

SCG025

Boat Reversing Gearbox

Service Manual

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1. Description

1.1 Brief description

SCG boat reversing gearbox units are servo-automatically controlled helical gear transmissions developed for use in pleasure craft and commercial craft. The servo-operated multiple-disc clutch requires only minimum effort for gear changing, making the SCG transmission suitable for single-lever remote control via a rod linkage or Bowden cable.

The SCG permits direct reversing at full engine speed, for example in emergency cases.

The torque transmission capacity of the clutch is exactly rated, preventing shock loads from exceeding a predetermined value to ensure maximum protection of the engine and thus providing the effect of a safety clutch.

The transmission units are characterized by low weight and small overall dimensions. The gearbox castings are made of a high-strength, corrosion-resistant aluminum alloy, optimum adhesion of paint for improved seawater resistance.

A choice of gear ratios, a high efficiency rating and low-noise operation are other prominent features of the SCG gearbox units.

The transmissions are immersion-lubricated. Maintenance is restricted to oil level checks (see 'Maintenance', chapter 4)

The shafts are supported by heavy-duty taper roller bearings and the gearbox is designed to take the axial propeller thrust (for permissible values see 'Technical data', item 1.2)

All transmission sizes are available for right-hand (RH) and left-hand (LH) rotation of the input shaft, the direction of rotation being specified as seen by an observer facing the output shaft. In gear lever position A, the engine shaft and the propeller shaft rotate in opposite directions, in position B in the same direction (Fig 1).

Engine manufacturers should note that the direction of rotation refers to an observer facing the flywheel, so that left-hand rotation of the engine corresponds to right-hand rotation

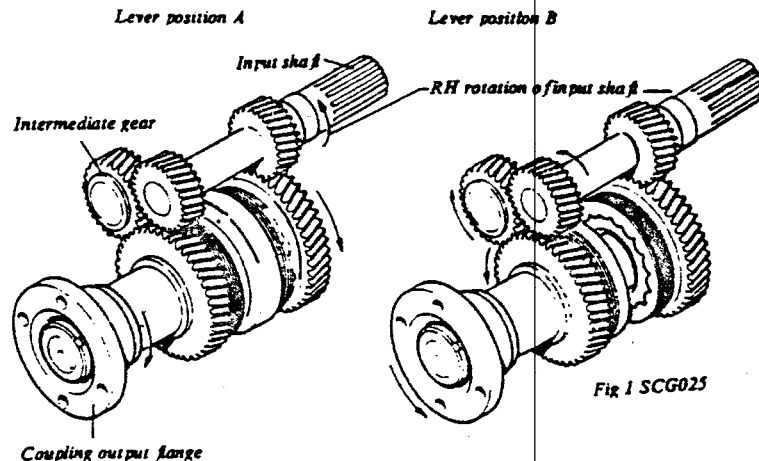


Fig 1 SCG025

> Power transmission using engine with LH rotation

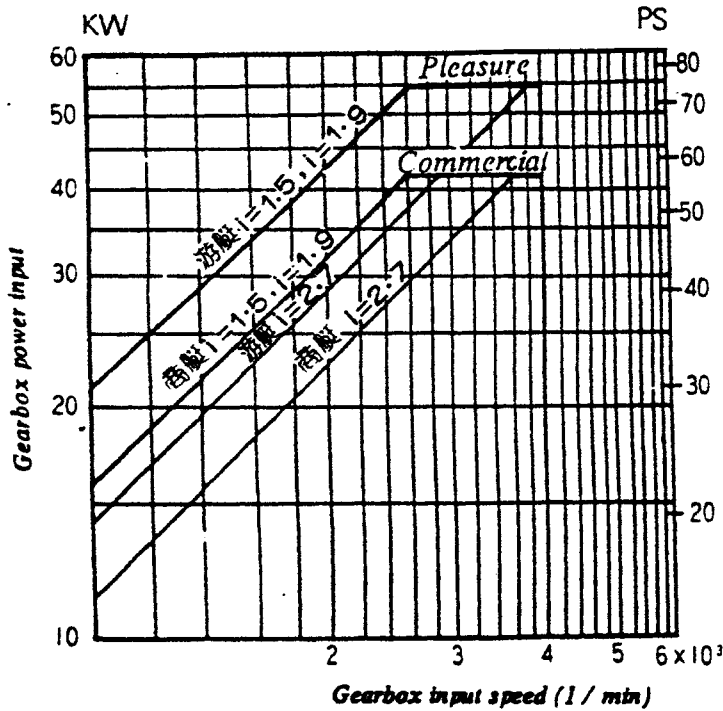
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ation of the gearbox input shaft.

