

Gear

SERIES PB 100

WITH CONTROLLABLE
PITCH PROPELLER





Gear

SERIES PB 100

WITH CONTROLLABLE
PITCH PROPELLER



Pay & Brinck a/s

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INSTRUCTIONS - AND PARTSBOOK

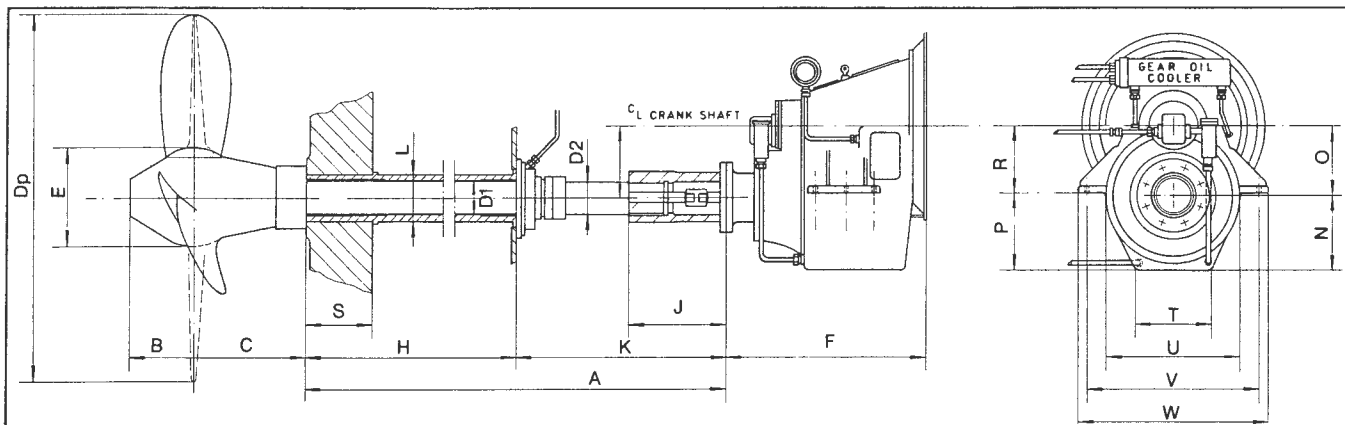


Gear

SERIES PB 100

**WITH CONTROLLABLE
PITCH PROPELLER**

DIMENSIONS — IDENTIFICATION DIAGRAM



GEARBOX SERIES: PB 100

| TYPE | REDUCTION | DIMENSIONS, mm (inch) | | | | | | | | | MAX. INPUT TORQUE kp (ft.lb.) | FLYWHEEL ADAPTER | WEIGHT kg (lbs) |
|--------|-----------|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|---------------|-------------------------------------|---------------------|--------------------|
| | | F | T | U | V | W | N | O | P | R | | | |
| PB 146 | 4.6 : 1 | 783 (30.8) | 320 (12.6) | 550 (21.7) | 680 (26.8) | 760 (29.9) | 300 (11.8) | 260 (10.2) | 244 (9.6) | 316 (12.4) | 160 (1157) | SAE 0 SAE 1 | 650 (1433) |
| PB 149 | 4.9 : 1 | 783 (30.8) | 320 (12.6) | 550 (21.7) | 680 (26.8) | 760 (29.9) | 300 (11.8) | 260 (10.2) | 244 (9.6) | 316 (12.4) | 160 1157 | SAE 0 SAE 1 | 650 (1433) |
| | | | | | | | | | | | | | |

CP - PROPELLER SYSTEM: PB 100

| TYPE | GEAR/PROPELLER CONFIGURATION | INPUT HP/RPM | DIMENSIONS, mm (inch) | | | | | | | | | | | | Weight kg (lbs) |
|-------|------------------------------|-----------------|------------------------|----------------|----------------|--------------|---------------|--------------|---------------|---------------|----------------|---------------|---------------|-----------------|--------------------|
| | | | Dp | D ₁ | D ₂ | L | E | B | Csteel | Cwood | Hstd | Kmin | J | Astd | |
| K 360 | 146-36/3 | 365/1800 | 14-1500 (55.1-59.1) | 120 (4.7) | 115 (4.5) | 179 (7.1) | 360 (14.2) | 230 (9.1) | 444 (17.5) | 474 (18.7) | 1500 (59.1) | 700 (27.6) | 400 (15.7) | 3000 (118.1) | 850 (1875) |
| K 380 | 146-38/3 | 365/1800 | 15-1600 (59.1-62.9) | 130 (5.1) | 125 (4.9) | 198 (7.8) | 380 (15.0) | 240 (9.4) | 462 (18.2) | 497 (19.6) | 2000 (78.7) | 700 (27.6) | 440 (17.3) | 4000 (157.3) | 1100 (2426) |
| K 380 | 149-38/3 | 365/1800 | 15-1600 (59.1-62.9) | 130 (5.1) | 125 (4.9) | 198 (7.8) | 380 (15.0) | 240 (9.4) | 462 (18.2) | 497 (19.6) | 2000 (78.7) | 700 (27.6) | 440 (17.3) | 4000 (157.3) | 1100 (2426) |

GEARBOX SERIES: PB 200

| TYPE | REDUCTION | DIMENSIONS, mm (inch) | | | | | | | | | MAX. INPUT TORQUE kp (ft.lb.) | FLYWHEEL ADAPTER | WEIGHT kg (lbs) |
|-----------------|-----------|-----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------------------------------|---------------------|--------------------|
| | | F | T | U | V | W | N | O | P | R | | | |
| PB 250- 38/3 | 5.0 : 1 | 844 (33.2) | 365 (14.4) | 660 (26.0) | 813 (32.0) | 890 (35.0) | 350 (13.8) | 320 (12.6) | 354 (13.9) | 316 (12.4) | 218 (1581) | SAE 0 | 850 (1874) |
| PB 250- 41/3 | 5.0 : 1 | 844 (33.2) | 365 (14.4) | 660 (26.0) | 813 (32.0) | 890 (35.0) | 350 (13.8) | 320 (12.6) | 354 (13.9) | 316 (12.4) | 218 (1581) | SAE 0 | 850 (1874) |
| PB 237- 41/3 | 3.7 : 1 | 844 (33.2) | 365 (14.4) | 660 (26.0) | 813 (32.0) | 890 (35.0) | 350 (13.8) | 320 (12.6) | 354 (13.9) | 316 (12.4) | 293 (2122) | SAE 0 | 850 (1874) |
| PB 237S 45/3 | 3.7 : 1 | 950 (37.4) | 365 (14.4) | 660 (26.0) | 813 (32.0) | 890 (35.0) | 350 (13.8) | 320 (12.6) | 354 (13.9) | 316 (12.4) | 381 (2755) | SAE 00 | 1050 (2315) |

CP - PROPELLER SYSTEM: PB 200

| TYPE | GEAR/PROPELLER CONFIGURATION | INPUT HP/RPM | DIMENSIONS, mm (inch) | | | | | | | | | | | | Weight kg (lbs) |
|-------|------------------------------|-----------------|--------------------------------|----------------|----------------|--------------|---------------|---------------|---------------|---------------|----------------|---------------|---------------|-----------------|--------------------|
| | | | Dp | D ₁ | D ₂ | L | E | B | Csteel | Cwood | Hstd | Kmin | J | Astd | |
| K 380 | 250-38/3 | 450/1800 | 1600 (62.9) | 130 (5.1) | 125 (4.9) | 198 (7.8) | 380 (15.0) | 240 (9.4) | 462 (18.2) | 497 (19.6) | 2000 (78.7) | 700 (27.6) | 440 (17.3) | 4000 (157.3) | 1100 (2426) |
| K 410 | 250-41/3 | 520/1800 | 15-16-1700 (59.1-62.9-66.9) | 140 (5.5) | 135 (5.3) | 214 (8.4) | 410 (16.1) | 275 (10.8) | 467 (18.4) | 497 (19.6) | 2000 (78.7) | 750 (29.5) | 450 (17.7) | 4000 (157.3) | 1300 (2866) |
| K 410 | 237-41/3 | 425/1225 | 15-16-1700 (59.1-62.9-66.9) | 140 (5.5) | 135 (5.3) | 214 (8.4) | 410 (16.1) | 275 (10.8) | 467 (18.4) | 497 (19.6) | 2000 (78.7) | 750 (29.5) | 450 (17.7) | 4000 (157.3) | 1300 (2866) |
| K 450 | 237S 45/3 | 555/1225 | (1650)-1700-(1750) | 150 | 150 | 224 | 450 | 300 | 536 | 574 | 2000 | 750 | 460 | 4000 | 1600 |

Technical drawing of a 1000 Series Outboard Motor, showing side and front views with dimension labels.

Side View Dimensions:

- D_p : Overall height
- E : Height to top of upper cowling
- B : Width of upper cowling
- C : Distance from upper cowling to lower cowling
- S : Thickness of lower cowling
- H : Distance from lower cowling to crankshaft centerline
- L : Length of lower cowling
- D_1 : Diameter of lower cowling
- D_2 : Diameter of crankshaft
- C_L : CRANK SHAFT
- J : Distance from crankshaft centerline to gear oil cooler
- K : Distance from lower cowling to gear oil cooler
- F : Distance from gear oil cooler to transom
- A : Total length

Front View Dimensions:

- R : Height to top of upper cowling
- P : Height to top of lower cowling
- O : Overall height
- N : Height to top of gear oil cooler
- T : Width of gear oil cooler
- U : Width of lower cowling
- V : Width of upper cowling
- W : Total width

[illegible]

| TYPE | GEAR/PROPELLER CONFIGURATION | INPUT HP/RPM | DIMENSIONS, mm (inch) | | | | | | | | | | | | Weight kg (lbs) |
|-------|------------------------------|--------------|------------------------|----------------|----------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|---------------|-----------------|-----------------|
| | | | Dp | D ₁ | D ₂ | L | E | B | C steel | C wood | H std | K min | J | A std | |
| K 500 | 354-50/3 | 725/1800 | 18-1900 (70.1-74.7) | 170 (6.7) | 160 (6.3) | 252 (9.9) | 500 (19.7) | 320 (12.6) | 554 (21.8) | 594 (23.4) | 2500 (98.3) | 850 (33.5) | 550 (21.6) | 5000 (196.9) | 2100 (4631) |
| K 500 | 339-50/3 | 850/1225 | 19-2000 (74.7-78.7) | 170 (6.7) | 160 (6.3) | 252 (9.9) | 500 (19.7) | 320 (12.6) | 554 (21.8) | 594 (23.4) | 2500 (98.3) | 850 (33.5) | 550 (21.6) | 5000 (196.9) | 2100 (4631) |
| K 550 | 339-55/3 | 1000/1225 | 2000 (78.7) | 180 (7.1) | 170 (6.7) | 268 (10.5) | 550 (21.6) | 350 (13.8) | 580 (22.8) | 620 (24.4) | 2500 (98.3) | 850 (33.5) | 550 (21.6) | 5000 (196.9) | 2600 (5733) |
| K 550 | 339-55/3 | 1125/1125 | 21-2200 (82.6-86.5) | 180 (7.1) | 170 (6.7) | 268 (10.5) | 550 (21.6) | 350 (13.8) | 580 (22.8) | 620 (24.4) | 2500 (98.3) | 850 (33.5) | 550 (21.6) | 5000 (196.9) | 2600 (5733) |

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GENERAL PART

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RECOMMENDED LUBRICATION OIL FOR PB-GEAR

ESSO:

Spartan EP 150

NOROL:

Transmission oil CC 150

TEXACO:

Meropa 150

MOBIL:

Mobil Gea 629

FINA:

Saturna 46

CASTROL:

Alpha SP 150

SHELL:

Omala 100

OIL CHANGING INTERVALS:

Change oil first time after 200 service service meter hours.
Later oil changing period 1000 - 1500 service meter hours.

Oil volume PB 1: 25 litres
PB 2: 30 litres
PB 3: 60 litres
PB 4: 90 litres

APPLICATION

The propeller is designed on the basis of the vessel's shape and application. The dimensions of the propeller shaft and propeller hub are decided from output and RPM and are identical regardless of application, while the propeller blades are designed for the ship's propulsion ratios, i.e. hull and speed. From the given data you try to design a propeller with the best efficiency, and will arrive at a certain pitch (designed pitch) - for that matter the same pitch as if a fixed propeller was designed.

During operation the engine will reach maximum output only when the conditions are the same as given for the design of the propeller; refer intersection point between engine output and propeller curve in the diagram. By changing the conditions, as speed, current, weather conditions and draught of the ship, the propeller will either be too heavy or too light; refer propeller curves in the diagram.

With a controllable pitch propeller you will always be able to adjust the pitch, so that maximum output of the engine is obtained, and the efficiency is kept relatively constant in this pitch area.

MANEUVERING

The clutch ought to be engaged with the propeller in neutral position and the engine running at low idle. The time for mechanical adjustment - alteration of the propeller pitch - is reduced with increasing RPM. Time from full ahead to full astern: on low idle approx. 8 - 14 secs., high idle approx. 5 - 8 secs. - depending on the size of the propeller equipment. The pitch control lever follows the speed of the servo piston. It is therefore no use in forcing the lever. The force is just supposed to overcome the friction in the transmissions.

By careful maneuvering it is recommended that the engine RPM is set at approx. 900 RPM on engines at 1200 RPM, and at 1200 RPM on engines at 1800 RPM, and the maneuvering takes place by means of the pitch control.

By maximum speed ahead to astern and vice versa, the RPM ought to be reduced with the pitch to obtain the most effective maneuvering and to avoid shocks. By using maximum engine RPM from ahead to astern, air may come into the propeller water, which reduces the effect and increases the possibility of vibrations.

NOTE! Do not give full pitch on the propeller until the ship has come under way.

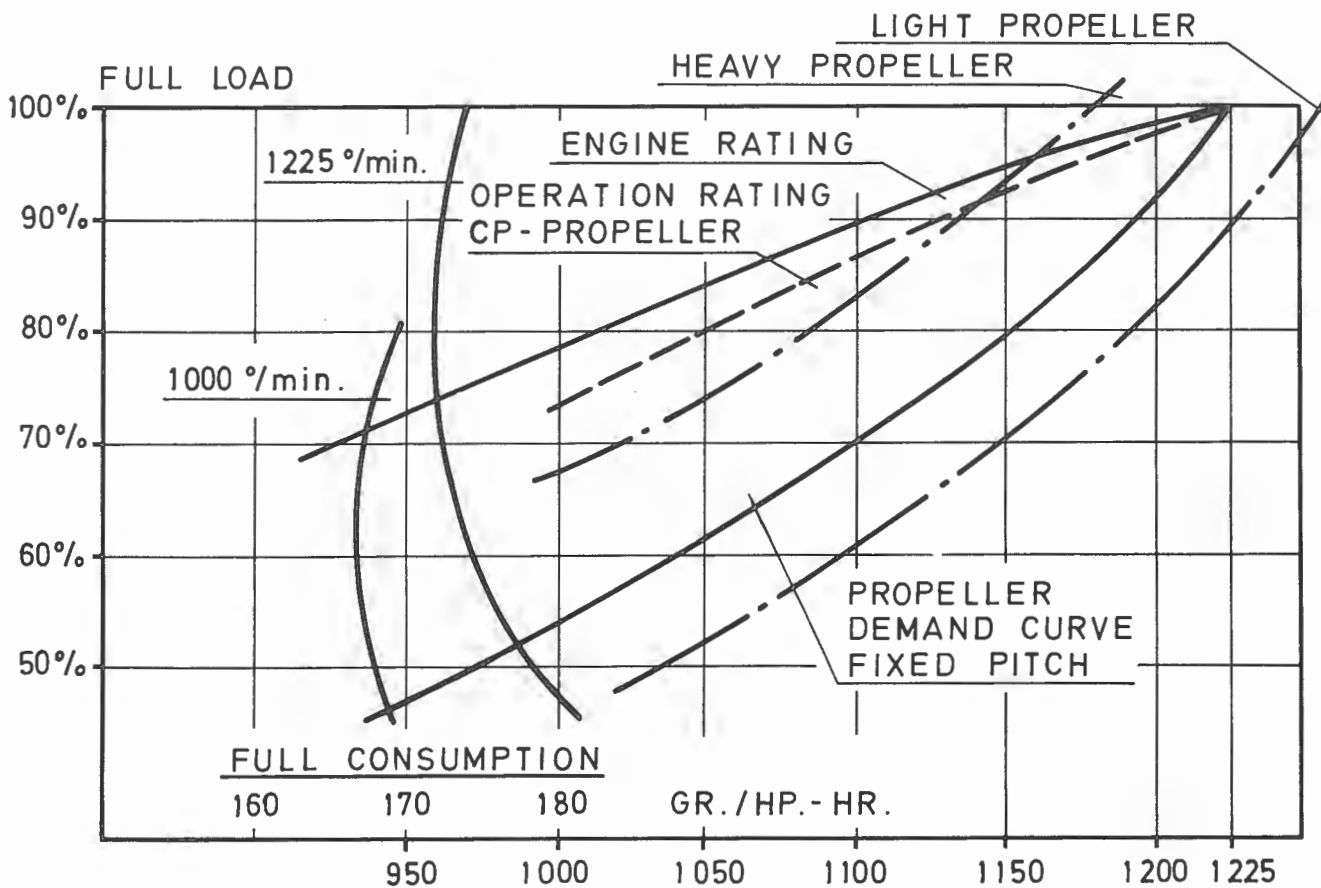
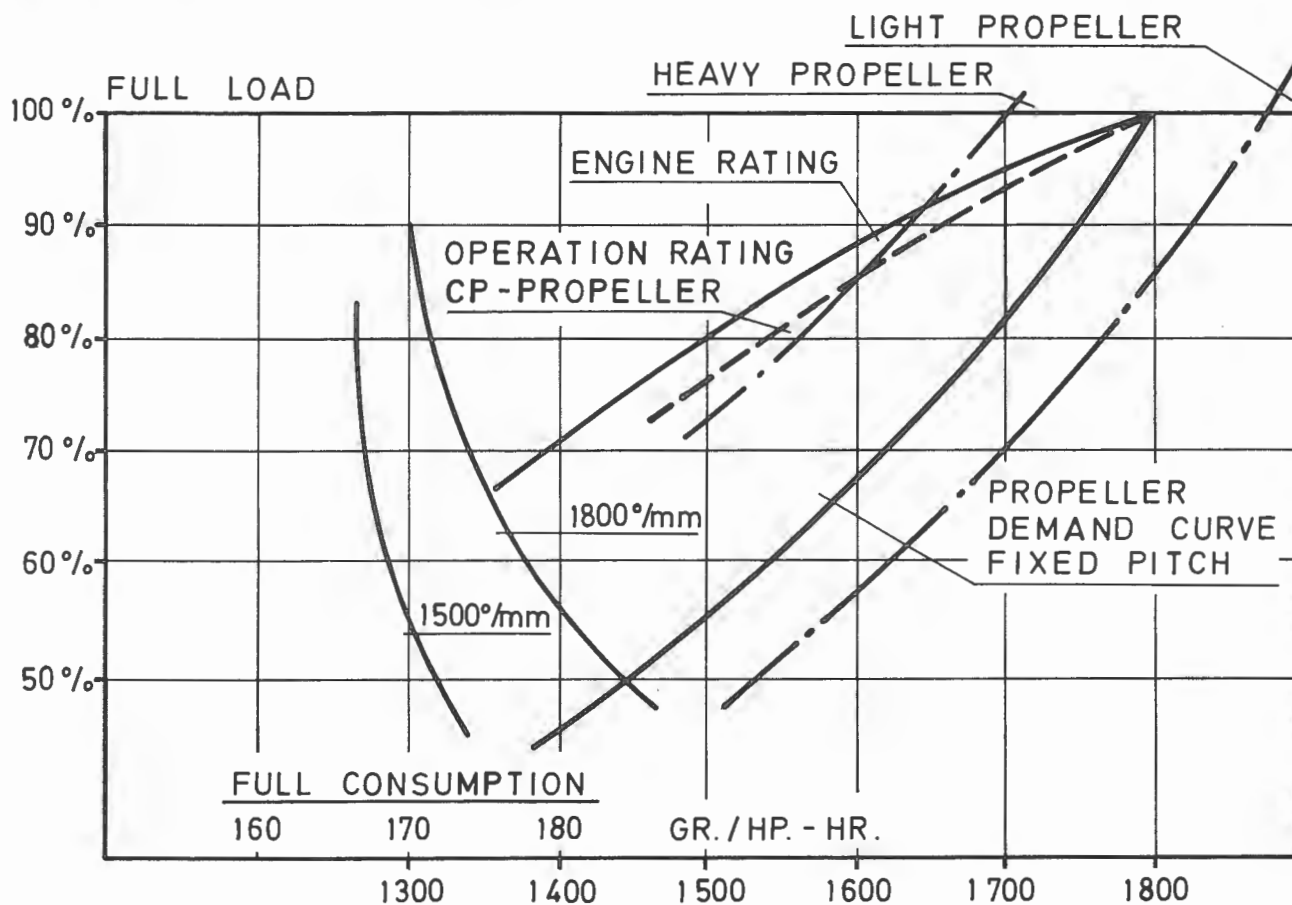
OPERATION

