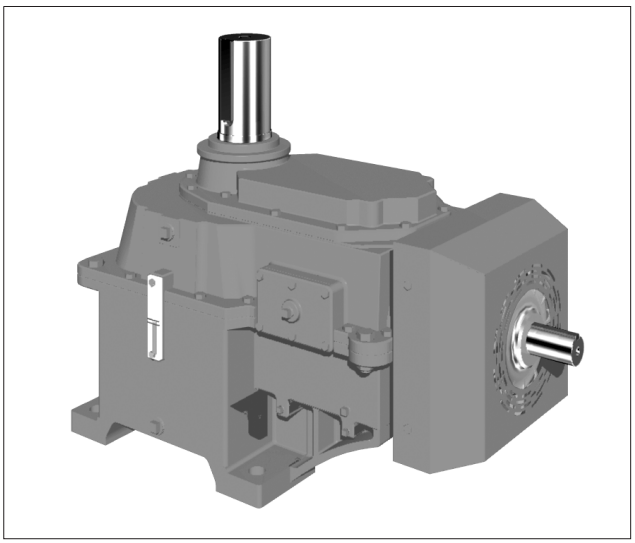
The Available Solution

SHI Sumitomo Heavy Industries

PARAMAX® DRIVE

FOR COOLING TOWERS SFC Series

Maintenance Manual



(Note)

- PARAMAX DRIVE FOR COOLING TOWERS should be handled, installed, and maintained by trained technicians. Carefully read the maintenance manual before use.
- Oil is removed from PARAMAX DRIVE FOR COOLING TOWERS before shipment. Supply oil according to the maintenance manual before operation.
- A copy of this maintenance manual should be sent to the actual user of PARAMAX DRIVE FOR COOLING TOWERS.
- This maintenance manual should be maintained by the user.

Sumitomo Heavy Industries, Ltd.
POWER TRANSMISSION & CONTROLS GROUP

Cat. No.
GM2201E-1

(Safety and other precautions)

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

□□Pay particular attention to the "DANGER" and "CAUTION" warnings regarding safety and proper use.

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

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

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

DANGER

- □Transport, installation, plumbing, operation, maintenance, and inspections should be handled by properly trained technicians ; otherwise, injury or damage to the machine may result.
- □Do not disassemble PARAMAX Drives FOR COOLING TOWERS during operation. Even if it is at rest, do not disassemble any parts other than the oil inlet/outlet when the input/output shafts of the PARAMAX DRIVE FOR COOLING TOWERS is connected to a motor or other mating machines; otherwise falling or operation out of control due to disengagement of gears, as well as death, injury, or damage to the machine may result.

CAUTION

- □The unit should be operated only within its design and performance specifications ; otherwise, injury or damage to a system may occur.
- □Keep hands and all foreign objects from the internal moving parts of the unit ; otherwise, injury or damage to a system may occur.
- □Damaged units should be taken off - line and not put back in operation until properly repaired.
- □Any modifications or alterations of any kind, to the unit, will void the warranty and all subsequent claims.
- □Do not remove the rating plate.

□□Oil has been removed from PARAMAX DRIVE FOR COOLING TOWERS before shipment from our factory, so supply recommended oil before use.

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1. Inspection upon delivery

⚠ CAUTION

- Unpack the unit after verifying that it is positioned right side up ; otherwise, injury may result.
- Verify that the unit received is in fact the one ordered. When a different product is installed, injury or damage to the system may result.
- Do not remove nameplate.

Upon delivery of the PARAMAX DRIVE FOR COOLING TOWERS, check the following :

(1) The descriptions on the rating plate conform to 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 conform to the one ordered, contact the nearest agent, distributor or service office.

1-1) How to check the rating plate

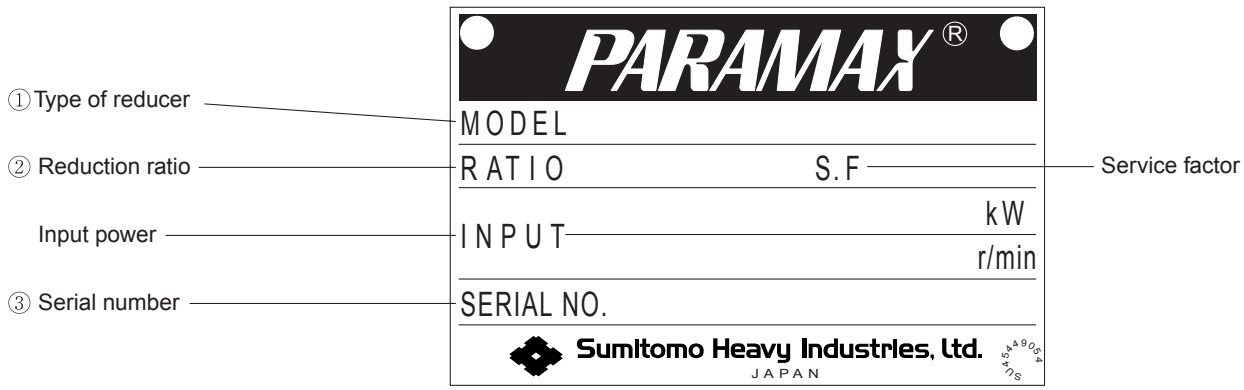


Fig. 1 Rating plate

· Have the ①MODEL, ②RATIO and ③SERIAL No. information ready when making inquiries.

