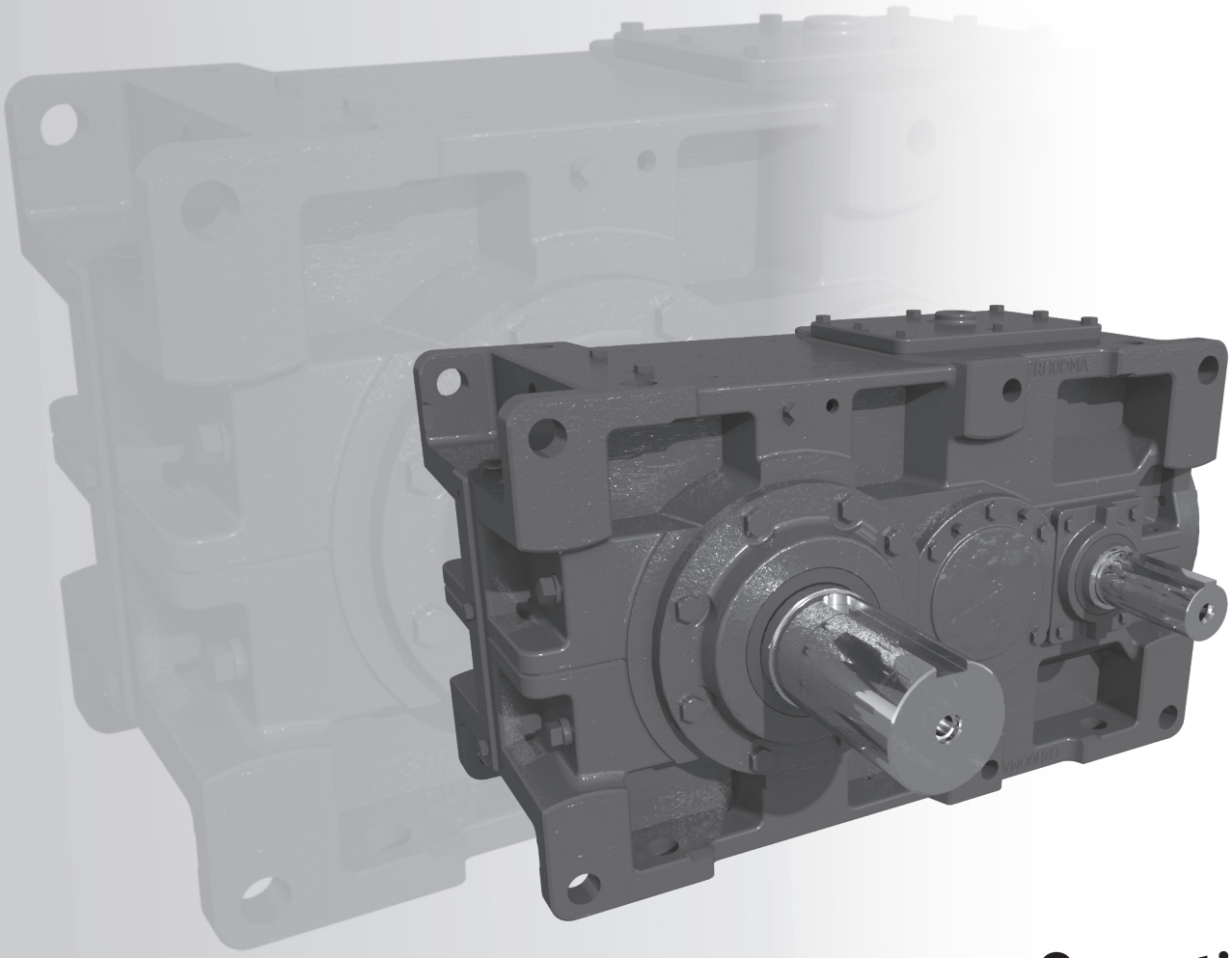
Sumitomo Drive Technologies

Paramax® 9000



Operation and Maintenance Manual

Sumitomo Machinery Corporation of America

07.901.60.013 Paramax O&M 2026

Table of Contents

Safety Precautions 1
Inspection and Storage 2
Transport 3
Nomenclature 4
Standard Speed 5
Installation 6
Connecting to Machinery 8
Operation 11
Lubrication 12
Daily Inspection 18
Construction Drawings 19
Parts Maintenance 25
Disassembly / Assembly 25
Troubleshooting 26

Addendums

Determining Proper Oil Level 28
Taconite and Labyrinth Seal Lubrication 29
Drywell and Drop Bearing Grease Procedure 30
Assembly - Monobloc Style Housing 31
Assembly - Internal Type Backstops 34
Paramax® Uniminer 37
Drive Package Installation 38

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. 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.

Items described in **CAUTION** may lead to serious danger depending on the situation. Be sure to observe important warnings described within.

DANGER

- Transport, installation, plumbing, operation, maintenance, and inspections must be performed by properly trained technicians ; otherwise, injury or damage to the machine may result
- When the unit is to be used in a system for transport of human beings, a secondary safety device should be installed to guard against accidents that may result in injury, death, or damage to the system.
- When the unit is to be used for an elevator, install a safety device on the elevator side to prevent it from falling; otherwise, serious injury, death, or damage to the elevator may result.

CAUTION

- 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.

- Paramax® reducers are shipped without oil. Before operation, fill with oil according to the instructions in the **Lubrication** section of this manual.

Inspection and Storage

Inspection Upon Delivery

⚠ CAUTION

- In order to avoid injury, verify that the reducer is positioned right-side up **before** unpacking. Some units are not shipped right-side up, so re-positioning may be required.
- Verify that the reducer received matches your order. Installing an incorrect product is may result in personal injury or damage to the system.
- Do not remove rating plate.

Upon delivery of the Paramax® reducer, verify that:

(1) The descriptions on the rating plate match your order.
(2) There were no parts damaged during transport.
(3) All bolts and nuts are firmly tightened.

If there is any doubt that the unit delivered does not match your order, contact the nearest Sumitomo agent, distributor or service office.

Rating Plate Information

① **Speed Reducer Model**

② **Serial Number**

Input Power

③ **Reduction Ratio**

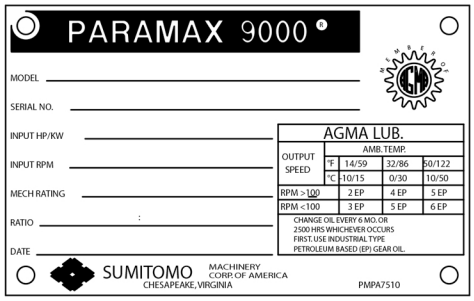


Fig.1 Paramax® Reducer Rating plate

Please have the following information ready when making enquiries:

①MODEL

② SERIAL NO.

③RATIO

Storage

When the Paramax® gearbox is inactive for a long period of time, long-term storage (LTS) preparation is required. It is necessary to prevent Paramax® gearboxes from rust or other degradation. This guideline describes the treatment and required maintenance before and after shipment for various time periods. The explanations apply to the following conditions only:

- Location and method of storage:

Sumitomo Drive Technologies (SDT) strongly recommends the storage area to be dry and relatively free of: humidity, dust, extreme temperature fluctuation and corrosive gas. Generally, the Paramax® gearbox is to be stored indoors, in an ordinary factory or a warehouse. The unit should be wrapped in plastic along with desiccant. The unit should be sealed while in storage and desiccant should be replaced periodically to keep inside of box dry. Color changing desiccant will aid in identifying when desiccant should be changed. *Consult factory for crating options for external storage.*

- Long-term storage specified with order:

If long-term storage is specified at the time of order entry, a NP-20 [JIS] equivalent rust preventative is sprayed into the Paramax® reducer and the air vent is replaced with a sealing plug before shipping the reducer from SDT factory. External machined surfaces are coated with a suitable NP-19 [JIS] petroleum base corrosion preventative such as "Black Bear Par-Al-Ketone", "Houghton Rust Veto 342", "Daphne Ever Coat No.1" or equivalent.

Long-Term Storage Preparation

The following describes the treatments and maintenance works for the exterior and interior of the Paramax® unit, if unit is to be prepared in the field.

NOTE: The storage time period starts from when the unit is shipped from SDT factory.

Preparation – After reducer is placed in the proper storage location

All storage terms

(1) Make sure appropriate amount of rust preventative NP-20 [JIS] is sprayed into the gearbox (see Table 1). Rotate the shaft of the reducer gearbox by hand to assure complete rust preventative coverage of the interior.
(2) Replace the air vent (if installed) and close the air vent hole with a sealing plug
(3) Apply bearing grease to completely cover the externally visible shaft seals. Seals can deteriorate if exposed to higher temperatures and UV rays. A proper grease layer covering would act as a barrier to protect it from deterioration and foreign particle infiltration. SDT recommends "Beacon EP2", "Mobil-Plex 48" or equivalent NLGI #2 for this purpose.

Storage (cont.), Transport

(4) Apply corrosion preventative coating to cover the external machined surfaces (e.g. input and output shafts, screw holes, mounting surface) using "Black Bear Par-Al-Ketone", "Houghton Rust Veto 342" or any other NP-19 [JIS] equivalent as recommended by SDT.

(5) Cover the reducer and shafts completely with waterproof plastic or better shielding material so the reducer is protected from dust, water and any substance that may be harmful to the reducer and seals. Desiccant between gearbox and plastic shall keep the unit dry from surrounding moisture.

Maintaining Storage Integrity

Storage term more than 3 months

NOTE: The following procedures (1) ~ (6) shall be repeated at least **every 3 months**

(1) Inspect seals and replace them if necessary. If the seal body or lip(s) show any of the following defects then the seal should be replaced **immediately**: tear (crack), delamination, porosity (blister) contamination or deformation.

(2) Manually turn the input or high speed shaft until the output or low speed shaft has made at least 3 complete revolutions; Min. No. of high speed shaft rotations required = 3 x reducer ratio (see Paramax® reducer nameplate).

(3) Verify that there is no abnormal sound and the shafts rotate properly and smoothly. Contact the nearest SDT agent, distributor, or sales office if you observe any abnormality.

(4) Apply bearing grease to completely cover and shield the shaft seals. SDT recommends "Beacon EP2", "Mobil-Plex 48" or equivalent for this purpose.

(5) Examine corrosion preventative coating on machines surfaces and reapply if necessary.

(6) Inspect the waterproof barrier and desiccant and replace if necessary.

NOTE: The following procedures (7) ~ (8) shall be repeated at least **every 6 months**

(7) Drain the rust preventative completely and make sure the appropriate amount of rust preventative NP-20 [JIS] is sprayed again back into the gearbox (see Table 1). Do not use a different rust preventative than what has been used previously; else flushing the unit completely before applying a new type will be required. Rotate the shaft of the reducer gearbox by hand to assure complete rust preventative coverage of the interior. The rust preventative usually protects the internal components against rust for a period of up to 6 months; it therefore must be replaced on a regular basis when long-term storage of more than 6 months is required.

Table 1: Quantity of rust preventative

Reducer Size	9015-9035	9040-9055	9060-9075	9080-9095	9100-9118	9121-9136
Quantity (gal.)	0.1	0.15	0.25	0.5	1	2

(8) Replace the air vent (if installed) and close the air vent hole with a sealing plug.

Operation After Storage

CAUTION! Do not operate the reducer with the rust preventative oil. Drain the rust preventative and fill with recommended lubricant (see SDT specifications of your Paramax® unit) before operating.

(1) Oil seals deteriorate when exposed to dirt, high temperatures and UV rays. Inspect the oil seals before operating the Paramax® reducer and if necessary have them replaced. If the seal body or lip(s) show any signs of tear (crack), delamination, porosity (blister) contamination or deformation then the seal should be replaced immediately by a qualified technician/mechanic.

(2) After starting the reducer gearbox, verify that there is no abnormal sound, vibration, or temperature rise during operation. Contact the nearest SDT agent, distributor, or sales office if you observe any abnormality.

Transport

⚠ DANGER

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

⚠ CAUTION

- Exercise ample care so as not to drop the reducer. If a hanging bolt or hole is provided, be sure to use it. After mounting a Paramax® reducer to the equipment, do not hoist the entire machine using the hanging bolt or hole; otherwise, personal injury or damage to the equipment and/or lifting device may result.
- Before hoisting, refer to the rating plate, crate, outline drawing, catalog, etc. for the weight of the Paramax drive or reducer. Never hoist a unit that exceeds the rating of the crane of other mechanism being used to lift it; otherwise, personal injury or damage to the equipment and/or lifting device may result.

Nomenclature

Standard Model

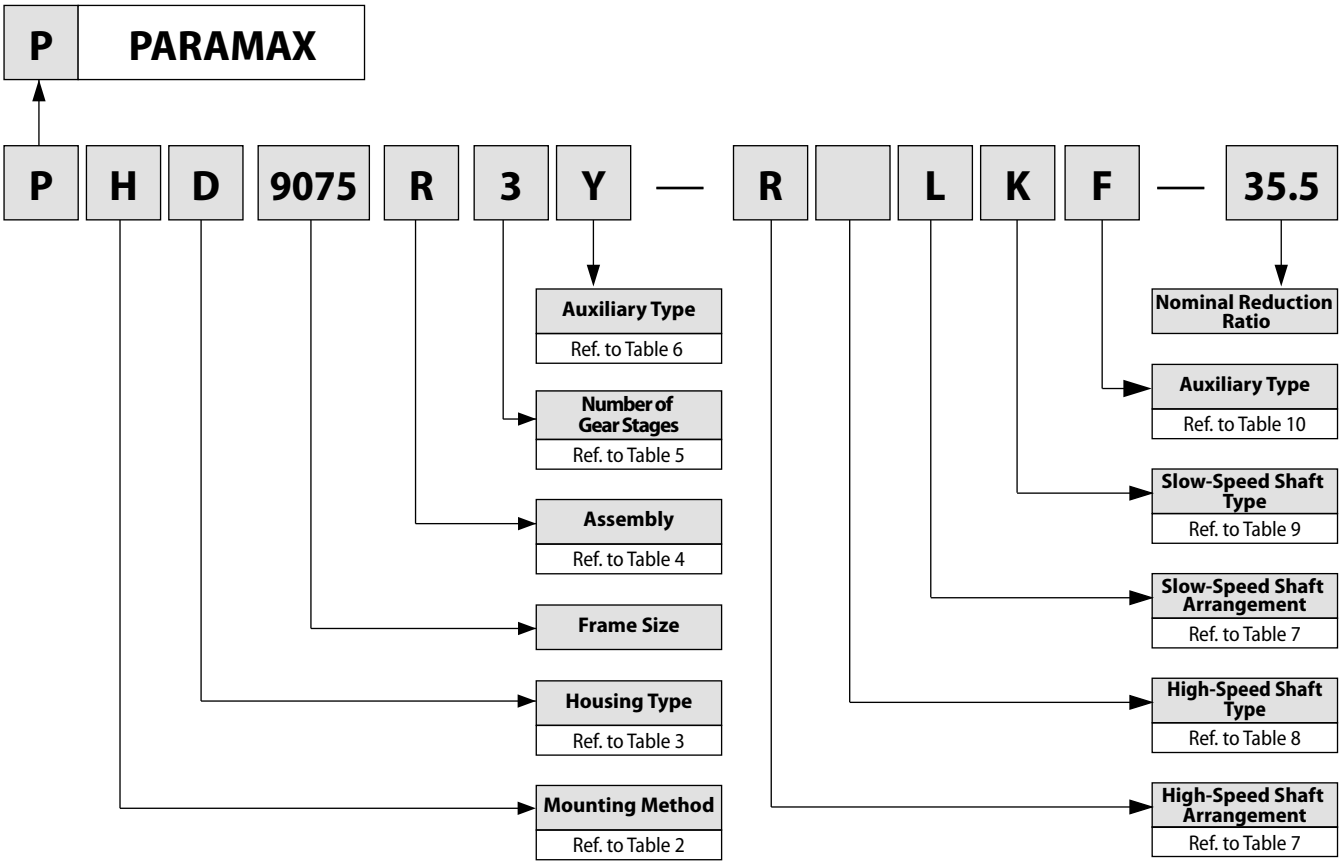


Table 2

Mounting method	
H	Horizontal
V	Vertical
W	Upright
R	Upright Flipped Over
F	Horizontal/Upside Down
T	Vertical/Upside Down

Table 3

Housing type	
A	Mono-block housing
D	Split housing
B	Special split housing

Table 4

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

Table 5

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

Table 6

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 duty LS bearing
J	Reverse wall mount
U	Ceiling mount
D	Drop Bearing - Light OHL
L	Drop Bearing - Heavy OHL
H	Thrust bearing

Table 7

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 is depended on the position of Bevel gear.

Table 8

High-Speed Shaft	
Blank	Solid shaft
M	Hollow Input with Motor (Right Angle Only)
Y	Hollow input shaft with flange (right angle shaft only)
J	With high speed adapter

Table 9

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

Table 10

Auxiliary Type	
F	1 Radial fan
G	1 Radial fan (opposite side)
B	Backstop
FB	1 Radial fan + Backstop
E	Immersion Oil Heater
C	Cooling Coil

Standard Speed

Input Speed

This manual shows the standard lubrication system when the input speed is within the standard input speed range (Refer to Table 11). When the input speed exceeds the standard input speed range, consult factory after checking the operating condition in detail. The lubrication system is determined according to the operating condition.

Gearbox

This manual is applied to the standard gearbox. Lubrication system for specially designed gearboxes may be completely different from the standard lubrication system. Consult the factory for the lubrication system of upright mounted gearboxes (W).