When operating a controllable pitch propeller the engine RPM always has to be increased before or at the same time as the pitch. To obtain maximum output on the engine, the engine should be run up on maximum RPM and the pitch increased gradually until the engine RPM decreases to the correct RPM for maximum output. With the propeller pitch in this position and by reducing the engine RPM, the output will follow the propeller curve, i.e. 10 per cent reduction of RPM gives approx. 35 per cent reduced output.

The ideal operation would however be if the output could follow the engine HP-curve, which to a certain extent is possible to obtain with a controllable pitch propeller. Provided the pitch limitation is not set too low, the propeller pitch can be increased so much that you approximately approach the operation area that corresponds with the engine output and the given RPM. To ensure that the engine is not overloaded, the operation area ought to be set a bit lower than the engine output, refer..... curve on the diagram.

NB! If you want to operate the engine more economical: Use maximum propeller pitch and RPM in the first place; then reduce only the engine speed with 50 - 75 RPM. It is important that the exhaust gas temperature is kept on a correct level, ref. the specifications from the engine supplier. This operation gives better fuel oil economy and less wear to the engine.

Where the engine is equipped with exhaust gas thermometer and air inlet manifold pressure gauge, the load can be controlled from the values given by the engine supplier and the results obtained on sea trial.



GEARBOX DESIGN

The gear is furnished with SAE flange to fit the engine flywheel housing.

Power transmission from the engine to the gear is through a flexible coupling connected to the engine flywheel and a hydraulically actuated disc clutch installed on the input shaft.

The driving shaft for the oil pump is led through the hollow bored input shaft. The pump is connected directly to the engine flywheel and starts to run as soon as the engine starts. The input shaft is supported by two spherical or cone roller bearings which takes the thrust from the helical toothed gear wheel. The speed reduction of the output shaft is effected by two precision machined helical reduction gear wheels.

The servomotor, which is installed in the output gear wheel, actuates the push pull rod extending to the propeller. The output shaft is supported in the rear end by two spherical or cone roller bearings which takes the propeller thrust. In the front end a sliding bearing is installed, which also leads the oil supply to the slide valve. The slide valve is placed in the front end of the servo motor piston rod, and can be controlled from the engine room as well from the wheelhouse (the bridge). The position in which the slide valve is set determines the pitch of the propeller blades.

PROPELLER DESIGN

The propellerhub is split radially in the senterline of the blades in order to simplify the assembling. The hub is made of manganese bronze and filled up with lubricating grease.

The propellerblades, which are designed for maximum efficiency, are carefully grinded and balanced. The blades are made of an alloy of nickel/aluminium/bronze of high strength.

The propeller hub sleeve is threaded to the aft of the push pull rod. The sleeve is thoroughly supported on a rib reinforced liner. The sleeve acts as a grease pump to get lubricants to bearing surfaces.

The slides engage the eccentric positioned rods at the hub end of the propeller blades. Sliding in the transfer slots of the propeller hub sleeve, they transfer the back and forth movement of the sleeve into a rotation of the blades, thus changing the pitch of the blades.

THE OIL SYSTEM

The oil pump sucks oil from the gear sump through a magnetic filter. From the pump the oil goes through an oil cooler to the distribution valve. Pressure oil is first directed to the hydraulic system of the disc clutch. When this pressure has been built up, a valve opens and lets oil pass on to the slide valve and servo motor. A small passage in the valve block supplies lubricating oil to the sliding bearing in case the valve should not open.

In the valve block there are outlets for lubricating oil to the bearings, clutch and gear wheels. A safety valve is installed in this valve block.

To control the oil flow when engaging the clutch the valve is furnished with an adjustment screw. If shocks should occur when engaging the clutch this adjustment screw has to be turned further inwards, thus extending the time of clutch engagement. Normal time for clutch engagement is 3 - 5 seconds.

If a leakage should arise in the system so that the oil pressure will not be sufficient for the clutch function, the three screws placed in the top cover of the gearbox can be screwed on into the clutch, thus engaging it and making it possible to reach harbour in any event. (This has to be done before the engine is started). The propeller blades can also be locked in forward position by a locking device in the split coupling flange on the propeller shaft. Also see groups G and H.

Axial throw must not exceed 0.005 mm per cm of the outer diameter of the flange (corresponding to 0.0005 inch per inch). Also see "Caterpillar Marine Installation Guide" (green book).

Remove the propeller shaft coupling flange. The piston rod and the push pull rod are connected by the rod coupling. Normally the distance between rod ends shall be 5 mm, but because the flow of water to the propeller may be different from vessel to vessel, this generally has to be adjusted. This will always be the case by multiple engine installations, and the push pull rods should be installed without clearance in the start. If maximum pitch is impossible to obtain, the push pull rod has to be cut.

MARINE GEAR INSTALLATION

MOUNTING MARINE GEAR TO ENGINE PB100 - PB200 SERIES

Note:

Drain hole must be drilled in the flywheel housing corresponding to drain hole on the marine gear flange.

The driving ring of the flexible coupling is to be bolted to the engine flywheel.

Concerning PB200S - PB300 and PB400 series the flexible coupling is to be bolted to engine flywheel through the top and side covers.

Control that the guide way fit in the flywheel is adequate. Check by using a dial gauge that the driving ring runs without throw.

The fastening bolts are to be furnished with spring washers and well tightened up.

The marine gear can now be bolted to the flywheel housing. Permatex or similar sealant must be used between flanges.

REMOTE CONTROL

The transmissions from the control levers on the bridge to the control connecting rods on the marine gear are usually of mechanical type, e.g. the Teleflex or the Morse. By extra long transmissions pneumatic remote control can be delivered. By long transmissions chains and rods can be used to get a more precise movement. It is a condition of major importance that there is no backlash in the connection between the transmission and the lever for the pitch control on the marine gear. A backlash in the transmission at this point would allow the control slide to move to a certain extent, which in turn would lead to uncontrollable change of propeller pitch.

ADJUSTMENT

The marine gear is furnished with mechanical stops limiting the pitch in both directions. These stops must be adjusted according to the maximum pitch to be used during operation. If for instance maximum pitch is to be used for full ahead on a free run the adjustment procedure will be as follows: The adjustment pins at the stops being loosened and the engine set to run at "high idle" - the pitch of the propeller is gradually increased till the engine RPM corresponds to the number of revolutions for maximum engine performance. In this position the pitch limit screw pos. 28. has to be locked securely. By running astern the pitch of the propeller is limited to 80 - 85 % of maximum load.

NOTE! The pitch of the propeller when running astern will always be substantially less than when running ahead.

MAINTENANCE INSTRUCTIONS MARINE GEAR

DAILY INSPECTION

1. Check oil level.
2. Inspect clutch pressure and servo pressure.
(Correct clutch pressure is indicated on technical data sheet).
3. Check marine gear oil temperature.

OIL CHANGE (interval page 6)

1. Change oil.
2. Check that no water or abnormal particles are present in the used oil.
3. Clean oil strainer and magneto.

YEARLY INSPECTION

1. Inspect gear wheel, especially if the teeth have contact over the whole length.
Wear at the teeth ends may indicate bearing trouble.
2. Inspect the oil cooler on the water side and clean if necessary.
3. Inspect through the cover that there is no wear on the flexible coupling.
4. Check the remote control and lubricate if necessary.
5. Inspect the oil pump driving shaft, especially the spline on the shaft ends.

TROUBLE SHOOTING GUIDE MARINE GEAR

PROBLEM:

POSSIBLE REASON:

Slow movement of
propeller pitch or
impossible to move

1. Low or no oil pressure
 - a) Check the oil level.
 - b) Inspect the suction line from the gear sump to the pump.
 - c) Inspect the oil pump drive.
 - d) Oil pump defect.
 - e) Wrong type of oil.
2. Normal clutch and servo pressure
 - a) Check remote control.
3. Clutch oil pressure normal, but too low servo pressure
 - a) Too big clearance in the oil slide bearing.
 - b) Leakage in the pipe from valve block to the slide bearing.
 - c) Wear in the slide.
 - d) Leakage in the safety valve.
4. Servo pressure is too high during the manoeuvring
 - a) Disconnect the push pull rod to the propeller and check if servo pressure still is too high. If the pressure now is normal, the fault must be in the propeller.
 - b) Servo piston is sticking.

PROBLEM:

POSSIBLE REASON:

The manoeuvring of the propeller is normal, but servo pressure is too high.

5. Servo pressure too high max. pitch

- a) Servo piston touches the cylinder bottom. Adjust the screw that limits the pitch (situated on the side cover of the gear).

Clutch is slipping or does not engage

6. Low clutch pressure

- a) See 1. a), b), c) and d) above.
- b) Throttle screw for oil to the clutch is closed too much (situated in the valve block right side).
- c) Wear in the sleeve on the pinion shaft.
- d) Leakage in the clutch piston.
- e) The piston on the valve block is sticking.
- f) Valve spring is broken or too weak.

Impossible to engage the propeller

7. Clutch pressure is normal

- a) The remote control moves the clutch valve level too little.

The pitch is unstable

8. a) Check the remote control.

The gear gets too warm

- 9. a) Too little cooling water to the cooler.
- b) Clean the oil cooler on the water side.
- c) Inspect the bearings.
- d) The clutch is slipping.

Water in the oil

- 10. a) Leakage in the oil cooler.
- b) There has been too much water in the ship (water entrance through the seal at the gear flange).

PROBLEM:

POSSIBLE REASON:

Noice in the
gear.

11. Noice at different speeds

- a) Inspect the gear wheels and bearings.
- b) Check the flexible coupling.

12. Noice at a certain RPM

- a) The engine plant must have a critical RPM and must not run at this speed. (If the low idle is too low this will cause gear hammering).

Abnormal oil
consumption

- 13. a) Leakage in the oil cooler.
- b) Leakage in the pipes or at the gear flange seal.

REMOVING CLUTCH

PB 100 - 200 - 200S - 300



Remove the four unbraco bolts on front side of clutch, and install pull bolts no. 3. and hydraulic jack as shown. and pull off clutch.

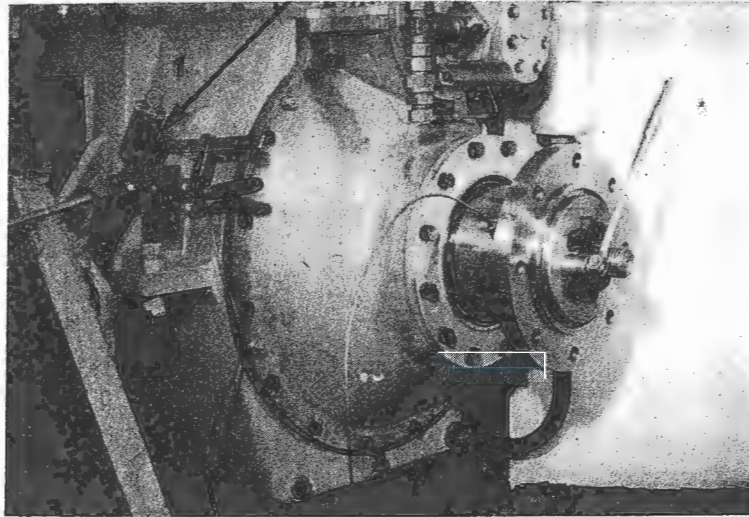
NOTE: Before replacing clutch is must be heated in oil to approx. 115° C (240° F).
Also check key, keyway and shaft before mounting.

Tools no.:

1. Press plate No. 4
2. Hydr. jack Cat. No. 6F25
3. Pull bolts No. 7

REMOVING GEAR OUTPUT FLANGE

PB 200S - PB.300



Remove plug on the flange side and fit the injection plug of the hydr. pump.
Loosen the eight bolts for the lock plate half way out.
Then pump till the flange is loose.

NOTE: The flange is refitted by alternate pumping and tightening the bolts.

Tool No.:

SKF hydr. pump No. 226400.

REPLACING THRUSTBEARING

PB 200 - PB 200S



Assemble tools as shown and press the bearing on.

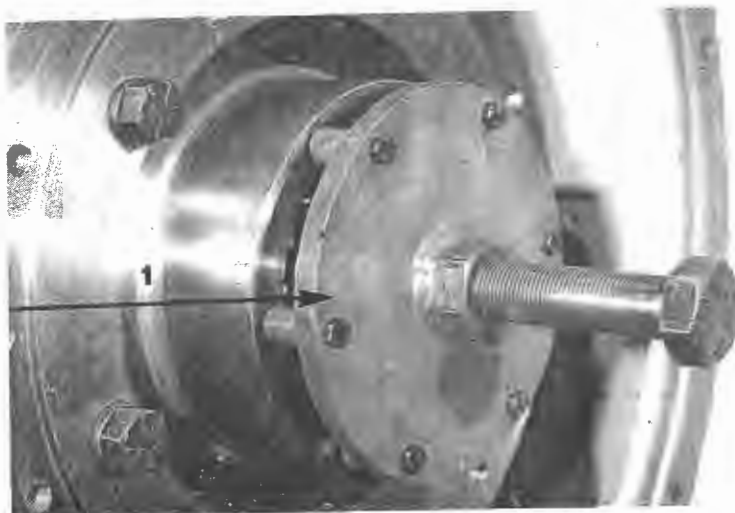
NOTE: Make shure that bearing has entered the shaft correctly before pressing.

Tools No.:

1. Hydr. jack Cat. No. 6F25
2. Pull bolt No. 9
3. Press plate No. 4
4. Push bolts No. 8
5. For P.B.200: Ring No. 3
For P.B.200S: Ring No. 5
6. Press - and lifting nut no. 17.

REMOVING CLUTCH HOUSING

PB200 - 200S - 300



Remove front cover for oil pump, drive shaft and retaining ring for bearing.

Fit the chuck and pull the clutch housing forwards.