1-2) Types of reducers

Symbols denote the following. Check that the type of reducer conforms to your order.

SFC	065	R2	S	—	RR	F	—	14

Series	Size Output Torque (kNm)	Gear Stages	Lubrication	Shaft Arrangement	Accessories	Nominal Ratio
SFC	045 (10.0) 055 (18.0) 060 (21.7) 065 (27.5) 070 (35.5) 075 (44.0)	R2 Right Angle Double Reduction	S : Splash (Standard) P : Shaft Driven Pump	RR	F : With Cooling Fan (Standard) FB : With Cooling Fan & Backstop N : No Cooling Fan NB : No Cooling Fan & With Backstop	6.3□ 7.1□ 8□ 9□ 10□ 11.2□ 12.5□ 14□ 16□ 18

2. Storage

When storing PARAMAX DRIVE FOR COOLING TOWERS for any extended periods of time before use, consider the following important points.

2-1) Temporary storage

(1) Store PARAMAX DRIVE FOR COOLING TOWERS in a clean, dry, covered storage area.

· Do not store PARAMAX DRIVE FOR COOLING TOWERS outdoors or in a wet location.

2-2) Long-term storage

(1) The oil seal will deteriorate when exposed to high temperatures and UV rays. Inspect and replace the oil seal after long-term storage if there are any signs of damage or cracking.

(2) After starting PARAMAX DRIVE FOR COOLING TOWERS, check that it is free from abnormal sound, vibration, or heatbuild-up. (If any kind of anomaly is observed) contact the nearest agent, dealer, or service office immediately.

(3) Every 2 - 3 months after shipment, operate PARAMAX DRIVE FOR COOLING TOWERS with the recommended lubricant for 5 - 10 minutes. If this is not possible, or when PARAMAX DRIVE FOR COOLING TOWERS is to be stored for more than 6 months, fill the unit with the proper amount of vapor phase inhibitor (JIS NP20 or its equivalent) according to the inhibitor manufacturers recommendations.

3. Transport

⚠ CAUTION

- Exercise ample care not to drop PARAMAX DRIVE FOR COOLING TOWERS during transport. When a hanging bolt or hole is provided, be sure to use it. After mounting PARAMAX DRIVE FOR COOLING TOWERS on a system, however, do not hoist the entire system using the hanging bolt or hole.
  Otherwise, personal injury or damage to the equipment and/or lifting device may result.
- Before hoisting, check the weight with the rating plate, crate, performance specifications, catalog, etc. Never hoist a PARAMAX DRIVE FOR COOLING TOWERS that exceeds the rating of the crane or other mechanism being used to lift it ; otherwise, injury or damage to the unit and/or lifting device may occur.

4. Installation

⚠ DANGER

- Never stand directly under a unit suspended by a crane or other lifting mechanism ; otherwise personal injury or death may result.

⚠ CAUTION

- Do not place any objects that will hinder ventilation around PARAMAX DRIVE FOR EXTRUDERS; otherwise, cooling effect is reduced, and may lead to a possible fire hazard due to excessive heat build-up.
- Do not step on or hang from PARAMAX DRIVE FOR COOLING TOWERS; otherwise, injury or damage to the machine may result.
- Do not touch the key way at the shaft end or on the inside of PARAMAX DRIVE FOR COOLONG TOWERS; otherwise, injury may result.
- Do not use PARAMAX DRIVE FOR COOLING TOWERS for purposes other than those shown on the rating plate or in the manufacturing specifications; otherwise, electric shock, personal injury or damage to the equipment may result.
- Do not place flammable objects around PARAMAX DRIVE FOR COOLING TOWERS; otherwise, fire may result.

4-1) Location of installation

Ambient temperature : 0℃ to +40℃ (+32°F to +104°F)
Ambient humidity : 85% max. (Air vent or air breather must be located outside of fan stack with extended piping)
Ambient atmosphere : There shall be no corrosive gas, explosive gas.
The installation space shall be well ventilated, and free from dust.
Location of installation : Indoors or outdoors.