Table 11. Standard Speed Table

Mounting	Shaft Position	Number of Gear Stages	Gearbox Size	Lubrication	Input Speed (r/min) 200 500 1000 1500 1800
Horizontal Mounting	Parallel Shaft	Double Reduction	9015 ~ 9055	Oilbath	
			9060 ~ 9085	Splash Lubrication	
			9090 , 9095		
			9100 , 9105		
			9110 , 9115		
		Triple Reduction	9015 ~ 9055	Oilbath	
			9060 ~ 9085	Splash Lubrication	
			9090 ~ 9115		
		Quadruple Reduction	9030 ~ 9055	Oilbath	
			9060 ~ 9085	Splash Lubrication	
			9090 ~ 9115		
	Right Angle Shaft	Double Reduction	9015 ~ 9055	Oilbath	
			9060 ~ 9075	Splash Lubrication	
			9080 , 9085		
			9095	Forced Lubrication (Electric Pump)	
			9105 , 9115		
		Triple Reduction	9030 ~ 9055	Oilbath	
			9060 ~ 9085	Splash Lubrication	
			9090 , 9095		
			9100 ~ 9115		
		Quadruple Reduction	9040 ~ 9115	Oilbath	
Vertical Mounting	Parallel Shaft	Double Reduction	9015 ~ 9085	Forced Lubrication (Shaft Driven Pump)	
			9090 , 9095	Forced Lubrication (Electric Pump)	
			9100 , 9105		
			9110 , 9115		
		Triple Reduction	9015 ~ 9085	Forced Lubrication (Shaft Driven Pump)	
			9090 ~ 9115	Forced Lubrication (Electric Pump)	
		Quadruple Reduction	9030 ~ 9105	Forced Lubrication (Shaft Driven Pump)	
			9110 , 9115	Forced Lubrication (Electric Pump)	
	Right Angle Shaft	Double Reduction	9015 ~ 9055	Forced Lubrication (Shaft Driven Pump)	
			9060 ~ 9075		(Note 4)
			9080 , 9085		(Note 4)
		Triple Reduction	9030 ~ 9085		
			9090 , 9095		
			9100 ~ 9115	Forced Lubrication (Electric Pump)	
		Quadruple Reduction	9040 ~ 9115	Forced Lubrication (Shaft Driven Pump)	

Notes: 1. Standard input speed range is indicated by unshaded cells.

2. Consult factory for non-standard lubrication or input speed indicated by shaded cells.

3. Lubrication may be changed when heat capacity, noise level, etc. are not within limits of this table.

4. Depending on the reduction ratio and rotation speed, external piping may be necessary. Consult factory for details.

Installation

⚠ DANGER

- Do not operate a standard unit in an explosive atmosphere; electric shock, personal injury, explosion, fire or damage to the to the equipment may occur.
- Install inverters in a location free from explosive gas; electric shock, personal injury, explosion, fire or damage to the equipment may occur.

⚠ CAUTION

- Do not use the Paramax® reducer for applications with input power and speeds other than those shown on the rating plate. Electric shock, personal injury or damage to the equipment may occur.
- Do not place flammable objects around the reducer; fire may occur.
- Do not place any object around the reducer that will hinder ventilation. Insufficient ventilation can cause excessive heat build-up that may cause burns or fire.
- Do not step on or hang from the reducer; injury may occur.
- Do not touch the shaft, inside the keyway or edge of the motor cooling fan with bare hands; injury may occur.
- When the reducer is used in a food processing application, install an oil pan to protect against oil contamination that may occur during equipment breakdown or failure.

Installation Location

Ambient Temperature:	14 °F to 104 °F (-10 °C to 40 °C)
Ambient Humidity:	85% maximum
Altitude:	3280 ft. maximum (1000 m)
Ambient Atmosphere:	The atmosphere should be free of corrosive gas, explosive gas or steam; well ventilated and dust free.
Location:	Indoors, clean and dry.

- Special reducers are required for installation conditions not described in these guidelines.
- Protect gearbox from exposure to direct sunlight.
- Reducers made for outdoor, explosion-proof or other special conditions are designed to operate under those conditions without any problem.
- Install reducers where inspection, maintenance and repair operations can be performed easily.
- Install reducers on a sufficiently rigid base.

Installation Angle

Install the Paramax® reducer on a level base. (Contact Sumitomo 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 a standard reducer, the installation angle must be within the limits shown in Fig. 2.

- Use installation bolts corresponding to JIS/ISO/ASTM strength class 10.9 or its equivalent.

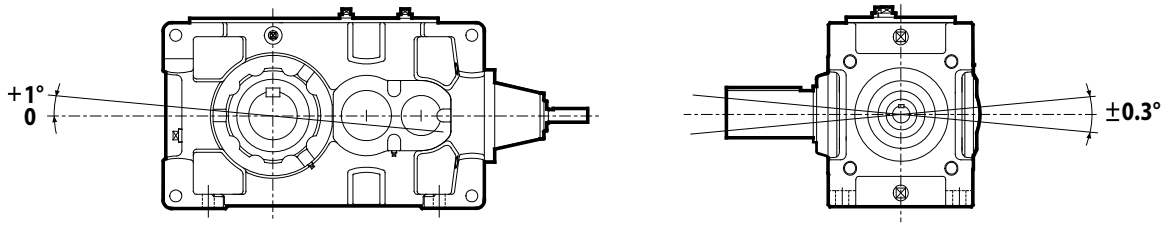


Fig. 2 Installation Angle Limits

Installation (cont.)

Installation Procedure - Reducer with Fan (Parallel Shaft)

⚠ CAUTION

- Avoid contact with sharp edges of keyways and other parts.
- During installation, keep small parts, such as screws, in a container so as not to lose them.
- Handle parts carefully to prevent damage. Avoid contact with water and dust.

Follow these steps to install the reducer:

(1) Remove bolts 1 and 2 and then remove the fan hood 3 (Fig. 3). If there is not enough space to tighten bolt 9,(Fig. 6) then:
   (a) Remove bolt 4 and then fan hood 5 (Fig. 4).
   (b) Remove bolt 6 and then fan rotor 7 (Fig. 5).

(2) Install the reducer on the mounting surface using bolt 9 (Fig. 6). If the fan rotor 7 (Fig. 5) and fan hood 5 (Fig. 4) are removed, then:
   (a) Install fan rotor 7 to the fan hub 8 with bolt 6 (Fig. 5).
   (b) Install fan hood 5 to the reducer with bolt 4 (Fig. 4).

(3) Install fan hood 3 to the reducer with bolts1 and 2 (Fig. 3).

Refer to Table 12 for tightening torques of bolts 1, 2, 4 and 6.

Fig. 3

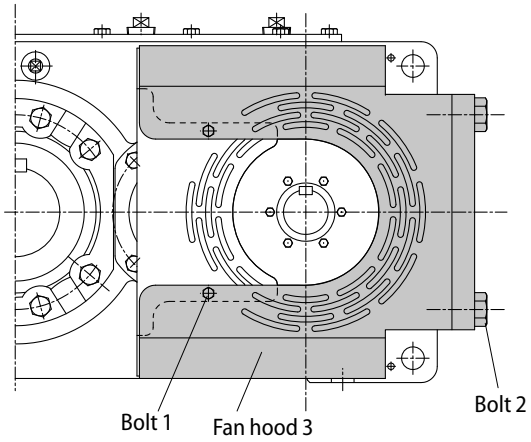


Fig. 4

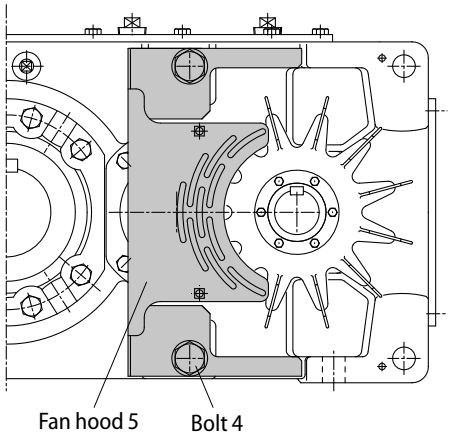


Fig. 5

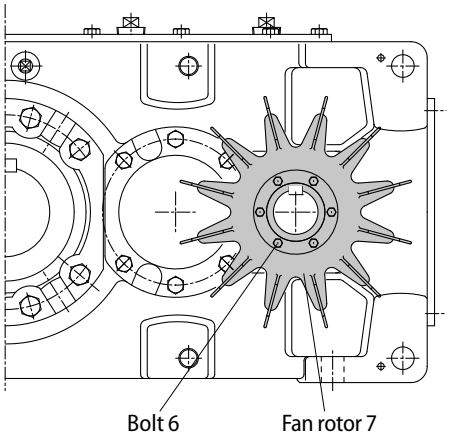


Fig. 6

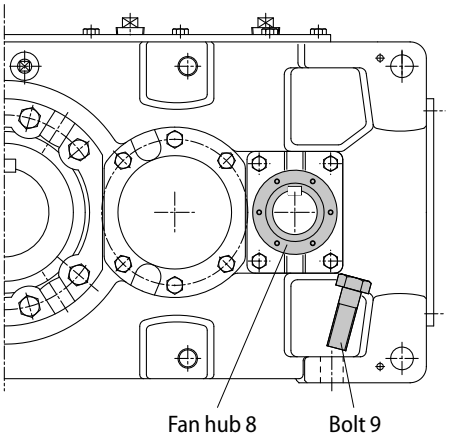


Table 12. Bolt Torque

Bolt	Torque in•lbf (Nm)		Bolt	Torque in•lbf (Nm)	
	Bolt 1, 2, 4	Bolt 6		Bolt 1, 2, 4	Bolt 6
M6		95.6 (10.8)	M20	1682 (190)	—
M8	100 (11.3)	—	M24	2903 (328)	—
M10	347 (39.2)	—	M30	5770 (652)	—
M12	862 (97.4)	—	M36	10090 (1140)	—

Torque tolerance: ±10%

Connecting to Machinery

⚠ CAUTION

- When connecting the Paramax® reducer to a load, confirm that the alignment is within the specified limits shown in the maintenance manual, drawings, catalog, etc. otherwise, damage to the system may occur due to misalignment.
- Correctly tighten all bolts to the torque specified in the drawing, catalog, etc. to prevent system damage from loose parts.
- When a belt is used to connect the reducer with other equipment, check that the belt tension and the pulley alignment are within the specified limits. When the unit is directly connected to other machinery, check that the alignment is within the specified limits; otherwise, the system may be damaged from misalignment.
- Remove the key temporarily attached to the output shaft of the Paramax® reducer when the shaft is free-rotating (i.e. not loaded); otherwise injury may occur.
- Confirm the direction of rotation before connecting the Paramax® reducer with its driven machine. Incorrect direction of rotation may cause injury or damage to the system.
- Install appropriate guard devices around rotating parts; otherwise, injury may occur.
- Position pulleys, sprockets, and gears as close to reducer as possible so the load point will be close to the reducer's vertical centerline (Fig. 9). Consult Catalogs, Data Sheets, or Consult factory for Overhung load limitations before operating.

(1) Coupling

- Follow Manufacturers installation recommendations when installing shaft connections to Sumitomo equipment. The following information is supplied for reference only. Manufacturers installation instructions supersedes any information supplied below.
- The dimensions (A,B and X) illustrated in Fig. 8 must be within the tolerance listed in Table 13.
- When attaching a coupling, do not to apply impact force or excessive thrust to the shaft; otherwise, the bearing may be damaged.
- Shrink fit or shaft-end thread is recommended for mounting (Fig. 8).

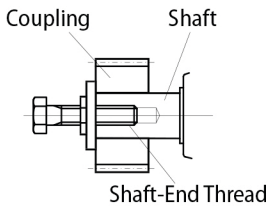


Fig. 7

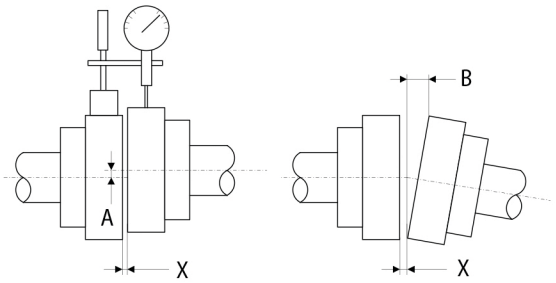


Fig. 8

Table 13. Coupling Alignment Tolerance

Tolerance for A dimension	0.002 in. (0.05mm)
Tolerance for B dimension	0.002 in. (0.05mm)
Tolerance forX dimension	Specified by coupling manufacturer

(2) Chain, Sprocket and Gear

- The chain tension angle must be perpendicular to the shaft of Paramax® reducer.
- The pitch circle of the sprocket and gear must be more than three times of the shaft diameter.

(3) V belt

- Excessive V belt tension will damage the output shaft and bearing. The amount must be specified by V belt manufacturer.
- Eccentricity of parallelism between two pulleys must be less than 0.5° (Fig. 10).
- Use a matched set with identical circumferential length when more than one V belt is used.

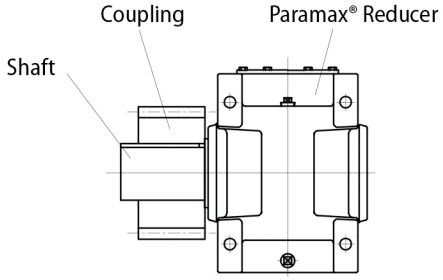


Fig. 9

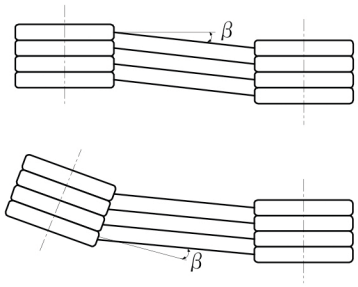


Fig. 10

Connecting to Machinery (cont.)

Hollow Shaft

Shrink Disk Type

The shrink disc has a keyless, shrink fit mechanism that shrinks the hub (HB) mechanically through the tightening locking bolt (ZS),and holds shaft and hub as one fixture (Fig. 11).

Mounting Procedure: (Fig. 12)

(1) Clean and degrease contact surfaces (a) and (c).

(2) Smear surface (c) and (ZS) with "Molykote 321" or its equivalent. However, keep surface (a) as clean as possible (no grease).

(3) Slide O-ring (b) onto the shaft. (only 9090 - 9115)

(4) Mount the reducer on the driven shaft and screw nut (e) until faces (g) and (h) make contact.

(5) Set the shrink disc (k) at dimensions (LV). Tighten locking bolt (ZS) to specified torque (TA) (using a torque wrench). Make sure that both plates are parallel when tightening bolts. After confirming that the shrink disc is set correctly, tighten the bolts with a wrench of appropriate length. Uniformly, tighten bolts clockwise (not diagonally) while keeping both plates parallel. It is recommended to tighten respective bolts by 30 degree each time.

Notes: a. In case of a vertical type unit, mount a thrust washer (B) to prevent the reducer from moving when locking nut (ZS) is loosened (Fig. 11).

b. A high-tension bolt (JIS/ISO/ASTM strength 10.9 or 12.9) is used as a locking bolt (ZS). When replacing it, use one specified by the manufacturer.

Removal Procedure: (Fig. 13)

(1) Loosen locking bolt (ZS) and remove shrink disc (k).

(2) Set thrust washer (f) and hexagon head bolt (n). Remove the reducer from the driven shaft using bolt (m).

Note: Parts (d), (e), (f), (ZY), (m), and (n) are optional. Order these as required.

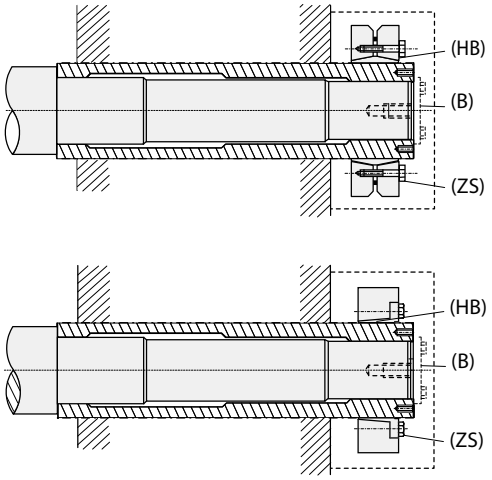


Fig. 11 Full Mounted Position

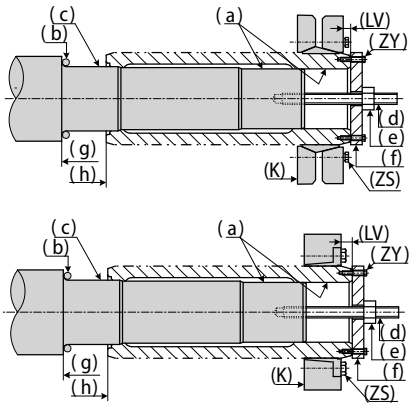


Fig.12 Mounting

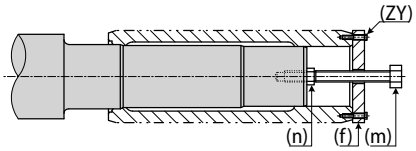


Fig. 13 Removal

Connecting to Machinery (cont.)

Hollow Shaft (cont.)

Keyway Connection

Sizes 9015 - 9055

Mounting Procedure: (Fig. 14)

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

(1) Smear surface of the shaft (e) with "molykote 321" or its equivalent.

(2) Turn nut (b) and slide the reducer over the driven shaft. Use plain washer (c) if necessary.

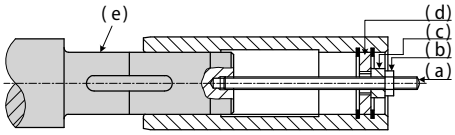


Fig. 14

Securing: (Fig. 15)

(1) After mounting the reducer on the driven shaft, tighten bolt (f). Bolt (f) is not supplied with the unit.

(2) Install cover (g) to protect the bore.

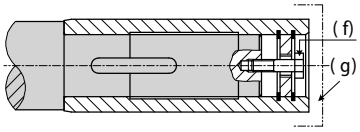


Fig. 15

Removal Procedure: (Fig. 16)

(1) Remove ring (d), mount bolt (n), and reset ring (d).