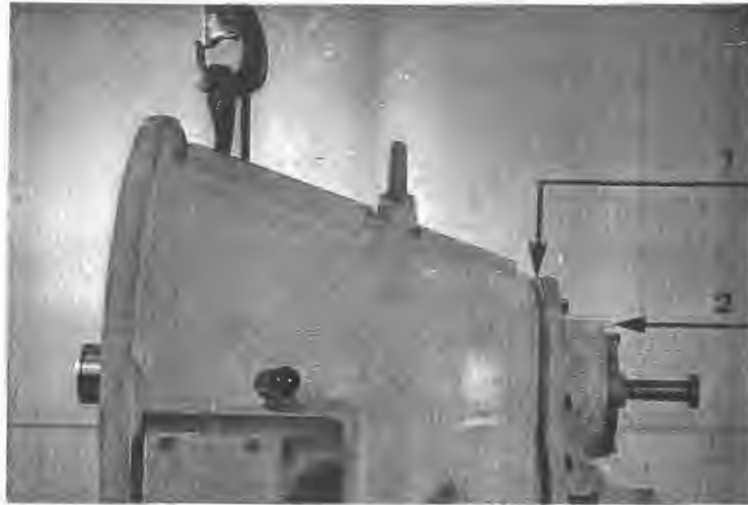
NOTE: When replacing, check that all clutch discs enter splines in clutch housing.

Tools No.:

1. Chuck No. 1

REMOVING PRIMARY SHAFT

PB 100 - PB 200



EXTERNAL: Remove oil pump, oil cooler, oil pump flange and retaining ring for the journal bearing.

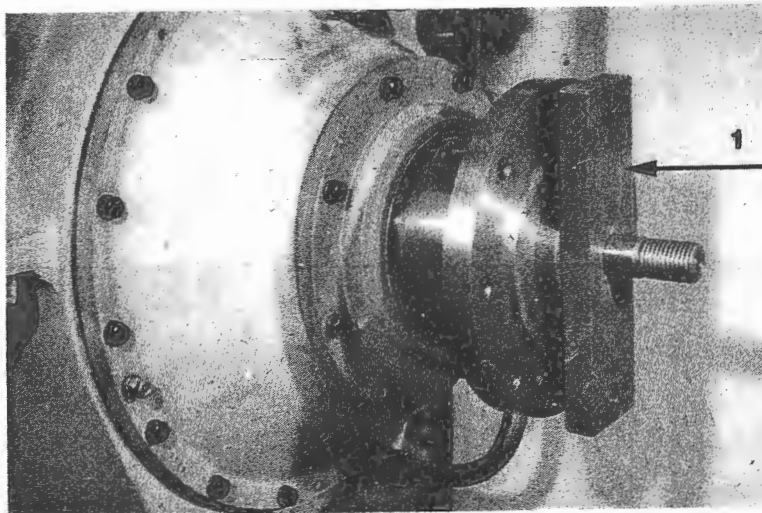
INTERNAL: Disconnect hydraulic hoses and remove bearing locking bolts.
Pull the rear cover approx. 15 mm (5/8") with pushbolts and insert retaining plate item 1.
Fit the chuck, item 2, and press the shaft forward.

NOTE: After replacing the primary shaft the thrustbearing is pulled over the shaft by means of tools No. 1 and 12.

Tools No.: 1. Retaining plate No. 16
2. Chuck No. 1

REMOVING GEAR OUTPUT FLANGE

PB 100 - PB 200



Remove lock nut on output shaft.
Install tool as shown and insert two 5/8"
bolts through flange holes, and pull the
flange off.

Tools no.: 1. Chuck No. 18.

REMOVING THRUSTBEARING

PB 200 - PB 200S



Insert claws item 5 between bearing rollers.
Install ring item 4 and tighten the nuts for
claws item 5.
Assemble hydr. jack and pull bolts as shown.

- Tools No.: 1. Press plate No. 4
2. Hydr. jack Cat. No. 6F25
3. Pull bolts No. 7
4. For P.B.2: Ring No. 3
For P.B.2S: Ring No. 5
5. Claws No. 11

REMOVING THRUST BEARING SECONDARY SHAFT PB 300



Remove the three plugs in the bottom of servo cylinder and use the three $\frac{1}{2}$ " push bolts. Connect S.K.F. hydr. pump. Pump and push alternately till the bearing inner ring is loose.

NOTE: Before replacing bearings they must be heated in oil to approx. 115°C (240°F) and slipped over the shaft.

Tools No.: 1. S.K.F. hydr. pump No. 226400
2. Push bolts No. 10

REMOVING TAPERED BEARING PRIMARY SHAFT PB 300



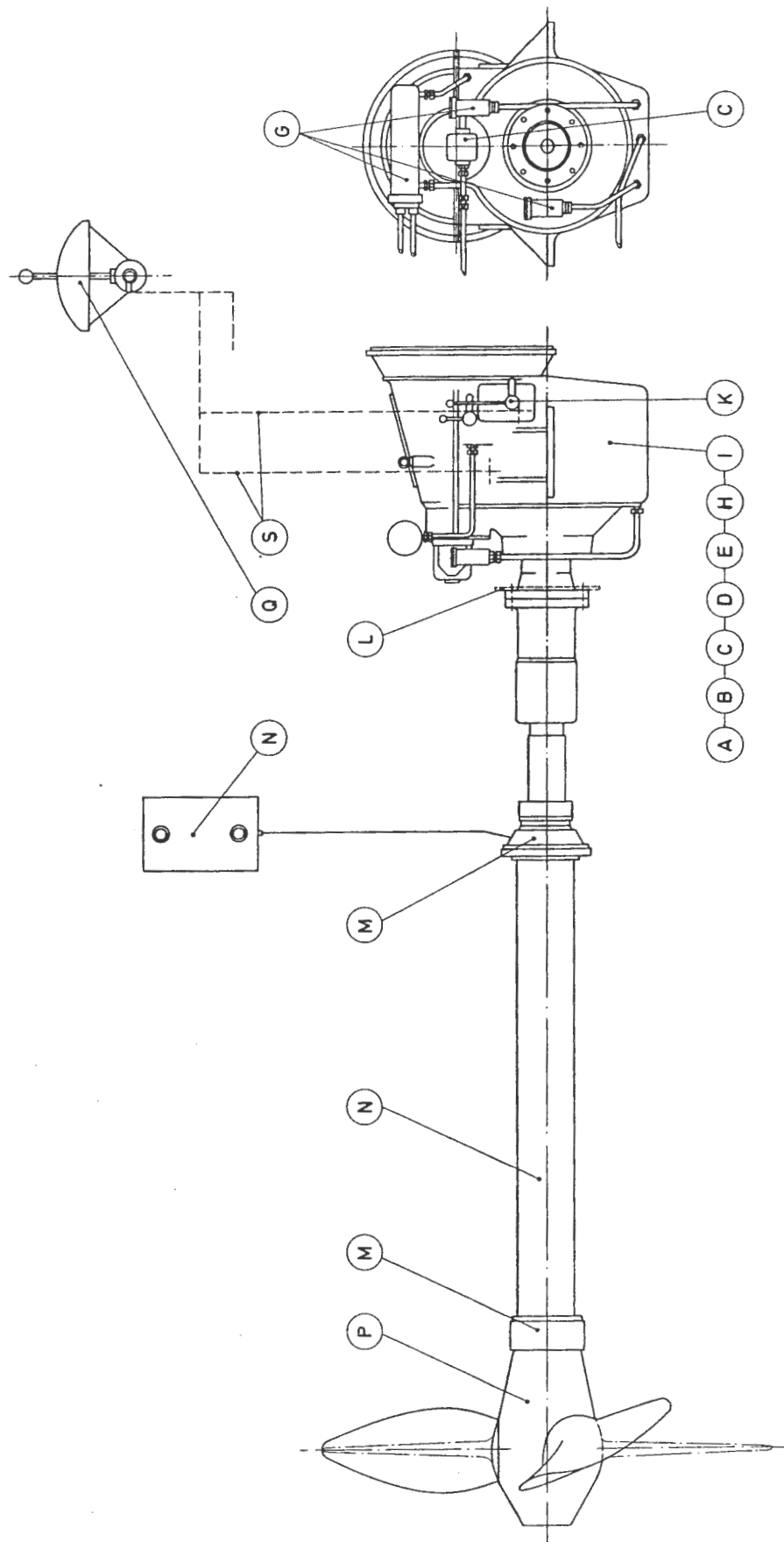
Assemble the two halves item 2 around bearing and bolt them to chuck item 1.

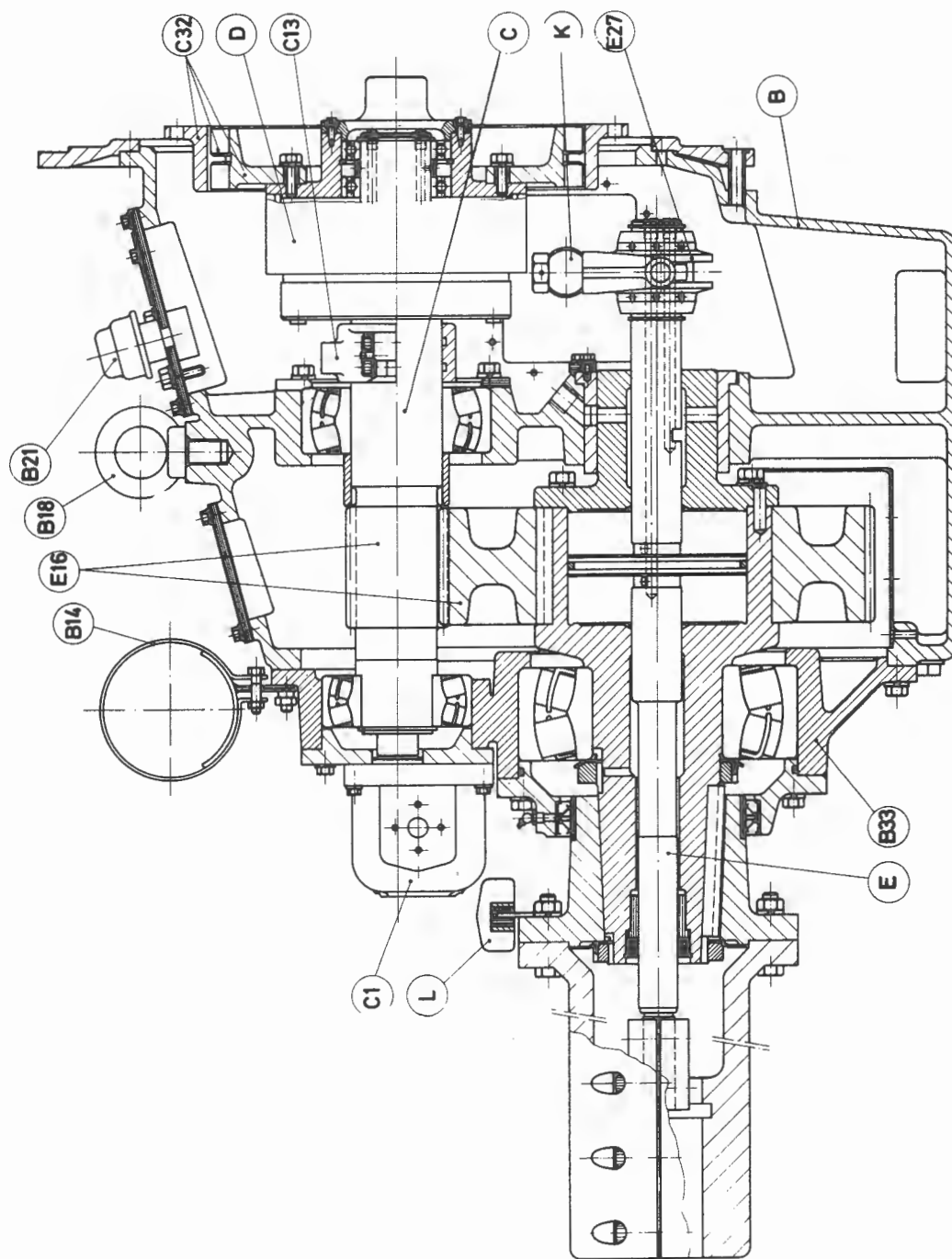
NOTE: Before replacing, bearings must be heated in oil to approx. 115°C (240°F) and slipped over the shaft.

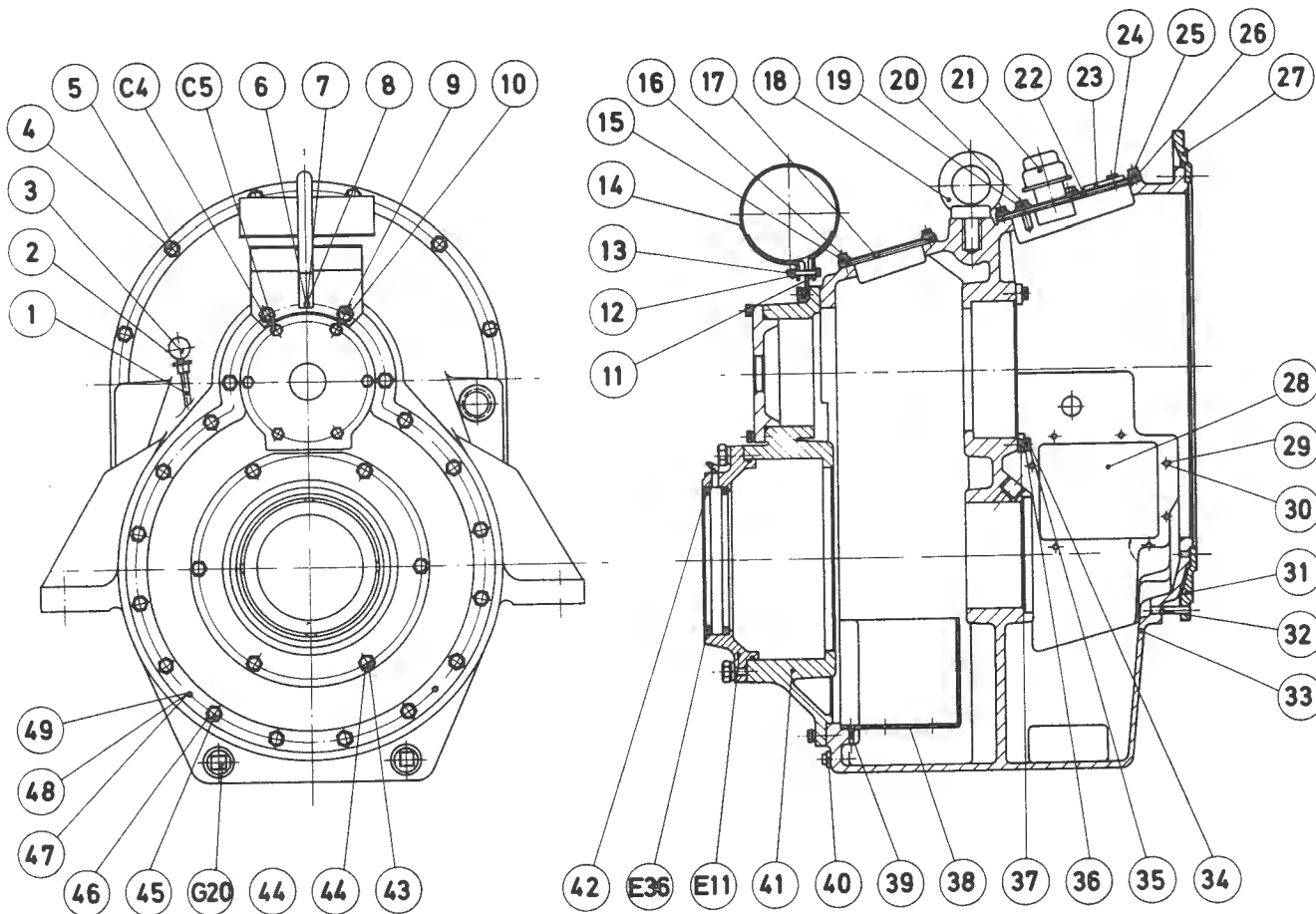
Tools No.:

1. Chuck No. 1
2. Clamp No. 2

| GROUP | DRAWING | GROUP | DRAWING |
|-------|-----------------------------|-------|--|
| 01 | GENERAL DESIGN | I | HYDRAULIC VALVE |
| A | MARINE GEAR CROSS SECTION | K | MANEUVRING OF SERVO AND CLUTCH |
| B | MARINE GEAR HOUSING | L | SHAFT BRAKE |
| C | PRIMARY SHAFT WITH OIL PUMP | M | STERN TUBE SEAL |
| D | CLUTCH | N | PROP. SHAFT WITH STERN TUBE AND LUB.OIL TANK |
| E | SECONDARY SHAFT | P | PROPELLER |
| G | OIL SYSTEM PART I | Q | CONTROL BOX |
| H | OIL SYSTEM PART II | S | REMOTE CONTROL EQUIPMENT |

