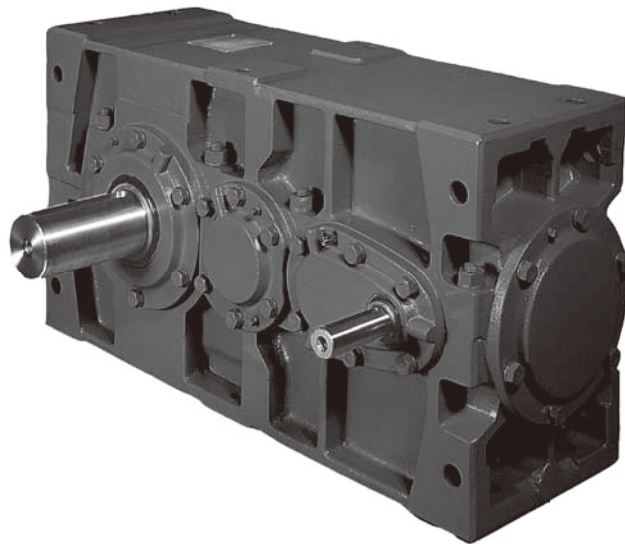


## PARAMAX<sup>®</sup>

### M Series



#### 《CAUTION》

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



# Introduction: Safety Precautions

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

After reading, retain this manual for future reference.


- Pay close attention to the "DANGER" and "CAUTION" warnings regarding safety and proper use.



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



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

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

## DANGER

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

# Introduction: Reading the Maintenance Manual, Table of Contents

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This is a maintenance manual for Paramax M Series.

Please refer to Motor Maintenance Manual (No. MM1001E) for unit with motor.

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# 1. Inspection Upon Delivery

## ⚠ CAUTION

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

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

- (1) Does the description on the nameplate match your order?
- (2) Were there any parts damaged during transport?
- (3) Are all bolts and nuts tightened firmly?

### 1-1 How to Check the Nameplate

Please refer to sample nameplate below.

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

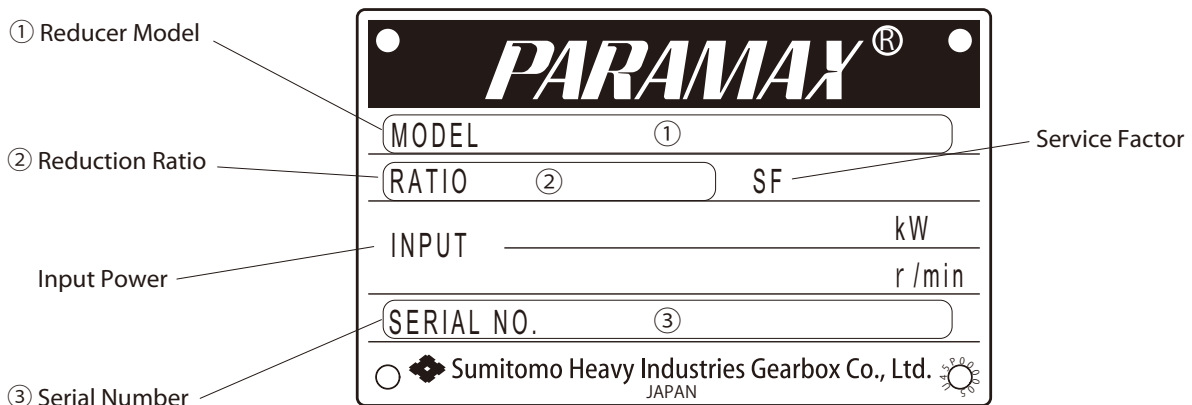
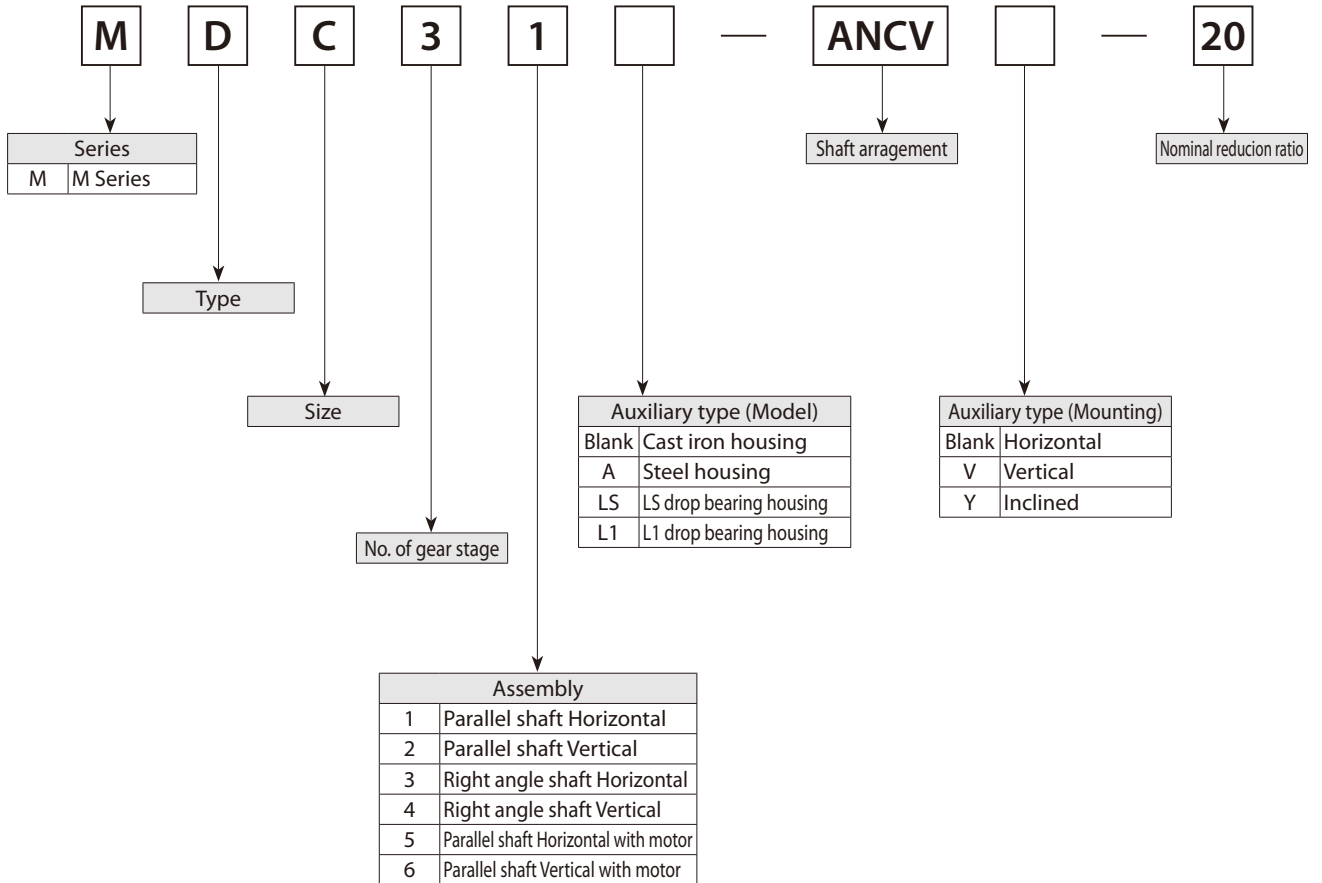


Fig. 1-1 Nameplate

# 1. Inspection Upon Delivery

## 1-2 Nomenclature

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



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

### 2-1 Storage Location

Store the product indoors in a clean, dry location.