(2) Attach bolt (J) to ring (d), and turn bolt (J) to disconnect the hollow shaft from the driven shaft.

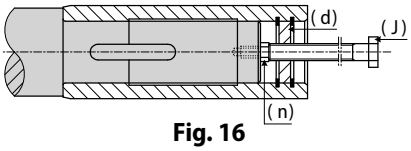


Fig. 16

Special Cases: (Fig. 17)

If the driven shaft has no shoulder when mounting, provide a distance ring (h) for fixing in place. Ring (h) is not supplied with the unit.

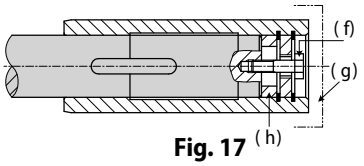


Fig. 17

Sizes 9060 - 9085

Mounting Procedure: (Fig. 18)

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) Smear surface of the shaft (e) with "molykote 321" or its equivalent.

(2) Turn nut (b) and slide the reducer over the driven shaft.

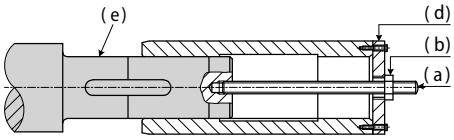


Fig. 18

Securing: (Fig. 19)

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

(2) Install cover (g) to protect the bore.

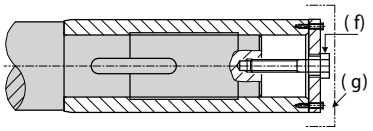


Fig. 19

Removal Procedure: (Fig. 20)

(1) Remove thrust washer (d), mount bolt (n), and reset thrust washer (d).

(2) Attach bolt (J) to thrust washer (d), and turn bolt (J) to disconnect the hollow shaft from the driven shaft.

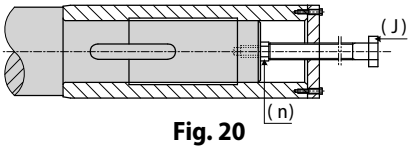


Fig. 20

Special Cases: (Fig. 21)

If the driven shaft has no shoulder when mounting, provide a distance ring (h) for fixing in place. Ring (h)is not supplied with the unit.

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

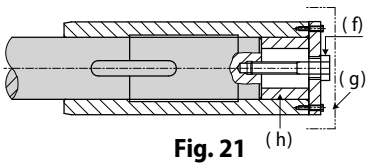


Fig. 21

Connecting to Machinery (cont.), Operation

Hollow Shaft (cont.)

Torque Arm (optional)

The hollow shaft reducer is fixed by the torque arm to prevent the reducer from revolving by an opposite reaction force. Fig. 22 shows the construction of a standard torque arm. Select a torque arm support with proper construction and strength, taking into con- sideration the reaction force of the reducer and the impact load.

Notes: a. The number of disc springs (s) differs according to the size of the reducer.

b. Use bolt (t) and nut (M) classified as JIS/ISO/ASTM strength class 8.8.

c. Adjust Nut (M1) to remove any clearance in the assembly. **Spacer/washer (s) should be able to spin by hand. If not, readjust/loosen M1 nut.** Lock in position using locking nut (M2).

d. Over tightening of the spring washers or incorrect torque arm assembly will create additional stresses and can lead to premature failure.

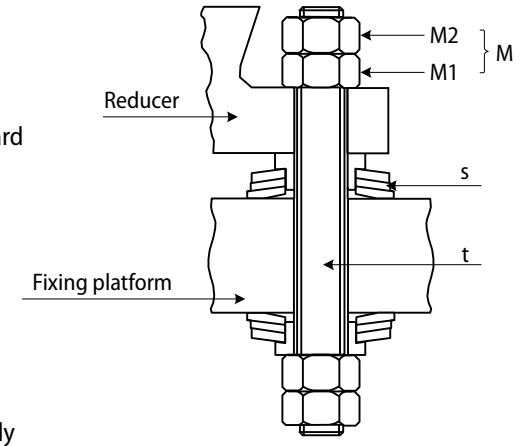


Fig. 22 Standard Torque Arm

Operation

⚠ DANGER

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

⚠ CAUTION

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

- **Paramax® reducers are shipped without oil. Units must be filled with the proper amount of recommended oil prior to start-up.**

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

(1) the wiring is correct

(2) the unit is properly coupled with the driven machine

(3) the foundation bolts are tightened securely

(4) the direction of rotation is correct.

After confirming these items, conduct a trial run with a light load. Begin full operation after confirmng that there is no abnormal sound, vibration and/or temperature rise. Check all items listed in Table 14.

Operation (cont.), Lubrication

Table 14. Initial Start-up and Break-in Period Checklist

Is the reducer generating an abnormal sound or vibration?	**(1)** Is the housing deformed because the installation surface is not level? **(2)** Is insufficient rigidity of the installation base generating excessive noise? **(3)** Is the shaft center aligned with the driven machine? **(4)** Is vibration from the driven machine transmitted to the reducer?
Is the surface temperature of the Paramax® reducer abnormally high?	**(1)** Is the the voltage rise or drop substantial? **(2)** Is the ambient temperature too high? **(3)** Does the current flowing to the motor exceed the rated current shown on the rating plate? **(4)** Is the oil at the specified level?

If any abnormality is observed, stop operation and contact your nearest Sumitomo agent, distributor or sales office.

Lubrication

Lubrication Method

- **Follow all applicable maintenance specifications. Reducer service life may decrease without proper maintenance.**

(1) Refer to Table 15 for the gear lubrication method for your reducer.
(2) Refer to Table 16 for the pages in this manual that cover lubrication maintenance.
(3) Refer to Table 11 on page 5 for standard input speed.

Table 15. Lubrication Method (For standard input speed. Contact Sumitomo if input speed is not standard.)

		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					

		Size	9090	9095	9100	9105	9110	9115	9118	9121	9126	9128	9131	9136
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	-	-	-	-	-	-	-	-	-	-	-	-

* In the case of continuous operation, oil splash or electric pump lubrication is determined by input frequency.

Lubrication (cont.)

Lubrication Method (cont.)

Table 16. Lubrication Maintenance Page Numbers

		Lubrication method	Supply of oil/grease before initial operation after purchase	Page Number				
				Oil/grease change period	Recommended oil / grease	Q'ty of oil/ grease	Disposal of oil/ grease	Parts
Gear	Oil	Oil bath	Self-lubrication	Necessary (Unnecessary for grease)	P. 15	P. 15	P. 16	P. 26
		Oil bath + grease						
		Oil splash lubrication						
		Shaft driven pump lubrication						
		Electric pump lubrication	Forced lubrication					

⚠ CAUTION

- For equipment with a motorized oil pump, run the pump before starting the drive unit or reducer. Start the motor for the reducer after lubricating oil has circulated through the bearing; otherwise, the equipment may be damaged.
- For equipment with a circulating oil system (motorized or mechanical), the oil level will need to be adjusted from the initial fill as oil fills the lubrication lines. We recommend comparing the static condition oil level with the operating level, and adding the difference to the static level.

  Refer to the addendum in this manual for specific lubrication system maintenance.

- Install a flow switch or flow sight to check the circulation of the lubricating oil. Stop the motor of drive unit or reducer if any abnormality occurs.

Lubrication Maintenance

Maximum Oil Change Interval

Table 17. Maximum Oil Change Interval

	Interval		Usage Conditions
Oil Feeding	At Purchasing		———
Oil Change	1st Time	After 500 hrs or six months of operation, whichever comes first.	———
	2nd Time	After 2500 hrs or six months of operation, whichever comes first.	———
	3rd Time or Later	Every 2500 hrs or six months, whichever comes first.	When case oil temperature is 158° F (70° C) or higher
		Every 5000 hrs or one year, whichever comes first.	When case oil temperature is lower than 158° F (70° C)

- Please consult lubrication supplier when atmosphere contains corrosive gas or where ambient temperature changes dramatically.

Table 18. Grease Interval

Interval	Input speed
Every 1500hrs	750 rpm or slower
Every 1000hrs	750 to 1800 rpm

- The grease lubricated models are packed with grease prior to shipment and grease nipples and grease relief plugs are attached. Please check the number of grease nipple and their positions carefully.
- Please check Table 15 for models that require grease lubrication.
- Please see Fig. 23 and 24 (page 15) for grease nipple and grease relief plug positions.
- For units with grease lubricated bearings:
  - **a.** Remove grease relief plug
  - **b.** **Slowly** pump grease into grease nipple **while shafts are rotating**. Sumitomo recommends using a manual, hand grease gun; use extreme caution when using a pneumatic grease gun.
  - **c.** Stop filling with grease and replace the relief plug when grease begins to purge.

Lubrication (cont.)

Lubrication Maintenance (cont.)

Lubricant Selection

- Refer to Table 19 to select the appropriate oil viscosity.
- Refer to Table 20 for recommended lubricants.
- The list of recommended lubricants is not a complete list. The lubricant recommendations are intended to help guide the customer in making a proper lubricant selection and are provided as a customer service benefit to our customers. Contact the lubricant supplier for current oil brands and available quantities.
- **Synthetics** can be considered as long as they are compatible with the various gearbox materials such as plain and alloy steels, bronze, copper, cast iron, acrylic plastic, NBR or FKM seals, denatured alkyde resin (internal Primer Paint), mineral oil with EP additives (test oil residue).
- Proper lubricant selection and maintenance practice is the responsibility of the customer.
- When ambient temperature spans beyond the range for a single viscosity grade oil shown below , it is recommended that the oil be selected for the **maximum** ambient temperature **and** an immersion oil heater be equipped to maintain the minimum temperature for that viscosity oil. If an immersion oil heater is not equipped, **seasonal oil changes will be required** to meet viscosity requirements.

Table 19. Oil Viscosity

Output speed	Ambient temperature			
		14° F (-10° C) to 59° F (15° C)	32° F (0° C) to 86° F (30° C)	50° F (10° C) to 122° F (50° C)
100 rpm or more	ISO* AGMA	VG68 2EP	VG150 4EP	VG220 5EP
100 rpm or less	ISO* AGMA	VG100 3EP	VG220 5EP	VG320 6EP

Table 20. Recommended Lubricants

	Brand	BP	CASTROL			CHEVRON/TEXACO/CALTEX		EXXON MOBIL		SHELL	TOTAL
Gear Oil	ISO VG68 AGMA 2EP	ENERGOL GR-XP-68	ALPHA SP68	OPTIGEAR BM68	TRIBOL 1100/68	MEROPA or *MEROPA XL ISO 68	-	SPARTAN EP68	MOBILGEAR 600 XP68	OMALA S2 G 68	CARTER EP68
	ISO VG100 AGMA 3EP	ENERGOL GR-XP-100	ALPHA SP100	OPTIGEAR BM100	TRIBOL 1100/100	MEROPA ISO 100	-	SPARTAN EP100	MOBILGEAR 600 XP100	OMALA S2 G 100	CARTER EP100
	ISO VG150 AGMA 4EP	ENERGOL GR-XP-150	ALPHA SP150	OPTIGEAR BM150	TRIBOL 1100/150	MEROPA or *MEROPA XL ISO 150	*MEROPA ELITE SYN XM ISO 150	SPARTAN EP150	MOBILGEAR 600 XP150	OMALA S2 G 150	CARTER EP150
	ISO VG220 AGMA 5EP	ENERGOL GR-XP-220	ALPHA SP220	OPTIGEAR BM220	TRIBOL 1100/220	MEROPA or *MEROPA XL ISO 220	*MEROPA ELITE SYN XM ISO 220	SPARTAN EP220	MOBILGEAR 600 XP220	OMALA S2 G 220	CARTER EP220
	ISO VG320 AGMA 6EP	ENERGOL GR-XP-320	ALPHA SP320	OPTIGEAR BM320	TRIBOL 1100/320	MEROPA or *MEROPA XL ISO 320	*MEROPA ELITE SYN XM ISO 320	SPARTAN EP320	MOBILGEAR 600 XP320	OMALA S2 G 320	CARTER EP320
Bearing Grease		ENERGREASE LS EP2	SPHEEROL AP3	OLISTA LONGTIME 3EP	TRIBOL 3020/1000-2	MULTIFAK EP2	-	BEACON EP2	MOBILUX EP2	GADUS S2 V220 2	MULTIS EP2

*Depicts extreme micro-pitting protection with excellent performance results in the FVA 54/7 Load and Endurance Stages

Oil Quantity

Estimated quantities of oil for standard specifications are listed in Table 21 Oil Quantity. The oil quantity shown in the catalog is not exact. Use a dipstick or visible oil gauge to check the oil level.

Oil Replenishment

- Supply oil through the inlet on the top of the main unit. Check the oil level with a dipstick or oil sight gauge (Fig. 23).
- Screw the dipstick to its deepest position to check the oil level; otherwise, the measured oil level will be incorrect (Fig. 24).
- Check oil level when lubricant is close to the lubricant operating temperature - in order to obtain accurate oil level readings. Large oil sumps will have considerable difference between cold and warm oil levels.
- When filling the unit for the first time or after 1 or more week of inoperation, fill or check the lubricant level to the bottom mark on the level gauge. Operate unit at a light load, for approximately 5 minutes, shut down equipment and check and readjust oil level if required.
- If unit is supplied with a lubrication system, it is important, to check the oil level before the lubricant has had time to drain.

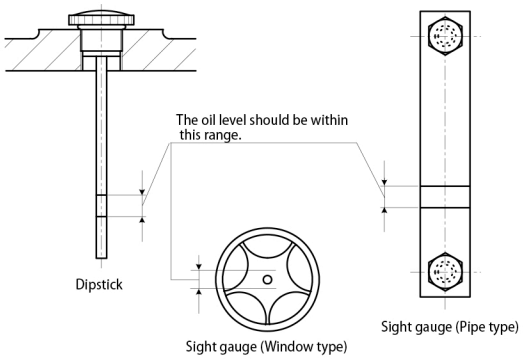


Fig. 23

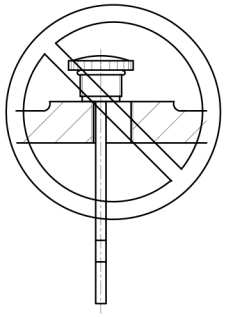


Fig. 24

Lubrication (cont.)

Lubrication Maintenance (cont.)

Oil Replenishment (cont.)

During the oil replenishment process, ensure that loose nuts, bolts washers dust, water and other foreign materials do not enter the reducer. The reducer will not be sufficiently lubricated if the oil level is below the recommended range. However, if the oil level is above the recommended range, the oil temperature will rise and cause the oil to deteriorate (See Fig. 23).

When draining oil from the reducer, remove the drain plug located under the unit and allow the oil to drain while it is still warm. Removing the breather will make draining or replenishing oil easier.

Replenishing Grease

(1) Remove the grease relief plug from the gear housing.
(2) To ensure even distribution, slowly add new grease through the grease fitting while the reducer is running. Continue adding grease until it begins to come out of the port.
(3) Replace grease relief plug

Typical Grease Fitting and Discharge Plug Locations

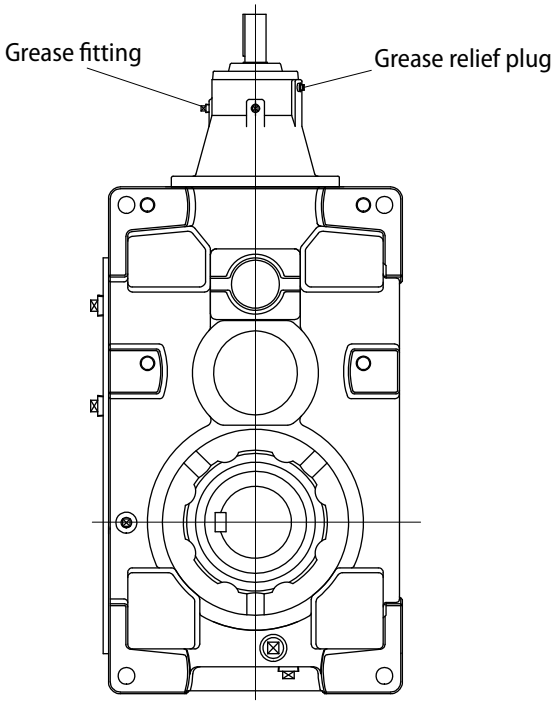


Fig. 25 Reducer Upright Mount

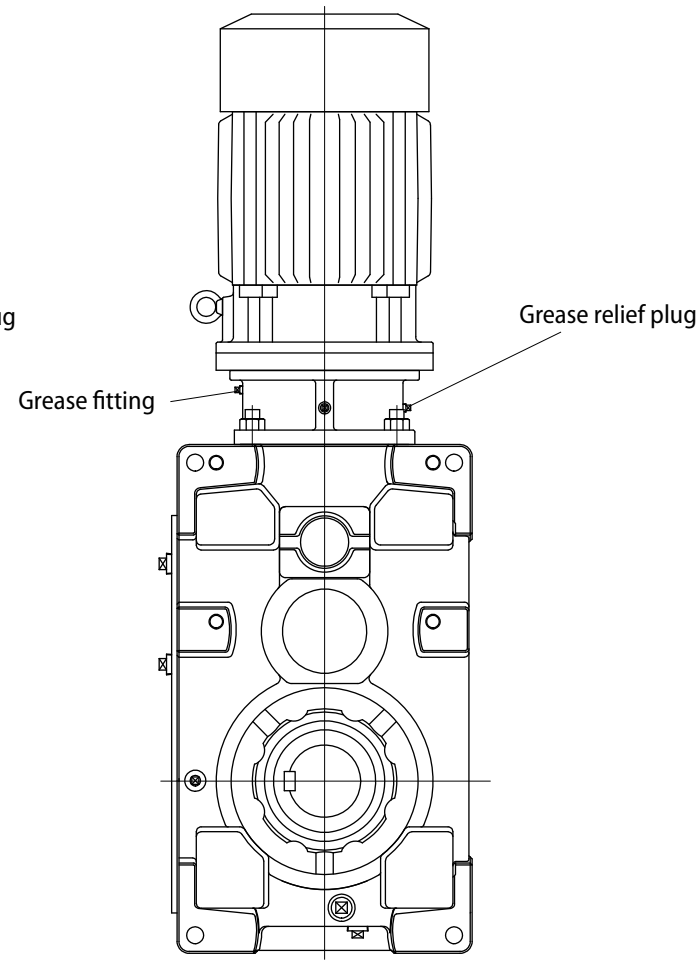


Fig. 26 Drive Unit Upright Mount

Lubrication (cont.)