1.2 Technical data and main dimensions

SCG 025

Power diagram



Technical data			SCG025-1	SCG025-2	SCG025-3
Forward gear 'A' ratio	<i>i</i>		1.54	1.88	2.74
Reverse gear 'B' ratio	<i>i</i>		2.67	2.67	2.67
Input torque <i>M</i> _{max}	pleasure craft	Nm	200	200	140
	commercial craft	Nm	150	150	110
Power input <i>P</i> _{max}	pleasure craft	KW	55		
	commercial craft	KW	40.8		
Input speed <i>N</i> _{max}	r/min		4000		
Propeller thrust <i>F</i> _{max}	N		4000		
Weight without oil	Kg		18.5		
Oil quantity	L		0.75		
Oil grade	Automatic-Transmission-Fluid (ATF)				

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The following special accessories can be obtained from the manufacturer:

- 1) Clamping coupling; 2) damping plate; 3) gearbox flange.

Gearbox flange	A(mm)	B(mm)	C(mm)	D(mm)	(mm)	X- Φ d(mm)
SAEJ 617 NO3	$\phi 409.58^{\circ} - 0.08$	$\phi 428.6$	$\phi 451$	240	15°	12- $\phi 11.0$
SAEJ 617 No5	$\phi 314.32^{\circ} - 0.08$	$\phi 333.4$	$\phi 355.6$	237	22.5°	8- $\phi 11.5$

1.3 Gear casing

The oil-tight gearbox housing is made of a corrosion resistant aluminium alloy. The gear casing is divided in a vertical plane into two equal halves. Amply dimensioned cooling fins ensure good heat dissipation and mechanical rigidity.

An oil filler screw with dipstick and an oil drain plug are screwed into the gear casing.

The actuating lever, actuating cam and cover plate are a pre-assembled unit fitted laterally to the gearbox unit.

Tapped holes (see 'Main dimensions' item 1.2) are provided on the face sides for bolting the transmission to a flywheel housing or an adapter flange.

1.4 Gear sets

The transmission is equipped with shaved, casehardened helical gears made of forged low-carbon alloy steel.

The drive shaft with the drive gear are an integral unit.

The multi-spline driving shaft connecting the transmission with the engine is hardened as well.

The driven shaft (propeller side) of the transmission is fitted with an integrally forged coupling flange.

The servo-automatic clutch system governs the direction of rotation of the input shaft but all SCG transmission units are available for clockwise (RH = right hand) or counterclockwise (LH = left-hand) rotation.

1.5 Multiple-disc clutch and clutch operation

The engine torque is applied to the input shaft (205) in the specified direction of rotation and, in shifting position A, via gear (307), the frictionally engaged clutch discs (312) and (313) to the external disc carrier (320) and from there via the guide sleeve (315) to the output shaft (325).

In shifting position B, the torque is transmitted from the input shaft (205) via intermediate gear (204), gear (324), clutch discs (312) and (313) to the external disc carrier (320), the guide sleeve (315) and the output shaft (325).

The transmission uses a positively driven, mechanically operated multiple-disc clutch system mounted on the output shaft.