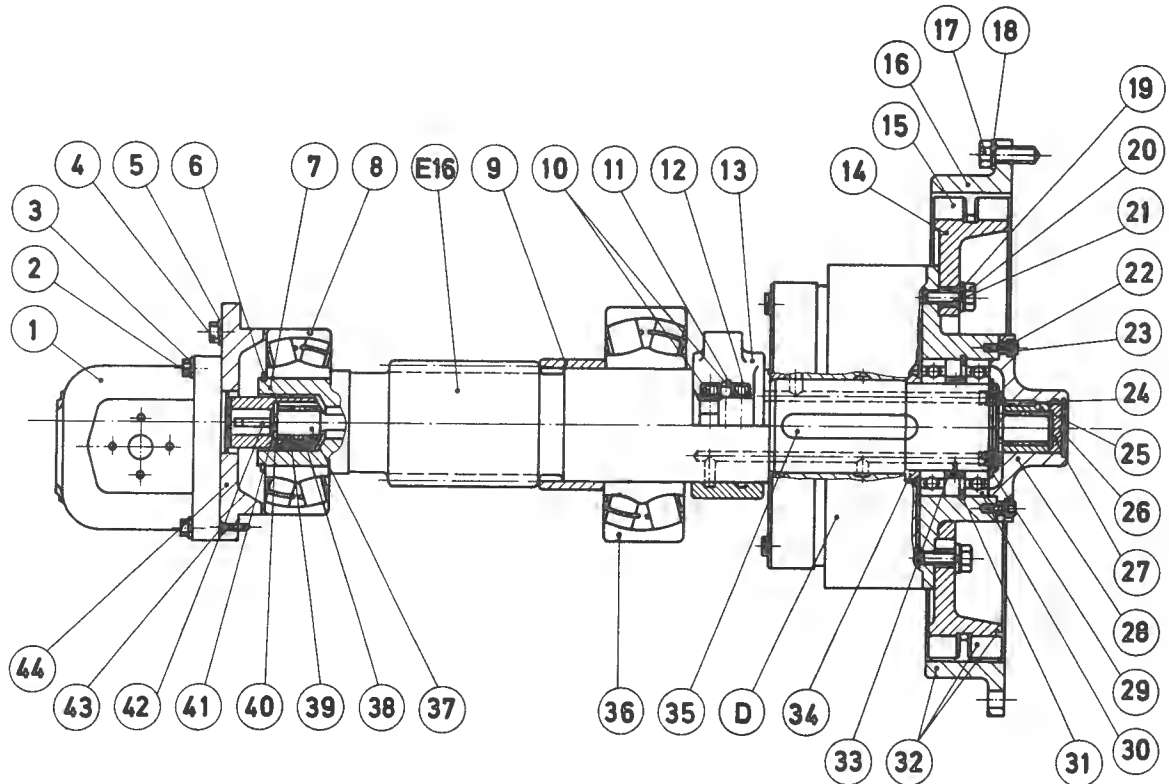






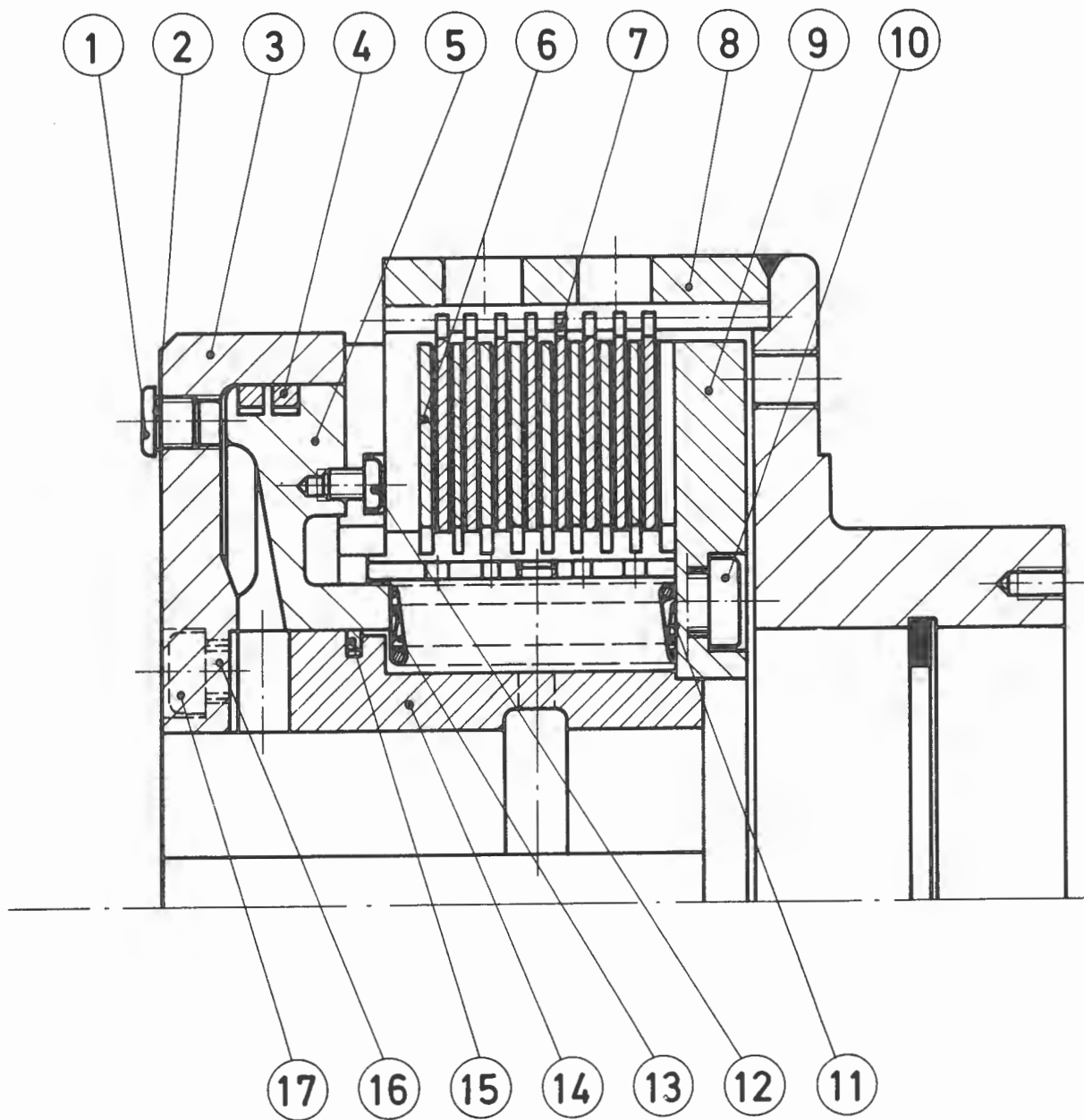
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-----------------------------|------|-----------|
| 1 | PIPE FOR DIPSTICK | 1 | 04.529054 |
| 2 | DIPSTICK WITH BALL | 1 | 04.529055 |
| 3 | BALL FOR DIPSTICK | 1 | 04.526031 |
| 4 | LOCKWASHER | 12 | 3B4507 |
| 5 | BOLT | 12 | 0T0320 |
| 6 | DOWEL | 1 | 04.526037 |
| 7 | NUT | 1 | 03.133860 |
| 8 | SPACER | 1 | 04.526039 |
| 9 | LOCKWASHER | 2 | 3B4508 |
| 10 | BOLT | 2 | 0S1587 |
| 11 | NUT | 1 | 1D4717 |
| 12 | LOCKWASHER | 1 | 3B4506 |
| 13 | BOLT | 1 | 0S1591 |
| 14 | BRACKET | 1 | 74.522061 |
| 15 | BOLT | 4 | 1B7182 |
| 16 | LOCKWASHER | 1 | 3B4505 |
| 17 | TOP COVER | 1 | 04.529039 |
| 18 | EYEBOLT | 1 | 04.526032 |
| 19 | CLUTCH EMERGENCY BOLT | 4 | 04.529056 |
| 20 | CLUTCH EMERGENCY LOCKWASHER | 4 | 3B4507 |
| 21 | BREATHER | 1 | 8B6992 |
| 22 | TOP COVER | 1 | 04.529026 |
| 23 | NAMEPLATE | 1 | 04.528052 |
| 24 | RIVET | 4 | 04.526036 |
| 25 | BOLT | 8 | 1B7182 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-------------------------------|------|-----------|
| 26 | LOCKWASHER | 8 | 3B4505 |
| 27 | FLANGE PB 146 ONLY | 1 | 04.529057 |
| 28 | SIDE COVER LEFT HAND | 1 | 04.529025 |
| 29 | BOLT | 8 | 1B7182 |
| 30 | LOCKWASHER | 8 | 3B4505 |
| 31 | O-RING PB 146 ONLY | 1 | 4F5675 |
| 32 | DRAIN TUBE PB 146 ONLY | 1 | 04.529058 |
| | UNBRAKO PLUG PB 146 ONLY | 1 | 03.133640 |
| 33 | GEARBOX WITH END COVER | 1 | 04.529000 |
| 34 | BOLT | 4 | 6H1717 |
| 35 | LOCKWASHER | 4 | 3B4508 |
| 36 | LOCK PLATE FOR OIL INLET RING | 2 | 04.526040 |
| 37 | THRUSTRING | 1 | 04.529059 |
| 38 | OIL SHIELD | 1 | 04.529060 |
| 39 | UNBRAKO BOLT COUNTERSUNK | 4 | 03.131422 |
| 40 | UNBRAKO PLUG | 1 | 03.034416 |
| 41 | COVER PART OF 04.529000 | | |
| 42 | NIPPLE | 1 | 3B8485 |
| 43 | BOLT | 6 | 0S1585 |
| 44 | LOCKWASHER | 6 | 3B4508 |
| 45 | BOLT | 16 | 0S1585 |
| 46 | LOCKWASHER | 16 | 3B4508 |
| 47 | DOWEL | 2 | 04.526037 |
| 48 | NUT | 2 | 03.133860 |
| 49 | SPACER | 2 | 04.526039 |



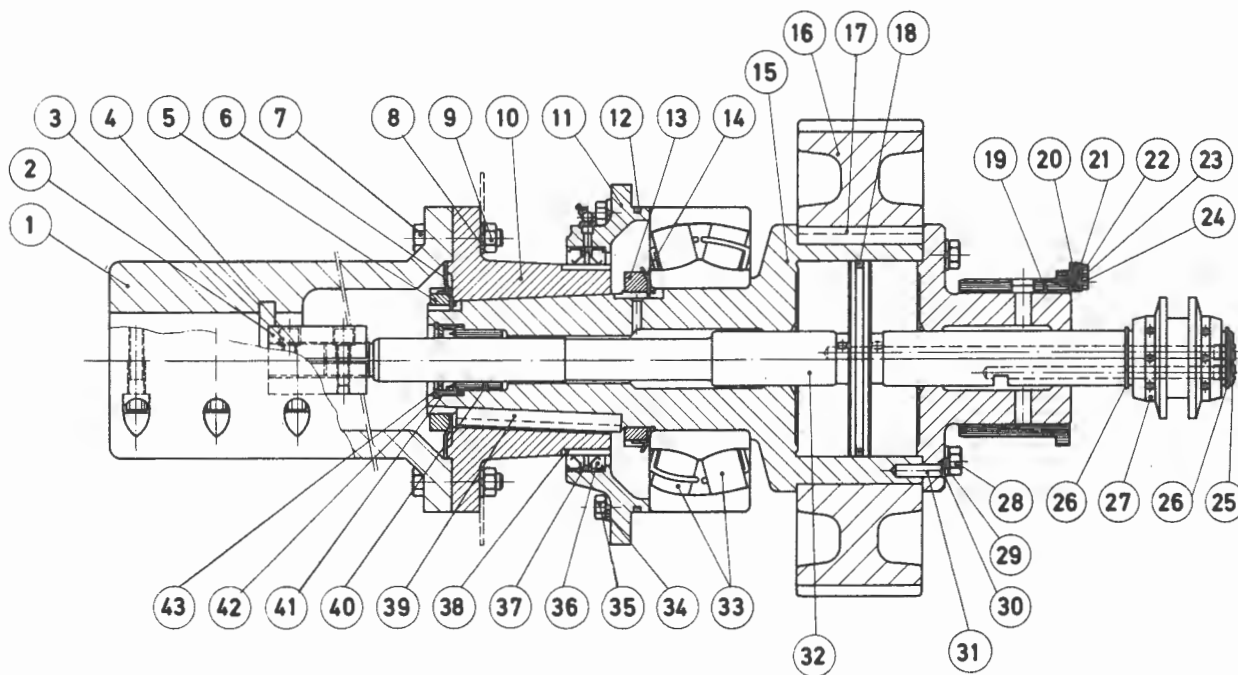
| ITEM | DESCRIPTION | QTY. | PART NO |
|------|----------------------------------|------|-----------|
| 1 | OIL PUMP | 1 | 04.522050 |
| 2 | BOLT | 4 | 1A9579 |
| 3 | LOCKWASHER | 4 | 3B4505 |
| 4 | BOLT | 4 | 0S1588 |
| 5 | LOCKWASHER | 4 | 3B4506 |
| 6 | LOCK RING | 1 | 03.150070 |
| 7 | SPLINE SLEEVE | 1 | 04.522033 |
| 8 | BEARING | 1 | 04.521080 |
| 9 | SPACER | 1 | 04.529043 |
| 10 | UNBRAKO BOLT, PART OF: 04.529029 | 4 | 03.130535 |
| 11 | DOWEL, PART OF: 04.529029 | 2 | 04.522029 |
| 12 | LOCKWASHER, PART OF: 04.529029 | 4 | 3B4506 |
| 13 | OIL INLET RING | 1 | 04.529029 |
| 14 | INNER MEMBER | 1 | 04.521123 |
| 15 | MOULDED BLOCK | 52 | 2N4619 |
| 16 | OUTER MEMBER | 1 | 04.521121 |
| 17 | BOLT | 8 | 0S1585 |
| 18 | LOCKWASHER | 8 | 3B4508 |
| 19 | WASHER | 8 | 4B4280 |
| 20 | LOCKWASHER | 6 | 3B4508 |
| 21 | BOLT | 6 | 03.130147 |
| 22 | DOWEL | 3 | 04.529044 |
| 23 | LOCKWASHER | 6 | 3B4504 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|---------------------------------------|------|-----------|
| 23 | UNBRAKO BOLT | 6 | 03.130209 |
| 24 | DOWEL, PART OF: 04.529032 | 1 | |
| 25 | SLEEVE, PART OF: 04.529032 | 1 | |
| 26 | LOCK RING, PART OF: 04.529032 | 1 | |
| 27 | WASHER, PART OF: 04.529032 | 1 | |
| 28 | END COVER WITH SPLINE SLEEVE COMPLETE | 1 | 04.529032 |
| 29 | UNBRAKO PLUG | 3 | 03.133610 |
| 30 | ROLLER BEARING | 1 | 04.521125 |
| 31 | LOCK RING | 1 | 03.151110 |
| 32 | FLEXIBEL COUPLING COMPLETE | 1 | 74.280051 |
| 33 | SPACER | 1 | 04.529046 |
| 34 | SPACER | 1 | 04.529047 |
| 35 | KEY | 1 | 04.529022 |
| 36 | BEARING | 1 | 03.181009 |
| 37 | PUMP DRIVE SHAFT | 1 | 04.529021 |
| 38 | DOWEL, PART OF: 04.522033 | 1 | |
| 39 | SLEEVE, PART OF: 04.522033 | 1 | |
| 40 | WASHER, PART OF: 04.522033 | 1 | |
| 41 | UNBRAKO BOLT | 1 | 03.131505 |
| 42 | KEY (PART OF OIL PUMP) | 1 | 04.522036 |
| 43 | UNBRAKO BOLT | 2 | 03.130529 |
| 45 | MOUNTING FLANGE FOR OIL PUMP | 1 | 04.526023 |



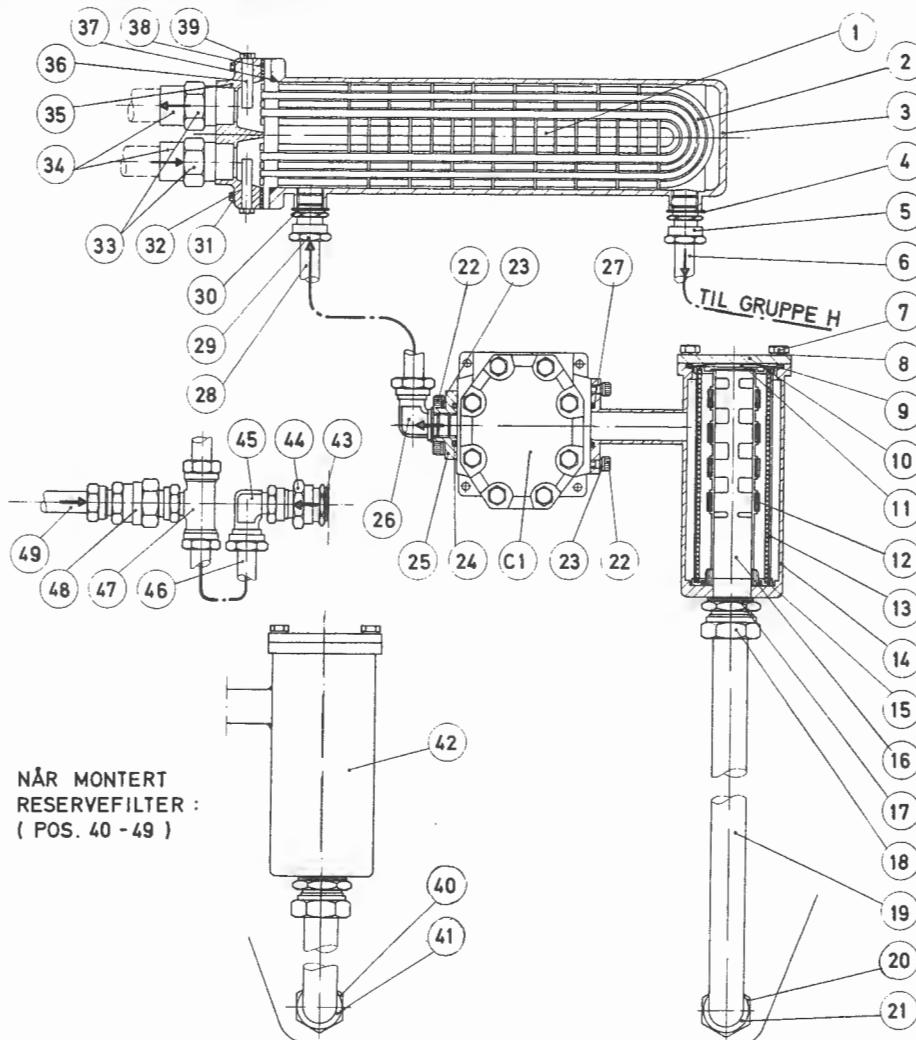
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|------------------------------|------|-----------|
| 0 | CLUTCH COMPLETE..... | 1 | 04.529003 |
| 1 | PLUG FOR EMERGENCY BOLT..... | 4 | 04.529015 |
| 2 | WASHER..... | 4 | 04.529016 |
| 3 | CYLINDER..... | 1 | 04.529013 |
| 4 | OUTER PISTON RING..... | 2 | 04.529009 |
| 5 | PISTON COMPLETE..... | 1 | 04.529012 |
| 6 | INNER DISC..... | 8 | 04.529004 |
| 7 | OUTER DISC..... | 7 | 04.529005 |
| 8 | OUTER FLANGE RING..... | 1 | 04.529011 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|------------------------------------|------|-----------|
| 9 | DISC..... | 1 | 04.529014 |
| 10 | UNBRAKO BOLT..... | 6 | 04.529017 |
| 11 | INNER SPRING..... | 12 | 04.529006 |
| 12 | UNBRAKO BOLT, PART OF: 04.529012.. | 3 | |
| 13 | OUTER SPRING..... | 12 | 04.529007 |
| 14 | INNER HUB..... | 1 | 04.529010 |
| 15 | INNER PISTON RING..... | 1 | 04.529008 |
| 16 | DOWEL..... | 2 | 04.529019 |
| 17 | UNBRAKO BOLT..... | 6 | 04.529018 |