Oil Quantity

Table 21. Oil Quantity

Units: gallons (liters)

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	1.3 (5)	—	—	1.3 (5)	1.3 (5)	—	1.3 (5)	—	—	1.3 (5)	1.6 (6)	—	1.9 (7)	—	—	2.4 (9)	2.9 (11)	—
9025	1.9 (7)	—	—	1.9 (7)	2.1 (8)	—	1.9 (7)	—	—	1.9 (7)	2.1 (8)	—	2.9 (11)	—	—	3.4 (13)	4.0 (15)	—
9030	2.6 (10)	2.6 (10)	—	2.6 (10)	2.6 (10)	3.7 (14)	1.9 (7)	2.4 (9)	—	2.4 (9)	2.6 (10)	2.6 (10)	3.7 (14)	4.2 (16)	—	4.2 (16)	5.3 (20)	5.3 (20)
9035	3.2 (12)	3.2 (12)	—	3.2 (12)	3.4 (13)	4.5 (17)	2.4 (9)	3.2 (12)	—	3.2 (12)	3.7 (14)	3.7 (14)	5.0 (19)	5.6 (21)	—	5.8 (22)	6.6 (25)	6.6 (25)
9040	4.2 (16)	4.2 (16)	5.0 (19)	4.2 (16)	5.0 (19)	6.6 (25)	5.0 (19)	4.8 (18)	4.8 (18)	4.8 (18)	4.8 (18)	4.5 (17)	6.3 (24)	7.7 (29)	9.3 (35)	7.7 (29)	9.3 (35)	9.3 (35)
9045	4.8 (18)	4.8 (18)	5.6 (21)	4.8 (18)	5.6 (21)	7.4 (28)	6.1 (23)	5.8 (22)	5.8 (22)	5.8 (22)	5.8 (22)	5.6 (21)	7.9 (30)	9.5 (36)	11 (43)	9.5 (36)	11 (43)	11 (43)
9050	5.6 (21)	5.6 (21)	6.3 (24)	5.6 (21)	6.3 (24)	8.5 (32)	5.3 (20)	5.6 (21)	6.3 (24)	5.8 (22)	6.6 (25)	6.1 (23)	8.2 (31)	9.3 (35)	12 (46)	9.5 (36)	12 (45)	12 (46)
9055	7.4 (28)	7.4 (28)	7.7 (29)	7.4 (28)	7.7 (29)	11 (40)	6.9 (26)	7.9 (30)	9.0 (34)	8.2 (31)	9.3 (35)	8.7 (33)	12 (45)	12 (46)	16 (59)	12 (47)	16 (59)	16 (59)
9060	6.6 (25)	7.7 (29)	10 (38)	6.6 (25)	8.7 (33)	9.8 (37)	*	7.4 (28)	9.5 (36)	6.6 (25)	7.4 (28)	8.5 (32)	12 (44)	15 (56)	18 (68)	14 (53)	18 (68)	18 (69)
9065	7.7 (29)	8.7 (33)	11 (43)	7.7 (29)	10 (38)	11 (42)	*	9.3 (35)	12 (45)	8.5 (32)	9.3 (35)	11 (40)	15 (56)	17 (65)	22 (85)	18 (67)	22 (85)	23 (86)
9070	9.8 (37)	12 (45)	15 (57)	10 (38)	13 (49)	15 (56)	*	12 (46)	14 (54)	10 (39)	12 (44)	14 (53)	17 (65)	22 (83)	28 (107)	22 (84)	28 (106)	29 (108)
9075	12 (46)	14 (52)	18 (67)	12 (47)	16 (59)	18 (67)	*	16 (59)	18 (68)	13 (49)	15 (56)	18 (67)	23 (87)	26 (100)	32 (122)	26 (100)	32 (120)	32 (122)
9080	14 (53)	16 (60)	19 (73)	14 (54)	17 (64)	19 (73)	*	16 (60)	18 (69)	14 (54)	15 (57)	17 (65)	24 (90)	30 (115)	34 (128)	29 (109)	34 (130)	34 (130)
9085	17 (67)	20 (75)	24 (90)	18 (68)	21 (80)	24 (90)	*	21 (80)	25 (94)	19 (71)	21 (79)	24 (89)	33 (126)	38 (144)	46 (174)	36 (137)	46 (176)	46 (175)
9090	—	32 (120)	40 (150)	32 (120)	32 (120)	40 (150)	—	32 (120)	32 (120)	24 (90)	24 (90)	29 (110)	—	—	—	—	—	—
9095	26 (100)	41 (155)	48 (180)	37 (140)	41 (155)	48 (180)	—	38 (145)	41 (155)	32 (120)	32 (120)	37 (140)	—	—	—	—	—	—
9100	—	48 (180)	55 (210)	45 (170)	48 (180)	58 (220)	—	45 (170)	48 (180)	37 (140)	37 (140)	45 (170)	—	—	—	—	—	—
9105	40 (150)	58 (220)	67 (255)	54 (205)	59 (225)	69 (260)	—	55 (210)	58 (220)	46 (175)	46 (175)	55 (210)	—	—	—	—	—	—
9110	—	66 (250)	79 (300)	63 (240)	69 (260)	79 (300)	—	61 (230)	66 (250)	53 (200)	53 (200)	63 (240)	—	—	—	—	—	—
9115	53 (200)	82 (310)	95 (360)	77 (290)	86 (325)	96 (365)	—	77 (290)	83 (315)	67 (255)	67 (255)	78 (295)	—	—	—	—	—	—
9118	—	92 (350)	103 (390)	—	92 (350)	103 (390)	—	—	—	—	—	—	—	—	—	—	—	—
9121	—	122 (460)	143 (540)	—	124 (470)	140 (530)	—	—	—	—	—	—	—	—	—	—	—	—
9126	—	122 (460)	140 (530)	—	124 (470)	137 (520)	—	—	—	—	—	—	—	—	—	—	—	—
9128	—	92 (350)	122 (460)	—	103 (390)	119 (450)	—	—	—	—	—	—	—	—	—	—	—	—
9131	—	135 (510)	180 (680)	—	145 (550)	172 (650)	—	—	—	—	—	—	—	—	—	—	—	—
9136	—	132 (500)	174 (660)	—	143 (540)	169 (640)	—	—	—	—	—	—	—	—	—	—	—	—

*** : Refer to Table 22.**

Lubrication (cont.)

Oil Quantity (cont.)

Table 22. Oil Quantity – Right Angle Shaft, Two-stage, Units: gallons (liters)

Size	Ratio		Ratio	
	6.3 – 9	10 – 18	8 – 11.2	12.5 – 22.4
9060	6.6 (25)	6.6 (25)	–	–
9065	–	–	8.5 (32)	8.5 (32)
9070	9.3 (35)	11 (41)	–	–
9075	–	–	12 (47)	14 (54)
9080	12 (46)	15 (55)	–	–
9085	–	–	15 (58)	18 (68)

Oil Fill and Drain Plug Locations

Fig. 27 Horizontal

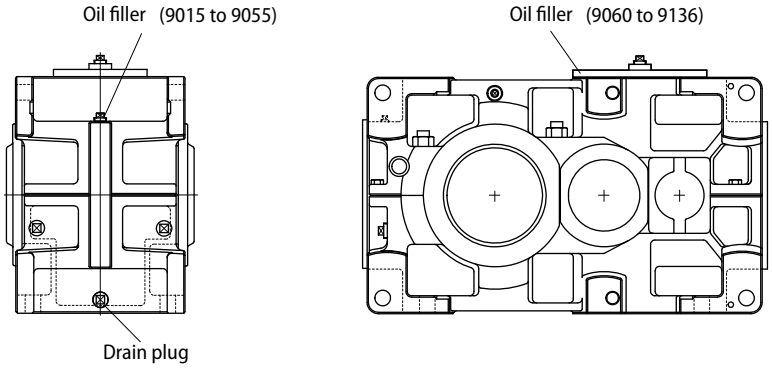


Fig. 28 Vertical

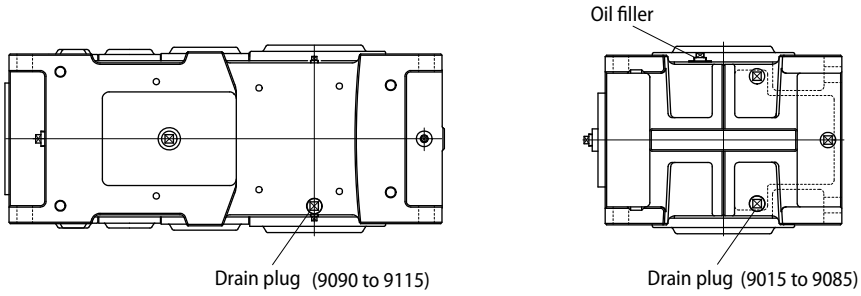
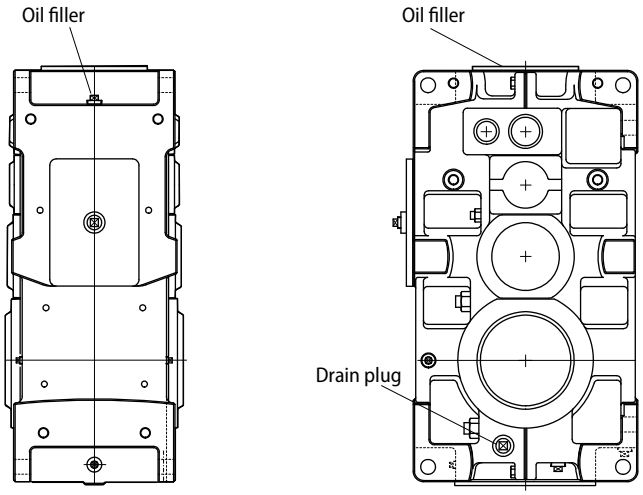


Fig. 29 Upright

Parallel Shaft, Triple Reduction
Parallel Shaft, Quadruple Reduction
Right Angle Shaft, Double Reduction
Right Angle Shaft, Triple Reduction
Right Angle Shaft, Quadruple Reduction



Parallel Shaft, Double Reduction

Daily Inspection

⚠ DANGER

- Do not handle the unit when connected to the power source. Be sure to turn off the power; possible, electric shock may occur.
- Do not touch any rotating parts (output shaft, etc.) during maintenance or inspection of the unit; loose clothing may become caught in these rotating parts and cause serious injury or death.
- Do not disassemble or modify explosion-proof motors; possible, explosion, ignition, electric shock or damage to the equipment may occur.
- The lead-in conditions or an explosion-proof motor must conform to the facilities electrical codes, extension regulations and explosion-proofing guide, as well as the maintenance manual; otherwise, explosion, ignition, electric shock or damage to the equipment may occur.

⚠ CAUTION

- Do not put fingers or foreign objects into the opening of the reducer; otherwise, electric shock, injury, fire or damage to the equipment may result.
- The Paramax® reducer is very hot during operation. Touching the unit with bare hands may cause serious burns.
- Do not touch the terminal when measuring insulation resistance; otherwise, electric shock may occur.
- Do not operate the unit without a safety cover in place to shield rotating parts; otherwise, loose clothing may become caught in the unit and cause serious injury.
- Promptly identify and correct, according to instructions in this maintenance manual, any abnormalities observed during operation. Do not operate until abnormality is corrected.
- Change lubricant according to the maintenance manual instructions. Be sure to use factory recommended lubricant.
- Do not change lubricant during operation or immediate after stopping operation; otherwise, burns may occur.
- Supply/discharge grease to/from the motor bearing according to the maintenance manual instructions. Avoid contact with rotating parts; otherwise, injury may occur.
- Do not operate damaged Paramax® reducer; otherwise, injury, fire or damage to the equipment may occur.
- Sumitomo does not accept any responsibility for damage or injury resulting from an unauthorized modification by the customer.
- Dispose of the Paramax® reducer and/or lubricant as general industrial waste.
- In order to prevent explosion or ignition when measuring the insulation resistance of an explosion proof motor, confirm that there is no gas, steam or other explosive substance around the unit .

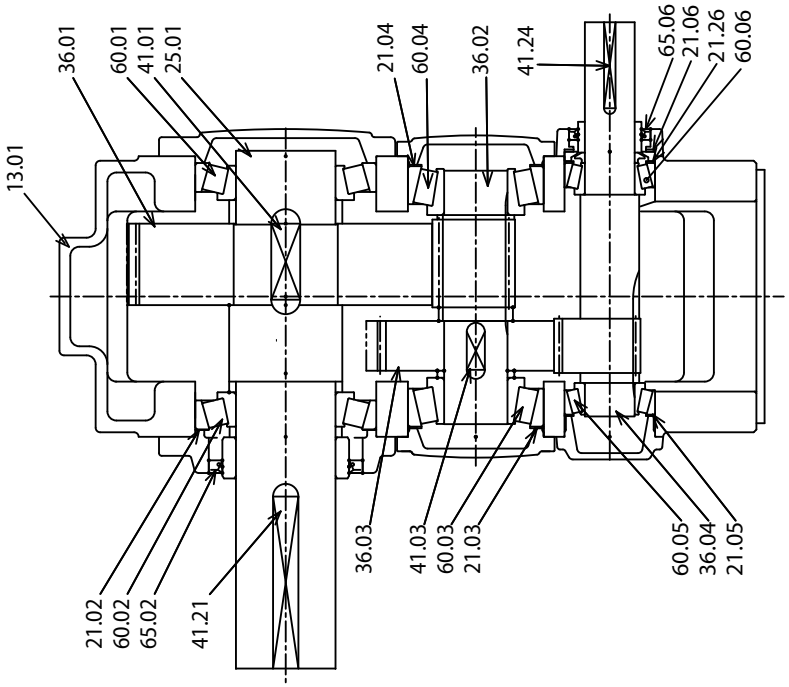
To ensure proper and continued optimum operation, use Table 23 to perform daily inspections. If any abnormality is found during the daily inspection, follow the corrective procedures listed in the **Troubleshooting** section (Page 26). If the abnormality cannot be corrected, contact the nearest Sumitomo agent, distributor or sales office.

Table 23. Daily Inspection Checklist

Inspection Item		Details
Electric Current		Is the current below the rated current shown on the rating plate?
Noise		Are there abnormal sounds coming from the reducer? Is there a sudden change in sound?
Vibration		Is there excessive vibration? Does vibration change suddenly?
Surface Temperature		Is the surface temperature abnormally high (higher than 194° F (90°C))? Does the surface temperature rise suddenly ? *The temperature rise during operation differs according to the model. The difference between the temperature of the gear surface and the ambient temperature may be as high as 176° F (80° C), as long as the temperature is not fluctuating.*
Oil Level (Oil-lubricated model)	At Rest	Does the oil level reach the top line of the oil gauge?
	In Operation	When compared to the oil level at rest, is this level different?
	When Using a Trochoid Pump	Is the oil signal or flow gauge functioning normally? *If functioning abnormally, stop the unit and inspect it; otherwise, inadequate oil will cause poor lubrication of reduction portion, broken pump and fill-up the oil pipe.*
Oil or Grease Leakage		Does oil or grease leak from the gear section?
Foundation Bolt		Are foundation bolts loose?
Chain and V-Belt		Are chain and V-belt loose?

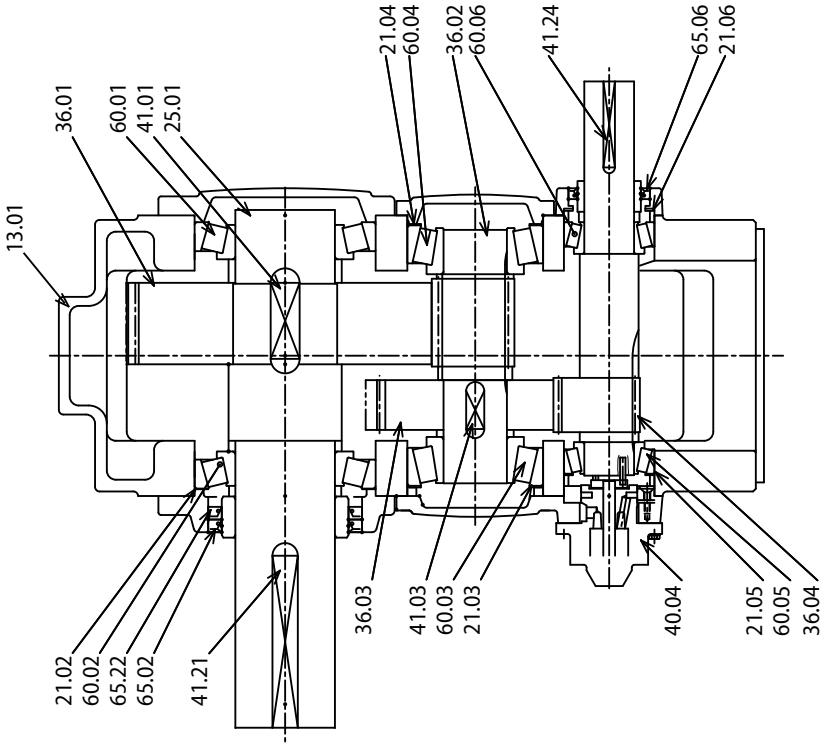
Construction Drawings

Fig. 30 Parallel Shaft, Horizontal - Double Reduction



Ref. No.	Part Name
13.01	Housing
21.02	Shim
21.03	Shim
21.04	Shim
21.05	Shim
21.06	Shim
21.26	Shim
25.01	Low Speed Shaft
36.01	Helical Gear
36.02	Helical Pinion Shaft
36.03	Helical Gear
36.04	Helical Pinion Shaft
40.04	Oil Pump
41.01	Key
41.03	Key
41.21	Key
41.24	Key
60.01	Bearing
60.02	Bearing
60.03	Bearing
60.04	Bearing
60.05	Bearing
60.06	Bearing
65.02	Oil Seal
65.06	Oil Seal
65.22	Oil Seal

Fig. 31 Parallel Shaft, Vertical- Double Reduction



Note: Figures and drawings contained within are for reference only and individual components may be different than those displayed.