- Special specifications are necessary when installation conditions are other than those mentioned here. In such cases contact the nearest agent, dealer or service office.
- When a product is made according to special specifications for outdoor use or use in explosive environments, the product can be safely operated under those specified conditions without problem.

4-2 Installation angle

The installation angle shall be less than the limits shown in Fig.2.

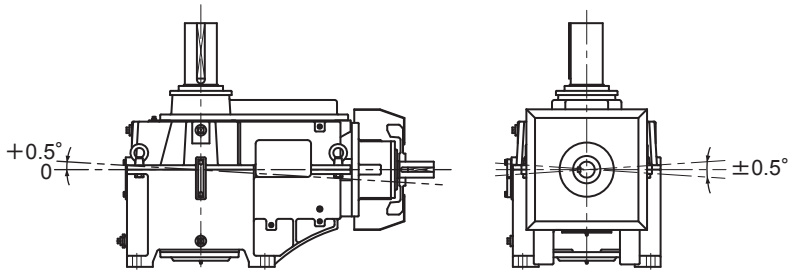


Fig.2 Limits for installation angle

- Install PARAMAX DRIVE FOR COOLING TOWERS on a sufficiently rigid base.
- Use installation bolts corresponding to JIS strength class 8.8 or its equivalent. The torque of installation bolts is shown in table1.

Table1 Torque of the installation bolts

		Size					
	Unit	SFC045	SFC055	SFC060	SFC065	SFC070	SFC075
Bolt Size	–	M24	M30			M36	
Torque	N·m	706	1400			2430	
	in·lbs	6250	12390			21510	

5. Coupling with other machines

⚠ CAUTION

- IF a backstop is installed in the reducer, verify that the applied motor rotation direction is correct. Difference in the direction of rotation may cause injury or damage to the system.
- Install appropriate guard devices around rotating parts ; otherwise, injury may result.
- When coupling PARAMAX DRIVE FOR COOLING TOWERS with a load, confirm that the alignment error is within the specified limits shown in the maintenance manual, drawings, catalog, etc. ; otherwise, damage to the system may result, due to misalignment.
- Correctly tighten respective bolts to the specified torque shown in the drawing, catalog, etc. ; otherwise ; scattering fragments may damage the system.
- Remove the key temporarily attached to the output shaft of PARAMAX DRIVE FOR COOLING TOWERS when the shaft is free-rotating (i. e. not loaded) ; otherwise, injury may result.

5-1) Installation coupler

· When attaching a coupler, be careful 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. 3)

The dimensions (A, B, and X) illustrated in Fig. 4 shall be within the tolerance shown in Table 2.

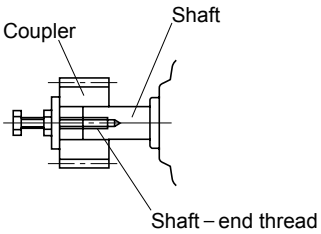


Fig. 3

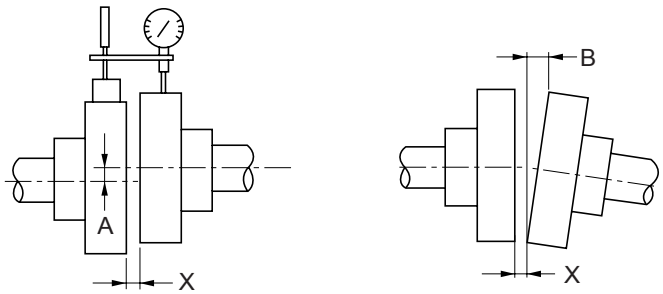


Fig. 4

Table 2 Aligning tolerance for coupling

Tolerance for A dimension	0.05mm	0.002in
Tolerance for B dimension	0.05mm	0.002in
X dimension	Specified by coupling manufacturer	

6. Lubrication

6-1) Shipping condition

· PARAMAX DRIVE FOR COOLING TOWERS units are shipped without oil. Supply recommended oil before operation.

6-2) Method of lubrication

The oil splash lubrication method is used for PARAMAX DRIVE FOR COOLING TOWERS.
Under certain conditions, grease or forced lubrication should be used.

(1) Splash lubrication
Standard input shaft rotating speed range 450～1800r/min.

(2) Forced lubrication

⚠ CAUTION

● For a system in which a lubricant motor pump is provided separately, switch on the pump motor prior to switching on the reducer motor. This will enable proper lubrication of the bearings prior to start up. Failure to do so may damage the unit.

Use a flow switch and/or sight to verify that lubricant is circulating, and for emergency motor stop if necessary.

(3) Grease lubrication for bearings
Grease lubrication will be required depending on an operating condition. In such case, the location and number of grease nipples should be confirmed in advance. The bearings are packed with grease at the time of shipment. Supply grease according to the input speed - every 1500 hours when the revolution is under 750r/min, and every 1000 hours when the revolution is 750-1800r/min.