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

### 2-2 Storage Period

- The storage period should be within 6 months.
- Standard rustproof specifications
  - External rustproof Rust prevention oil is applied when shipping from the factory. Check rust conditions every 6 months after shipment. Reapply the rust prevention process, if necessary.
  - Internal rustproof Rustproof period 6 months  
Store in an ordinary factory or warehouse in an environment where free of moisture, dust, extreme temperature changes, corrosive gas, etc.
- If the storage period exceeds 6 months or for export, adherence to special rust prevention specifications is required. Please consult factory.
- If the storage period exceeds 6 months, operate the unit for few minutes with no load every 2 to 3 months.

### 2-3 Operation After Storage

- Oil seals are affected by temperature, ultraviolet light and other ambient conditions and can easily degrade. After long storage period, inspect before operation, and replace any degraded seals with new seals.
- If the storage period exceeds 2 years, change the oil seal and grease before operation.
- At startup, check that there are no abnormal sound, vibration, temperature rise, or other symptoms. If any abnormalities are found, immediately contact the nearest authorized service station.

# 3. Transport

---

 **DANGER**

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

 **CAUTION**

- Exercise ample care so as not to drop the unit.  
When a hanging bolt or hole is provided, be sure to use it. After mounting a unit to a machine, do not hoist the entire machine using the hanging bolt or hole; otherwise, personal injury or damage to the equipment and/ or lifting device may result.
- Before hoisting, refer to the nameplate, crate, outline drawing, catalog, etc. to check the weight of the unit. Never hoist a unit that exceeds the rating of the crane or other mechanism being used to lift it; otherwise, personal injury or damage to the equipment and/ or lifting device may result.
- Use proper hanging metal fitting and make sure hanging bolt and nut are not loosened before lifting.



# 4. Installation

## CAUTION

- Do not use the products for purposes other than those shown on the nameplate or in the manufacturing specifications; otherwise, electric shock, personal injury, or damage to the equipment may result.
- Do not place flammable objects around the reducer; otherwise, fire may result.
- Do not place any object around the reducer that will hinder ventilation. Insufficient ventilation can cause excessive heat build-up that may result in burns or fire.
- Do not step on or hang from the reducer; otherwise personal injury or damage to the equipment may result.
- Do not touch the shaft end or inside keyways; otherwise personal injury may occur.
- When the unit is used in food processing applications, install an oil pan to protect against oil contamination that may occur during equipment breakdown or failure; otherwise, oil leakage may damage the products.

### 4-1 Installation Location

Ambient temperature	-10 to 40°C
Ambient humidity	Max. 85%
Atmosphere	No corrosive or volatile gases, no steam Dust-free, well-ventilated area.
Installation location	Indoors (Dry area with minimal dust)

- Special reducers are required for installation conditions not described in these guidelines.
- 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.

### 4-2 Installation Angle

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

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

### 4-3 Installation Method

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

# 5. Connecting to machinery

## ⚠ CAUTION

- Confirm the rotation direction before connecting to the driven machine. Incorrect rotation direction may cause personal injury or damage to the equipment.
- Remove the key temporarily attached to the output shaft when the reducer operates alone; otherwise, personal injury may occur.
- Install appropriate guard devices around rotating parts ; otherwise, personal injury may result.
- When connecting the product with a load, check that the alignment, belt tension and parallelism of the pulleys are within the specified limits. When the unit is directly connected to other machinery, check that the accuracy of direct connection is within the specified limits. When a belt is used to connect the unit to other machinery, check the belt tension. Correctly tighten bolts on the pulley and coupling before operation; otherwise, personal injury or damage to the equipment may result due to debris scattering.

### 5-1 Installation of Coupling

- 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. 5-1).

#### (1) Coupling

- The dimensions (A, B and X) illustrated in Fig. 5-2 must be within the tolerance shown in Table 5-1.

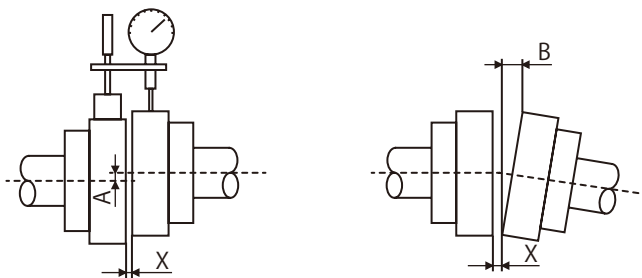


Fig. 5-2

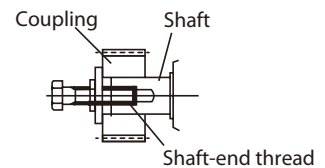


Fig. 5-1

Table 5-1 Coupling alignment tolerance

Tolerance for A dimension	0.05mm
Tolerance for B dimension	0.05mm
X dimension	Specified by coupling manufacturer

#### (2) Chain, Sprocket and Gear

- The chain tension angle must be perpendicular to the shaft of reducer.
- The pitch circle of the sprocket and gear must be more than three times of the shaft diameter.
- Locate the sprocket and gear as close to reducer as possible so the load point will be closer to the reducer's vertical center line (Fig. 5-3).

#### (3) V Belt

- Excessive V belt tension will damage the output shaft or bearing. Refer to the V belt catalogue for tension.
- The parallelism, eccentricity  $\beta$  of the two pulleys should be within  $20'$ . (Fig. 5-4)
- Use a matched set with identical circumferential length when more than one V belt is used.

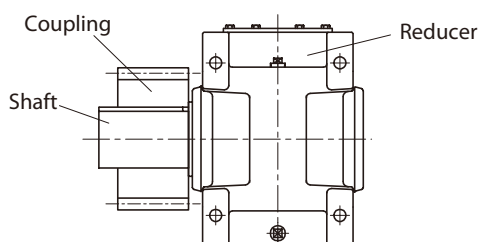


Fig. 5-3

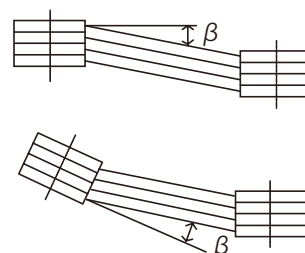


Fig. 5-4

# 6. Operation

## DANGER

- Do not approach or touch rotating parts (output shaft, etc.) during operation; otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.