Construction Drawings (cont.)

Fig. 32 Parallel Shaft, Horizontal - Triple Reduction

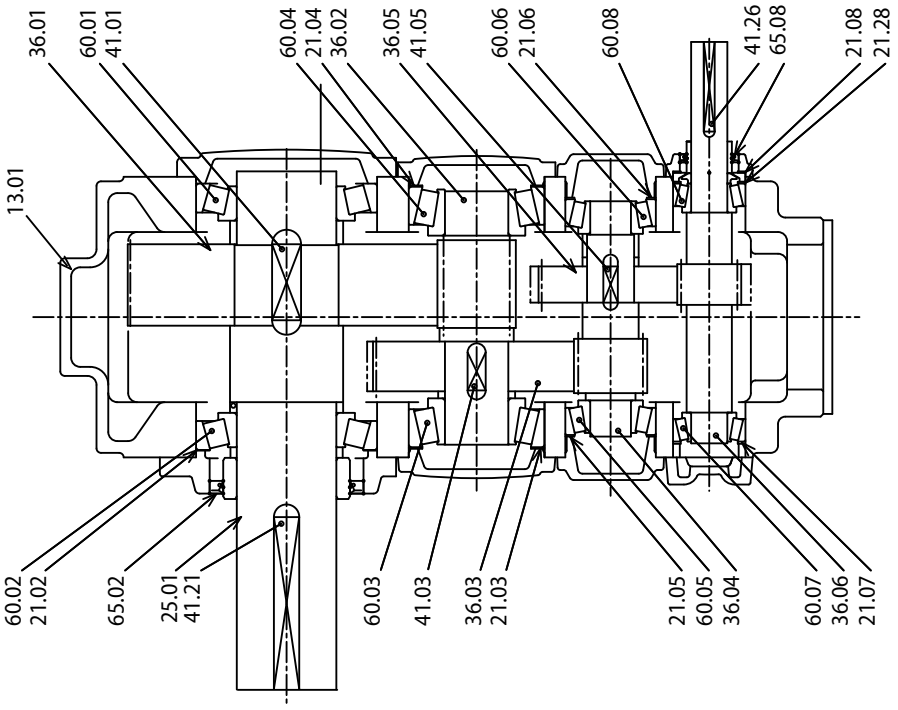
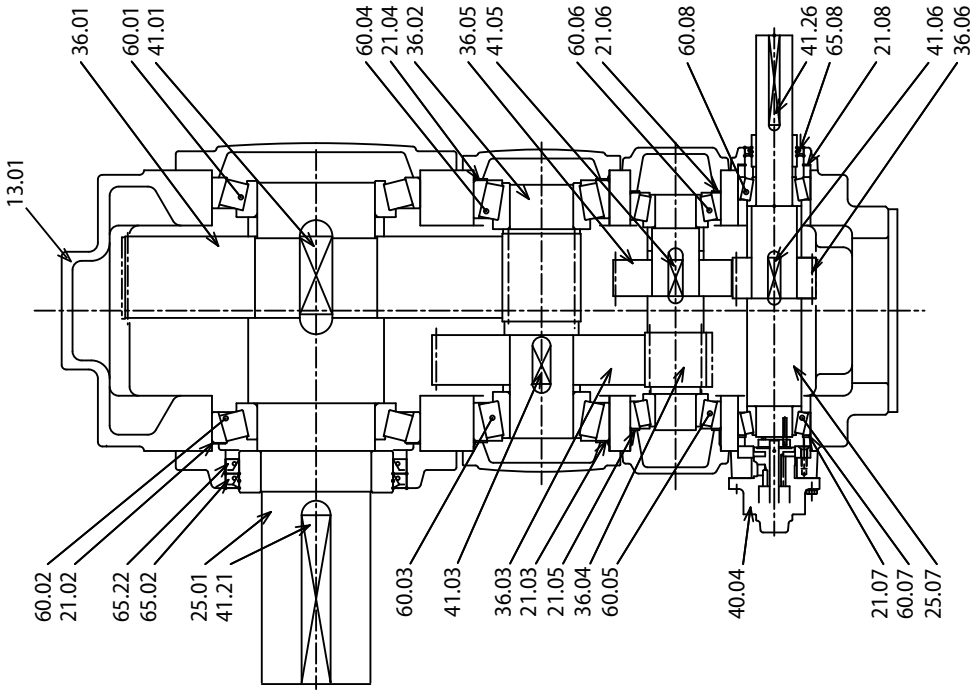


Fig. 33 Parallel Shaft, Vertical - Triple Reduction



Ref. No.	Part Name
13.01	Housing
21.02	Shim
21.03	Shim
21.04	Shim
21.05	Shim
21.06	Shim
21.07	Shim
21.08	Shim
21.28	Shim
25.01	Low Speed Shaft
25.07	High Speed Shaft
36.01	Helical Gear
36.02	Helical Pinion Shaft
36.03	Helical Gear
36.04	Helical Pinion Shaft
36.05	Helical Gear
36.06	Helical Pinion Shaft
40.04	Oil Pump
41.01	Key
41.03	Key
41.05	Key
41.06	Key
41.21	Key
41.26	Key
60.01	Bearing
60.02	Bearing
60.03	Bearing
60.04	Bearing
60.05	Bearing
60.06	Bearing
60.07	Bearing
60.08	Bearing
65.02	Oil Seal
65.08	Oil Seal
65.22	Oil Seal

Note: Figures and drawings contained within are for reference only and individual components may be different than those displayed.

Construction Drawings (cont.)

Fig. 34 Parallel Shaft, Horizontal - Quadruple Reduction

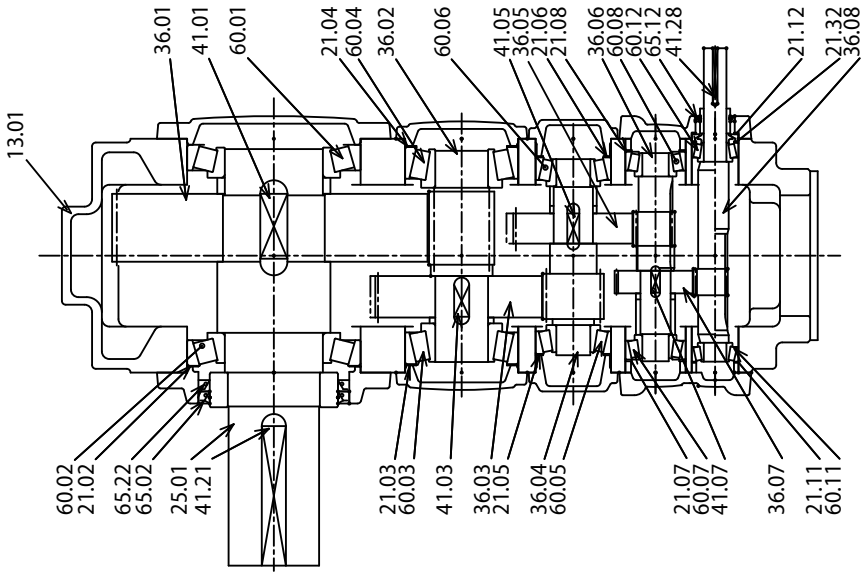
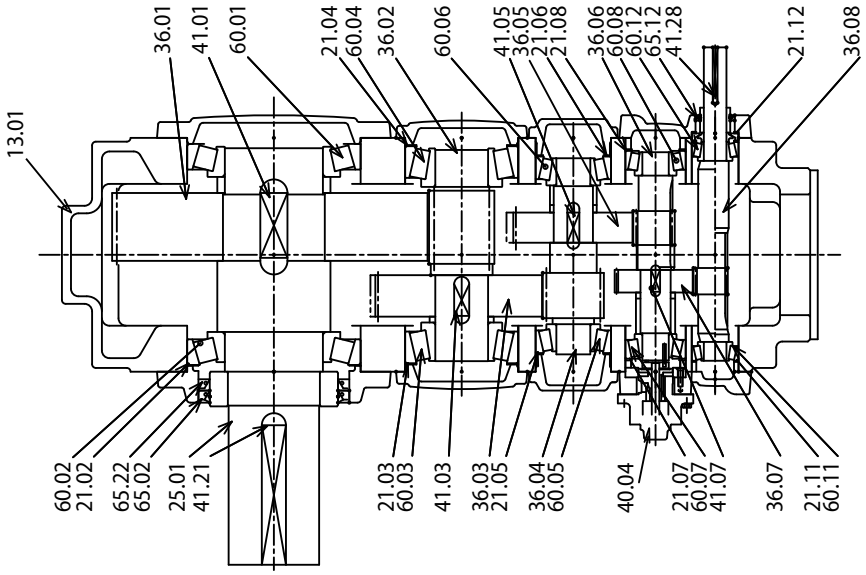


Fig. 35 Parallel Shaft, Vertical- Quadruple Reduction

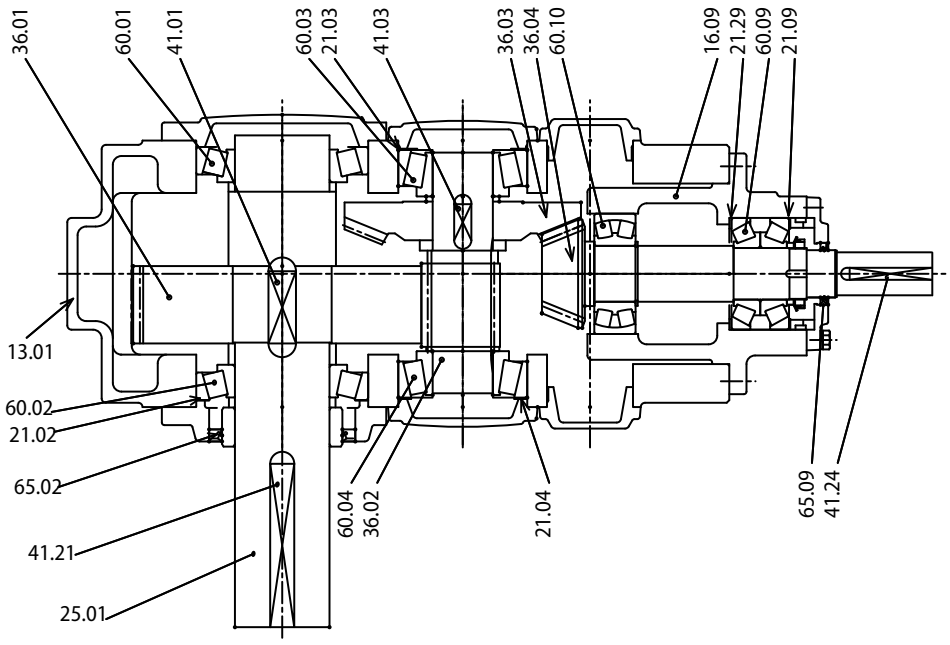


Ref. No.	Part Name
13.01	Housing
21.02	Shim
21.03	Shim
21.04	Shim
21.05	Shim
21.06	Shim
21.07	Shim
21.08	Shim
21.11	Shim
21.12	Shim
21.32	Shim
25.01	Low Speed Shaft
36.01	Helical Gear
36.02	Helical Pinion Shaft
36.03	Helical Gear
36.04	Helical Pinion Shaft
36.05	Helical Gear
36.06	Helical Pinion Shaft
36.07	Helical Gear
36.08	Helical Pinion Shaft
40.04	Oil Pump
41.01	Key
41.03	Key
41.05	Key
41.07	Key
41.21	Key
41.28	Key
60.01	Bearing
60.02	Bearing
60.03	Bearing
60.04	Bearing
60.05	Bearing
60.06	Bearing
60.07	Bearing
60.08	Bearing
60.11	Bearing
60.12	Bearing
65.02	Oil Seal
65.22	Oil Seal
65.12	Oil Seal

Note: Figures and drawings contained within are for reference only and individual components may be different than those displayed.

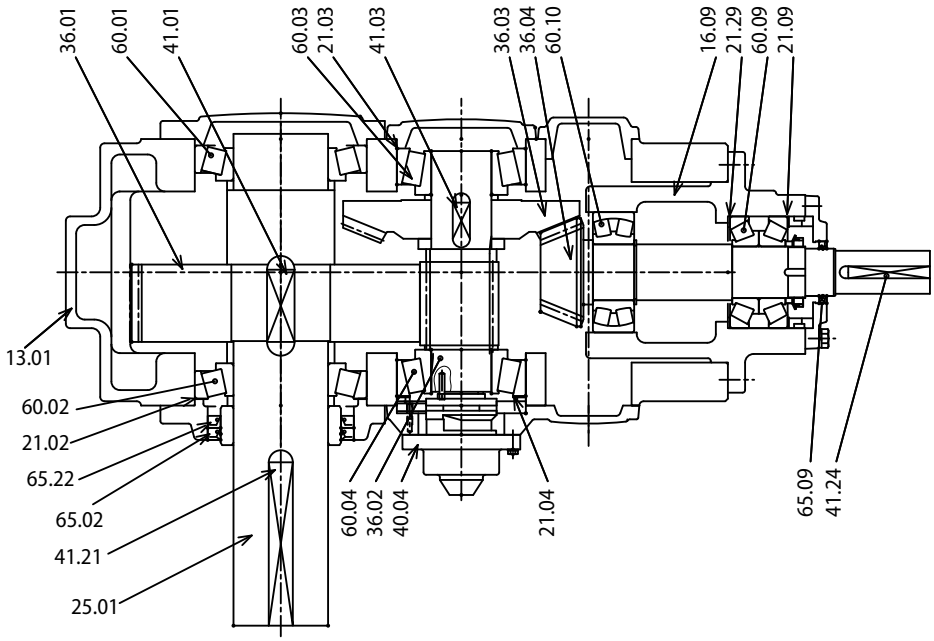
Construction Drawings (cont.)

Fig. 36 Right Angle Shaft, Horizontal - Double Reduction



Ref. No.	Part Name
13.01	Housing
16.09	Bearing Housing
21.02	Shim
21.03	Shim
21.04	Shim
21.09	Shim
21.29	Shim
25.01	Low Speed Shaft
36.01	Helical Gear
36.02	Helical Pinion Shaft
36.03	Bevel Gear
36.04	Bevel Pinion Shaft
40.04	Oil Pump
41.01	Key
41.03	Key
41.21	Key
41.24	Key
60.01	Bearing
60.02	Bearing
60.03	Bearing
60.04	Bearing
60.09	Bearing
60.10	Bearing
65.02	Oil Seal
65.22	Oil Seal
65.09	Oil Seal

Fig. 37 Right Angle Shaft, Vertical- Double Reduction



Note: Figures and drawings contained within are for reference only and individual components may be different than those displayed.

Construction Drawings (cont.)