The thrust force required for obtaining positive frictional engagement between the clutch discs

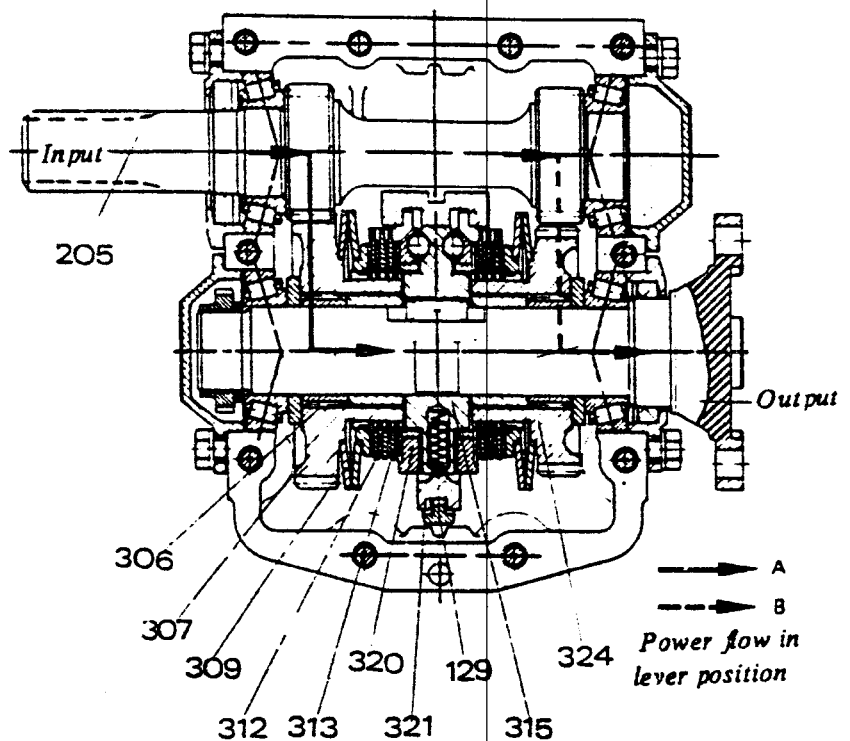
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is provided by a servo-automatic system. The essentially comprises a number of balls which, by the rotary movement of the external disc carrier, are urged against inclined surfaces provided in pockets between the guide sleeve and the external disc carrier and in this manner exert axial pressure.

The thrust force and, as a result, the transmittable friction torque are thus proportional to the input torque applied. Due to the cup springs (309) supporting the clutch disc stack and a limitation of the range of axial travel of the external disc carrier (320), the thrust force will not exceed a predetermined value.

The actuating sleeve (312) is held in the middle position by spring-loaded pins. To initiate the shifting operation, the actuating sleeve (321) need merely be displaced axially by a shifting fork until the arresting force has been overcome.

The actuating sleeve (321) is moved automatically by the spring-loaded pins, while the external disc carrier, which follows this movement, is rotated by the frictional forces exerted by the clutch discs, and the shifting operation is completed servo-automatically as described above.



1.6 Shaft bearings

Both the input and the output shafts are carried in amply dimensioned taper roller bearings.

The propeller thrust can be absorbed by the bearings (for permissible values see 'Technical data', item 1.2)

The intermediate gear and the movable gears are carried in sturdy needle roller bearings.

1.7 Shaft seals

External sealing of the input and output shafts is provided by radial sealing rings.

The running surfaces on the shafts are casehardened.

1.8 Lubrication

The transmissions are immersion-lubricated. The bearings are generously supplied with splash oil.

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2. Installation

2.1 Delivery condition

SCG 025 gearbox units leave the factory in fully assembled condition. For safety reasons, the gearbox is not filled with oil for shipment. The actuating lever is mounted on the actuating shaft. On request, the gearbox is delivered with the cooling unit attached.

The multi-spline shaft end on the engine side is provided with an oil film and protected by a plastic cap. The bright surfaces of the coupling flange on the output side are coated with an anticorrosive agent for shipment and storage. The casing is aluminium alloy and thus resistant to seawater.