## CAUTION

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

- Reducers are shipped without oil. Units must be filled with the proper amount of recommended oil prior to start-up.
- For long term rust prevention, export rust prevention or sealed lubricant specification, hole for air breather is plugged. Replace the plug with attached air breather after installing.
- For special piping, pipes are shipped as accessory to avoid the damage during transport. Plumb the pipe after installing.

After the unit is installed and filled with oil, check the following items before operating.

- Is the unit properly connected to the driven machine?
- Are mounting bolts tightened firmly?
- Is the direction of rotation correct?
- Is the oil filled to the correct oil level at stop?

After confirming above items, conduct a trial run with light load. Move on to actual operation after confirming that there is no abnormal sound, vibration, and/or temperature rise.

Check the items shown in Table 6-1.

Table 6-1 Check List

Is the reducer generating an abnormal sound or vibration?	<ul style="list-style-type: none"> <li>• Is the housing deformed because the installation surface is not flat?</li> <li>• Is insufficient rigidity of the installation base generating abnormal sound?</li> <li>• Is the shaft center aligned with the driven machine?</li> <li>• Is the vibration of the driven machine transmitted to the reducer?</li> </ul>
Is the surface temperature of reducer abnormally high?	<ul style="list-style-type: none"> <li>• Is the ambient temperature too high?</li> <li>• Is the oil at the specified level?</li> </ul>

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

# 7. Daily Inspection and Maintenance

## DANGER

- Do not approach or touch any rotating parts (output shaft, etc.) during run-time maintenance or inspection of the unit; otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.
- When shutdown inspection is conducted to check the tooth surface, make sure to stop the motor and driven unit; otherwise, loose clothing may become caught in the gear meshing part and cause serious injury or death.
- Do not operate the unit without a safety cover (removed during inspection) in place to shield rotating parts; otherwise loose clothing may become caught in these rotating parts and cause serious injury or death.

## CAUTION

- Do not put fingers or foreign objects into the opening of the reducer; otherwise, electric shock, personal injury, fire, or damage to the equipment may result.
- The reducer becomes very hot during operation. Touching the unit with bare hands may cause serious burns.
- Promptly identify and correct according to the maintenance manual if any abnormalities observed during operation. Do not operate until abnormality is corrected.
- Change lubricant according to the maintenance manual. Be sure to use factory recommended lubricant: otherwise damage to the equipment may result.
- Do not change lubricant during operation or immediately after stopping operation; otherwise, burns may occur.
- Do not operate damaged reducer; otherwise, personal injury, fire, or damage to the equipment may result.
- We cannot assume any responsibility for damage or personal injury resulting from an unauthorized modification by a customer, as it is out of warranty.
- Dispose reducer and/or lubricant in accordance with local regulations.

### 7-1 Daily Inspection

To ensure proper and continued optimum operation, use Table 7-1 to perform daily inspection.

Table 7-1 Daily inspection

Inspection items		Inspection details
Noise		Is there abnormal sound coming from the reducer? Is there sudden change in sound?
Vibration		Is there excessive vibration ? Does vibration change suddenly?
Surface temperature		Is the surface temperature abnormally high (higher than 80°C )? Does the surface temperature rise suddenly? (The temperature rise during operation differs according to the models. It is no problem even if surface temperature is around 70 °C , as long as it is steady.)
Oil level		Does the oil level reach the top line of the oil gauge? (Check it with a dipstick or oil gauge while the machine is shut down.)
Lubrication	Forced lubrication	Is the function of oil signal or flow gauge normal? If functioning abnormally, which means lubrication failure due to inadequate oil, broken pump or clogging pipe, stop the unit and inspect.
Oil or grease leakage		Does oil or grease leak thru oil seal?
Foundation bolt		Are foundation bolts loose?
Chain, V belt		Are chain and V-belt loose?

When any problem is found during daily inspection, take corrective measures listed in section 8. Troubleshooting. If the problem cannot be corrected, contact our nearest agent, distributor, or sales office.

# 7. Daily Inspection and Maintenance

## ⚠ DANGER

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

### 7-2 Check the Lubrication Method

- Please look for the relevant items and make certain to do maintenance. Neglecting maintenance is a source of trouble.
- Provide flow switch or flow sight to check the circulation of the lubricant. Stop the reducer when abnormality occurs.
- Lubrication method may differs from Table 7-2 depending on specification. Check the manufacturing specification for details.

Table 7-2 Standard Lubrication

	Lubrication	
	Gear	Bearing
Horizontal	Oil bath lubrication	Oil bath or grease lubrication
Vertical	Oil bath or splash lubrication	Grease lubrication is applied to the upper surface and the right angle shaft input, and oil bath lubrication is applied to the other parts.

### 7-3 Lubrication Maintenance

#### (1) Oil Change Interval

Table 7-3 Oil Change Interval

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

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

#### (2) Grease Interval

Table 7-4 Grease Interval

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

- The grease lubricated models are packed with grease prior to shipment and attached grease nipple and grease discharge plug. Please check the number of grease nipples and their positions carefully.
- Please check with the specification whether there is grease lubrication.

# 7. Daily Inspection and Maintenance

## (3) Lubricant selection

Refer to Table 7-5 to select appropriate oil viscosity. Table 7-6 shows recommended lubricants.

Table 7-5 Oil Viscosity

ISO*/AGMA	Ambient temperature °C	
	-10 to 16	10 to 50
VG68/2EP	VG68/2EP	VG150/4EP

\* :Viscosity at ISO 40°C (mm<sup>2</sup>/s)

Table 7-6 Recommended Lubricant

Gear Oil	Viscosity Classification (ISO) mm <sup>2</sup> /s (40°C)	AGMA	BP	CASTROL			CHEVRON TEXACO		EXXON MOBIL		SHELL	TOTAL
				ALPHA SP68	OPTIGEAR BM68	TRIBOL 1100/68	GEAR COMPOUNDS EP68	MEROPA WM68	-	MOBILGEAR 600XP 68		
	VG68	2EP	ENERGOL GR-XP-68	ALPHA SP68	OPTIGEAR BM68	TRIBOL 1100/68	GEAR COMPOUNDS EP68	MEROPA WM68	-	MOBILGEAR 600XP 68	Shell Omala S2 G 68	CARTER EP68
	VG150	4EP	ENERGOL GR-XP-150	ALPHA SP150	OPTIGEAR BM150	TRIBOL 1100/150	GEAR COMPOUNDS EP150	MEROPA WM150	SPARTAN EP150	MOBILGEAR 600XP 150	Shell Omala S2 G 150	CARTER EP150
Bearing grease			ENERGREASE LS EP2	SPHEEROL AP3	Olista Longtime 3EP	TRIBOL 3020/1000-2	DURALITH GREASE 68	MULTIFAK EP2	BEACON EP2	MOBILPLEX 48	Shell Gadus S2 V 220 2	MULTIS EP2

## (4) Oil Quantity

An estimated oil quantity for standard specifications is shown in "10. Oil quantity". Use a dipstick or visible oil gauge to check the oil level even after filling with indicated oil quantity.