Fig. 38 Right Angle Shaft, Horizontal - Triple Reduction

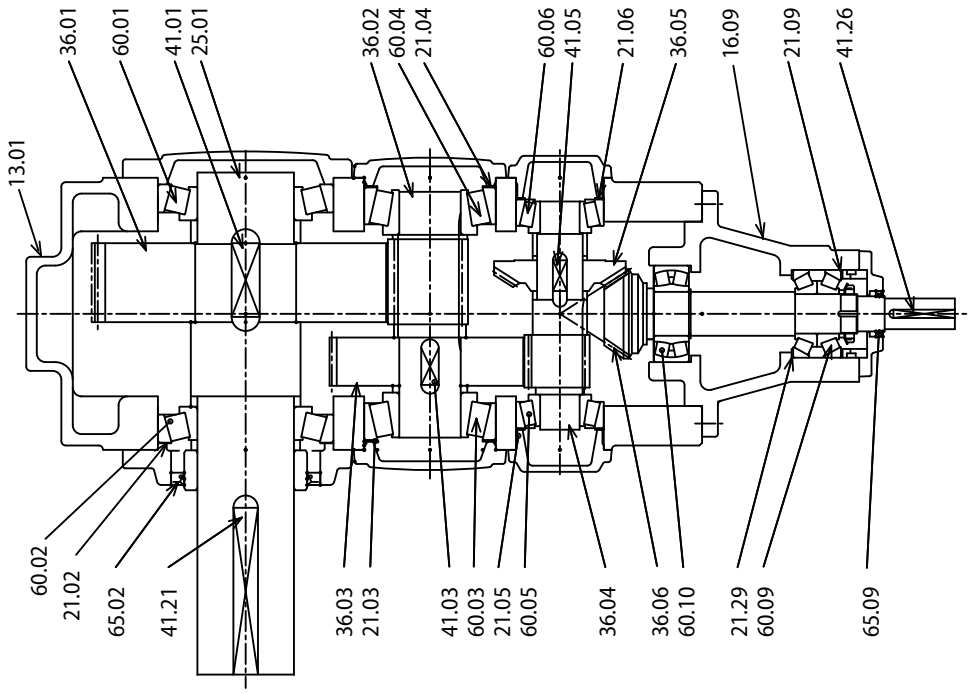
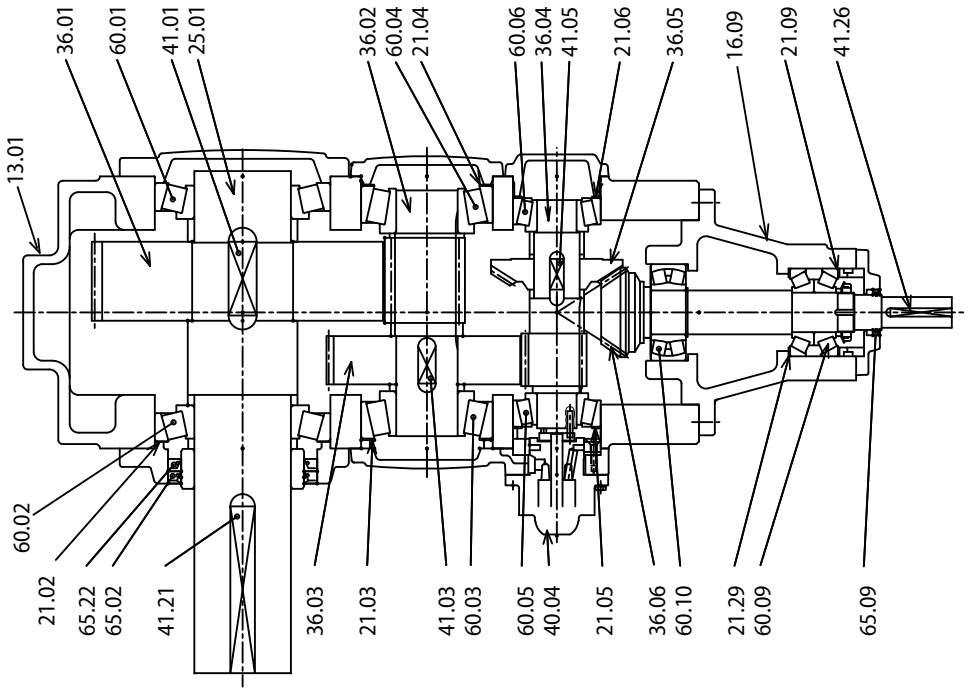


Fig. 39 Right Angle Shaft, Vertical - Triple Reduction



Ref. No.	Part Name
13.01	Housing
16.09	Bearing Housing
21.02	Shim
21.03	Shim
21.04	Shim
21.05	Shim
21.06	Shim
21.09	Shim
21.29	Shim
25.01	Low Speed Shaft
36.01	Helical Gear
36.02	Helical Pinion Shaft
36.03	Helical Gear
36.04	Helical Pinion Shaft
36.05	Bevel Gear
36.06	Bevel Pinion Shaft
40.04	Oil Pump
41.01	Key
41.03	Key
41.05	Key
41.21	Key
41.26	Key
60.01	Bearing
60.02	Bearing
60.03	Bearing
60.04	Bearing
60.05	Bearing
60.06	Bearing
60.09	Bearing
60.10	Bearing
65.02	Oil Seal
65.09	Oil Seal
65.22	Oil Seal

Note: Figures and drawings contained within are for reference only and individual components may be different than those displayed.

Construction Drawings (cont.)

Fig. 40 Right Angle Shaft, Horizontal - Quadruple Reduction

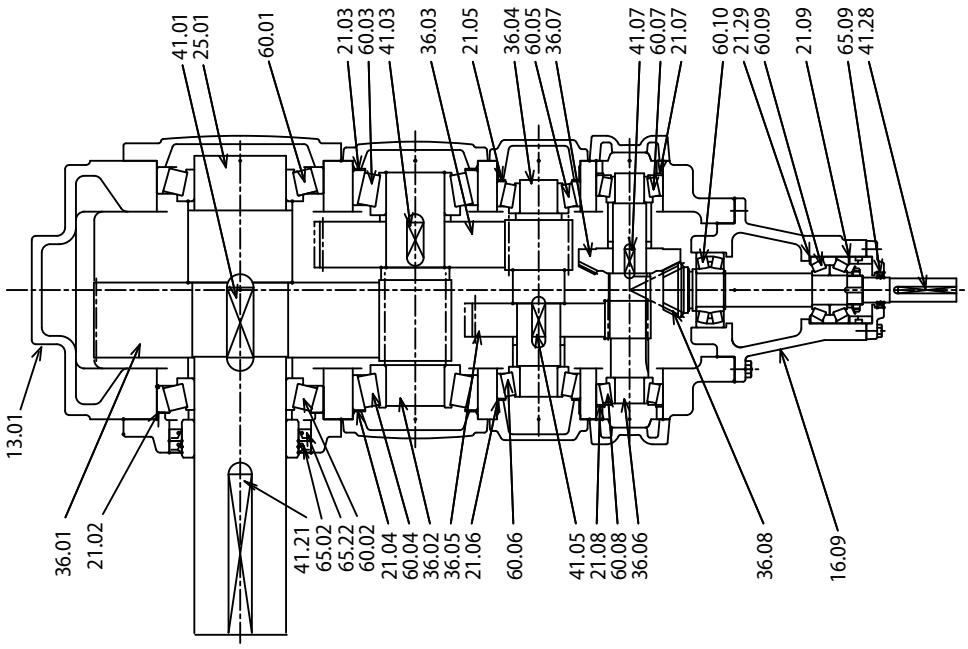
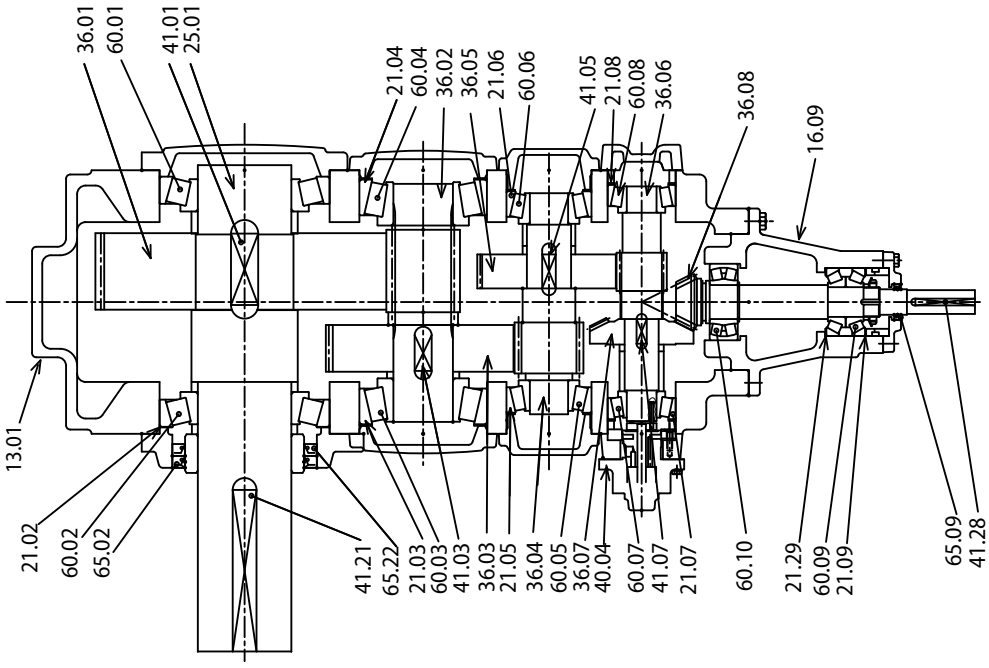


Fig. 41 Right Angle Shaft, Vertical- Quadruple Reduction



Ref. No.	Part Name
13.01	Housing
16.09	Bearing Housing
21.02	Shim
21.03	Shim
21.04	Shim
21.05	Shim
21.06	Shim
21.07	Shim
21.08	Shim
21.09	Shim
21.29	Shim
25.01	Low Speed Shaft
36.01	Helical Gear
36.02	Helical Pinion Shaft
36.03	Helical Gear
36.04	Helical Pinion Shaft
36.05	Helical Gear
36.06	Helical Pinion Shaft
36.07	Bevel Gear
36.08	Bevel Pinion Shaft
40.04	Oil Pump
41.01	Key
41.03	Key
41.05	Key
41.07	Key
41.21	Key
41.28	Key
60.01	Bearing
60.02	Bearing
60.03	Bearing
60.04	Bearing
60.05	Bearing
60.06	Bearing
60.07	Bearing
60.08	Bearing
60.09	Bearing
60.10	Bearing
65.02	Oil Seal
65.09	Oil Seal
65.22	Oil Seal

Note: Figures and drawings contained within are for reference only and individual components may be different than those displayed.

Parts Maintenance, Disassembly / Reassembly

Parts Maintenance

To increase the reducer's service life, replace these items every three to five years:

Replacement parts

- Bearing, oil seal, nilos ring, collar, key, shim, packing stopper, and visible gauge.
- Check and replace shaft and gear if they are damaged.

Return Paramax® reducers to the factory to replace parts. Be sure to include the model number, ratio, serial number and quantity

Disassembly / Reassembly

1. Reducer

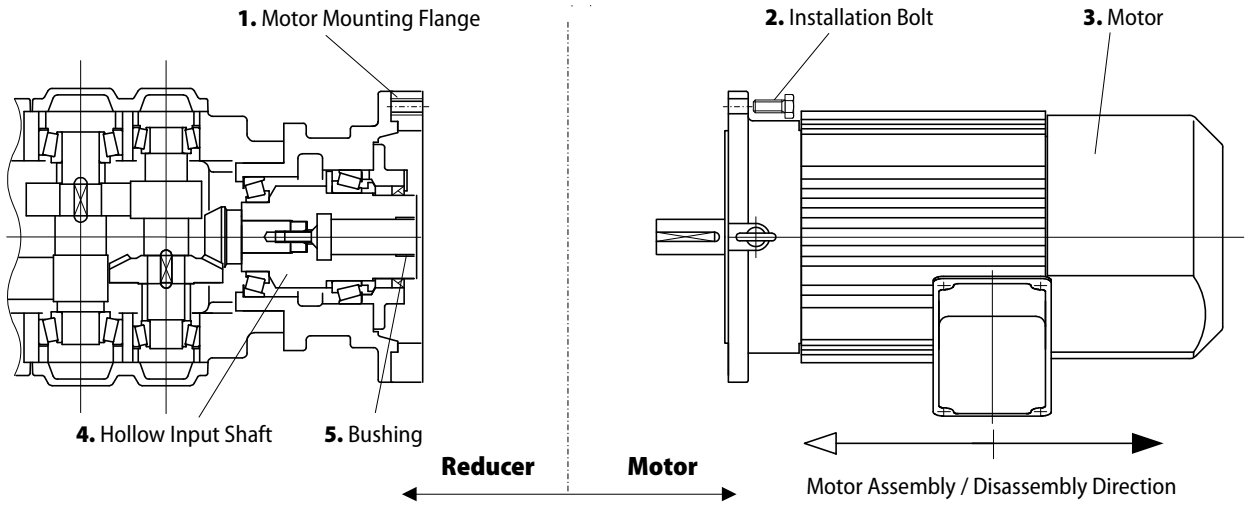
⚠ CAUTION

- Repair, disassembly and reassembly must be performed by properly trained technicians; otherwise, the system may be damaged.

2. Drive Unit

- Keep hands and all foreign objects from keyway and other sharp edges; otherwise, injury may occur.
- Disassemble in a clean, dry location.
- Keep accessory parts, such as screws, in a box to prevent loss.
- Handle parts carefully to avoid damage.

Fig. 42 Separating Reducer from the Motor



Disassembly Procedure

(1) Remove the installation bolts (2).
(2) Separate motor (3) from reducer. Handle reducer and motor carefully. **Do not** allow key or motor shaft to scrape the bushing (5); otherwise, bushing may be damaged.

Assembly Procedure

(1) Position the reducer so that the motor (3) may be easily mounted.
(2) Apply grease to the motor (3) output shaft.
(3) Align the motor's (3) output shaft key with the hollow input shaft (4) keyway.
(4) Slowly insert the motor (3) output shaft into the hollow input shaft (4). **Do not** allow key or motor shaft to scrape the bushing (5); otherwise, bushing may be damaged.
(5) Ensure that the motor (3) is properly inserted into the hollow input shaft (4). Tighten the installation bolts (2) to secure the motor (3) to the motor mounting flange (1).

Troubleshooting

⚠ CAUTION

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

Refer to Table 24 whenever the reducer is operating abnormally and immediately take the appropriate corrective action. Consult the factory if this does not correct the problem, or if the reducer exhibits symptoms not listed in this table.

Table 24. Troubleshooting Guide

Symptom			Cause	Correction
The motor does not operate at no-load.			Power failure	Contact local power company.
			Defective electric circuit	Check the circuit.
			Fuse failure	Replace the fuse.
			Tripped protective device	Remove the cause of operation and reset the device.
			Load locking	Check the load and safety device.
			Poor switch contact	Adjust the contact section.
			Disconnected motor stator coil	Repair or replace.
			Bearing failure	Replace with new bearing.
			3-phase is working as single-phase	Check the power supply with a voltmeter. Check the motor, coil in the transformer, contactor, fuse, etc. and repair or replace them.
The motor operates at no-load.	When load is applied	The switch is overheated.	Lack of switch capacity	Replace the switch.
			Overload	Reduce load.
		Fuse failure	Lack of fuse capacity	Replace the fuse.
			Overload	Reduce load.
		The speed will not increase and the motor is overheated.	Voltage drop	Contact the local power company.
			Overload	Reduce load.
			Short-circuited motor stator coil	Repair or replace.
		The motor stops.	The key is missing	Install a key.
			The bearing is burned	Repair or replace.
			Poor adjustment of overload device	Adjust the overload device.
	The motor runs in the reverse direction.		Wiring error	Wire in accordance with specification.
	Fuse failure		The outlet wire is short-circuited	Repair or replace.
			Poor contact between motor and starter	Complete the connection.
			Overload	Reduce load.
Excessive temperature rise			Voltage drop or voltage rise	Contact the local power company.
			Bearing failure	Replace with a new bearing.
			The ambient temperature is high	Reduce ambient temperature.
			Damage due to overload applied to gears, bearings, etc.	Repair or replace.
Oil leakage	Oil leaks from the input/output shaft.		Damaged oil seal	Replace with a new oil seal.
			Scratches or abrasion on the shaft shoulder or collar	Repair or replace.
	Oil leaks from the split line of the housing.		Loose hardware	Tighten the hardware to proper torque specification values.

Troubleshooting (cont.)

Table 24. Troubleshooting Guide (cont.)

Symptom		Cause	Correction
Abnormal sound. Excessive vibration.		Damaged gears, shafts or bearings	Contact Sumitomo for repair or replacement.
		Deformed housing due to uneven installation surface	Flatten the installation surface or use shims for adjustment.
		Resonance due to insufficient rigidity of installation base	Reinforce the installation base to improve the rigidity.
		Misalignment with the driven machine	Align the shaft center.
		Vibration of driven machine transmitted to the reducer	Isolate driven machine from reducer.
Abnormal sound from motor		Contamination	Remove contamination.
		Damaged bearings	Install new bearing.
Inverter tripping	Shut-off due to overcurrent	Sudden acceleration / deceleration	Increase the acceleration / deceleration time.
		Sudden change in load	Decrease the load.
	Grounding overcurrent	Grounding on the output side	Make correction to eliminate grounding.
	DC overcurrent	Short-circuiting on the output side	Make correction to eliminate short-circuiting. Check cables.
	Shut-off to regenerative overvoltage	Sudden deceleration	Make the deceleration time longer Reduce the braking frequency.
	Thermal relay operation	Overload	Decrease the load to the specified value.

Paramax® Lubrication Addendum Determining Proper Oil Level

1. Introduction

To ensure proper bearing and gear mesh lubrication, we recommend maintaining the correct oil level in the gear reducer at all times. A low oil level may starve the bearings, and/or gear mesh and contribute to catastrophic failure. A high oil level will cause excessive oil churning, which may increase the oil operating temperature, inhibiting the gear reducers' ability to dissipate heat and causing premature lubrication failure.

The oil quantities shown in our manuals and catalogs are not exact for all mounting configurations, accessories and unit options. To ensure proper oil level, use the markings on the provided dipstick or visible oil sight gauge to monitor the oil level when filling unit.

2. Procedure

Follow these instructions to ensure the full service life of the gear reducer:

a. Upon initial start-up:
- ~ Sumitomo ships some units factory lubricated. Before operating the unit, ensure that the unit is adequately lubricated.
- ~ Before operating, fill the unit with the lubricant recommended in the Sumitomo Operating and Maintenance Manual (see page 15) to the level indicated on the dipstick or visible oil gauge. The unit should be in the level mounting position, unless otherwise stated on the provided certified outline drawing.

b. When filling gear reducer for the first time, or after it has been sitting for a period of time we recommend:
- ~ Filling the gear reducer to the bottom mark on the level gauge, operating the unit for 10-15 minutes, and then shutting-down the equipment.
- ~ Check and readjust the oil level if required.

c. After initial start-up:
- ~ Shutdown the equipment after the unit reaches its operating temperature.
- ~ Check the oil level with the unit in its level mounting position.
- ~ Maintain the oil level between the high and low marks on the level gauge.

If the gear reducer is using a lubrication system (shaft driven or motorized), check the oil level as described above after the lubrication system has been in operation (but before the lubrication system has had time to drain into the reducer or reservoir sump).

Check the oil level when the oil is close to its normal operating temperature. Extreme ambient temperatures may provide a 'false' oil level reading when compared to operating temperatures, so it is important to check the oil level when it is within 5% of operating temperature.

You may see a change in the reading on the oil level gauge while the gear reducer is in operation. This is normal. The oil inside the gear reducer is churning and may create a 'false' high or low level reading, so it is important to check the oil level when the unit is in its static mode.

Paramax® Lubrication Addendum Taconite and Labyrinth Seal Procedure

1. Introduction

Taconite and **labyrinth** seals are used in the most severe dust environment. They use a purging grease system to prevent outside contaminants from entering the reducer. See Fig A-1 below for illustrations of taconite and labyrinth seal assemblies.