6-3) Selection of lubricant

Refer to Table 3 to select mineral oil or synthetic oil.
Table 4 shows recommended lubricants.

Table 3 Lubricant table

	Ambient temperature		
	-20 ～ 40℃ -4 ～ 104℉	-15 ～ 40℃ 5 ～104℉	0 ～ 40℃ 32 ～ 104℉
Oil Heater	Installed	Not Installed	Not Installed
Lubricant	Mineral oil	Synthetic oil	Mineral oil
ISO* AGMA	VG320 6EP	VG320 6S	VG320 6EP

*ISO : Kinetic viscosity (mm^2/s) at 40℃ (104°F)

Table 4 Recommended lubricants

● Mineral Oil

Brand	ARAL	BP	CASTROL	CHEVRON	EXXONMOBIL		GULF	OPTIMOL	SHELL	TEXACO	TOTAL FIAN ELF	TRIBOL
ISO VG320 AGMA 6EP	DEGOL BG320	ENERGOL GR-XF-320	ALPHA SP320	GEAR COMPOUNS EP320	SPARTAN EP320	MOBIL-GEAR 632	EP LUBRI-CANT HD320	OPTIGEAR BM 320	OMALA 320	MEROPA WM 320	CARTER EP320	TRIBOL 1100/320

● Synthetic Oil

Brand	EXXONMOBIL	
ISO VG320 AGMA 6S	MOBIL GEAR SHC XMP 320	MOBIL GEAR SHC 320

6-4) Oil quantity

An estimated quantity of oil for standard specifications is shown in Table 5. The oil quantity shown in Table 5 and the catalog is not exact. Use a dipstick or visible oil gauge to check the oil level.

Table 5 Approx. quantity of oil

Size	Units	SFC045	SFC055	SFC060	SFC065	SFC070	SFC075
Oil Quantity	liters	24	34	45	55	75	95
	gal(US)	6.3	9.0	12	15	20	25

6-5) Oil supply

Supply oil through the filling port atop the main unit. Check the oil level with a visual oil gauge. (Fig. 5) Exercise care when supplying oil to ensure that loose nuts, bolts, washers, dust, water, and other foreign substances will not enter the unit.
If oil level is lower than the specified range, lubrication will be insufficient. In case the oil level is higher, deterioration of oil is accelerated due to oil temperature rise.

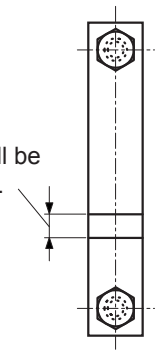


Fig. 5

6-6) Waste oil

Remove the drain plug under the main unit to drain waste oil while it is still warm. (i. e. Soon after operation of the unit has ceased. But not immediately after.)

7. Backstop

Use of a backstop (optional) is to prevent reverse rotation of the cooling fan.
Backstop is located internally. Backstop is lubricated by the internal gear oil.

8. Operation

DANGER

- Never approach or touch any rotating parts (shaft, etc.) during operation. Loose clothing caught in these rotating parts may result in severe injury and/or death.

CAUTION

- Check the oil level with the oil gauge before operation.
- When using pole change motors to change from high speed to low speed, control the fan rotation speed so that regeneration braking torque does not act on the reducer.
- If the reducer has a backstop installed and the reducer is not operated for an extended period, operate the unit a minimum of 5 minutes for every 200 hours of non-operation.
- The reducer will get very hot during operation. Do not touch or come in contact in any way with the reducer ; otherwise, you may suffer burns.
- If the reducer is operating in an abnormal way, stop the unit immediatery ; otherwise, electric shock, personal injury, or fire may result.
- Do not operate the reducer in a manner that exceeds its rating criteria ; otherwise, injury or damage to the system may result.
- Do not remove any covers or open the reducer during operation ; otherwise, splashing lubricant may cause burns.
- Do not loosen the oil filler plug during operation ; otherwise, splashing lubricant may cause burns.
- When reversing the direction of rotation, first bring the unit to a complete stop, then commence reverse rotation ; otherwise, the system may be damaged.

After installation, check the following points prior to operation.
(1) Is the oil filled to the correct oil level ?
(2) Is the reducer correctly coupled with the mating machine ?
(3) Are foundation bolts firmly tightened ?
(4) Does the direction of rotation conform to the one specified and designed for ?
After confirming the above, allow for a no-load break-in period. Then gradually apply the design load.
At this time, confirm the following :

Table 6

Items to be checked during break-in period/possible causes.	
Abnormal sound and vibration	(1) The housing is deformed because the installation surface is irregular. (2) Resonance is occurring due to the lack of rigidity of the installation base. (3) The shaft center is not properly aligned with the motor. (4) The vibration of the fan is transmitted to the reducer.
The surface temperature of the reducer is abnormally high.	(1) The motor current has exceeded the rated current shown in the rating plate. (2) The voltage rise and drop of the motor is too large. (3) The ambient temperature at which the reducer is operating is too high. (4) The oil is not at its specified level (too low or too high).