Before leaving the factory, each transmission is subjected to a test run with the prescribed ATF oil. The residual oil remaining in the transmission after draining acts as a preservative and provides reliable protection against corrosion for at least 1 year if the units are properly stored.

2.2 Transport

Care should be taken when transporting the gearbox or the engine-gearbox assembly to prevent undue shocks and impacts. This applies particularly to the input and output shafts.

2.3 Removal of preservative

Use a suitable solvent for removing the anticorrosive agent, but never emery cloth or paper, since otherwise the sealing elements might be damaged.

It is advisable, especially after long periods of storage to flush the transmission with the prescribed oil and remove residual oil.

2.4 Painting the gearbox

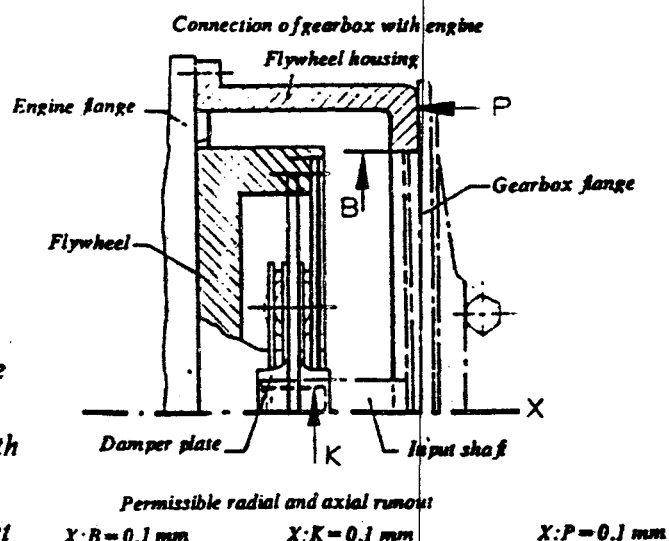
Always cover the running surfaces and sealing lips of the radial sealing rings on both shafts before painting. Make certain that the breather hole on the oil filler screw is not closed by paint. Indicating plates should remain clearly legible.

2.5 Connection of gearbox with engine

Insert a torsio-elastic damping plate between the engine and the transmission to compensate for minor alignment errors and protect the input shaft from external forces and loads. Radial clearance should be at least 0.5 mm (parallel shift of ± 0.25 mm)

If the flywheel housing of the engine is of suitable design, the gearbox unit should be directly bolted to such housing by means of the tapped holes provided in the gearbox. Make certain to use bolts of appropriate length and tighten them to the correct torque.

An adapter flange is available on request for each gearbox unit. (see 'Main dimensions', item 1.2)



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The radial and axial runout values shown in the drawing below should never be exceeded between the engine and transmission.

The input shaft end is provided with a triangular spline. Triangular spline $\Phi 30 \times \Phi 34 / 36$ teeth, tooth angle 60° , flat root.

2.6 Connection of gearbox with propeller

We recommend a flexible connection between the gearbox and the propeller shaft if the engine is flexibly mounted, in order to compensate for angular deflections. The installation of a special propeller thrust bearing is not required, since the propeller thrust will be taken by the transmission bearing, provided the value specified under 'Technical data' (item 1.2) is not exceeded. However, the output shaft should be protected from additional loads. Special care should be taken to prevent torsional vibration.

2.7 Suspension of engine-gearbox assembly in the boat

Special care should be taken to protect the gearbox from detrimental stresses and loads if the engine-transmission assembly is not elastically suspended in the boat or craft.

The gearbox should be conveniently accessible for maintenance.

If the oil drain plug of the gearbox is not accessible, the oil will have to be sucked off.

2.8 Position of gearbox in the boat

The inclination of the gearbox unit in the direction of the shafts should not permanently exceed an angle of 20° (see illustration).

The gearbox can also be mounted with the output shaft in the upward position. Interchange the oil dipstick and the oil drain plug in this case (fill up with oil the index mark on the dipstick).