## (5) Fill/Drain oil

Supply oil through the filling port on top of the main unit. Check the oil level with a dipstick or visible oil gauge. (Fig. 7-1).

Screw the dipstick to its deepest position to check the oil level; otherwise, the measured oil level will be incorrect. (Fig. 7-2).

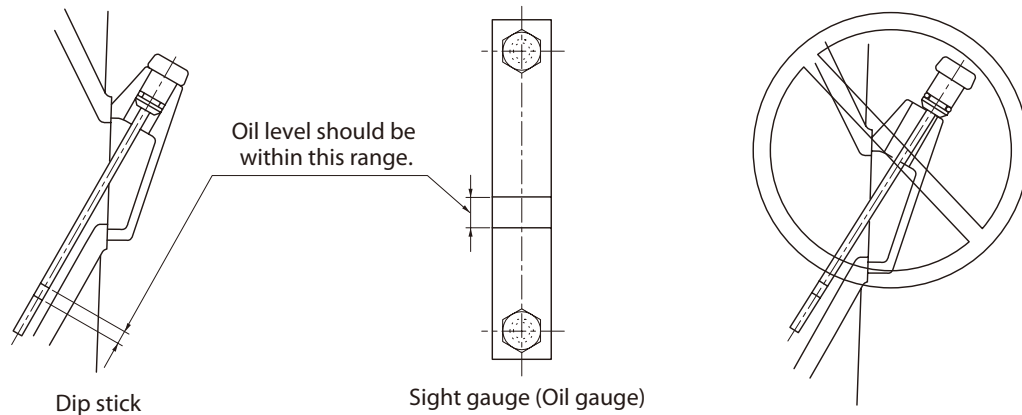


Fig. 7-1

Fig. 7-2

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

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

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

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

# 7. Daily Inspection and Maintenance

## (6) Fill/Drain Grease

- Except for some models, bearings are grease lubricated. Verify the number and locations of the grease fittings.
- Grease is supplied before shipment. For grease supply after starting operation, supply necessary amount according to the following table 7-7.

Do not exceed the recommended amount of grease.

Table 7-7 Grease replenishment interval and amount

### Parallel shaft Horizontal (Assembly 1, 5)

Double Reduction						Triple Reduction						Quadruple Reduction																		
Size	Input speed r/min				Replenishing quantity g	Unit: hour	Size	Input speed r/min				Replenishing quantity g	Unit: hour	Size	Input speed r/min				Replenishing quantity g	Unit: hour										
	1800	1500	1200	1000				1800	1500	1200	1000				1800	1500	1200	1000												
A	Oil bath						A	6 months	6 months	6 months	6 months	10		A	6 months	6 months	6 months	6 months	10											
B							3000	3000	3000					3000							3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
C										2000	2000				2000	2000	2000	2000												
D							1000	1000	1000					1000							1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
E										500 Note 2	500 Note 2				500 Note 2	500 Note 2	500 Note 2	500 Note 2												
F							1000	1000	1000					1000							1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
G										500	500				500	500	500	500												
H							500	500	500					500							500	500	500	500	500	500	500	500	500	500
K										500	500				500	500	500	500												
L							500	500	500					500							500	500	500	500	500	500	500	500	500	500

### Parallel shaft Vertical (Assembly 2, 6)

Double Reduction						Triple Reduction						Quadruple Reduction											
Size	Input speed r/min				Replenishing quantity g	Unit: hour	Size	Input speed r/min				Replenishing quantity g	Unit: hour	Size	Input speed r/min				Replenishing quantity g	Unit: hour			
	1800	1500	1200	1000				1800	1500	1200	1000				1800	1500	1200	1000					
A	2000	2000	2000	2000	10	A	2000	2000	2000	2000	10	A	2000	2000	2000	2000	10	A	2000	2000	2000	2000	10
B																							
C	50	50	50	50	30	C	50	50	50	50	30	C	50	50	50	50	30	C	50	50	50	50	
D																							Forced lubrication Note 3
E	70	70	70	70	30	E	70	70	70	70	30	E	70	70	70	70	30	E	70	70	70	70	
F																							100
G	1000	1000	1000	1000	70	G	1000	1000	1000	1000	70	G	1000	1000	1000	1000	70	G	1000	1000	1000	1000	
H																							500
K	500	500	500	500	100	K	500	500	500	500	100	K	500	500	500	500	100	K	500	500	500	500	
L																							500

### Right angle shaft Horizontal and Vertical (Assembly 3, 4)

Double Reduction						Triple Reduction						Quadruple Reduction											
Size	Input speed r/min				Replenishing quantity g	Unit: hour	Size	Input speed r/min				Replenishing quantity g	Unit: hour	Size	Input speed r/min				Replenishing quantity g	Unit: hour			
	1800	1500	1200	1000				1800	1500	1200	1000				1800	1500	1200	1000					
A	3000	3000	6 months	6 months	20	A	3000	6 months	6 months	6 months	20	A	6 months	6 months	6 months	6 months	10	A	6 months	6 months	6 months	6 months	10
B	2000	2000	3000	3000	40	B	2000	3000	3000	3000	30	B	6 months	6 months	6 months	6 months	20	B	6 months	6 months	6 months	6 months	20
C						1000						1000						2000					
D	500 Note 2	500 Note 2	1000	1000	100		D	500	1000	1000	60		D	2000	2000	3000	3000		60	D	2000	2000	3000
E						1000	1000					1000	1000					150		E			
F	500	500	500	500	200			F	500	500	500			200	F	500	500		1000	1000	100	F	500
G						Forced lubrication Note 3	Forced lubrication Note 3	Forced lubrication Note 3				Forced lubrication Note 3	200		G			Forced lubrication Note 3				Forced lubrication Note 3	
H	500	500	500	500	200				H	500	500			500	200	H	500		500	1000	1000		100
K						500	500	500	500			200	K			500		500				500	
L	500	500	500	500	200					L	500		500	500	200		L		500	500	1000		1000

Note: 1. The above tables show the service intervals and the amount of oil required for high speed shaft bearings. For intermediate shaft bearings and low speed shaft bearings, double the service intervals.

2. Forced lubrication may be used depending on the specifications.

3. Grease lubrication may be used depending on the specifications.

The lower bearing of the output shaft is given grease lubrication, if the output shaft is facing downward. Therefore, replenish grease every 6 to 12 months.

4. Replenish grease every 6 to 12 months is recommended even if the total operation time is less than that mentioned in the tables.