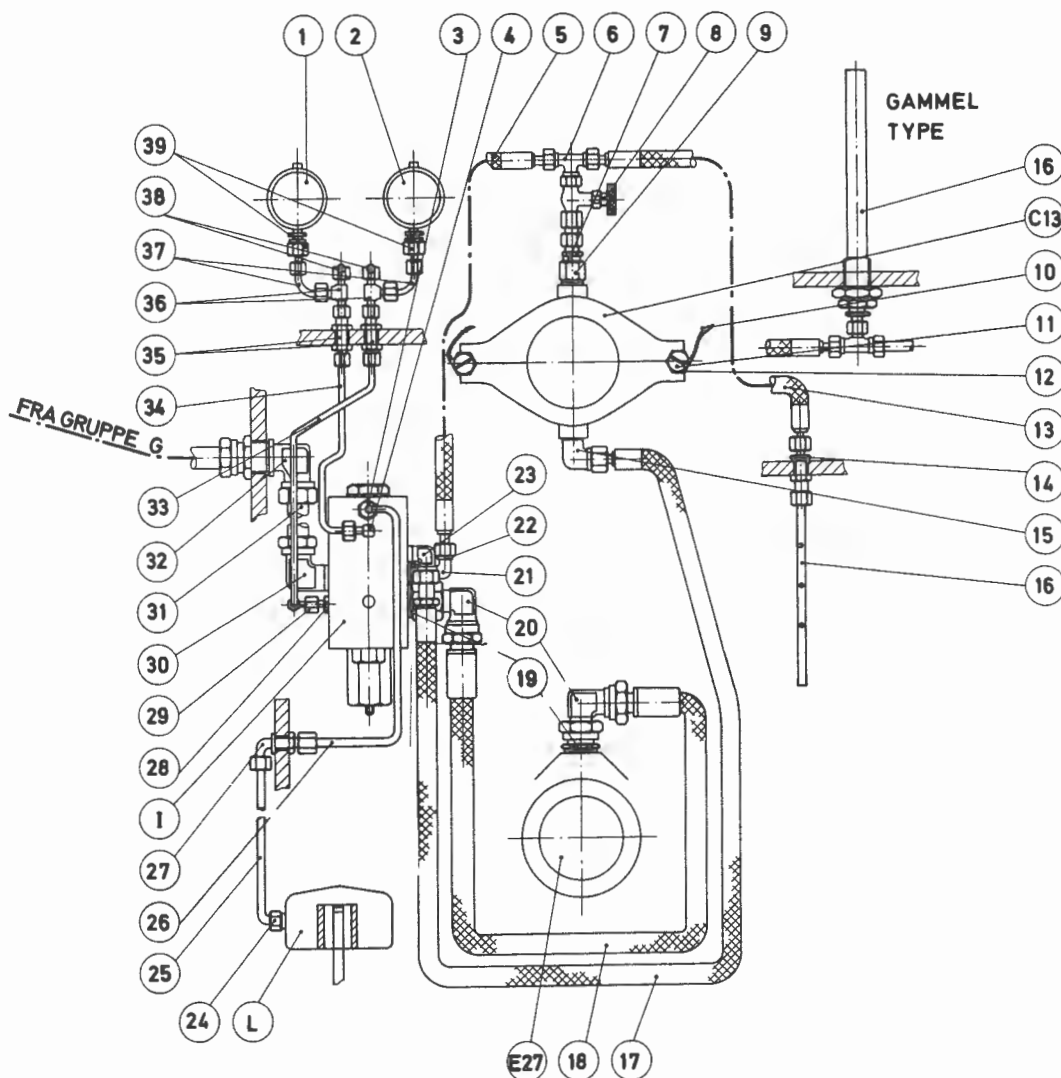
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|---|------|-----------|
| 1 | FLANGE 120 MM PROP. SHAFT | 1 | 04.529036 |
| 2 | FLANGE 130 MM PROP. SHAFT | 1 | 04.529037 |
| 3 | LOCKWASHER | 4 | 3B4508 |
| 4 | UNBRAKO BOLT | 4 | 03.130546 |
| 5 | NUT | 1 | 03.181010 |
| 6 | LOCK | 1 | 03.181011 |
| 7 | REAMED BOLT | 8 | 04.529045 |
| 8 | LOCKWASHER | 8 | 04.529048 |
| 9 | NUT | 8 | 04.529049 |
| 10 | GEAR FLANGE | 1 | 04.529028 |
| 11 | REAR END COVER | 1 | 04.529031 |
| 12 | O-RING | 1 | 03.053096 |
| 13 | NUT | 1 | 03.181012 |
| 14 | LOCK | 1 | 03.181013 |
| 15 | SERVOSHAF WITH COVER | 1 | 04.529020 |
| 16 | HELICAL GEAR & PINION SHAFT 4,6:1 | 1 | 04.529001 |
| 17 | HELICAL GEAR & PINION SHAFT 4,9:1 | 1 | 04.529002 |
| 18 | KEY | 1 | 04.529023 |
| 19 | PISTON RING | 1 | 04.529027 |
| 20 | BEARING | 1 | 04.522009 |
| 21 | LOCK PLATE FOR BEARING | 1 | 04.522008 |
| 22 | SPACER | 1 | 04.522007 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|----------------------------------|------|-----------|
| 22 | BOLT | 2 | 1B7182 |
| 23 | LOCKWASHER | 3 | 3B4505 |
| 24 | BOLT | 1 | 2H3755 |
| 25 | UNBRAKO PLUG | 3 | 03.133640 |
| 26 | LOCK RING | 2 | 03.150050 |
| 27 | SLIDE | 1 | 04.529033 |
| 28 | BOLT | 8 | 0S1587 |
| 29 | LOCKWASHER | 8 | 3B4508 |
| 30 | LOCK RING FOR DOWEL | 2 | 04.529050 |
| 31 | DOWEL | 2 | 04.527069 |
| 32 | SERVO PISTON AND SHAFT | 1 | 04.529034 |
| 33 | BEARING COMPLETE | 1 | 03.181017 |
| 34 | LOCKWASHER | 8 | 3B4508 |
| 35 | BOLT | 8 | 0S1585 |
| 36 | SEALING RING | 2 | 04.529042 |
| 37 | SPACER | 1 | 04.529051 |
| 38 | WEAR RING | 1 | 04.529035 |
| 39 | KEY | 1 | 04.529030 |
| 40 | BEARING | 1 | 04.522017 |
| 41 | SEALING RING | 1 | 03.053656 |
| 42 | SPACER | 1 | 04.522019 |
| 43 | LOCK RING | 1 | 03.151065 |
| 44 | UNBRAKO BOLT | 6 | 03.130567 |



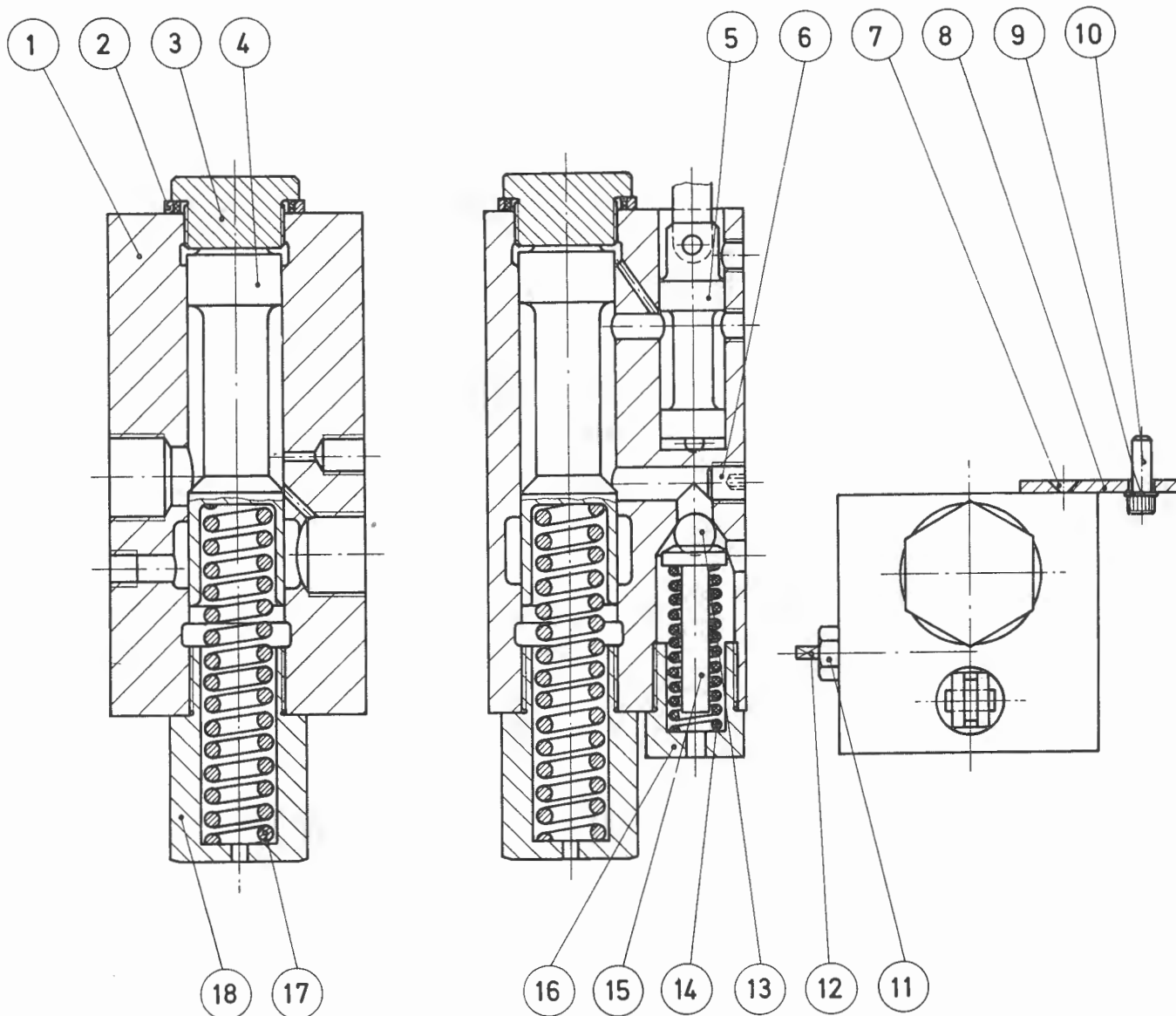
| ITEM | DESCRIPTION | QTY. | PART NO. | ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--|------|---------------|------|---|------|---------------|
| 1 | GEAR OIL COOLER COMPLETE | | | 21 | WASHER..... | 1 | 03.054023 |
| | PB 100 FROM S.NO. 1001-UP..... | 1 | 74.525600 | 22 | UNBRAKOBOLT..... | 8 | 03.130523 |
| | PB 237 FROM S.NO. 2001-UP..... | 1 | 74.525600 | 23 | LOCKWASHER..... | 8 | 3B4505 |
| | PB 250 FROM S.NO. 2001 TO S.NO. 2170 | 1 | 74.525600 | 24 | O-RING..... | 1 | 03.053257 |
| | PB 250 FROM S.NO. 2171-UP..... | 1 | 74.525610 | 25 | FLANGE..... | 1 | 04.522076 |
| 2 | TUBE STACK | | | 26 | COUPLING..... | 1 | 03.033017 |
| | PB 100 FROM S.NO. 1001-UP..... | 1 | 04.522112 | 27 | O-RING..... | 1 | 03.053258 |
| | PB 237 FROM S.NO. 2001-UP..... | 1 | 04.522112 | 28 | PIPE 22 \varnothing x 1,5 x 200..... | 1 | Special-order |
| | PB 250 FROM S.NO. 2001 TO S.NO. 2170 | 1 | 04.522112 | 29 | COUPLING..... | 1 | 03.033007 |
| | PB 250 FROM S.NO. 2171-UP..... | 1 | 04.525611 | 30 | WASHER..... | 1 | 03.054019 |
| 3 | BODY | | | 31 | LOCKWASHER STAINLESS..... | 6 | 03.133827 |
| | PB 100 FROM S.NO. 1001-UP..... | 1 | 04.522113 | 32 | BOLT STAINLESS..... | 6 | 03.130532 |
| | PB 237 FROM S.NO. 2001-UP..... | 1 | 04.522113 | 33 | ADAPTER..... | 2 | 03.031719 |
| | PB 250 FROM S.NO. 2001 TO S.NO. 2170 | 1 | 04.522113 | 34 | ADAPTER..... | 2 | 03.035097 |
| | PB 250 FROM S.NO. 2171-UP..... | 1 | 04.525612 | 35 | END COVER..... | 1 | 04.522110 |
| 4 | WASHER..... | 1 | 03.054019 | 36 | ZINKPLUG..... | 1 | 04.104903 |
| 5 | COUPLING..... | 1 | 03.033007 | 37 | O-RING..... | 1 | 03.053035 |
| 6 | PIPE 22 \varnothing x 1,5 x 915..... | 1 | Special-order | 38 | GASKET..... | 1 | 04.522111 |
| 7 | BOLT..... | 4 | 0S1594 | 39 | ADAPTER..... | 1 | 04.104942 |
| 8 | LOCKWASHER..... | 4 | 3B4506 | | | | |
| 9 | O-RING..... | 1 | 03.053030 | 40 | COUPLING..... | 2 | 03.033008 |
| 10 | TOP COVER..... | 1 | 04.526085 | 41 | WASHER..... | 2 | 03.054023 |
| 11 | SPRING..... | 1 | 3B3440 | 42 | EMERGENCY OIL FILTER COMPLETE, FOR SPARE PARTS, SEE ITEM 7 TO 15. | 1 | 04.525607 |
| 12 | ELEMENT..... | 1 | 2S1641 | 43 | WASHER..... | 1 | 03.054019 |
| 13 | SCREEN..... | 1 | 3S3875 | 44 | VALVE..... | 1 | 03.033330 |
| 14 | OIL FILTER BODY WITH TOP COVER..... | 1 | 04.526086 | 45 | COUPLING..... | 1 | 03.033170 |
| 15 | GASKET..... | 1 | 04.522090 | 46 | PIPE 22 \varnothing x 1,5 x 150..... | 1 | Special-order |
| 16 | OIL FILTER COMPLETE..... | 1 | 04.522085 | 47 | TEE COUPLING..... | 1 | 03.033186 |
| 17 | WASHER..... | 1 | 03.054023 | 48 | VALVE..... | 1 | 03.033320 |
| 18 | COUPLING..... | 1 | 03.033008 | 49 | PIPE FROM EVENTUAL EMERGENCY OIL PUMP | | |
| 19 | PIPE 28 \varnothing x 2 x 700..... | 1 | Special-order | | | | |
| 20 | COUPLING..... | 1 | 03.033008 | | | | |

If emergency oil filter is installed:



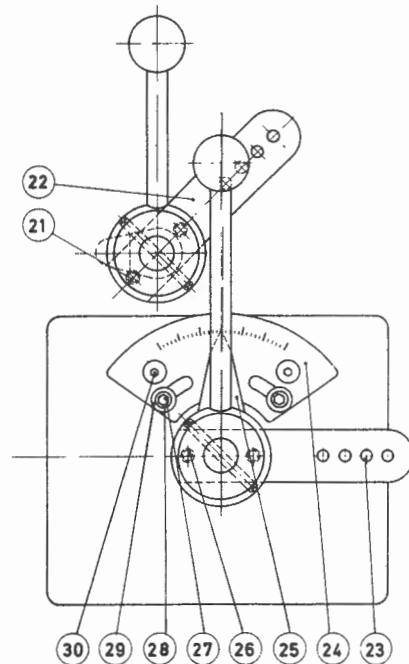
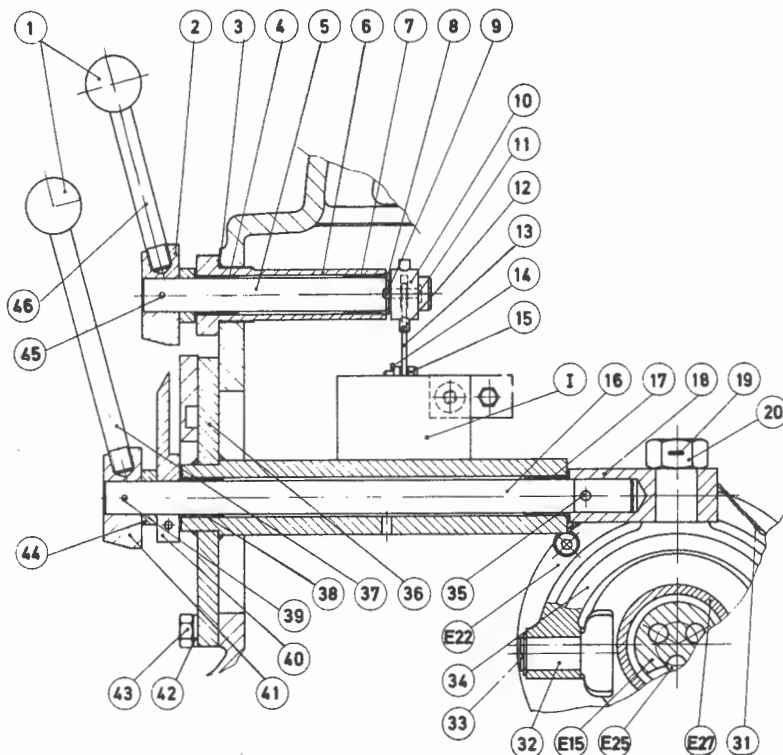
| ITEM | DESCRIPTION | QTY. | PART NO |
|------|---|------|-----------|
| 1 | GAUGE CLUTCH PRESSURE 0—25 kg/cm ² | 1 | 04.521363 |
| 2 | GAUGE SERVO PRESSURE 0—40 kg/cm ² | 1 | 04.521364 |
| 3 | COUPLING | 1 | 03.033001 |
| 4 | COUPLING | 1 | 03.033011 |
| 5 | HOSE ASSMBLY | 1 | 04.528036 |
| 6 | TEE COUPLING | 1 | 03.033178 |
| 7 | WASHER | 1 | 03.054012 |
| 8 | NIPPLE | 1 | 03.033262 |
| 9 | VALVE | 1 | 04.528039 |
| 10 | LOCK WIRE, SOLD IN CM | 100 | 04.528072 |
| 11 | BOLT | 2 | 04.528065 |
| 12 | SPACER | 2 | 04.528071 |
| 13 | HOSE ASSMBLY | 1 | 04.528037 |
| 14 | COUPLING | 1 | 03.033142 |
| 15 | COUPLING | 1 | 03.033014 |
| 16 | OIL JETS, FROM S.NO. 1001 TO S.NO. 1029 REINSTALL NEW TYPE | 1 | 04.529041 |
| 17 | OIL JETS FROM S.NO. 1030-UP | 1 | 04.528044 |
| 18 | HOSE ASSMBLY | 1 | 04.528041 |
| 19 | WASHER | 1 | 03.054019 |
| 20 | COUPLING | 1 | 03.033170 |
| 21 | COUPLING | 1 | 03.033162 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|----------------------------|------|---------------|
| 22 | WASHER | 1 | 03.054009 |
| 23 | COUPLING | 1 | 03.033014 |
| 24 | COUPLING | 1 | 03.033001 |
| 25 | PIPE 6" x 1,5 x 1200 | 1 | Special-order |
| 26 | PIPE 6" x 1,5 x 350 | 1 | Special-order |
| 27 | COUPLING | 1 | 03.033151 |
| 28 | WASHER | 1 | 03.054006 |
| 29 | COUPLING | 1 | 03.033161 |
| 30 | COUPLING | 1 | 03.033017 |
| 31 | PIPE 22" x 1,5 x 42 | 1 | Special-order |
| 32 | COUPLING | 1 | 03.033157 |
| 33 | PIPE 6" x 1,5 x 215 | 1 | Special-order |
| 34 | PIPE 6" x 1,5 x 160 | 1 | Special-order |
| 35 | COUPLING | 2 | 03.033141 |
| 36 | TEE COUPLING | 2 | 03.033260 |
| 37 | PIPE 6" x 1,5 x 150 | 2 | Special-order |
| 38 | BALL | 2 | 04.526062 |
| 39 | GAUGE COUPLING | 2 | 03.033220 |



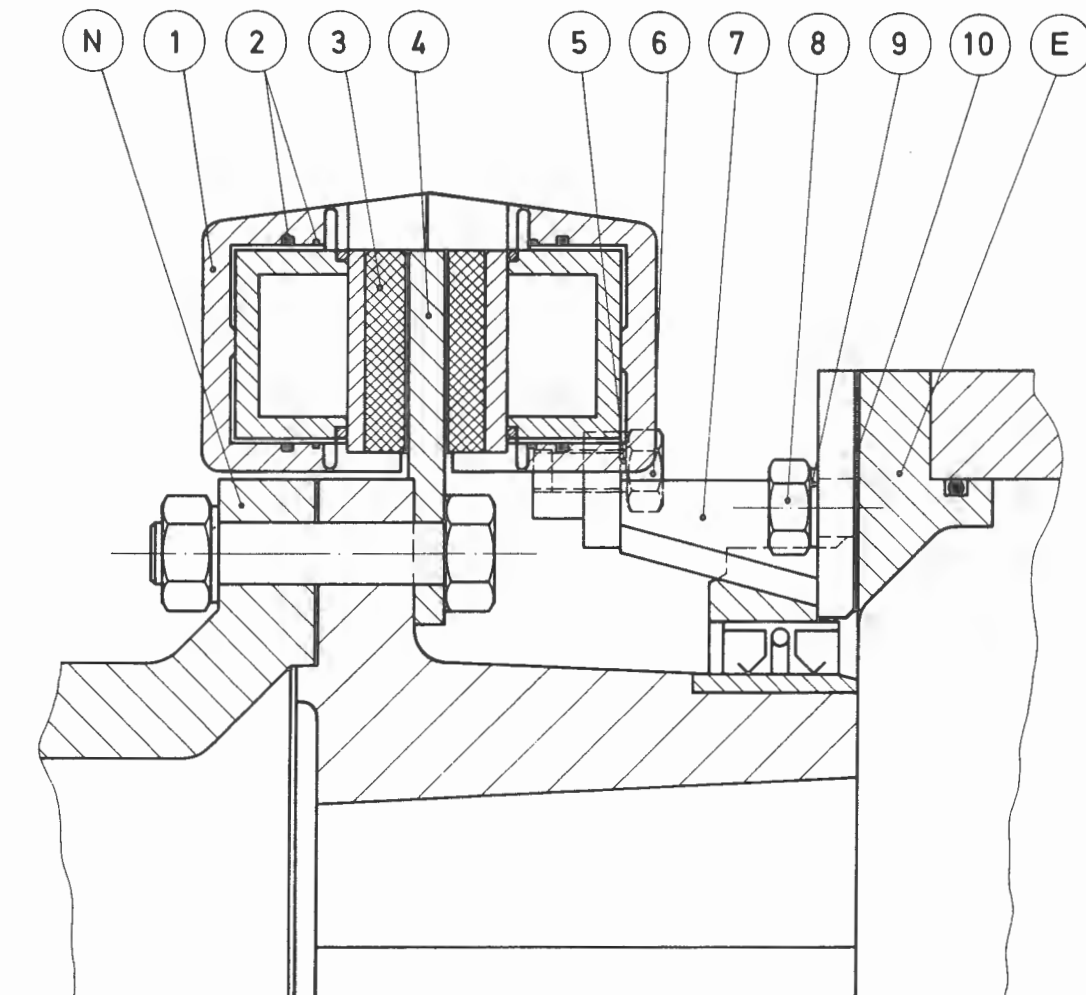
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--------------------------------------|------|--------------|
| 0 | VALVE COMPLETE. | 1 | 04.522080 |
| 1 | VALVE HOUSING. | 1 | Not separate |
| 2 | PLAIN WASHER (COPPER) | 1 | 04.527000 |
| 3 | PLUG. | 1 | 04.526091 |
| 4 | PISTON FROM S.NO. 1001 TO S.NO. 1002 | 1 | 04.522100 |
| | PISTON FROM S.NO. 1003-UP | 1 | 04.522105 |
| 5 | VALVE. | 1 | 04.526094 |
| 6 | UNBRAKO PLUG. | 1 | 03.133640 |
| 7 | UNBRAKO BOLT. | 2 | 03.131420 |
| 8 | PLATE. | 2 | 04.526099 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-----------------------|------|-----------|
| 9 | LOCKWASHER. | 2 | 3B4505 |
| 10 | UNBRAKO BOLT. | 2 | 03.130522 |
| 11 | NUT. | 1 | 1D4716 |
| 12 | ADJUSTING SCREW. | 1 | 04.526092 |
| 13 | BALL. | 1 | 4B9786 |
| 14 | SPRING. | 1 | 04.526095 |
| 15 | RETAINER. | 1 | 04.522103 |
| 16 | CAP. | 1 | 04.526096 |
| 17 | SPRING. | 1 | 04.522101 |
| 18 | CAP. | 1 | 04.526097 |



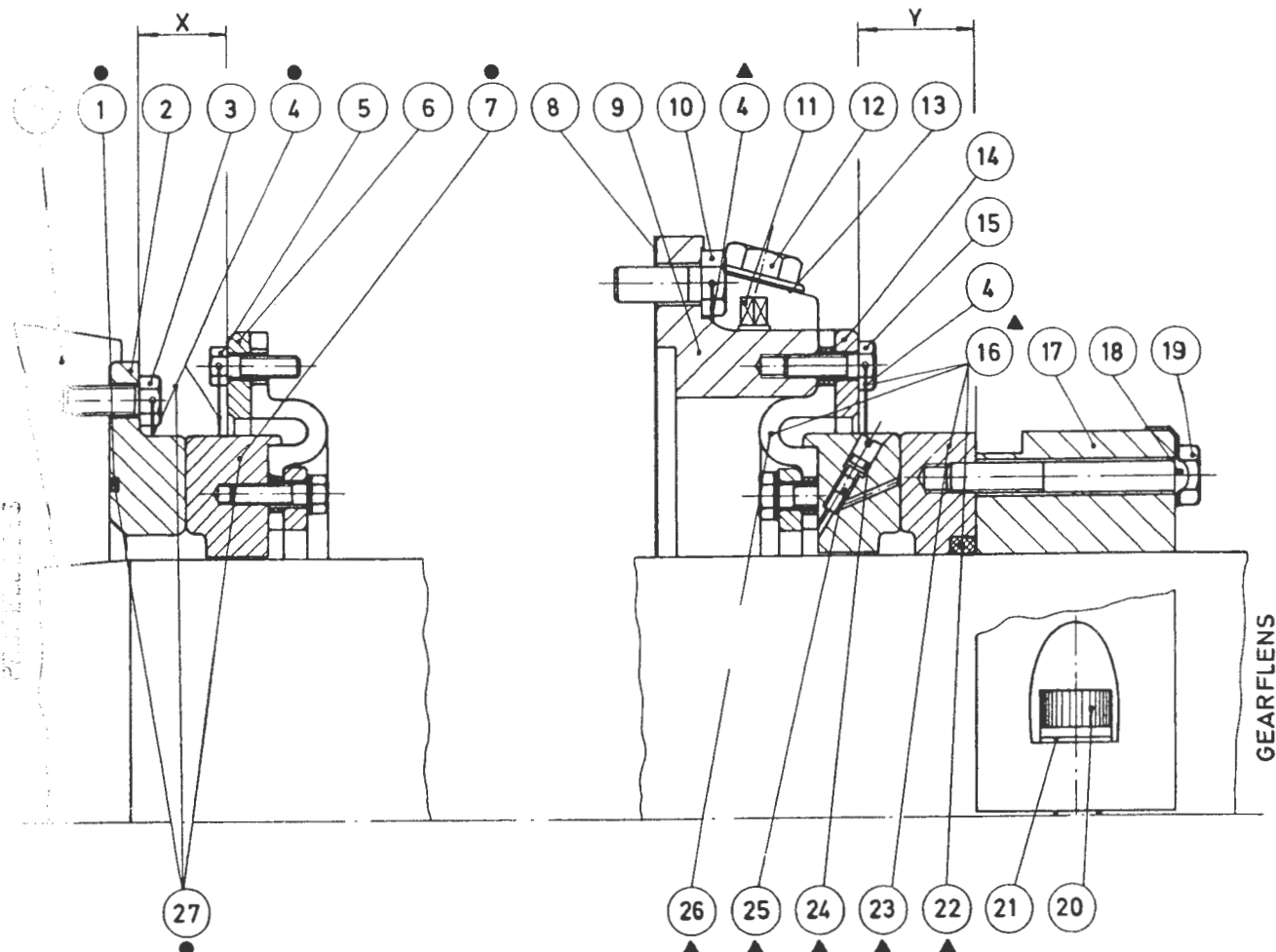
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--------------------|------|-----------|
| 1 | BALL | 2 | 04.526061 |
| 2 | HUB | 1 | 04.528067 |
| 3 | WASHER | 1 | 03.054023 |
| 4 | BUSHING | 1 | 04.526060 |
| 5 | SHAFT | 1 | 04.526065 |
| 6 | SLEEVE | 1 | 04.528068 |
| 7 | BUSHING | 1 | 04.526060 |
| 8 | LOCK RING | 1 | 03.150020 |
| 9 | COTTER PIN | 1 | 3B4607 |
| 10 | LEVER | 1 | 04.528070 |
| 11 | PIN | 1 | 04.526072 |
| 12 | GUIDE PIN | 1 | 04.526074 |
| 13 | LINK | 1 | 04.526070 |
| 14 | COTTER PIN | 1 | 3B4607 |
| 15 | PIN | 1 | 04.526073 |
| 16 | SHAFT | 1 | 04.529052 |
| 17 | BUSHING | 1 | 04.526060 |
| 18 | HUB | 1 | 04.529053 |
| 19 | COTTER PIN | 1 | 3B4631 |
| 20 | NUT | 1 | 04.522223 |
| 21 | UNBRAKO BOLT | 2 | 03.131419 |
| 22 | LEVER | 1 | 04.528062 |
| 23 | LEVER | 1 | 04.528062 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-------------------------------|------|-----------|
| 24 | INDICATOR PLATE | 1 | 04.526056 |
| 25 | POINTER | 1 | 04.526057 |
| 26 | UNBRAKO BOLT | 2 | 03.131419 |
| 27 | UNBRAKO BOLT | 2 | 03.130159 |
| 28 | NUT | 2 | 1D4716 |
| 29 | WASHER | 2 | 4B4277 |
| 30 | UNBRAKO BOLT | 2 | 03.131420 |
| 31 | LOCK WIRE, SOLD IN CM | 60 | 04.528072 |
| 32 | SLIDING SLEEVE | 1 | 04.522073 |
| 33 | LOCK RING | 1 | 03.150020 |
| 34 | YOKE | 1 | 04.529040 |
| 35 | GUIDE PIN | 1 | 04.526074 |
| 36 | SIDE COVER WITH BRACKET | 1 | 04.529024 |
| 37 | HANDLE | 1 | 04.528060 |
| 38 | BUSHING | 1 | 04.526060 |
| 39 | COTTER PIN | 1 | 04.528075 |
| 40 | UNBRAKO BOLT | 1 | 03.130522 |
| 41 | UNBRAKO BOLT | 1 | 04.528067 |
| 42 | LOCKWASHER | 8 | 3B4505 |
| 43 | UNBRAKO BOLT | 8 | 1B7182 |
| 44 | SPROCKET | 1 | 04.528062 |
| 45 | COTTER PIN | 1 | 04.528075 |
| 46 | HANDLE | 1 | 04.526066 |



| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-----------------------------------|-------|-----------|
| 0 | SHAFT BRAKE COMPLETE | 1 | 74.526003 |
| 1 | DISC BRAKE CALIPER COMPLETE | 1 | 04.526010 |
| 2 | SEAL KIT | 1 set | 04.526012 |
| 3 | BRAKE PAD | 2 | 04.526011 |
| 4 | DISC, 2 PARTS | 1 | 04.526043 |
| 5 | LOCKWASHER | 2 | 3B4609 |

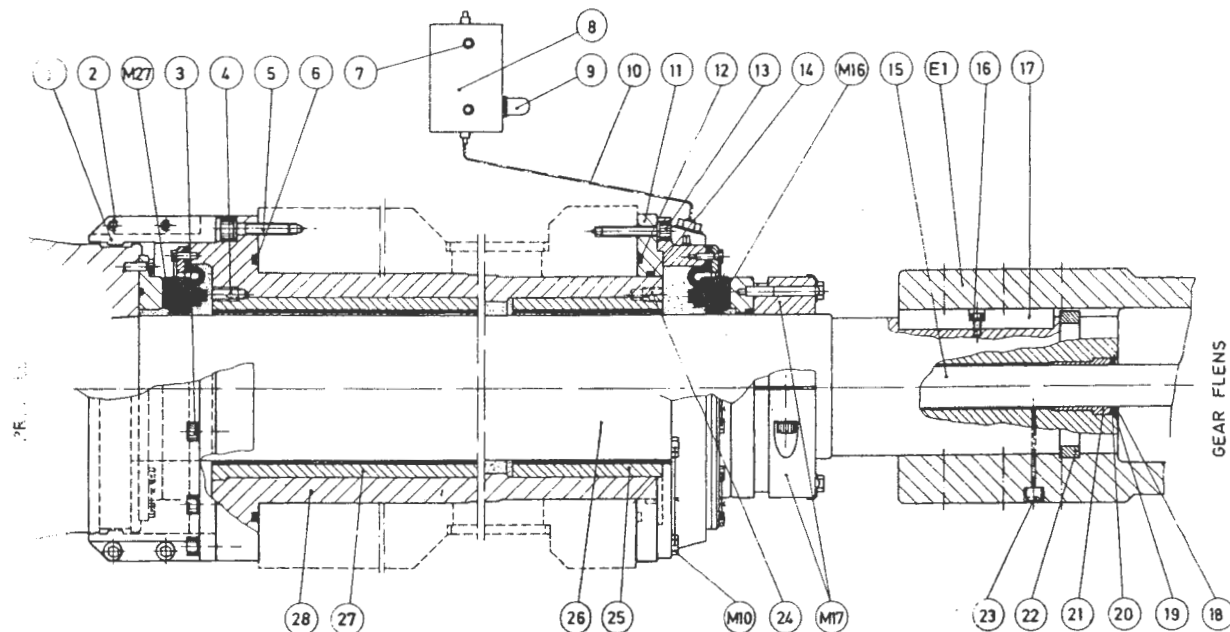
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|------------------|------|-----------|
| 6 | BOLT | 2 | 03.130165 |
| 7 | BRACKET | 1 | 04.526044 |
| 8 | BOLT | 2 | 1A1460 |
| 9 | LOCKWASHER | 2 | 3B4508 |
| 10 | SHIM PACK | | 04.526017 |