2.9 Operation of gearbox

The gearbox is suitable for single lever remote control. Upon loosening the retaining screw, the actuating lever (see illustration). Make certain that the lever does not contact the actuating lever cover plate the minimum distance between lever and cover should be 0.5 mm .

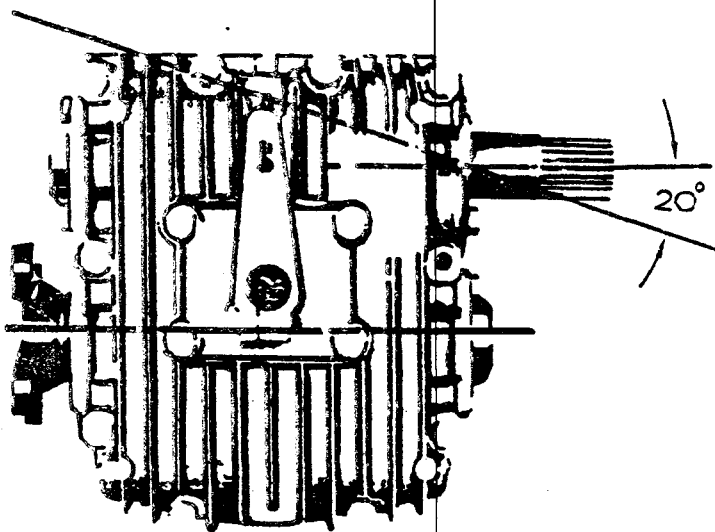
The control cable or rod should be arranged at right angles to the actuating lever in the neutral position of the lever. The zero position of the operating lever on the control console should coincide with the zero position of the actuating lever on the gearbox.

The shifting travel, as measured at the pivot point of the actuating lever, between the neutral position and end positions A and B should be at least angle.

A larger amount of lever travel is in no way detrimental.

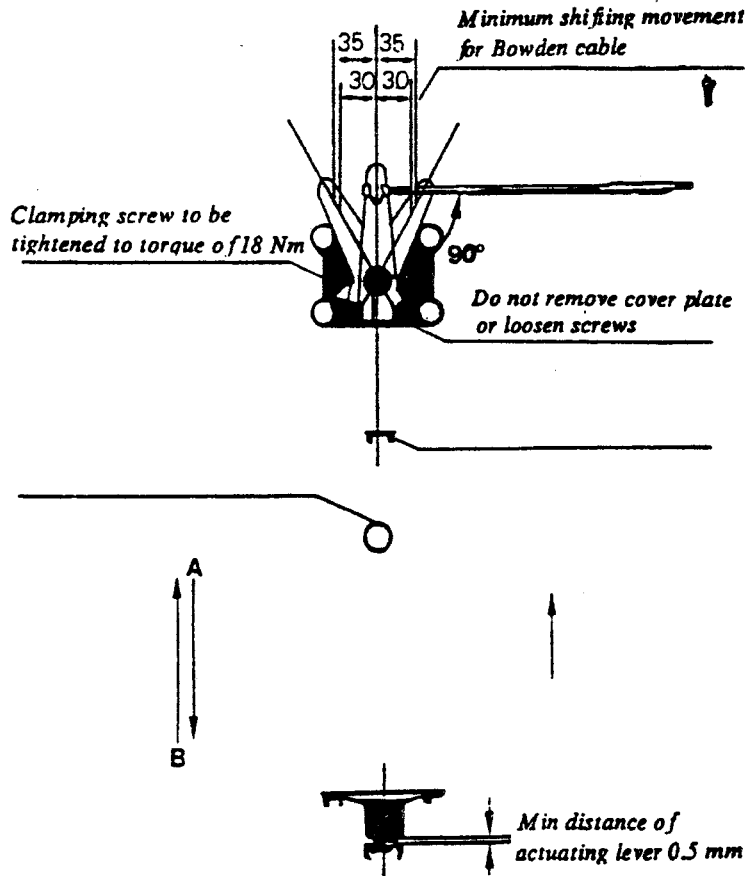
However, if the lever travel is shorter, proper gear engagement might be impeded which, in turn, would mean premature wear, excessive heat generation and resulting damage.