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

# 7. Daily Inspection and Maintenance

## 7-4 Parts Maintenance

To increase the reducer's service life, overhaul and replace below items every 3 to 5 years. Please contact factory for overhaul.

Replacement parts

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

## 7-5 Oil Cooler (Optional) Maintenance

- Inspect and clean the cooling pipe and water cooler unit regularly. Inspection term depends on the lubricant condition or quality of cooling water, at least perform every 3 to 6 months.
- Even though regular inspection and cleaning is performed, water leakage due to corrosion may occur if water quality management is insufficient.
- Quality of cooling water should conform to water quality standard guideline, JRA-GL 02-1994 (Table 7-8).

### (1) Maintenance of Cooling Pipe

- Cooling pipe can be removed from reducer after draining lubricant and removing bolts for cooling pipe. Inspect the cooling pipe after removing the bolts and separating with cover.
- Drain cooling water if not operate for long time. Remaining water may cause corrosion. Drain cooling water under the environment where water freezes in winter as well.

### (2) Maintenance of Water-Cooler Unit

- Check the condition of piping outside by removing the bonnet at water U-turn side. Check the condition of piping inside after draining the oil from drain plug.
- Check the corrosion-proof zinc and replace it if it is less than half size. Depending on water quality, it may be necessary to replace in 3 to 6 months.
- Drain cooling water every day under the environment where water freezes in winter.

Table 7-8 Cooler Water Quality Standard (JRA-GL 02-1994)

Item		Standard value (Circulating cooling water)
Standard Items	pH (25°C)	6.5 to 8.2
	Electric conductivity (25°C)	mS/m Not exceeding 80
	Chloride ion	mg/L Not exceeding 200
	Sulfuric acid ion	mg/L Not exceeding 200
	Acid consumption amount (pH4.8)	mg/L Not exceeding 100
	Total hardness	mg/L Not exceeding 200
	Calcium hardness	mg/L Not exceeding 150
	Ionic state silica	mg/L Not exceeding 50
Reference Items	Iron	mg/L Not exceeding 1.0
	Copper	mg/L Not exceeding 0.3
	Sulfide ion	mg/L Not detected
	Ammonium ion	mg/L Not exceeding 1.0
	Residual chlorine	mg/L Not exceeding 0.3
	Free carbon	mg/L Not exceeding 4.0
	Stability index	6.0 to 7.0



# 8. Troubleshooting

## ⚠ CAUTION

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

Refer to Table 8-1 whenever the reducer is operating abnormally and take the appropriate corrective action immediately. Consult factory if not recovered.

Table 8-1 Troubleshooting Guide

Symptom		Cause	Measure
The output shaft does not rotate at no-load.		Damage to gear/shaft due to over load	Confer with authorized service station.
The output shaft rotates at no-load.	When load is applied, the output shaft stops.	The key is missing.	Install a key.
		The bearing is burned.	Confer with authorized service station.
		Poor adjustment of protective device	Adjust the protect device.
	Rotates in reverse.	Wiring error	Wire correctly.
Excessive temperature rise		Overload	Decrease the load to the specified value.
		Damage to bearing	Confer with authorized service station.
		The ambient temperature is high.	Improve the ventilation.
		Damage to gear/bearing due to over load	Confer with authorized service station.
Oil leakage	Oil leaks from the input/output shaft.	Damage to oil seal	Confer with authorized service station.
		Scratches or abrasion on the shaft where the sealing lip touches	Confer with authorized service station.
	Oil leaks from the split line of housing.	Loose bolt	Tighten the bolt to proper torque.
Abnormal sound Excessive vibration	Damage to gear/shaft/bearing		Confer with authorized service station.
	Housing is deformed due to uneven installation surface.		Flatten the installation surface or use liners for adjustment.
	Resonance due to insufficient rigidity of installation base		Reinforce the installation base to improve the rigidity.
	Misalignment with driven machine		Align the shaft center.
	Vibration of driven machine transmitted to the reducer		Operate the reducer alone to check the noise source.

# 9. Construction Drawings

## 9-1 Construction Drawings (Parallel Shaft)

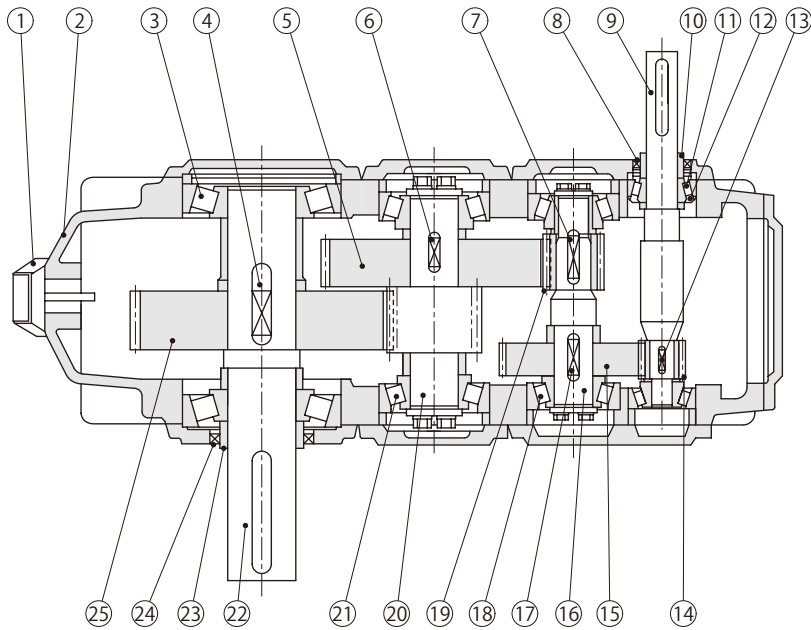


Fig. 9-1 Horizontal Parallel Shaft Triple Reduction

Table 9-1 Parts List

No.	Part Name
1	Dip Stick
2	Housing
3	Bearing
4	Key
5	Helical Gear
6	Key
7	Key
8	Oil Seal
9	High Speed Shaft
10	Collar
11	Bearing
12	Nilos-ring
13	Key
14	Helical Pinion
15	Helical Gear
16	Intermediate shaft
17	Key
18	Bearing
19	Helical Pinion
20	Helical Pinion Shaft
21	Bearing
22	Slow Speed Shaft
23	Collar
24	Oil Seal
25	Helical Gear