2. Procedure

Follow these instructions to maintain lubrication of taconite and labyrinth seals:

a. Unless specified otherwise, the taconite, and labyrinth seals are each packed with NLGI #2EP mineral grease prior to shipping. Grease does not need to be added to the seals before startup.

b. Add grease to the seals according to the guidelines indicated in Table A-1. Refer to Table A-2 for recommended greases.

Table A-1. Lubrication Cycle

Shaft RPM	Hours of Operation
< 750	5000
750 ~ 1800	3000

A highly contaminated environment may require a more frequent lubrication cycle.

c. If the unit will not be operated for more than 6 months, apply a thin layer of grease to the outside surface of the seals to prevent dry-out. Before starting the unit, check the seals' integrity, and replace if required; then purge and add new grease to the seals.

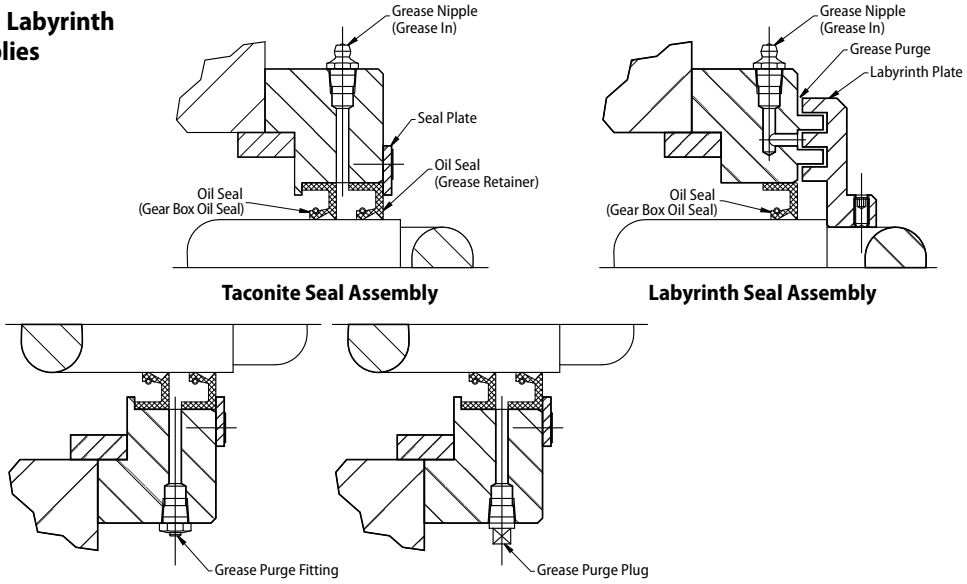
d. Units may be equipped with either a spring loaded grease relief fitting, or a plug in the grease purge port.

- ~ If your unit has a plug, begin by removing the plug.
- ~ While rotating the reducer shafts to ensure even grease distribution, **slowly** add grease until new grease begins to come out of the grease purge port. Wipe away excess grease and reinstall plug if necessary.

Table A-2. Recommended NLGI #2 Mineral Greases

Grease	BP	Castrol			Chevron/Texaco		Exxon/Mobil		Shell	Total
Mineral	Ener-Grease LS EP2	Spheerol AP3	Olista Longtime 3EP	Tribol 3020/ 1000-2	Dualith Grease EP2	Multifak EP2	Beacon EP2	Mobilux EP2	Alvania EP2	Multis EP2
Food grade					FM EP2					

Fig. A-1 Taconite and Labyrinth Seal Assemblies



Taconite Seal Assembly **Labyrinth Seal Assembly**

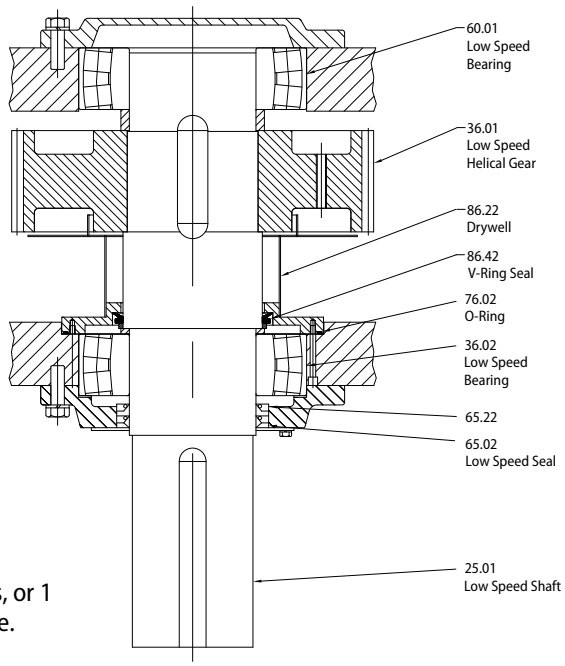
Paramax® Lubrication Addendum Drywell and Drop Bearing Grease Procedure

1. Introduction

Drywells are designed for applications that cannot have any oil leaking down the low speed shaft. Applications range from treatment plant agitators to food mixers.

Drywell assemblies consist of a drywell baffle that is designed to keep the oil out of the bottom low speed bearing chamber. There is a grease V-ring seal between the bearing and the drywell baffle. This is to prevent the bearing grease from entering the main housing. The low speed bearing is packed with grease, which is replenished by pumping grease through the grease nipple, and the excessive supply is purged out. See Fig. A-2. The drop bearing/drywell is the same as the drywell except the low speed bearing has been lowered to increase the lateral load capacity of the unit.

Fig. A-2 Drywell/Drop Bearing Assembly



2. Procedure

Follow these instructions to maintain the lubricating grease for the bottom low speed bearing:

a. The low speed bearing is packed with NLGI #2EP grease prior to shipping (unless otherwise specified). It is **not** required to add grease to the low speed bearing chamber before startup.

b. Add grease to the low speed bearing every 2500 hours of operation.

- ~ Refer to Table A-3 for approximate quantity.
- ~ Refer to Table A-4 for recommended mineral greases.

c. Remove the grease relief piping and clean out any excess grease every 5000 hours, or 1 year, which ever comes first. Old, unused grease will 'dry out' and harden over time. This process is required to prevent the purge line from clogging.

d. Units may be equipped with either a spring loaded grease relief fitting, or a plug in the grease purge port.

- ~ If your unit has a plug, begin by removing the plug.
- ~ While rotating the reducer shafts to ensure even grease distribution, **slowly** add the recommended amount of the grease. **Do not over grease**.
- ~ After 30 minutes of continuous operation, reinstall plug, if necessary, cleanup, and dispose of all purged grease.

e. It is not uncommon for grease to continue to purge from the unit for a period of time after adding new grease. If this happens, **do not** add additional grease to the unit.

Table A-3. Recommended Approximate Grease Quantity

Unit Size	9030	9035 9040	9045	9050	9055 9060	9065	9070	9075 9080	9085 9090	9095	9100	9105 9110	9115	9118	9121
Grams	79	144	173	194	278	524	407	494	632	778	943	1184	1465	2025	2549
Ounces	2.8	5.1	6.1	6.8	9.8	18.5	14.4	17.4	22.3	27.4	33.3	41.8	51.7	71.4	89.9

Table A-4. Recommended NLGI #2 Mineral Greases

Grease	BP	Castrol			Chevron/Texaco		Exxon/Mobil		Shell	Total
Mineral	Ener-Grease LS EP2	Spheerol AP3	Olista Longtime 3EP	Tribol 3020/ 1000-2	Dualith Grease EP2	Multifak EP2	Beacon EP2	Mobilux EP2	Alvania EP2	Multis EP2
Food grade					FM EP2					

Paramax® Assembly Addendum Monobloc Style Housing

CAUTION !

- Repair, disassembly, and reassembly must be performed by properly trained technicians; otherwise, the reducer assembly may be damaged beyond repair.

DANGER !

- Avoid contact with sharp edges of keyways and other parts.
- Disassemble unit in a clean and dry environment.
- Keep accessory parts, such as screws and washers, in a container to prevent loss.
- Handle parts carefully to avoid damage.

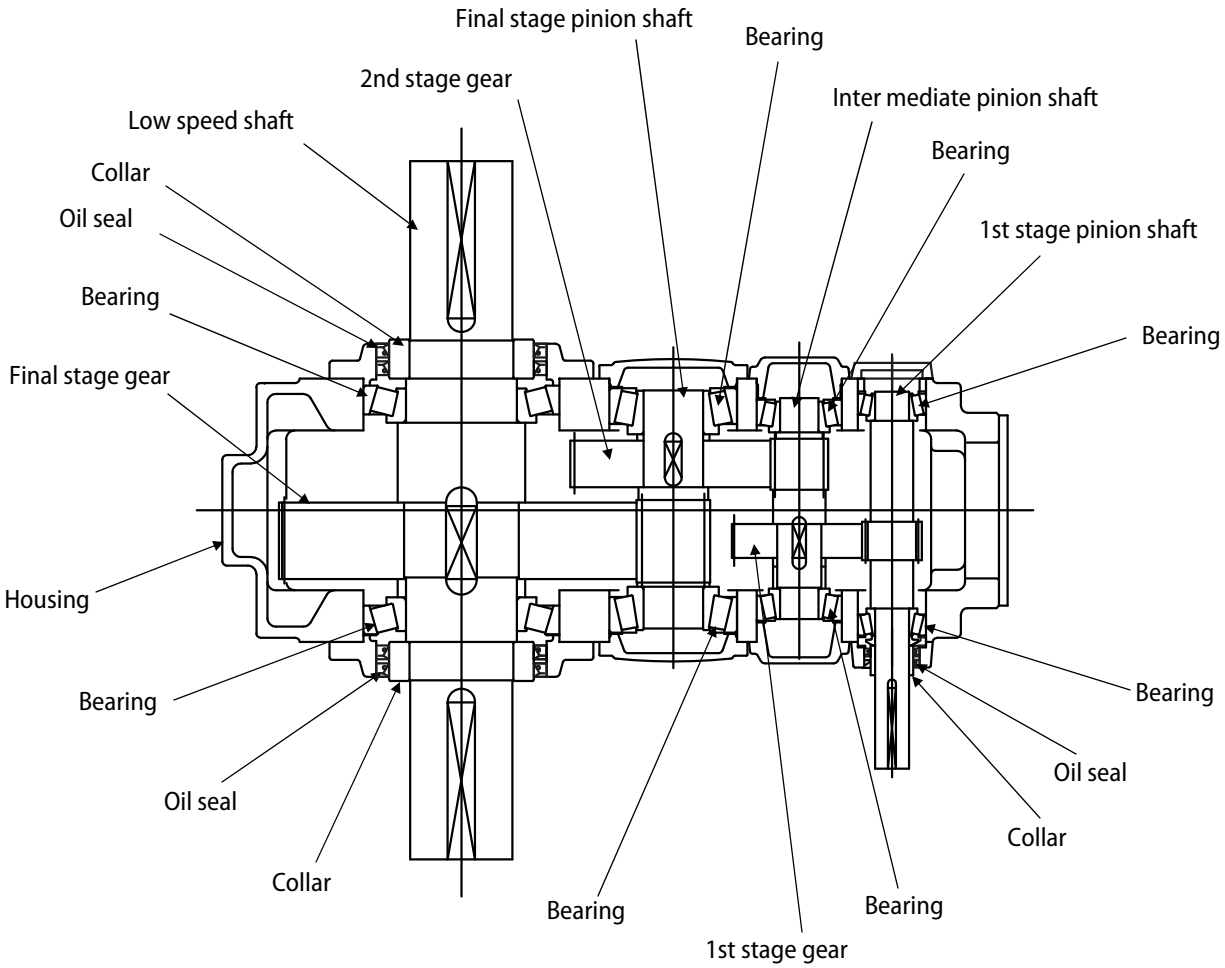
1. Introduction

Our standard practice for PARAMAX reducers is to return them to the factory for maintenance or rebuild. Also, we can provide training programs for repair workshop. We recommend that you take a training program before repairing the reducer.

CAUTION !

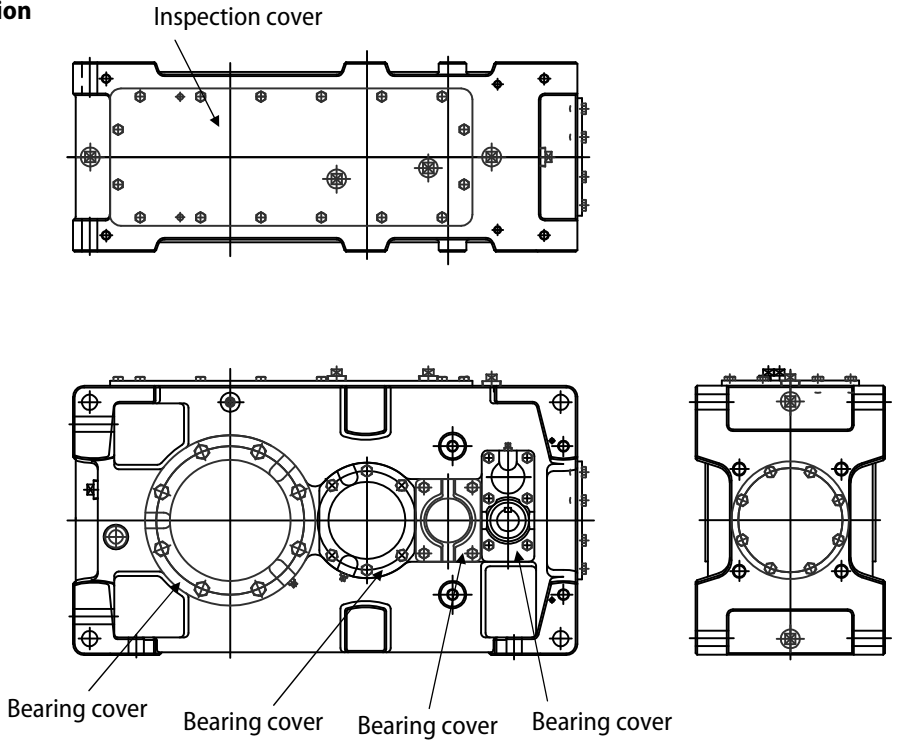
- Using Fig. A-3 and Fig. A-4, understand the structure of PARAMAX reducers before proceeding with work. The housing and shaft orientation are critical for proper disassembly and reassembly.

Fig. A-3 Sectional Drawing (Typical 3-Stage Reducer)



Paramax® Assembly Addendum Monobloc Style Housing (cont.)

Fig. A-4 Cover Position



2. Disassembly

- Remove all bearing covers from the housing, except the high-speed closed cover (to support the HS shaft). All covers are "bolt on". (See Fig. A-4) For double extended HS shaft projection, leave one HS cover (bottom side when positioned vertically) attached to support the HS shaft.
- Position the housing vertically. (See Fig. A-5)
- Carefully pull out only 1st stage assembled shaft.
- Set a spacer block between the inside housing and the gear selected for removal. (See Fig. A-6) (Confirm spacer and shaft orientation. The unit may need to be 'flipped' if multiple gears are removed.)
- Use a press machine against the shaft end (See Fig. A-6). When the shaft is pushed thru the gear, the gear, bearing and collar can be removed through the inspection cover.
- Remove the lower bearing from the shaft. The fit of shaft and bearing is interference.
- Flip housing and repeat above process for other gearsets.

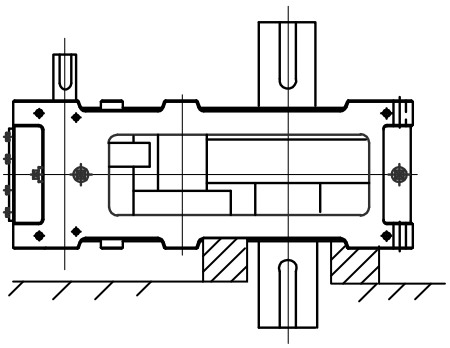


Fig. A-5 Housing Orientation

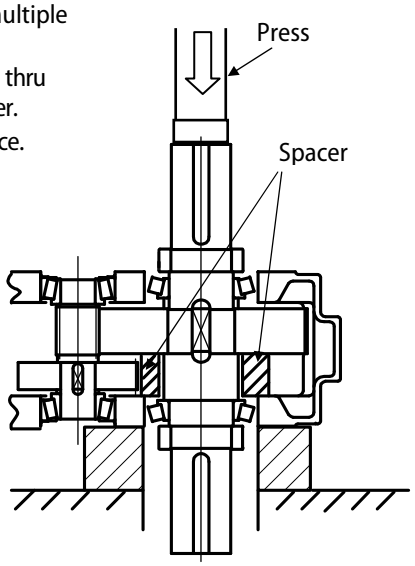


Fig. A-6 Press Direction and Spacer Block

Paramax® Assembly Addendum Monobloc Style Housing (cont.)

CAUTION !

- Always discard and replace removed bearings, oil seals and collars. Do not re-use these items.

3. Reassembly

- Clean inside and outside of the housing and covers.
- Position the housing vertically.
- Use oil bath, induction heater, furnace or gas and evenly heat the gear up to approximately 160 °C. (± 5 °C)
- Carefully position the gear in the housing and set spacer block between the inside housing wall and the gear. (See Fig. A-7)
- Place the shaft into the gear bore through the housing bore and use press to fit the gear onto the shaft up to the shaft shoulder. (See Fig. A-7)
- Use oil bath, induction heater or furnace and heat bearings and collars up to approximately 120 °C. (± 5 °C). All bearings are tapered roller bearings.
- Fit the required spacers, bearings and collars to the shaft.
- Adjust bearing clearance with shims. Standard bearing clearance values are available from factory personnel.
- Apply liquid gasket to covers and install on the housing, except 'open' covers.
- Refer to **Section 4 Oil Seal Assembly** for information on proper procedures to install oil seals into 'open' covers.
- Tighten all the bolts and check tightening torque. Bolt torque values are available from factory personnel.