The position of the cover plate underneath the actuating lever is factory-adjusted to ensure equal lever travel from neutral position to A and B.



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When installing the gearbox, make certain that shifting is not impeded by restricted movability of the Bowden cable or rod linkage, by unsuitably positioned guide sheaves, too small a bending radius, ect.



2.10 Cooling unit

Max engine power (kw) usable, without cooling in continuous operation: Ahead—40kw, Astern—25kw. When these values are exceeded, a cooling unit is required. The minimum volume of flow is 10 ltr / min. In case of doubt please contact the transmission manufacturer.

3. Operation

3.1 General information

All SCG boat reversing gearbox units are test-run on a test stand at the factory prior to delivery.

For safety reasons the oil is drained before shipment.

3.2 Initial operation

Fill the gearbox with oil (ATF) of the recommended grade. The oil level should be up to the index mark on the dipstick (see illustration).

To check the oil level, just insert the dipstick, do not screw in. Retighten the hex screw with the

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dipstick after the oil level check. Do not forget sealing ring.

3.3 Operating temperature

The maximum permissible temperature of the transmission oil is 120°C.

3.4 Operation of gearbox

The zero position of the operating lever on the control console must coincide with the zero position of the actuating lever on the transmission. Shifting is initiated by a cable or rod linkage via the actuating lever and an actuating cam. The completion of the gear changing operation is servo-automatically controlled.

Gear changing should be smooth, not too slow, and continuous (without interruption).

Direct changes from forward to reverse are permissible, since the multiple-disc clutch permits gear changing at high rpm, including sudden reversing at top speeds in the event of danger.

3.5 Sailing and moving in tow

Rotation of the propeller without load while the boat is sailing, being towed, or anchored in a river, as well as operation of the engine with the propeller stopped (for charging the battery), will have no detrimental effects on the gearbox.

Important

When the boat is sailing (engine stopped), the gear lever must be in zero position. Never put the gear lever in the position corresponding to the direction of travel of the boat.

Locking of the propeller shaft by an additional brake is not required use the gear lever position opposite your direction of travel for this purpose.

3.6 Lay-up periods

If the transmission is not used for periods of more than 1 year it should be completely filled with oil of the same grade to prevent corrosion. Protect the input shaft and the output flange by means of an anticorrosive coating if required.

3.7 Preparation for re-use

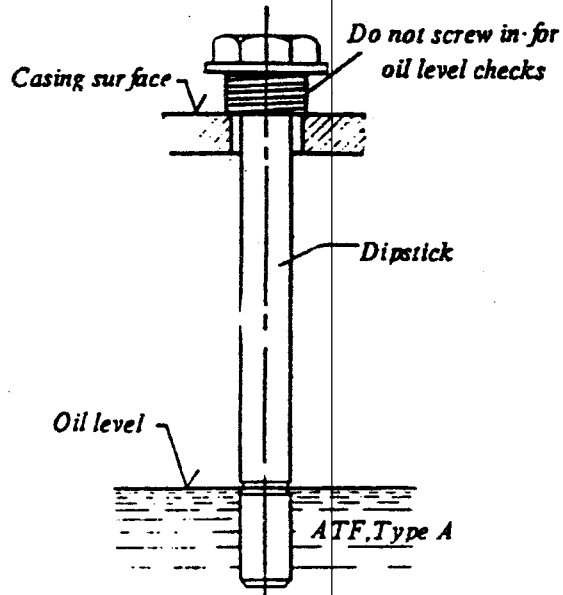
see item 2.3

4. Maintenance

4.1 Transmission oil

To ensure trouble-free operation of the clutch only use Automatic Transmission Fluid (ATF).