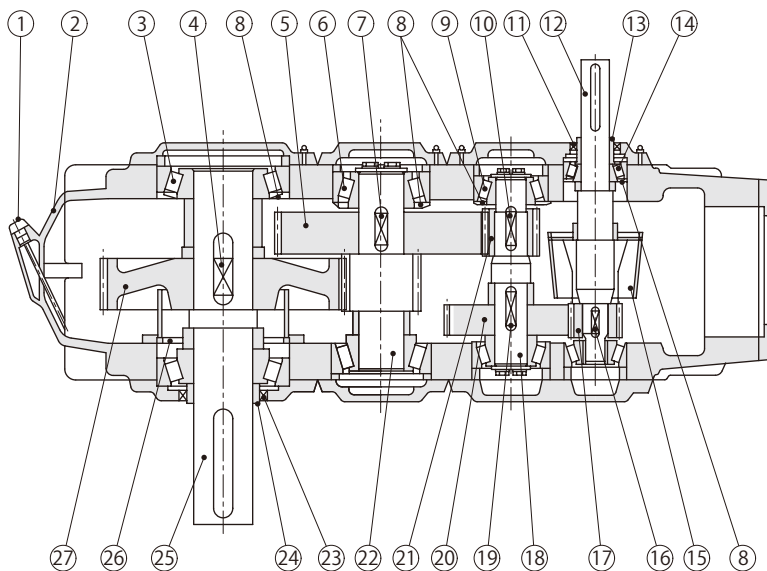


Fig. 9-2 Vertical Parallel Shaft Triple Reduction

Table 9-2 Parts List

No.	Part Name
1	Dip Stick
2	Housing
3	Bearing
4	Key
5	Helical Gear
6	Bearing
7	Key
8	Nilos-ring
9	Bearing
10	Key
11	Oil Seal
12	High Speed Shaft
13	Collar
14	Bearing
15	Oil thrower
16	Key
17	Helical Pinion
18	Intermediate shaft
19	Key
20	Helical Gear
21	Helical Pinion
22	Helical Pinion Shaft
23	Oil Seal
24	Collar
25	Slow Speed Shaft
26	Flange cylinder
27	Helical Gear

# 9. Construction Drawings

## 9-2 Construction Drawings (Right Angle Shaft)

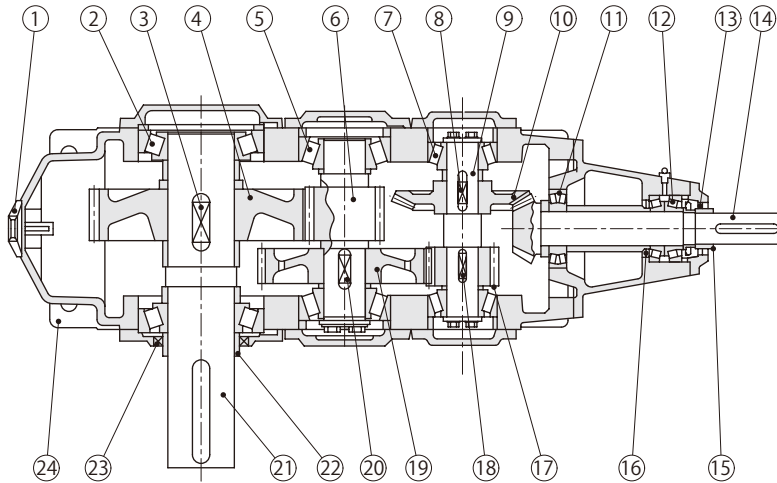


Fig. 9-3 Horizontal Right Angle Shaft Triple Reduction

Table 9-3 Parts List

No.	Part Name
1	Dip Stick
2	Bearing
3	Key
4	Helical Gear
5	Bearing
6	Helical Pinion Shaft
7	Bearing
8	Key
9	Intermediate shaft
10	Spiral Bevel Gear
11	Bearing
12	Bearing
13	Oil Seal
14	Bevel Pinion Shaft
15	Collar
16	Nilos-ring
17	Helical Pinion
18	Key
19	Helical Gear
20	Key
21	Slow Speed Shaft
22	Collar
23	Oil Seal
24	Housing

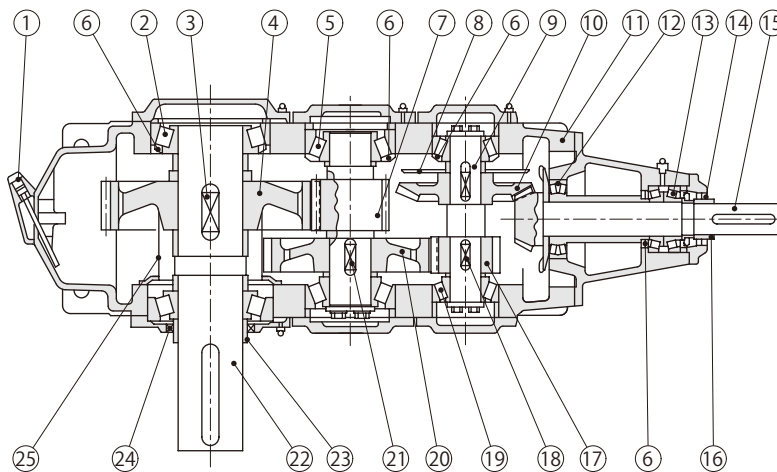


Fig. 9-4 Vertical Right Angle Shaft Triple Reduction

Table 9-4 Parts List

No.	Part Name
1	Dip Stick
2	Bearing
3	Key
4	Helical Gear
5	Bearing
6	Nilos-ring
7	Helical Pinion Shaft
8	Oil Retainer
9	Intermediate shaft
10	Spiral Bevel Gear
11	Housing
12	Bearing
13	Bearing
14	Oil Seal
15	Bevel Pinion Shaft
16	Collar
17	Helical Pinion
18	Key
19	Bearing
20	Helical Gear
21	Key
22	Slow Speed Shaft
23	Collar
24	Oil Seal
25	Flange cylinder

# 10. Oil Quantity

Table 10-1 N Type Oil Quantity

Unit: Liter

Size	Double reduction				Triple reduction				Quadruple reduction			
	Parallel shaft		Right angle shaft		Parallel shaft		Right angle shaft		Parallel shaft		Right angle shaft	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
	Assembly 1, 5	Assembly 2, 6	Assembly 3	Assembly 4	Assembly 1, 5	Assembly 2, 6	Assembly 3	Assembly 4	Assembly 1, 5	Assembly 2, 6	Assembly 3	Assembly 4
A	6	7	4	5	6	4	7	5	-	-	-	-
B	10	12	8	7	11	7	12	9	-	-	-	-
C	13	13	11	8	18	10	17	12	-	-	-	-
D	18	19	18	14	30	19	31	22	-	-	-	-
E	26	35	24	26	43	29	45	32	-	-	-	-
F	40	56	41	51	75	42	75	53	-	-	-	-
G	82	86	80	82	135	68	137	90	-	-	-	-
H	115	98	100	90	140	70	134	128	136	119	141	154
K	160	130	130	112	193	110	180	185	195	173	191	180
L	215	190	135	180	257	160	250	265	275	228	273	300

Table 10-2 D Type Oil Quantity

Unit: Liter

Size	Double reduction		Triple reduction				Quadruple reduction			
	Parallel shaft		Parallel shaft		Right angle shaft		Parallel shaft		Right angle shaft	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
	Assembly 1, 5	Assembly 2, 6	Assembly 1, 5	Assembly 2, 6	Assembly 3	Assembly 4	Assembly 1, 5	Assembly 2, 6	Assembly 3	Assembly 4
A	4	6	4	4	5	4	4	4	5	5
B	7	11	8	7	8	6	8	8	5	5
C	11	12	13	11	12	10	13	16	12	12
D	21	17	24	17	23	22	24	22	24	24
E	38	38	43	35	44	34	43	53	44	42
F	60	57	71	40	70	56	71	67	72	79
G	105	90	126	70	125	100	121	115	122	139

Note: The oil amounts shown in the table are for continuous operation at the standard input speed (1000 to 1800 r/min).