When an anomaly is found, stop operation, and contact the nearest agent, dealer, or service office.

9. Daily inspection and maintenance

DANGER

- Never approach or touch any rotating parts (shaft, etc.) when maintaining or inspecting the reducer during operation.
  Loose clothing cought in these rotating parts may result in severe injury and/or death.
- Be sure to stop both the driving and driven machines before checking any tooth surfaces; otherwise, you may be caught in the gear engaging section, resulting in severe injury and/or death.
- Do not operate any units without all (safety) covers in place. Failure to do so may cause injury and/or death.

CAUTION

- The surface of the reducer will get hot, do not touch the reducer ; otherwise, a burn may result.
- Do not change the oil during operation or soon after operation has ceased ; otherwise, the hot oil may cause burns.
- Do not remove any covers or open the reducer during operation ; otherwise, splashing hot lubricant may cause burn.
- Change lubricant according to the maintenance manual, and use only those recommended lubricants ; otherwise, the system may be damaged.
- Do not operate damaged PARAMAX DRIVE FOR COOLING TOWERS; otherwise, injury, fire, or damage to the system may result.
- We cannot assume any responsibility for damage or injury resulting from an unauthorized modification by a customer.

9-1) Dailyinspection

To ensure proper and contined optimum operation, use the table below to perform daily inspections of the unit.

Table 7

Inspection item	Details of inspection
Noise	Is there abnormal sound or sudden change in the noise characteristics during operation ?
Vibration	Is there any abnormal vibration or sudden change in the vibration of the reducer?
Surface temperature	Is the temperature of the surface of the reducer abnormally high ? Or is it rising rapidly? (The temperature rise during operation differs according to the type of reducers. A surface temperature of approx. 80℃ (176 °F)will not cause any adverse effects as long as it does not rise significantly above this level.)
Oil level	Is the oil level decreasing ? (Check the oil level with a dipstick or visible oil gauge when the reducer is not operating)
Oil leakage	Is oil leaking from the oil seal or other sections?
Foundation bolt	Have any bolts come loose ?

When any abnomality is found during daily inspection, take appropriate corrective measures based on "10. Troubleshooting (P.9)"
If normal operation is still not possible, contact the nearest agent, distributor, or service office.

9-2) Change of lubricant

(1) Change oil 500 hours or 6 months whichever comes first after initial start-up.
(2) In case of the oil temperature is below 80℃ (176 °F), a 8000 hours or 1 year (Whichever comes first) change interval is recommended.
(3) In case of the oil temperature is above 80℃ (176 °F), a 4000 hours or 6 months (Whichever comes first) change interval is recommended.

Deterioration of the oil will be accelerated when the ambient temperature changes rapidly or the ambient atmosphere contains corrosive gases. In these situations consult with the lubricant manufacturer.

10. Troubleshooting

⚠ CAUTION

● Promptly identity and correct, according to instructions in this maintenance manual, any abnormalities observed during operation. Do not operate until abnormality is corrected.

When any abnomality occurs in the reducer, refer to the following table and take appropriate measures as soon as possible. If they are not repairable, contact the nearest agent, distributor or service office.

Table 8

Details of trouble		Cause	Correction
The input shaft rotates, but the output shaft will not.		Damage due to overloaded gears or shafts	Repair at a specialized workshop
The output shaft turns when there is no load.	But it seizes up when a load is applied.	The key is out of position	Place the key in position
		Scorched bearing	Repair at a specialized workshop
		Poor adjustment of protective device	Adjust the protective device
	Reverse rotation is possible.	Incorrect wiring for the motor	Change the connection
Excessive temperature rise		Overload	Reduce the load to the specified value
		Scorched bearing	Repair at a specialized workshop
		The ambient temperature is too high	Improve the ventilation method
		Damage due to overload applied to gears, bearings, etc.	Repair at a specialized workshop
Oil leakage	Oil leaks from the input / output shaft sections.	Damaged oil seal	Change the oil seal
		Scratches or abrasion of the lip contact section	Repair at a specialized workshop
	Oil leaks from the joint surface of the housing.	Loose tightening bolt	Tighten the tightening bolts to the proper torque
Abnormal sound. Excessively high vibration.		Damaged gears, shafts, or bearings	Repair at a specialized workshop
		Deformation of the housing due to irregular 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
		Incorrect alignment with the mating machine	Align the shaft center
		Transmission of the vibration of the mating machine to the reducer	Independently operate the reducer to check the source of abnormal sound