4.2 Oil quantity



Correct readings up to 20° inclination in direction of shafts

Type	SCG 025				
Oil quantity	0.75 ltr				

Use the index mark on the dipstick as a reference (see item 3.2)

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4.3 Oil level checks

Check the oil level in the gearbox about once a month. Correct oil level: index mark on dipstick (see item 3.2). Always use the same oil grade when topping up.

4.4 Oil change

Change the oil for the first time after about 25 hours of operation, then at intervals of at least 1 year.

4.5 Checking the Bowden cable or rod linkage

The Bowden cable or rod linkage should be checked at shorter time intervals. Check the zero position of the operating lever (on the control console) and of the actuating lever (on the gearbox) on this occasion. The minimum lever travel from the neutral position to operating positions (O—A = O—B) should be 35 mm for the outer and 30 mm for the inner pivot point. Make certain that these minimum values are safely reached check the cable or rod linkage for easy movability (see item 2.9).

5. Trouble-shooting

In the event of any trouble, first check whether all instructions in this installation and operating manual have been observed. The table below will, to a limited extent, assist you in finding the cause of malfunctions.

To avoid the forfeiture of possible warranty claims it should be remembered that it is not permissible to do any repair or other work on the gearbox during the guarantee period. The guarantee period are six months after despatch from the gearbox plant.

5.1 Possible troubles and remedies

5.1.1 Delay gear engagement

a) Noticeable effect:

Propeller will start rotating with several seconds delay or only after increase in engine speed.

b) Possible cause

Lever travel O—A not equal to lever travel O—B

Insufficient clearance between actuating lever and cover plate.

Bowden cable fails to move lever through required minimum travel O—A = O—B =
35 mm / 30 mm.

c) Remedy

Detach Bowden cable and operate gearbox by hand to find whether malfunction is caused by gearbox or Bowden cable.

If caused by transmission:

Adjust cover plate until lever is exactly in midway position Travel O—A = O—B =
35 mm / 30 mm.

Adjust to minimum clearance of 0.5 mm.

If caused by Bowden cable:

Check total travel of Bowden cable if too short, adjust accordingly.

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5.1.2 Transmission fails to move into gear

Noticeable effect:

Excessive effort required to move actuating lever.

Possible cause:

Insufficient clearance between actuating lever and cover plate. Guide sheaves for Bowden cable unsuitably positioned radii too small.

Remedy:

Detach Bowden cable and operate lever by hand. If lever jams, adjust clearance to 0.5 mm. Check and adjust accordingly.

5.1.3 Boat fails to attain top speed specified

a) Noticeable effect:

Increased operating temperature.

b) Possible cause:

Use of wrong oil.

Boat operated without cooling unit.

Transmission operating in upper limit range.

c) Remedy:

Use ATF oil and check oil level.

Install cooling unit.

Use suitable SCG transmission unit.

5.1.4 Oil leakage

a) Noticeable effect:

Oil leakage points visible on transmission unit.

b) possible cause

Corrosion effects in area of radial sealing ring and shaft; damaged radial sealing rings.

c) Remedy:

Check and correct oil level Remove and dismantle transmission remachine shafts, replace radial sealing rings.