If the operating conditions are different, the lubrication method and the oil level may not be the same. Be sure to check the oil level with a dip stick or a sight gauge (oil gauge).

# 11. Oil filler and Drain Plug Locations

## 11-1 Horizontal

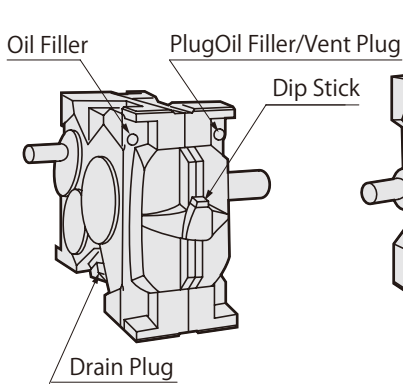


Fig.11-1 N Type A-G Size

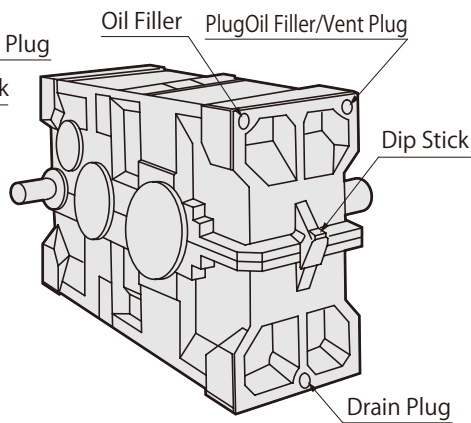


Fig.11-2 N Type K-L Size

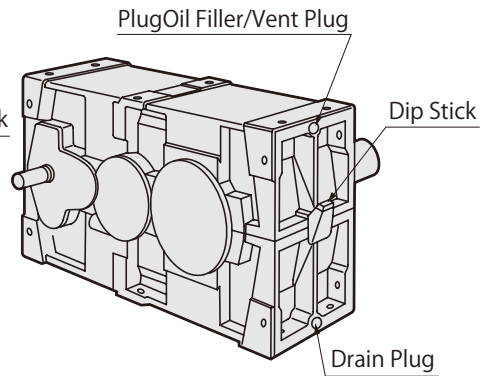


Fig.11-3 D Type A-G Size

## 11-2 Vertical

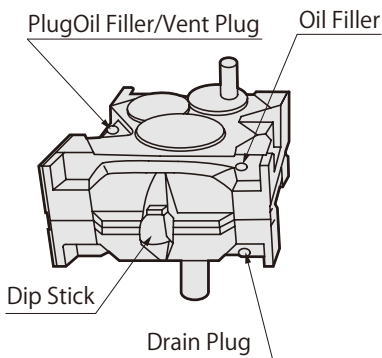


Fig.11-4 N Type A-G Size

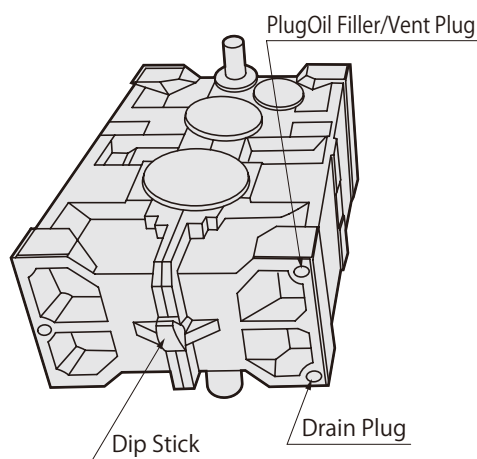


Fig.11-5 N Type H-L Size

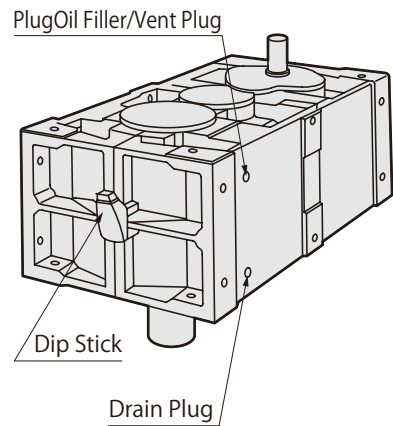


Fig.11-6 D Type A-G Size

Note: The positions of the high speed shaft are different for both the horizontal and vertical types, and the positions of the oil fillers are the same.

## 11-3 Size of Oil Filler and Drain Plug

Table 11-1 Size of Oil Filler and Drain Plug

Unit: Inch

Reducer Size	A	B	C	D	E	F	G	H HJ	K KJ	L LJ	N NJ	Q QJ
Size of Oil Filler Drain Plug	1/2		3/4			1		1 1/4				

# 12. Warranty

The scope of our product warranty is limited to our manufacturing range.