11. Disassembly / reassembly and disposal

11-1) Disassembly and reassembly

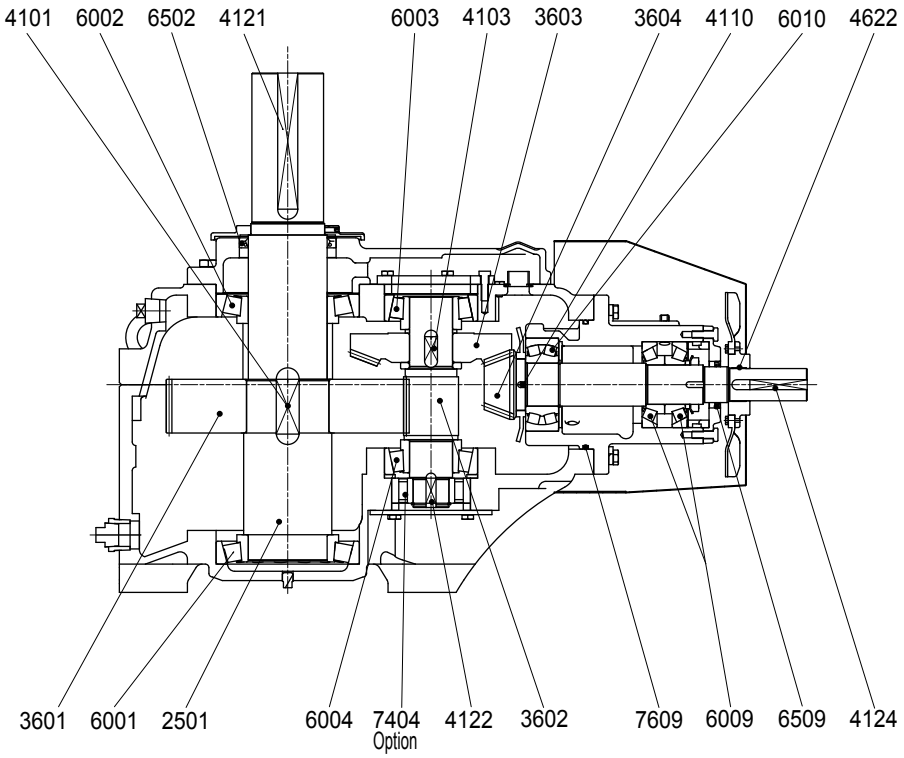
⚠ CAUTION

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

11-2) Disposal

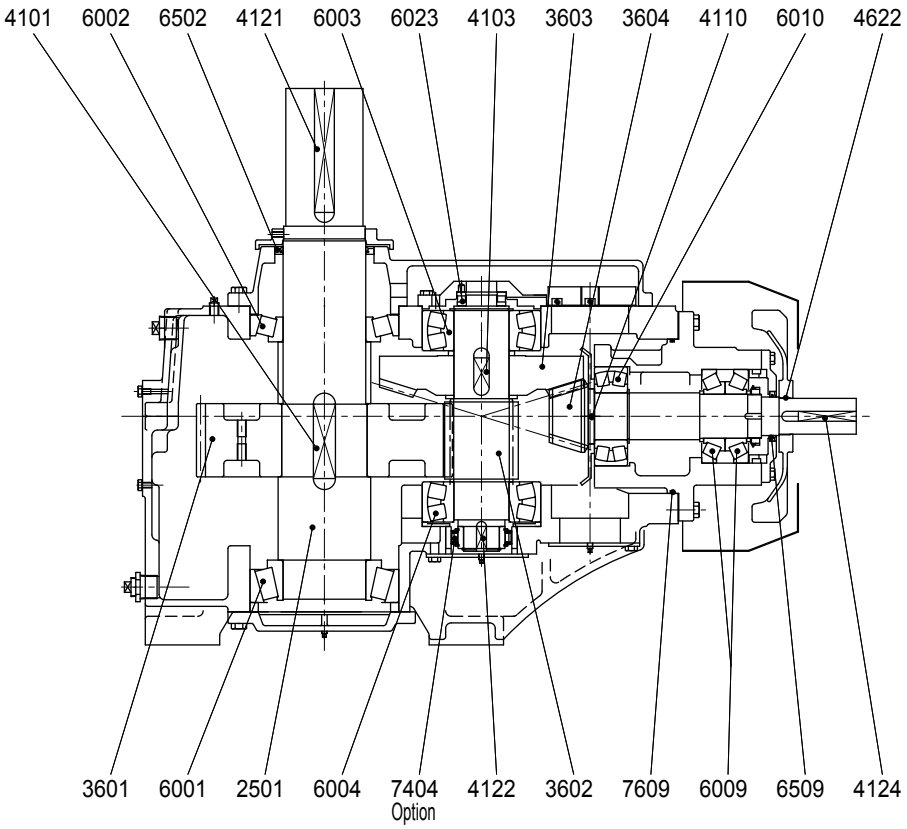
⚠ CAUTION

● Dispose the reducer and lubricant as general industrial waste.