OUTER GOL-SEAL REP.KIT
 A INNER GOL-SEAL REP.KIT

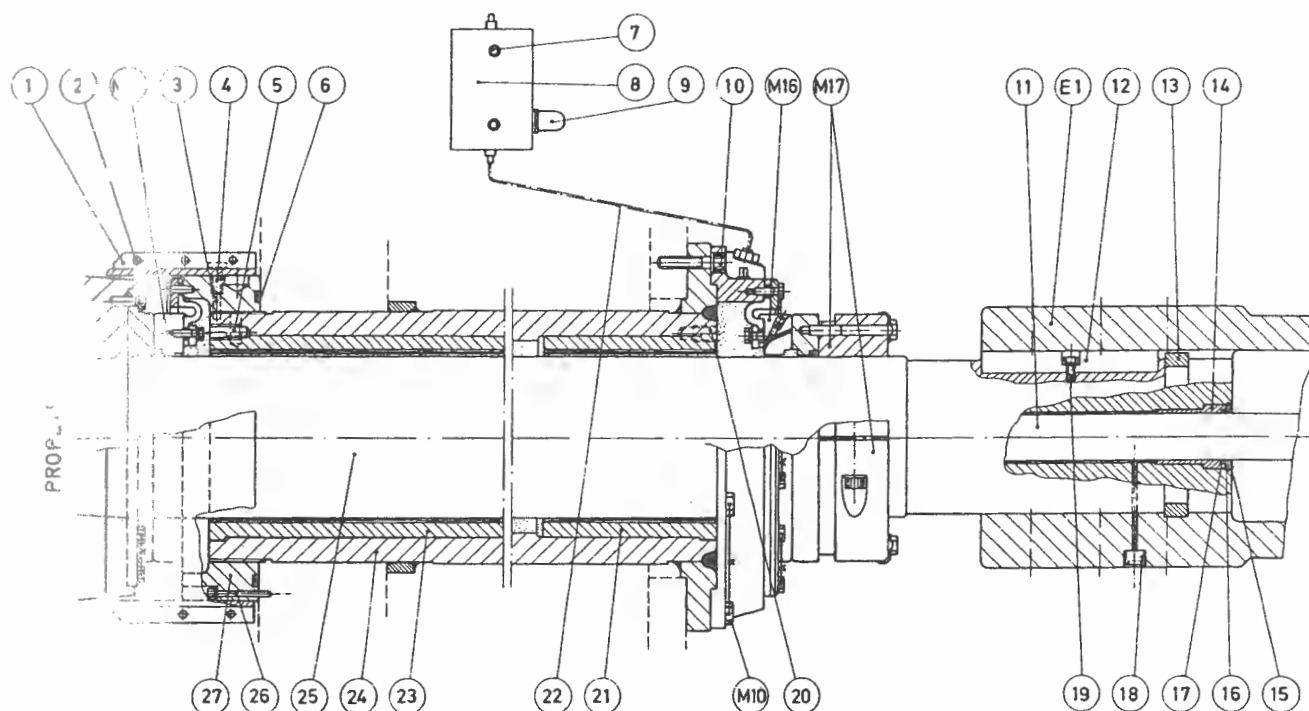
| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|---|------|-----------|
| 1 | O-RING 120 MM PART OF: 04.521620.1 | 1 | 03.053264 |
| 2 | O-RING 130 MM PART OF: 04.521629.1 | 1 | 03.053266 |
| 3 | RUNNING RING 120 MM | 1 | 04.521802 |
| 3 | RUNNING RING 130 MM | 1 | 04.521803 |
| 3 | STAINLESS BOLT PROP. PLANT DELIVERED BEFORE 1.1.80 | 8 | 03.130714 |
| 3 | STAINLESS BOLT PROP. PLANT DELIVERED AFTER 1.1.80 | 8 | 03.130124 |
| 3 | STAINLESS LOCK WIRE 1Ø PART OF REP.KIT | | 04.521716 |
| 5 | STAINLESS BOLT PROP. PLANT DELIVERED BEFORE 1.1.80 | 12 | 03.130714 |
| 5 | STAINLESS BOLT PROP. PLANT DELIVERED AFTER 1.1.80 | 12 | 03.130124 |
| 6 | HOLD DOWN RING 120 MM | 1 | 04.521812 |
| 6 | HOLD DOWN RING 130 MM | 1 | 04.521814 |
| 7 | MEMBRANE WITH RAILCORING COMPLETE 120 MM | | |
| 7 | PART OF 04.521620.1 | 1 | 04.521822 |
| 7 | MEMBRANE WITH RAILCORING COMPLETE 130 MM | | |
| 7 | PART OF 04.521629.1 | 1 | 04.521823 |
| 8 | GASKET 120 MM | 1 | 04.521832 |
| 8 | GASKET 130 MM | 1 | 04.521834 |
| 9 | FLANGE 120 MM | 1 | 04.521842 |
| 9 | FLANGE 130 MM | 1 | 04.521844 |
| 10 | STAINLESS SCREW FOR GOL-SEAL 120 MM PROP. PLANT DELIVERED BEFORE 1.1.80 | 6 | 03.130721 |
| 10 | STAINLESS SCREW FOR GOL-SEAL 120 MM PROP. PLANT DELIVERED AFTER 1.1.80 | 6 | 03.130134 |
| 10 | STAINLESS SCREW FOR GOL-SEAL 130 MM PROP. PLANT DELIVERED BEFORE 1.1.80 | 6 | 03.130742 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--|------|-------------|
| | STAINLESS SCREW FOR GOL-SEAL 130 MM | | |
| 11 | PROP. PLANT DELIVERED AFTER 1.1.80 | 6 | 03.130147 |
| 12 | BLEEDING SCREW | 1 | 04.521900 |
| 12 | PLUG | 1 | 04.521901 |
| 13 | GASKET | 1 | 04.528086 |
| 14 | HOLD. DOWN RING 120 MM | 1 | 04.521852 |
| 14 | HOLD. DOWN RING 130 MM | 1 | 04.521854 |
| 15 | STAINLESS BOLT | 12 | 03.130124 |
| 16 | INNER REP. KIT GOL-SEAL 120 MM | 1 | 04.521616.1 |
| 16 | INNER REP. KIT GOL-SEAL 130 MM | 1 | 04.521625.1 |
| 17 | CLAMPING COLLAR 120 MM | 1 | 04.521862 |
| 17 | CLAMPING COLLAR 130 MM | 1 | 04.521863 |
| 18 | LOCK PLATE | 2 | 04.521902 |
| 19 | STAINLESS BOLT | 2 | 03.130135 |
| 20 | STAINLESS BOLT | 1 | 03.130241 |
| 21 | LOCKWASHER | 1 | 3B4508 |
| 22 | O RING 120 MM PART OF 04.521616.1 | 1 | 03.053201 |
| 22 | O-RING 130 MM PART OF 04.521625.1 | 1 | 03.053208 |
| 23 | RUNNING RING 120 MM PART OF 04.521616.1 | 1 | 04.521872 |
| 23 | RUNNING RING 130 MM PART OF 04.521625.1 | 1 | 04.521873 |
| 24 | O-RING PART OF 04.521616.1—04.521625.1 | 1 | 03.053202 |
| 25 | LUB VALVE PART OF 04.521616.1—04.521625.1 | 1 | 04.521903 |
| 26 | MEMBRANE WITH RAILCORING COMPLETE 120 MM | | |
| 26 | PART OF 04.521616.1 | 1 | 04.521882 |
| 26 | MEMBRANE WITH RAILCORING COMPLETE 130 MM | | |
| 26 | PART OF 04.521625.1 | 1 | 04.521883 |
| 27 | OUTER REP.KIT GOL-SEAL 120 MM | 1 | 04.521620.1 |
| 27 | OUTER REP.KIT GOL-SEAL 130 MM | 1 | 04.521629.1 |



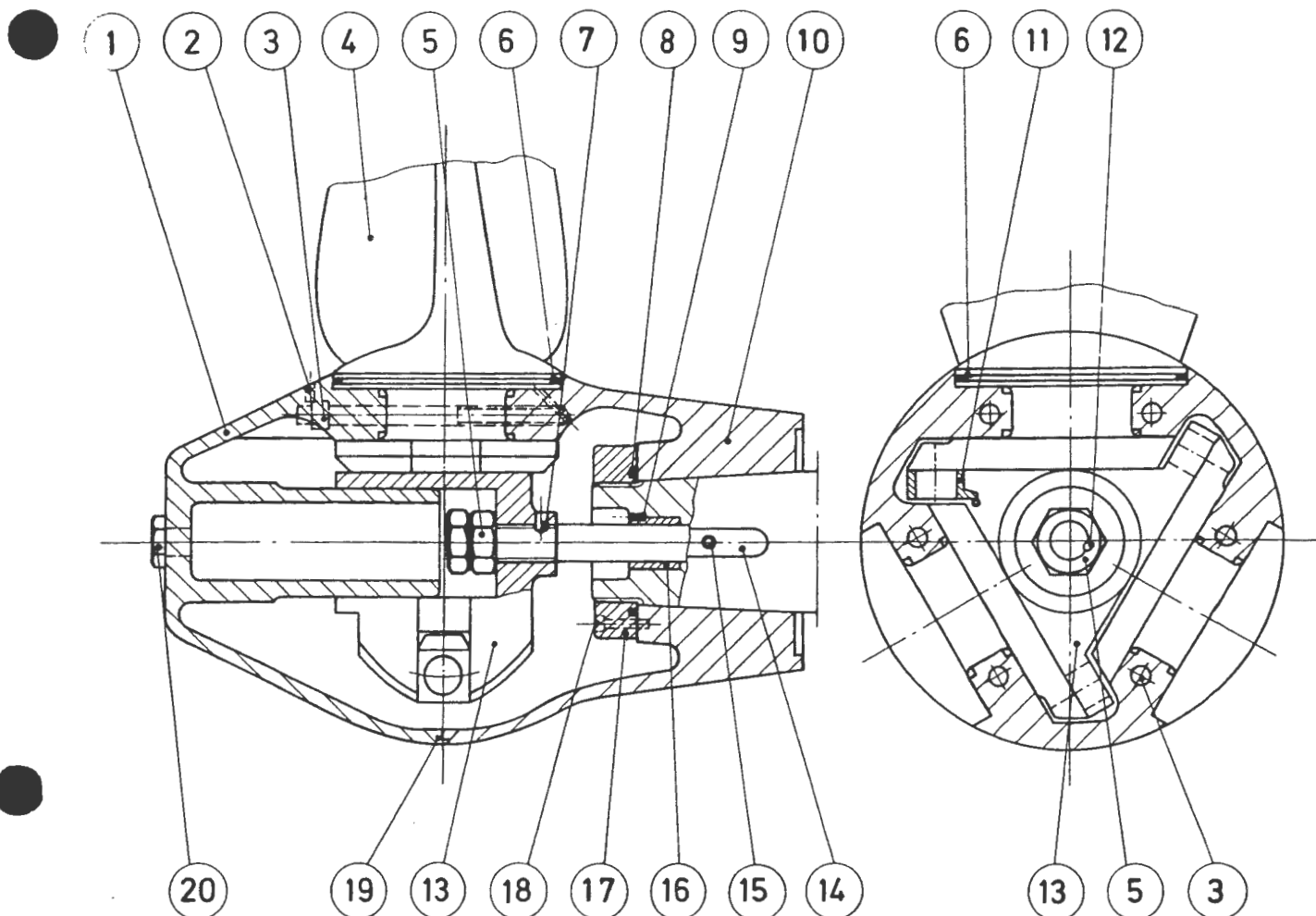
ITEM LIST FOR PROP. PLANT INSTALLED FROM OUTSIDE

| ITEM | DESCRIPTION | QTY. | PART NO. | ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-------------------------------------|------|-------------------|------|-------------------------------------|------|-------------------|
| 1 | ROPE GUARD 120 MM | | | 13 | LOCK SCREW FOR INNER STERN TUBE | | |
| | PROP. PLANT DELIVERED BEFORE 1.1.82 | 1 | 04.521621 | | PROP. PLANT DELIVERED 1.6.78—1.6.80 | 8 | 03.130548 |
| | ROPE GUARD 120 MM | | | | LOCK SCREW FOR INNER STERN TUBE | | |
| | PROP. PLANT DELIVERED AFTER 1.1.82 | 1 | 04.521932 | | PROP. PLANT DELIVERED AFTER 1.6.80 | 8 | 03.130242 |
| | ROPE GUARD 130 MM | | | 14 | O-RING 120 MM | 1 | 03.053085 |
| | PROP. PLANT DELIVERED BEFORE 1.1.82 | 1 | 04.521630 | | O-RING 130 MM | 1 | 03.053088 |
| | ROPE GUARD 130 MM | | | 15 | PUSH PULL ROD | 1 | Individual length |
| | PROP. PLANT DELIVERED AFTER 1.1.82 | 1 | 04.521933 | 16 | UNBRAKO BOLT | 1 | 03.130221 |
| 2 | UNBRAKOBOLT STAINLESS PROP. PLANT | | | 17 | KEY 120 MM | 1 | 04.521521 |
| | DELIVERED BEFORE 1.1.81 | 6 | 03.130522 | | KEY 130 MM | 1 | 04.521522 |
| | UNBRAKOBOLT STAINLESS PROP. PLANT | | | 18 | SNAP RING 120 MM | 1 | 03.151055 |
| | DELIVERED 1.1.81—1.1.82 | 6 | 03.130222 | | SNAP RING 130 MM | 1 | 03.151060 |
| | UNBRAKOBOLT STAINLESS PROP. PLANT | | | 19 | SEALING RING RETAINER 120 MM | 1 | 04.521414 |
| | DELIVERED AFTER 1.1.82 | 4 | 03.130240 | | SEALING RING RETAINER 130 MM | 1 | 04.521526 |
| 3 | STAINLESS BOLT FOR ROPE GUARD | | | 20 | SEALING RING 120 MM | 1 | 03.053625 |
| | PROP. PLANT DELIVERED BEFORE 1.6.80 | 8 | 03.130526 | | SEALING RING 130 MM | 1 | 03.053650 |
| | STAINLESS BOLT FOR ROPE GUARD | | | 21 | BUSHING 120 MM | 1 | 04.521187 |
| | PROP. PLANT DELIVERED 1.6.80—1.1.82 | 8 | 03.130234 | | BUSHING 130 MM | 1 | 04.521525 |
| | STAINLESS BOLT FOR ROPE GUARD | | | 22 | THRUSTRING 120 MM | 1 | 04.521523 |
| | PROP. PLANT DELIVERED AFTER 1.1.82 | 12 | 03.130239 | | THRUSTRING 130 MM | 1 | 04.521524 |
| 4 | THREAD PIN | 2 | 03.132940 | 23 | PLUG PROP. PLANT DELIVERED BEFORE | | |
| 5 | LOCK SCREW STAINLESS FOR STERN TUBE | | | | 1.1.81 | 1 | 03.133715 |
| | | 12 | 03.130251 | | PLUG PROP. PLANT DELIVERED AFTER | | |
| 6 | O-RING 120 MM | 1 | 03.053092 | | 1.1.81 | 1 | 03.133640 |
| | O-RING 130 MM | 1 | 03.053092 | 24 | THREAD PIN | 2 | 03.132940 |
| 7 | SIGHT GLASS | 2 | 04.142002 | 25 | SHAFT BUSHING INNER | 1 | Special order |
| 8 | OIL TANK ASS. | 1 | 74.142000 | 26 | PROPELLER SHAFT | 1 | Individual length |
| 9 | LEVEL SWITCH | 1 | 74.103072 | 27 | SHAFT BUSHING OUTER | 1 | Special order |
| 10 | OIL SUPPLY TUBE 28 \varnothing MM | 1 | Individual length | 28 | STERN TUBE | 1 | Individual length |
| 11 | MOUNTING FLANGE FOR STERN TUBE | | | | | | |
| | 120 MM | 1 | 04.521942 | | | | |
| | MOUNTING FLANGE FOR STERN TUBE | | | | | | |
| | 130 MM | 1 | 04.521943 | | | | |
| 12 | O-RING 120 MM | 1 | 03.053092 | | | | |
| | O-RING 130 MM | 1 | 03.053092 | | | | |