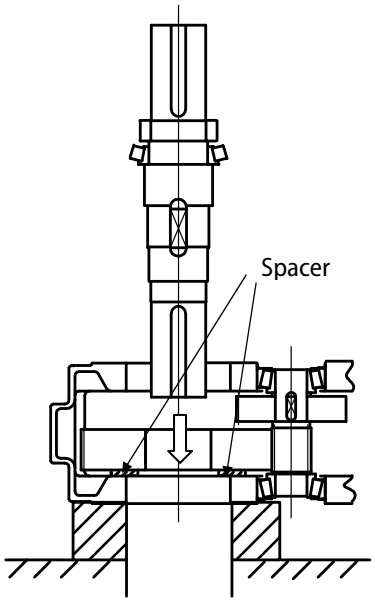


Fig. A-7 Insert of Shaft

4. Oil Seal Assembly

- Insert oil seal into the cover. Do not tap on the oil seal directly. Put a collar on the oil seal (or seal setting jig) and press. Use of press machine is recommended for even and continuous pressure.
- For single seal, install seal to be flush (or slightly recessed) with face of cover. For double seal, install inner seal so that outer seal is flush (or slightly recessed) with face of cover, without compressing inner seal.
- When installing, pay close attention that the oil seal is straight and parallel to seal bores. The seal should not be angled during installation and not be set at the location of a grease hole.
- Lightly apply grease to oil seal lip.
- Install the cover with oil seal.
- When installing the cover, pay close attention if oil seal lip may be cut or damaged from the keyway and protect as required.

Paramax® Assembly Addendum Internal Type Backstops (cont.)

CAUTION !

- Repair, disassembly, and reassembly must be performed by properly trained technicians; otherwise, the reducer assembly may be damaged beyond repair.

DANGER !

- Work on reducer/backstop components should always be preformed after the unit is removed from the machine equipment. DO NOT work on backstops when machinery is in loaded condition, otherwise injury or death may occur.
- Keep unprotected hands and all foreign objects from keyway and other sharp edges of parts; otherwise, injury may occur.

1. Introduction

Our standard practice for PARAMAX reducers is to return them to the factory for maintenance or rebuild. Also, we can provide training programs for repair workshop. We recommend that you take a training program before repairing the reducer.

CAUTION !

- Understand the structure of PARAMAX reducers before proceeding with work. The housing and shaft orientation are critical for proper disassembly and reassembly.
- Avoid contact with sharp edges of keyways and other parts.
- Disassemble unit in a clean and dry environment.
- Keep accessory parts, such as screws and washers, in a container to prevent loss.
- Handle parts carefully to avoid damage.

Fig. A-8 Parallel Shaft

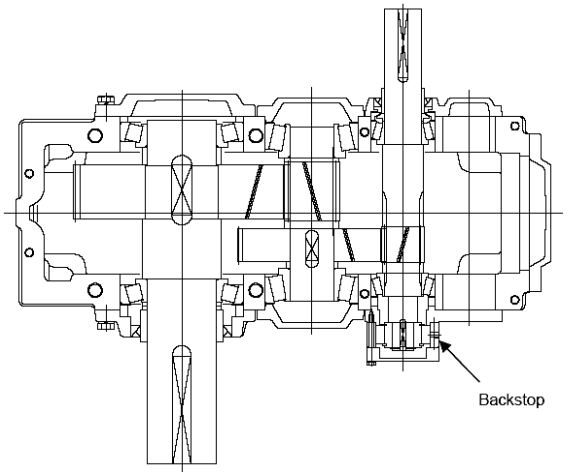
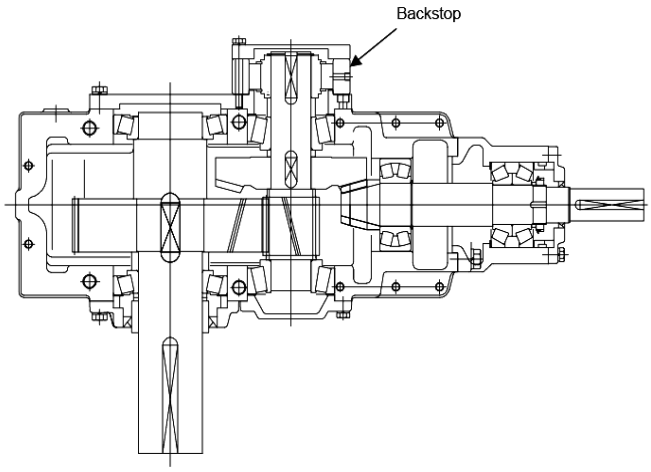


Fig. A-9 Right Angle Shaft



2. Description

The internal type backstop is used to prevent reverse shaft rotation or overrunning condition. The backstop is sized accordingly to transmit the appropriate shaft torque at the mounted shaft. The main components of internal backstops are: outer race, inner race, and cage assembly with sprags that centrifugally disengage at normal running speed. Backstops must be installed so that the inner race overruns.

3. Prior to Installation

Ensure that the specified concentricity between inner and outer race is maintained. The inner race should be fitted to a shaft of h6 or j6 tolerance. The mounting register for the outer race should be to h7 or g7 tolerance.

Paramax® Assembly Addendum Internal Type Backstops (cont.)

Check the freewheeling direction prior to installation. If reversal of the freewheeling direction is required, simply reverse unit on shaft. (See Removal of Cage.) When installing the outer race, use bolts of 8.8 quality or better, and tighten to the torque level specified in Table A-5 below.

DANGER !

- When removing the backstop, always keep the bore in the horizontal position; otherwise the outer race may slip from the cage.

4. Installation

The backstop unit should be unpacked and installed in a clean, dry working environment.

CAUTION !

- Ensure no debris enters the unit during installation

4a. Installation as a Complete Assembly: (Preferred)

- Fit the inner race on to the shaft, ensuring alignment of the keyways, fitted as far back as the shaft spacer allows.
- Any axial loading used should be applied only to the inner race.
- The inner race must be retained axially on the shaft - circlips are suitable.
- Fit the cover to the outer race, to its register using the specified bolts.

4b. Inner and Outer Race Installed Separately: (Due to Size of Unit)

- First install the inner race and cage onto the shaft as described above.
- Position the outer race over the inner assembly while slightly rotating the inner race in the freewheeling direction. This procedure is simplified if the sprags are rotated to their disengaging position and held there by means of an O-ring.
- Fit the outer race to its register using the specified bolts.

Table A-5
Bolt Tightening Torque

Backstop Size	Thread In Outer Race	Tightening Torque [Nm]	Removal Thread Cage
20	M6	9,9	M3
25	M6	9,9	M3
30	M6	9,9	M3
35	M6	9,9	M3
40	M8	24	M3
45	M8	24	M3
50	M8	24	M3
60	M10	47	M4
70	M10	47	M4
80	M10	47	M4
90	M12	82	M4
100	M16	200	M5
130	M16	200	M5
180	M20	390	M5
180-II	M20	390	M5
220	M20	390	M5
220-II	M24	670	M5

5. After installation

After installation, ensure that the backstop can be rotated in the required direction. The drag torque produced when freewheeling, is about 1/1000 of the torque capacity of the backstop.

Paramax® Assembly Addendum Internal Type Backstops (cont.)

6. Removal of Cage Assembly from Inner Race After Installation

Because of maintenance, or reversal of freewheeling direction on units with non-standard asymmetric inner races, it may be necessary to remove the sprag cage from the inner race.

6a. Removal

- Remove circlip from inner race.
- Screw suitable bolts into the removal holes in of the cage disk. Do not use bolts that are long enough to contact sprags!
- Using the removal bolts pull the cage from the inner race, while slightly rotating the cage in the freewheeling direction.

CAUTION !

- The re-installation procedure will be simplified if the sprags are secured in the disengaged position and held there by means of an O-ring, rubber band (or non-adhesive tape), **PRIOR** to complete removal.

6b. Installation

- Slide the cage assembly on to the inner race, slightly rotating the cage in the freewheeling direction.
- Ensure that the driver pin on the face of the cage disk locates in the gap formed by the ends of the circlip. The cage can be installed without removal of the outer race if the inner race, shaft and cage can be rotated while the cage is slid along the inner race.
- Reinstall second circlip, ensuring the gap formed by its ends accommodates the driver pin on the face of the cage disk.

7. Dismantling

Follow the installation procedure in reverse sequence in order to dismantle / remove the backstop.

CAUTION !

- Apply liquid sealant (Loc-tite preferred) to the cover and between backstop and housing, if required.

8. Lubrication

CAUTION !

- Refer to Paramax Maintenance Manual for specific reducer oil recommendations and quantity.
- After working on backstop or any part of reducer, flush the appropriate bearing(s) and unit to remove any particlates that may cause damage to rotating elements.

Paramax® Assembly Addendum
Paramax Uniminer

1. Introduction

Paramax Uniminer is primarily a Paramax Unit, with a main feature of allowing the assembly to be flipped – providing alternative shaft assembly. The majority of operating and maintenance items associated with the unit can be found in the standard manual. This addendum will identify the details which are not part of the standard manual.

2. Installation

The unit installation and alignment procedures should follow normal installation procedures.

A common drive package for Paramax Uniminer consists of a motor adapter and rigid flanged low speed shaft, or moment coupling. Follow normal rigid flanged coupling installation procedures from the coupling vendor. Follow normal coupling installation procedures for the specified type of high speed coupling.

CAUTION !

- Coupling alignment is essential to long-life operation of the coupling and gearbox.
- Proper motor alignment is facilitated by Motor Adapters. ALL shaft alignments must be confirmed prior to operation.
- Shaft Mounted assemblies will require a torque arm. All Torque Arms need some flexibility to allow for movement of the drive assembly. Torque Arms installed in a pre-loaded condition will overstress the drive assembly components and potentially cause premature failure.

3. Flipping the Unit for Alternative Assembly

Reducers are designed to be flippable in the field. New units can be flipped by removing a dipstick, oil breather and two pipe plugs and changing them from top to bottom. Use proper sealer to seal the pipe plugs. When unit in service needs to be flipped use the following procedure:

Disconnect unit from driven equipment and from the motor. Drain the oil.

- Unbolt foot-mounted unit from the foundation.
- Uncouple Shaft Mounted units with a Motor Adapter from Shaft and Torque Arm.

When applicable, remove any external accessories such as pumps, coolers, filters, etc. Motor Adapters with Torque Arm mounts top and bottom do not need removal.

Remove INSPECTION COVER, oil breather, dipstick and drain plugs or valves (if included) and exchange them between top and bottom. Top Inspection Cover should always have gasket. Bottom Cover should use sealant. Use proper sealer to reseal components. We STRONGLY recommend refilling the unit with new or at least filtered oil to the level indicated on the provided dipstick or oil sight gauge (if provided).

Unit can be reinstalled, following the applicable standards and instructions for installation.

CAUTION !

- BACKSTOPS! For units installed with backstops, please confirm the correct shaft rotation. Reversing the backstop rotation may be necessary to provide required shaft rotation.

Drive Package Installation Addendum
Foot Mounted & Shaft Mounted Considerations

This addendum provides essential installation practices for Sumitomo gear units when supplied as drive packages (gearbox + baseplates or swingbase). This information is a summary of the installation requirements for Sumitomo supplied drive packages. Consult the gear unit, coupling, motor, etc component manuals for detailed instructions not listed below.

Drive packages include a gearbox and motor mount typically through a baseplate, bedplate or transition base for foot mounted or a swingbase, motor adapter or top mount for a shaft mounted arrangement. Motors are often connected through couplings or v-belt or chain drives for top mount configurations. Foot mounted drive packages are connected through a flexible coupling. Shaft mount drive packages are connected to the driven machine by hollow shaft or a rigid flanged coupling.

Proper mounting ensures correct shaft alignment, protects bearings and gears, preserves tooth contact quality, helps reduce noise and vibration and achieve extended operational life.

All drive packages are initially aligned at the factory, i.e., high speed couplings and motors (if supplied) are aligned to the gearbox as an 'alignment check'.

Planning & Documentation

Prior to installation, the gearbox certified dimensions are to be used to plan the orientation, installation, mounting and effective operation of the drive package.

Understanding the mounting requirements are critical to the safe installation and operation of the drive package.

Key Principles of Rigging and Lifting

Consider consulting with ASME B30 SAFETY STANDARD Cranes and Related Equipment—Cableways, Derricks, Hoists, Hooks, Jacks, and Slings.

B30 carries no direct legal mandate. It is a voluntary consensus standard, not a federal regulation. Please note that in practice, courts, insurers, and OSHA investigators often treat B30 compliance as potential evidence. Non-compliance can be treated as evidence of negligence.

Lift Planning and Preparation: Before any lift, interpret work orders, clarify requirements, and plan tasks to comply with legislation, standards, and workplace safety requirements. Ensure all personnel are trained and competent, and that safety signage, barricades, and personal protective equipment (PPE) are in place.

Lifting Equipment Selection: Choose appropriate lifting equipment such as slings, chains, wire ropes, hooks, and mechanical devices based on load type, weight, and configuration.

Drive Package Installation Addendum
Foot Mounted & Shaft Mounted Considerations (cont.)

Preparations for Mounting the Gear Unit

Foot Mounted Units and Mounting Foundations

- Foot Mounted units will use the baseplate mounts to secure the drive package to the foundation.
- Foundations must be structurally sound, flat, level and dimensionally correct before mounting.
- The equipment requires a foundation suitable to meet all operational requirements of the machinery. Careful consideration should be given to the foundation material and design. Concrete, Soleplates, and fabricated foundations should be constructed and fit for purposes intended to meet all operational requirements of the machinery.
- Avoid concrete or grout (type or installation method) that may shift the unit/base during curing. Ex: Expanding or shrinking should not affect the installation.

Shaft Mounted Units

- Shaft Mounting is typically either flange mounted rigid coupling or hollow shaft mounted to the driven shaft.
- Driven shafts must be concentric and dimensionally correct with appropriate shaft surface finish for the mount method.
- Rigid flanged couplings should be of high quality (material and fabrication) in order to perform the intended function and loads of supporting the drive package during all operation conditions.
- Rigid flanged couplings should be machined and mounted to minimize the runout of the mating components.
- The auxiliary mounting point is either by a torque arm or mounting flange. Mounting flanges are typically for smaller units and conform to ISO B5, B14 flange dimensions or a custom design. The certified drawing will define the mounting flange dimensions.

Coupling Installation

- Follow coupling manufacturer mounting instructions.
- Verify that shaft and hub tolerances are correct and the keys fit properly.
- Generally, heavy interference fit couplings require heating coupling halves 275°F (135°C) - preferably in a controlled temperature environment such as oven or oil bath to avoid damaging the coupling.
- Anti-seize compound may be used on shafts for interference fit couplings with keys. **DO NOT** use anti-seize compound on locking hub (shrink disc Type connections). Be sure to follow straight or taper locking hub manufacturer's mounting instructions.
- **DO NOT** force-fit components in such a way to load or impact the bearings. This could cause permanent bearing damage.

Drive Package Installation Addendum
Foot Mounted & Shaft Mounted Considerations (cont.)

General Mounting Procedures

Foot Mounted Assemblies

1. Safely place the gear unit and bed plate onto the foundation.
   Preferred method is to lift and place as one assembly. However, lifting in components can be done to meet safe lifting capacities. Proper reassembly of disassembled components is critical to the installation.
2. Adjust or shim the baseplate as required to align the bedplate to the driven equipment. Sumitomo standard method is shims for bedplate only. Sumitomo does not typically require shims between bedplate and gear unit.
3. Once alignment is correct, torque the baseplate mounting bolts based on size and bolt strength. Use the mounting bolts appropriate for the bedplate hole sizes. Use installation bolts corresponding to JIS/ISO/ASTM strength class10.9 or equivalent.
4. Recheck all shaft alignments after tightening baseplate mounting bolts. Re-shimming is required if shafts are not aligned.
5. Depending on the design, be sure to follow grout curing recommendations before operations.
6. Perform Final Coupling Assembly to connect drive package to driven equipment.

Shaft Mounted Assemblies

1. Safely lift the drive package as one assembly to align the low-speed shaft to the driven equipment.
2. For Hollow Shaft assemblies follow the hollow shaft mounting instructions in the product installation manual.
3. For Rigid Flanged Couplings connect the coupling halves and secure with the appropriate coupling bolts. Torqued appropriately for bolt size and strength.
4. Recheck all shaft alignments after mounting the drive package. Re-shimming is required if shafts are not aligned.

Alignment Requirements

Accurate alignment prevents vibration, bearing overload, premature coupling wear and overheating. Sumitomo supplied drive packages are aligned at the factory, however, misalignment from transport is common and the installer must confirm proper alignment prior to operation.

Alignment expectations depend on coupling type and RPM. Use precision tools and follow coupling manufacturers installation instructions.

Headquarters & Manufacturing

Sumitomo Machinery Corporation of America
4200 Holland Boulevard
Chesapeake, VA 23323
Tel: +1-757-485-3355 • 1-800-SMCYCLO
Fax: +1-757-485-7490
www.sumitomodrive.com
E-mail: sma.customerservice@shi-g.com

After Hours Technical Support
sma.service@shi-g.com 1-800-983-1000

www.sumitomodrive.com/Paramax9000

World Headquarters

Japan
Sumitomo Heavy Industries, Ltd.
Power Transmission & Controls Group
ThinkPark Tower, 1-1, Osaki 2-chome,
Shinagawa-ku, Tokyo 141-6025 Japan
Tel: +81-36-737-2511 • Fax: +81-36-866-5160

For facilities located in the Americas, please visit www.sumitomodrive.com/locations

For worldwide locations, please visit www.sumitomodrive.com/worldwide

07.901.60.13; Supersedes Manual 07.901.60.12
©2026 Sumitomo Machinery Corporation of America
Printed in USA