POS.NO	Part Name
2501	Slow speed shaft
3601	Helical gear
3602	Helical pinion shaft
3603	Bevel gear
3604	Bevel pinion shaft
4101	Key
4103	Key
4110	Key
4121	Key
4122	Key
4124	Key
4622	Tolerance ring
6001	Tapered roller bearing
6002	Tapered roller bearing
6003	Tapered roller bearing
6004	Tapered roller bearing
6009	Tapered roller bearing
6010	Spherical roller bearing
6502	Oil seal
6509	Oil seal
7404	Backstop
7609	O-ring

Fig.6 SFC045・SFC055



POS.NO	Part Name
2501	Slow speed shaft
3601	Helical gear
3602	Helical pinion shaft
3603	Bevel gear
3604	Bevel pinion shaft
4101	Key
4103	Key
4110	Key
4121	Key
4122	Key
4124	Key
4622	Tolerance ring
6001	Tapered roller bearing
6002	Tapered roller bearing
6003	Spherical roller bearing
6004	Spherical roller bearing
6009	Tapered roller bearing
6010	Spherical roller bearing
6023	Thrust cylindrical roller bearing
6502	Oil seal
6509	Oil seal
7404	Backstop
7609	O-ring

Fig.7 SFC060・SFC065・SFC070・SFC075

13. Locations of oil filler and drain plug

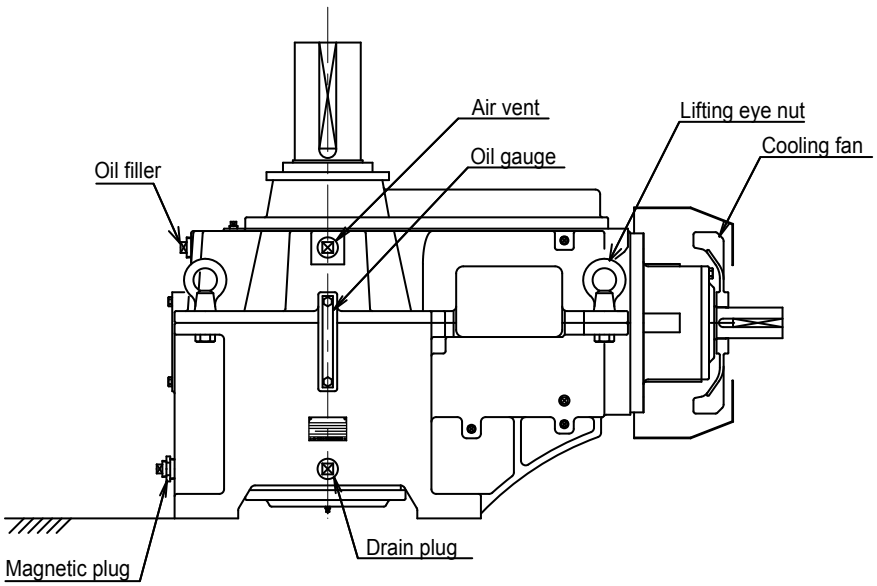


Fig9. Locations of oil filler and drain plug

Worldwide Sumitomo Network

U.S.A
Sumitomo Machinery
Corporation of America
4200 Holland Blvd.,
Chesapeake, VA 23323
Tel :(1)757-485-3355
Fax:(1)757-487-3193

Canada
SM-Cyclo of Canada, Ltd.
870A Equestrian Court Oakville,
Ontario, Canada L6L 6L7
Tel :(1)905-469-1050
Fax:(1)905-469-1055

Mexico
SM-Cyclo De Mexico, S.A. de C.V.
Calle ÒCÓ No. 506A
Parque Industrial Almacentro
Apodaca, N. L., Mexico 66600
Tel :(52)8-369-3697
Fax:(52)8-369-3699

Brazil
SM-Cyclo Reductores Do Brasil Ltda.
Av. Dr. Ulysses Guimar‹es,
3533, 09990-080 Diadema,
S‹o Paulo, Brazil
Tel :(55)11-4071-4388
Fax:(55)11-4071-2922

Chile
SM-Cyclo De Chile, Ltda.
SAN Pablo Ave, 3507 Quinta Normal,
Santiago, Chile
Tel :(56)2-786-6963
Fax:(56)2-786-6964

Argentina
SM-Cyclo De Argentina S.A.
Montes de Oca #6719, (B1606BMG)
Munro, Buenos Aires, Argentina
Tel :(54)11-4765-5332
Fax:(54)11-4765-5517