SCG025齿轮箱说明书零件序号、名称对照表

Spare part description of SCG025 reduction gearbox operation manual

序号 no.	零件图号或规格 Part no.Or Spec.	零件名称或规格 Part description or specifications	数量 Quantity	备注 Remarks
1	GWU025-1001/2	左(右)箱体 Housing assembly	1	
2	GWU025-1040	端盖 Bearing shield input	2	
3	GWU025-1031A	端盖 Bearing shield output	2	
4	GB848-85	垫圈 Spring washer	41	
5	GB5783-86	螺栓 M8×16Hex head screw	20	
6	GWU025-1019A	操纵杆 Actuating level	1	
7	GB5782-86	螺栓 M8×20Hex head screw	1	
8	GB1235-76	油封 D28×d20×H7 Sealing ring for shift cover	1	
8-1	4624902	轴承 Inner race taper roller bearing input shaft	2	
9	GWU025-1009	盖板 Cover plate	1	
10	GB879-86	弹性销 A4×14 Spring dowl pin	1	
11	GWU025-1025A	驱动凸轮 Actuating cam assembly	1	
12	GB308-77	钢球 φ7 Steel ball	1	
13	GWU025-1026	凸轮弹簧 Cam spring	1	
14	GWU025-1024	拨叉 Fork	1	
15	GWU025-1023	衬套 Shift fork assembly	2	
16	GWU025-1022	拨叉轴 Actuating shaft	1	
17	GWU025-1021	丝堵 plug	1	
18	06-16K/B-81	管接用垫圈 16 Sealing ring	2	
19	GWU025-1029	量油尺 Oil dipstick/breather assembly	1	
20	GWU025-1028	抽油塞 M16×1.5 Oil drain plug	1	
21	GB5782-86	螺栓 M8×110Hex head screw	10	
22	GB6170-86	螺母 M8 Hex head nut	10	
23	GWU025-1041A	塞盖 Plug	1	
24	GWU025-2002	中间轴 Intermediate gear shaft	1	
25	GWU025-2002	挡板 Retaining plate	2	
26	GWU025-2003A	中间齿轮 Intermediate gear	1	
27	502204	轴承 Cage	2	
28	GWU025-1030	纸垫 Gasket	4	
29	GWU025-1007	纸垫 Gasket	1	
30	HG4-69-76	油封 PG35×56×12 Sealing ring	1	
31	HG4-69-76	油封 PG38×56×12 Sealing ring	1	
32	2007107E	轴承 Outer race taper roller bearing input shaft	4	33、34、35

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Spare part description of SCG025 reduction gearbox operation manual

序号 no.	零件图号或规格 Part no.Or Spec.	零件名称或规格 Part description or specifications	数量 Quantity	备注 Remarks
36	GWU025-2010A	输入轴 Input shaft	1	
37	GWU025-1032	垫圈 o = 0.2 Shim	3	
38	GWU025-1032	垫圈 o = 0.3 Shim	3	
39	GWU025-1032	垫圈 o = 0.4 Shim	3	
40	GWU025-1032	垫圈 o = 0.5 Shim	3	
41	GWU025-3001	螺母 M 30×1.5 Screw	1	
42	GWU025-3002	挡圈 Spacer	1	
43	GWU025-3003A	止动环 Thrust washer	2	
44	GWU025-3005A	正车齿轮 Forward gear	1	
45	49241/40	轴承 Needle cage	2	
46	GWU025-3004	衬套 Needle cage inner race	2	
47	GWU025-3011	隔圈 Spacer	2	
48	GWU025-3012	碟簧 Cup disc	4	
49	GWU025-3013B	挡环 Thrust ring	2	
50	GB894-86	轴用挡圈 55 Circlip	2	
51	GWU025-3015A	内摩擦片 Internal clutch disc	10	图 8
52	GWU025-3016A	外摩擦片 External clutch disc	8	图 6
53	GWU025-3017	垫圈 o = 0.2 Shim	3	
54	GWU025-3017	垫圈 o = 0.3 Shim	3	
55	GWU025-3017	垫圈 o = 0.4 Shim	3	
56	GWU025-3017	垫圈 o = 0.5 Shim	3	
57	GWU025-3026C	托架 Disc cartier	2	
58	GB308-77	钢球 φ 9 Steel ball	6	
59	GWU025-3021C	导套 guide sleeve	1	
60	GWU025-3027A	驱动套 Actuating sleeve	1	
61	GWU025-3023	定位弹簧 Compression spring	3	
62	GWU025-3022A	限位销 Detent pin	3	
63	GWU025-3028A	定位销 Driving pin	3	
64	GWU025-3024	卡簧 Spring	3	
65	GWU025-3029A	倒车齿轮 Reverse gear	1	
66	GWU025-3025	输出轴 Output shaft	1	
67	GWU025-3025	平键 Key	4	
68	GB858-76	止动垫圈 30Thrust washer	1	

