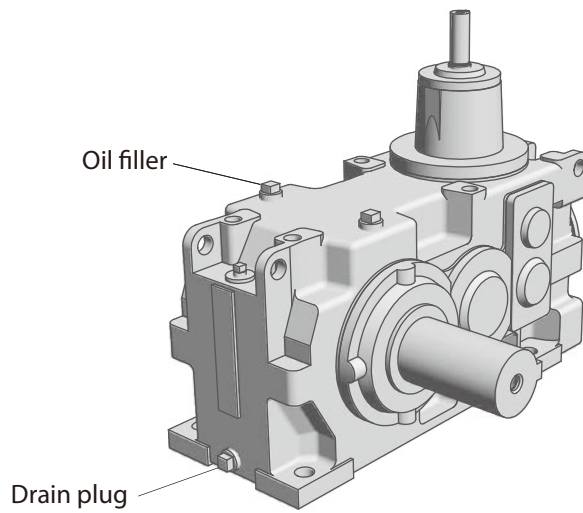


Fig. 13-4

13-5 Special right-angle shaft vertical

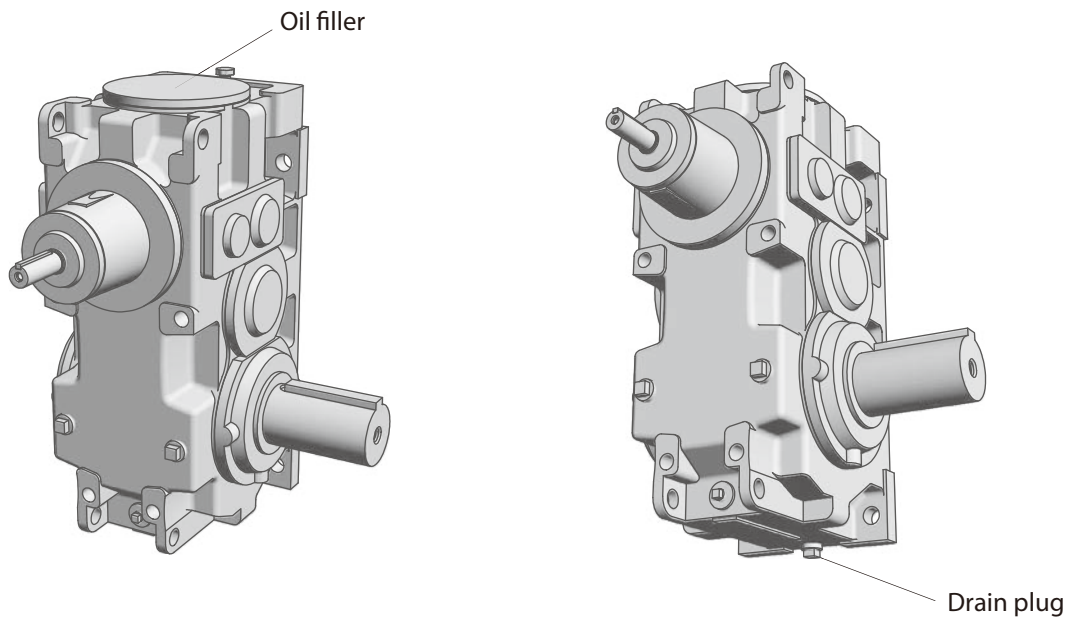


Fig. 13-5

14. Warranty **COMMON**

The scope of warranty of our delivered products is limited only to what we manufactured.

Warranty (period and description)

Warranty Period	The warranty period applies only to new products and represents 18 months after the shipment or 12 months after the actual operation, whichever is shorter.
Description	<p>If the product failed within the warranty period, during which despite a proper mounting, connection and maintenance & administration are followed according to the maintenance manual, and the product is properly run based on the specification on the catalog or under conditions agreed separately, we will repair or provide an alternative product at our discretion for free of charge, except the exclusions below.</p> <p>However, as far as the product is connected with customers' other devices, we will not indemnify those expenses on dismounting from/mounting on the devices, etc. and other associated construction expenses, transportation expenses and opportunity loss and operation loss the customers suffered from, and other indirect damages.</p>
Exclusion from the warranty	<p>The following items will be excluded from the warranty:</p> <ol style="list-style-type: none"> 1. A breakdown resulting from defects in the installation of the product and coupling with other devices, etc. 2. A breakdown resulting from insufficient maintenance & administration and improper handling of the product, including a case that the product is not stored according to our defined storage manual. 3. A breakdown resulting from operation which does not fall within our specification and other operation conditions and use status we hardly can know or a failure caused by the use of lubricant which we do not recommend. 4. A breakdown resulting from defects, special specification, etc of device prepared and connected by customer. 5. A breakdown resulting from disassembly, parts replacement, and modification conducted by the customer (excluding disassembly for inspection and adjustment of the brake gap, for manual release of the brake, and for other purposes guided in the maintenance manual). 6. A breakdown resulting from defects in parts supplied or specified by customers. 7. A breakdown caused by inevitable force including earthquake, fire, flood disaster, salt damage, gas damage, and lightning strike, etc. 8. Natural wear and tear, abrasion, and deterioration of such relevant consumable parts as a bearing and oil seal, etc. under normal usage. 9. A breakdown caused for reasons not attributable to each of the above item.

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Specifications, dimensions, and other items are subject to change without prior notice.