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



# Worldwide Locations

<b>U.S.A</b> <b>Sumitomo Machinery Corporation of America (SMA)</b> 1453 Cornwall Blvd. Chesapeake, VA 23323, U.S.A. TEL (1)757-485-3355 FAX (1)757-485-7490	<b>Austria</b> <b>Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)</b> SCG Branch Austria Office Gruentalerstraße 30A, 4020 Linz, Austria TEL (43)732-330958 FAX (43)732-331978	<b>Korea</b> <b>Sumitomo (SHI) Cyclo Drive Korea, Ltd. (SCK)</b> Room #913, Royal Bldg, Saemun-ro 5 gil 19, Jongro-gu, Seoul, Korea 03173 TEL (82)2-730-0151 FAX (82)2-730-0156
<b>Canada</b> <b>SM Cyclo of Canada, Ltd. (SMC)</b> 1453 Cornwall Road, Oakville, Canada ON L6J 7T5 TEL (1)905-469-1050 FAX (1)905-469-1055	<b>Belgium</b> <b>Hansen Industrial Transmissions NV (HIT)</b> Leonardo da Vincilaan 1, Edegem, Belgium TEL (32)34-50-12-11 FAX (32)34-50-12-20	<b>Taiwan</b> <b>Tatung SM-Cyclo Co., Ltd. (TSC)</b> 22 Chungshan N. Road 3rd., Sec. Taipei, Taiwan 104, R.O.C. TEL (886)2-2595-7275 FAX (886)2-2595-5594
<b>Mexico</b> <b>SM Cyclo de Mexico, S.A. de C.V. (SMME)</b> Av. Desarrollo 541, Col. Finsa, Guadalupe, Nuevo León, México, CP67132 TEL (52)81-8144-5130 FAX (52)81-8144-5130	<b>France</b> <b>SM-Cyclo France SAS (SMFR)</b> 8 Avenue Christian Doppler, 77700 Serris, France TEL (33)164171717 FAX (33)164171718	<b>Singapore</b> <b>Sumitomo (SHI) Cyclo Drive Asia Pacific Pte. Ltd. (SCA)</b> 15 Kwong Min Road, Singapore 628718 TEL (65)6591-7800 FAX (65)6863-4238
<b>Brazil</b> <b>Sumitomo Industrias Pesadas do Brasil Ltda. (SHIB)</b> Rodovia do Acucar (SP-075) Km 26 Itu, Sao Paulo, Brasil TEL (55)11-4886-1000 FAX (55)11-4886-1000	<b>Italy</b> <b>SM-Cyclo Italy Srl (SMIT)</b> Via dell' Artigianato 23, 20010 Cornaredo (MI), Italy TEL (39)293-481101 FAX (39)293-481103	<b>Philippines</b> <b>Sumitomo (SHI) Cyclo Drive Asia Pacific Pte. Ltd.</b> Philippines Branch Office (SMPH) C4 & C5 Buildings Granville Industrial Complex, Carmona, Cavite 4116, Philippines TEL (63)2-584-4921 FAX (63)2-584-4922
<b>Chile</b> <b>SM-Cyclo de Chile Ltda. (SMCH)</b> Camino Lo Echevers 550, Bodegas 5 y 6, Quilicura, Región Metropolitana, Chile TEL (56)2-892-7000 FAX (56)2-892-7001	<b>Spain</b> <b>Sociedad Industrial de Transmisiones S.A. (SIT)</b> Ubarburu Pasealekua, 67, San Sebastián, Guipúzcoa, Spain TEL (34)943-457-200 FAX (34)902-431-278	<b>Vietnam</b> <b>SM-Cyclo (Vietnam) Co., Ltd. (SMVN)</b> Factory 2B, Lot K1-2-5, Road No. 2-3-5A, Le Minh Xuan Industrial Park, Binh Chanh Dist., HCMC, Vietnam TEL (84)8-3766-3709 FAX (84)8-3766-3710
<b>Argentina</b> <b>SM-Cyclo de Argentina S.A. (SMAR)</b> Ing Delpini 2230, B1615KGB Grand Bourg, Malvinas Argentinas, Buenos Aires, Argentina TEL (54)3327-45-4095 FAX (54)3327-45-4099	<b>United Kingdom</b> <b>SM-Cyclo UK Ltd. (SMUK)</b> Unit 29, Bergen Way, Sutton Fields Industrial Estate, Kingston upon Hull, HU7 0YQ, East Yorkshire, United Kingdom TEL (44)1482-790340 FAX (44)1482-790321	<b>Malaysia</b> <b>SM-Cyclo (Malaysia) Sdn. Bhd. (SMMA)</b> No.7C, Jalan Anggerik Mokara 31/56, Kota Kemuning, Seksyen 31, 40460 Shah Alam, Selangor Darul Ehsan, Malaysia TEL (60)3-5121-0455 FAX (60)3-5121-0578
<b>Guatemala</b> <b>SM Cyclo de Guatemala Ensambladora, Ltda. (SMGT)</b> Parque Industrial Unisur, 0 Calle B 19-50 Zona 3, Bodega D-1 Delta Bárcenas en Villa Nueva, Guatemala TEL (502)6648-0500 FAX (502)6631-9171	<b>Turkey</b> <b>SM Cyclo Turkey Güç Aktarım Sis. Tic. Ltd. Sti. (SMTR)</b> Barbaros Mh. Çiğdem Sk. Ağaoğlu, Office Mrk. No:1 Kat:4 D.18 Ataşehir, İstanbul, Turkey TEL (90)216-250-6069 FAX (90)216-250-5556	<b>Indonesia</b> <b>PT. SM-Cyclo Indonesia (SMID)</b> Jalan Sungai Blok F 25 No. 09 K, Delta Silicon III, Lippo Cikarang, Bekasi 17530, Indonesia TEL (62)21-2961-2100 FAX (62)21-2961-2211
<b>Colombia</b> <b>SM Cyclo Colombia, S.A.S. (SMCO)</b> Parque Industrial Celta, Km 7.0 Autopista Medellín, Costado Occidental, Funza, Cundinamarca, Colombia TEL (57)1-826-9766	<b>India</b> <b>Sumi-Cyclo Drive India Private Limited (SDI)</b> Gat No. 186, Rasoni Industrial Park, Alandi Markal Road, Fulgaon-Pune, Maharashtra, India TEL (91)96-0774-5353	<b>Thailand</b> <b>SM-Cyclo (Thailand) Co., Ltd. (SMTH)</b> 195 Empire Tower, Unit 2103-4, 21st Floor, South Sathorn Road, Yannawa, Sathorn, Bangkok 10120, Thailand TEL (66)2670-0998 FAX (66)2670-0999
<b>Peru</b> <b>SM Cyclo de Perú, S.A.C (SMPE)</b> Jr. Monte Rosa 255, Oficina 702, Lima, Santiago de Surco, Perú TEL (51)1-713-0342 FAX (51)1-715-0223	<b>China</b> <b>Sumitomo (SHI) Cyclo Drive Shanghai, Ltd. (SCS)</b> 11F, SMEG Plaza, No. 1386 Hongqiao Road, Changning District, Shanghai, China 200336 TEL (86)21-3462-7877 FAX (86)21-3462-7922	<b>Australia</b> <b>Sumitomo (SHI) Hansen Australia Pty. Ltd. (SHAU)</b> 181 Power St, Glendenning, NSW 2761, Australia TEL (61)2-9208-3000 FAX (61)2-9208-3050
<b>Germany</b> <b>Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)</b> Cyclostraße 92, 85229 Markt Indersdorf, Germany TEL (49)8136-66-0 FAX (49)8136-5771	<b>Hong Kong</b> <b>SM-Cyclo of Hong Kong Co., Ltd. (SMHK)</b> Room 19, 28th Floor, Metropole Square, No.2 On Yiu Street, Shatin, New Territories, Hong Kong TEL (852)2460-1881 FAX (852)2460-1882	<b>Japan</b> <b>Sumitomo Heavy Industries, Ltd. (SHI)</b> ThinkPark Tower, 1-1 Osaki 2-chome, Shinagawa-ku, Tokyo 141-6025, Japan TEL (81)3-6737-2511 FAX (81)3-6866-5160

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