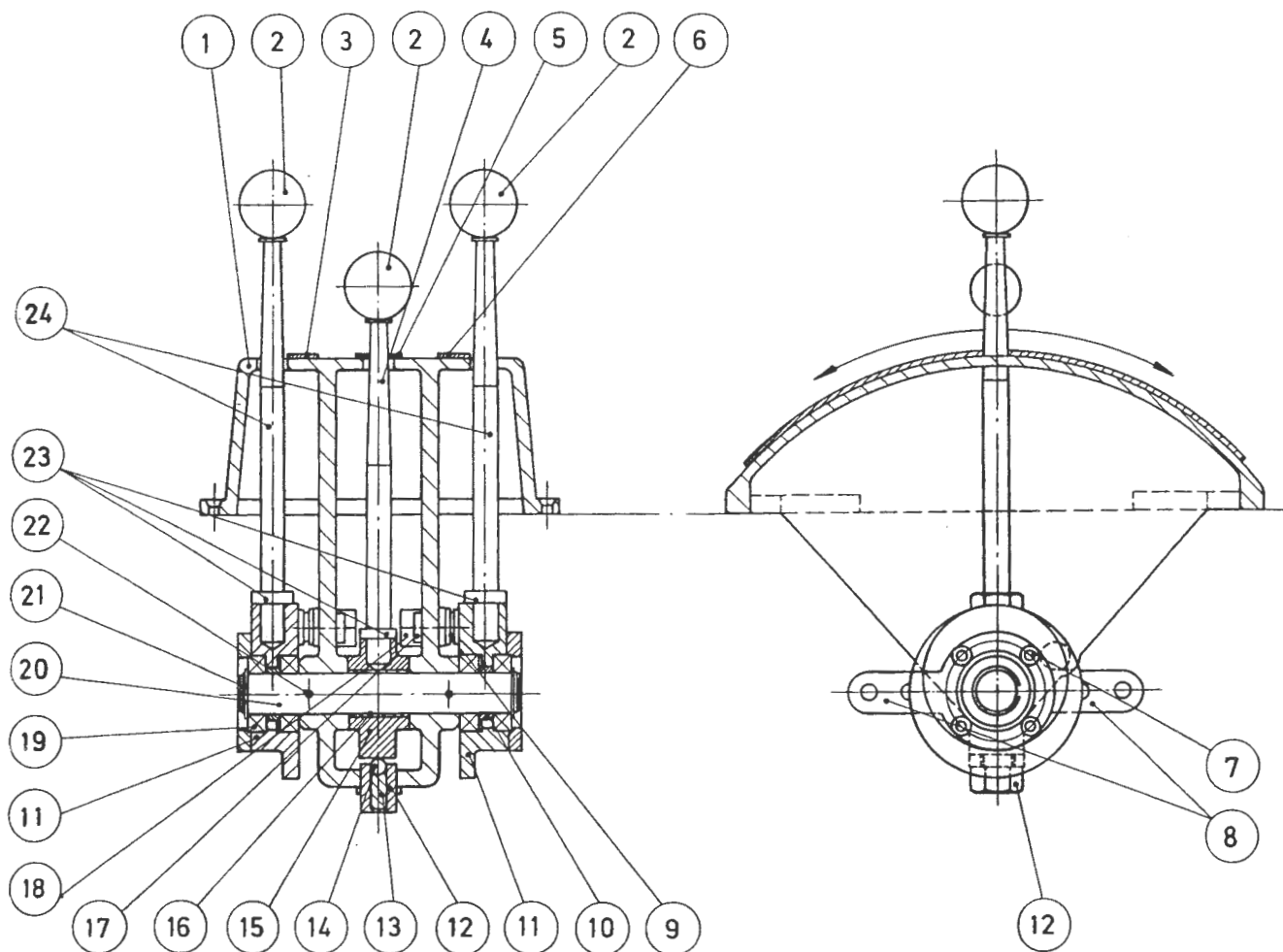
MR: PARTLIST FOR PROP. PLANT INSTALLED FROM ENGINE ROOM.

| ITEM | DESCRIPTION | QTY. | PART NO. | ITEM | DESCRIPTION | QTY. | PART NO. |
|------|---|------|-------------------|------|--|------|-------------------|
| 1 | GUARD 120 MM | 1 | 04.521621 | 14 | BUSHING 120 MM | 1 | 04.521187 |
| 2 | GUARD 130 MM | 1 | 04.521630 | 15 | BUSHING 130 MM | 1 | 04.521525 |
| 3 | UNBRAKO BOLT STAINLESS PROP. PLANT | 6 | 03.130522 | 16 | SNAP RING 120 MM | 1 | 03.151055 |
| 4 | UNBRAKO BOLT STAINLESS PROP. PLANT DELIVERED AFTER 1.1.80 | 6 | 03.130222 | 17 | SNAP RING 130 MM | 1 | 03.151060 |
| 5 | LOCK SCREW FOR STERN NUT PROP. PLANT DELIVERED BEFORE 1.1.79 | 1 | 03.130531 | 18 | SEALING RING RETAINER 120 MM | 1 | 04.521414 |
| 6 | STAINLESS BOLT FOR ROPE GUARD PROP. PLANT DELIVERED BEFORE 1.1.80 | 8 | 03.130526 | 19 | SEALING RING RETAINER 130 MM | 1 | 04.521526 |
| 7 | STAINLESS BOLT FOR ROPE GUARD PROP. PLANT DELIVERED AFTER 1.1.80 | 8 | 03.130234 | 20 | SEALING RING 120 MM | 1 | 03.053625 |
| 8 | DOWEL PROP. PLANT DELIVERED BEFORE 1.1.80 | 1 | 04.521606 | 21 | SEALING RING 130 MM | 1 | 03.053650 |
| 9 | THREAD PIN PROP. PLANT DELIVERED AFTER 1.1.80 | 2 | 03.132940 | 22 | PLUG PROP. PLANT DELIVERED BEFORE 1.1.81 | 1 | 03.133715 |
| 10 | O-RING | 1 | 03.053090 | 23 | PLUG PROP. PLANT DELIVERED AFTER 1.1.81 | 2 | 03.133640 |
| 11 | SIGHT GLASS | 2 | 04.142002 | 24 | UNBRAKO BOLT | 1 | 03.130221 |
| 12 | OIL TANK ASS. | 1 | 74.142000 | 25 | THREAD PIN | 2 | 03.132940 |
| 13 | LEVEL SWITCH | 1 | 74.103072 | 26 | SHAFT BUSHING INNER | 1 | Special order |
| 14 | LOCK SCREW FOR INNER STERN TUBE PROP. PLANT DELIVERED 1.6.78-1.1.80 | 8 | 03.130548 | 27 | OIL SUPPLY TUBE 28 \varnothing MM | 1 | Individual length |
| 15 | LOCK SCREW FOR INNER STERN TUBE PROP. PLANT DELIVERED AFTER 1.1.80 | 8 | 03.130242 | 28 | SHAFT BUSHING OUTER | 1 | Special order |
| 16 | PUSH PULL ROD | 1 | Individual-length | 29 | STERN TUBE | 1 | Individual length |
| 17 | KEY 120 MM | 1 | 04.521521 | 30 | PROPELLER SHAFT | 1 | Individual Length |
| 18 | KEY 130 MM | 1 | 04.521522 | 31 | LOCK SCREW FOR STERN NUT PROP. PLANT DELIVERED BEFORE 1.1.81 | 1 | 03.130524 |
| 19 | THRUSTING 120 MM | 1 | 04.521523 | 32 | LOCK SCREW FOR STERN NUT PROP. PLANT DELIVERED AFTER 1.1.81 | 1 | 03.130226 |
| 20 | THRUSTING 130 MM | 1 | 04.521524 | 33 | STERN NUT 120 MM (ENGINE ROTATION: SAE STANDARD) | 1 | 04.521619 |
| | | | | 34 | STERN NUT 130 MM (ENGINE ROTATION: SAE STANDARD) | 1 | 04.521628 |



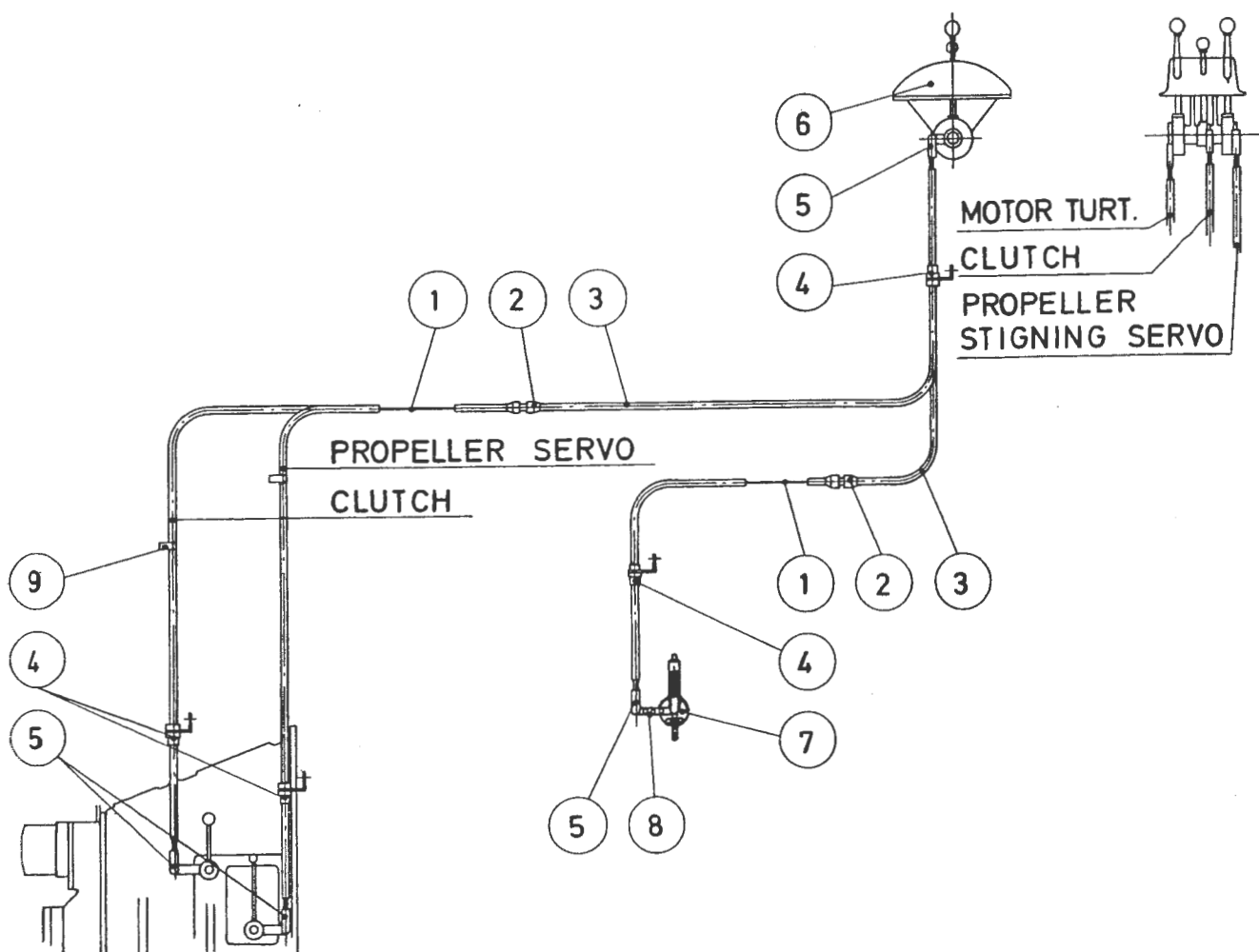
WHEN ORDERING SPARE PARTS, PLEASE ALWAYS SPECIFY
PROPELLER AND DIMMENTIONS.

| ITEM | DESCRIPTION | QTY. | PART NO. | ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--|------|------------------|------|---|------|-----------|
| 1 | INNER/OUTER PROPELLER HEAD, COMPLETE..... | 1 | Special order | 11 | SLIDE K 360 | 1 | 04.521730 |
| 2 | STAINLESS LOCK SCREW FOR ITEM 3 PROP. PLANT DELIVERED BEFORE 1.1.81 | 6 | 03.032421 | 12 | SLIDE K 380 | 1 | 04.521740 |
| | STAINLESS LOCK SCREW FOR ITEM 3 PROP. PLANT DELIVERED AFTER 1.1.81 | 6 | 03.132054 | 13 | STAINLESS SCREW..... | 1 | 03.132054 |
| 3 | BOLT — PROPELLER HEAD K 360..... | 6 | 04.521738 | | POSITIONER SLIDE K 360..... | 1 | 04.521737 |
| | BOLT — PROPELLER HEAD K 380..... | 6 | 04.521748 | | POSITIONER SLIDE K 380..... | 1 | 04.521747 |
| 4 | PROPELLER WING | 3 | Special order | 14 | KEY K 360..... | 1 | 04.521734 |
| 5 | NUT — PUSH PULL ROD K 360 | 2 | 04.521726 | | KEY K 380..... | 1 | 04.521744 |
| | NUT — PUSH PULL ROD K 380 | 2 | 04.521750 | 15 | UNBRAKO BOLT | 1 | 03.130221 |
| 6 | O-RING K 360..... | 0 | Not used | 16 | BUSHING — PUSH PULL ROD K 360 | 1 | 04.521725 |
| | O-RING K 380..... | 3 | 03.053089 | | BUSHING — PUSH PULL ROD K 380 | 1 | 04.521749 |
| 7 | STAINLESS SCREW..... | 1 | 03.132072 | 17 | PROPELLER NUT K 360..... | 1 | 04.521735 |
| 8 | O-RING K 360..... | 1 | 03.053038 | | PROPELLER NUT K 380..... | 1 | 04.521745 |
| | O-RING K 380..... | 1 | 03.053040 | 18 | UNBRAKO BOLT PROP. PLANT DELIVERED BEFORE 1.1.81..... | 1 | 03.130535 |
| 9 | STAINLESS SCREW..... | 1 | 03.132054 | | UNBRAKO BOLT PROP. PLANT DELIVERED AFTER 1.1.81..... | 1 | 03.130235 |
| 10 | INNER/OUTER PROPELLER HEAD, COMPLETE..... | 1 | Special order | 19 | SEALING STRAP Ø2,62 MM (SOLD IN CM) | 220 | 03.053720 |
| | | | | | SEALING STRAP Ø3,17 MM (SOLD IN CM) | 220 | 03.053725 |
| | | | | | PROP PLANT DELIVERED BEFORE 1.1.80—PLEASE SPECIFY DIAMETER | | |
| | | | | 20 | PLUG 1/2" STAINLESS..... | 1 | 04.521715 |



| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|---|------|-----------|
| 0 | CONTROL BOX COMPLETE FOR TELEFLEX | 1 | 74.343001 |
| | CONTROL BOX COMPLETE WITH SPROCKET, 30 TEETH, BOX DELIVERED BEFORE 15.11.80 | 1 | 74.343030 |
| | CONTROL BOX COMPLETE WITH SPROCKET, 25 TEETH, BOX DELIVERED AFTER 15.11.80 | 1 | 74.343031 |
| 1 | TOP COVER | 1 | 04.343002 |
| 2 | BALL | 3 | 04.343010 |
| 3 | PLATE (ENGINE MOTOR) | 1 | 04.660006 |
| 4 | HANDLE | 1 | 04.343009 |
| 5 | NAME PLATE (PB) | 1 | 04.660005 |
| | PLATE (CLUTCH ON) | 1 | 04.660007 |
| | PLATE (CLUTCH OFF) | 1 | 04.660008 |
| 6 | PLATE (PROPELLER) | 1 | 04.660009 |
| 7 | BOLT FOR LEVER | 8 | 04.343014 |
| | BOLT FOR SPROCKET | 8 | 9F6580 |
| | LOCKWASHER FOR SPROCKET | 8 | 3B4504 |
| 8 | LEVER | 2 | 04.343024 |
| | SPROCKET, 30 TEETH, BOX DELIVERED BEFORE 15.11.80 | 2 | 04.343023 |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--|------|-----------|
| | SPROCKET, 25 TEETH, BOX DELIVERED AFTER 15.11.80 | 2 | 04.343025 |
| 9 | BRAKE PAD | 2 | 04.343021 |
| 10 | SPACER | 2 | 04.343015 |
| 11 | HUB | 2 | 04.343006 |
| 12 | ADJUSTING SCREW | 1 | 04.343016 |
| 13 | SPRING | 1 | 04.343017 |
| 14 | BALL | 1 | 04.343019 |
| 15 | HUB | 1 | 04.343007 |
| 16 | BUSHING | 1 | 04.343004 |
| 17 | SPRING | 2 | 04.343018 |
| 18 | ADJUSTING SCREW | 2 | 04.343022 |
| 19 | BEARING | 4 | 04.343005 |
| 20 | SHAFT | 1 | 04.343020 |
| 21 | LOCK RING | 2 | 03.150025 |
| 22 | GUIDE PIN | 2 | 04.343003 |
| 23 | NUT | 3 | 04.343012 |
| 24 | HANDLE | 2 | 04.343008 |



| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|-----------------------------------|------|-----------|
| 1 | CABLE 5/16" | 3 | 04.340002 |
| 2 | CONNECTOR | | 04.340003 |
| 3 | STEEL CONDUIT | | 04.340001 |
| 4 | SWIVEL ASSY. NOT SEPARATE PART | | |
| 5 | FORK ASSY | 6 | 04.340005 |
| 6 | CONTROL BOX COMPLETE FOR TELEFLEX | 1 | 74.343001 |
| | CONTROL BOX COMPLETE WITH | | |

| ITEM | DESCRIPTION | QTY. | PART NO. |
|------|--|------|----------------------|
| | SPROCKET, 30 TEETH, BOX DELIVERED BEFORE 15.11.80 | 1 | 74.343030 |
| | CONTROL BOX COMPLETE WITH SPROCKET, 25 TEETH, BOX DELIVERED AFTER 15.11.80 | 1 | 74.343031 |
| 7 | ENGINE GOVERNOR CONTROL | 1 | Original Caterpillar |
| 8 | EXTENDED LEVER | 1 | 74.344000 |
| 9 | CLAMP | | 04.340004 |