United Kingdom
Sumitomo (SHI) Cyclo Drive Europe, Ltd.
Marfleet Kingston Upon Hull HU9 5RA,
United Kingdom
Tel :(44)1482-788022
Fax:(44)1482-713205

SM-Cyclo U.K. Ltd.
Marfleet Kingston Upon Hull HU9 5RA,
United Kingdom
Tel :(44)1482-790340
Fax:(44)1482-790321

France
SM-Cyclo France E.U.R.L.
65/75 Avenue Jean Mermoz
F-93120 La Courneuve France
Tel :(33)149-929494
Fax:(33)149-929490

Italy
SM-Cyclo Italy S.r.l.
Via dell' Artigianato 23 20010
Cornaredo (Mi)
Tel :(39)02-9356-2121
Fax:(39)02-9356-9893

Netherlands
SM-Cyclo Benelux BV
Den Engelsman 16D NL-6026 RB
Maarheeze The Netherlands
Tel :(31)495599777
Fax:(31)495593177

Sweden
SM-Cyclo Scandinavia AB
FšretagsvŠgen 30A S-232 37
Arlšv Sweden
Tel :(46)40430220
Fax:(46)40431001

Spain
SM-Cyclo Iberia,S.L.
C/Landabarri No.4 Escalera12nd izqda
E-48940 Leioa (Vizkaya) Spain
Tel :(34)944-805-389
Fax:(34)944-801-550

Switzerland
SM-Cyclo Switzerland AG
Lerzenstrasse 27 CH8953 Dietikon
Tel :(41)1-774-5300
Fax:(41)1-774-5301

Belgium
SMBE Branch Belgium Office
Lacomble laan 36 B-1030 Bruessel
Tel :(32)2-469-0517
Fax:(32)2-469-0207

Germany
Sumitomo (SHI) Cyclo Drive Germany,
GmbH
Cyclostra§e 92
D-85229 Markt Indersdorf
Tel :(49)8136-66-0
Fax:(49)8136-5771

SCG Branch Hannover Office
Rotermundstr. 11 D-30165 Hannover
Tel :(49)5113-5339-5910
Fax:(49)5113-5339-5911

Austria
SCG Branch Austria Office
Gruentalstr,30a A-4028 Linz, Austria
Tel :(43)732-330-958
Fax:(43)732-331-978

China
Sumitomo (SHI) Cyclo Drive China, Ltd.
No. 7 Sanijing Road Dongli Economic
Development Zone, Tianjin
Tel :(86)22-2499-3501
Fax:(86)22-2499-3133

Hong Kong
SM-Cyclo of Hong Kong Co., Ltd.
Rm 708, Kowloon Plaza, 485
Castle Peak Road, Kowloon, Hong Kong
Tel :(852)2460-1881
Fax:(852)2460-1882

Singapore
Sumitomo (SHI) Cyclo Drive
Asia Pacific Pte., Ltd.
No.36 Tuas South Street 3,
Singapore 638031
Tel :(65)6863-2238
Fax:(65)6863-4238

Malaysia
SM-Cyclo of Malaysia Sdn. Bhd.
No.2, Jalan BP 4/1,
Bandar Bukit Puchong, 47100 Puchong,
Selangor Darul Ehsan, Malaysia
Tel :(60)3-80612909
Fax:(60)3-80613909

Thailand
SM-Cyclo of Thailand Co., Ltd.
195, Empire Tower
Unit 1504, 15th Floor
South Sathorn Road, Yannawa Sathorn
Bangkok 10120, Thailand
Tel :(66)2-670-0998
Fax:(66)2-670-0999

Australia
SM-Cyclo of Australia Pty., Ltd.
13 Centre Place, Wetherill Park,
NSW 2164
Tel :(61)2-9756-2455
Fax:(61)2-9756-2002

Philippine
SCA Branch Philippines Office
Unit 504, Amberland Plaza
Condominium, Julia Vargas Ave.,
Ortigas Center Metro Manila
Tel:(63)2-637-2106
Fax:(63)2-632-7372

Taiwan
Tatung SM-Cyclo Co., Ltd.
22 Chungshan N. Road.,
3rd Sec. Taipei,
Taiwan, 104 R.O.C.
Tel :(886)2-2595-7275
Fax:(886)2-2595-5594

Korea
SM-Cyclo of Korea Co., Ltd.
Royal Bldg. 9F. Rm. 913
5 Danju-dong Chongro-ku, Seoul 110
Tel :(82)2-730-0151
Fax:(82)2-730-0156

POWER TRANSMISSION & CONTROLS GROUP
Sumitomo Heavy Industries, Ltd.
5-9-11, KITA-SINAGAWA SINAGAWA-KU, TOKYO 141-8686, JAPAN
PHONE: (03)5488-8363 FAX: (03)5488-8355

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