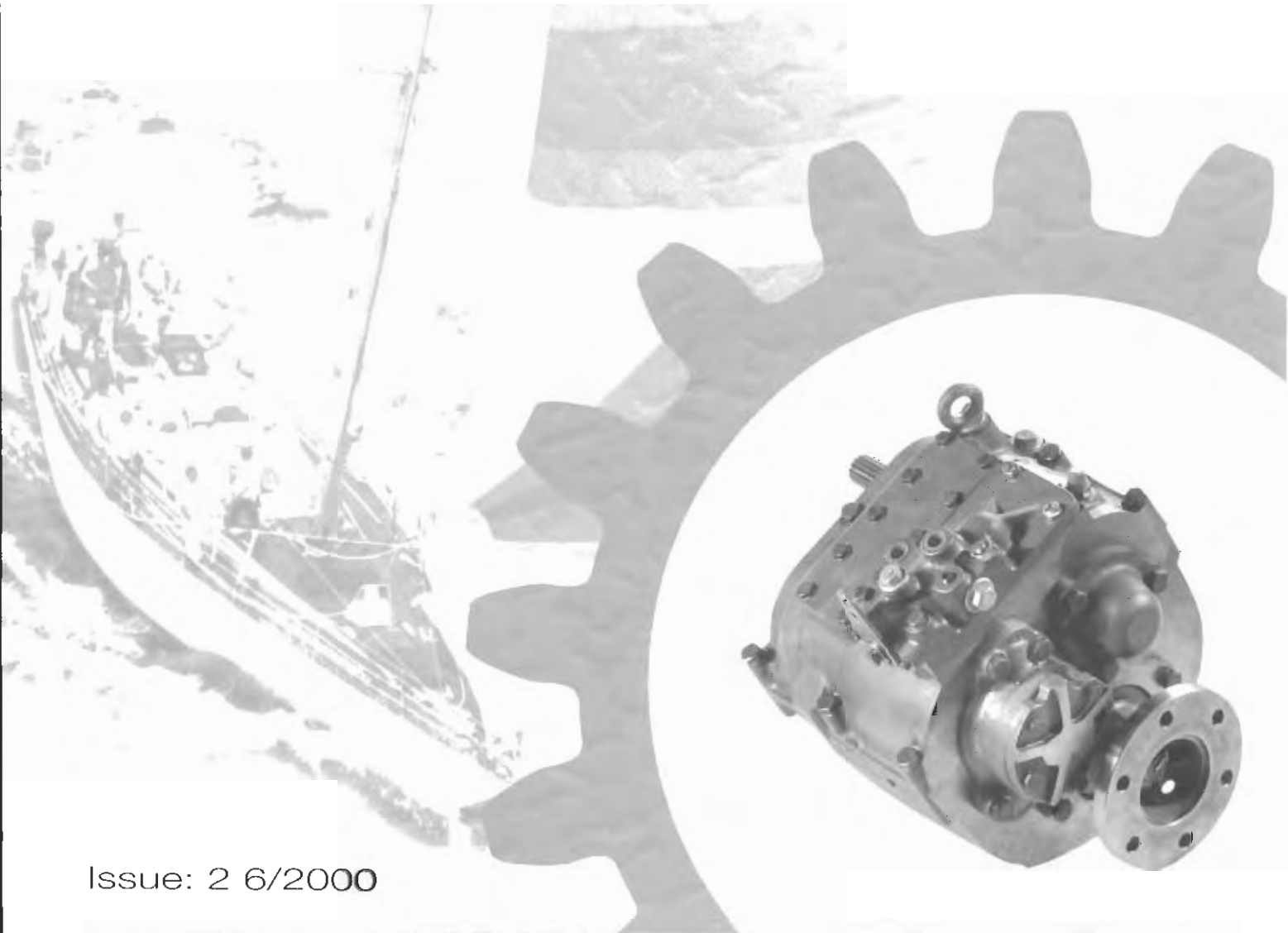
PRM

Marine Transmissions

PRM 500

Workshop Manual



Issue: 2 6/2000

The following international symbols are used in this service manual.

WARNING: THIS SYMBOL WARNS OF POSSIBLE PERSONAL INJURY

CAUTION: THIS SYMBOL WARNS OF POSSIBLE DAMAGE TO TRANSMISSION

PRM500 WORKSHOP MANUAL
ISSUE 2 6/00

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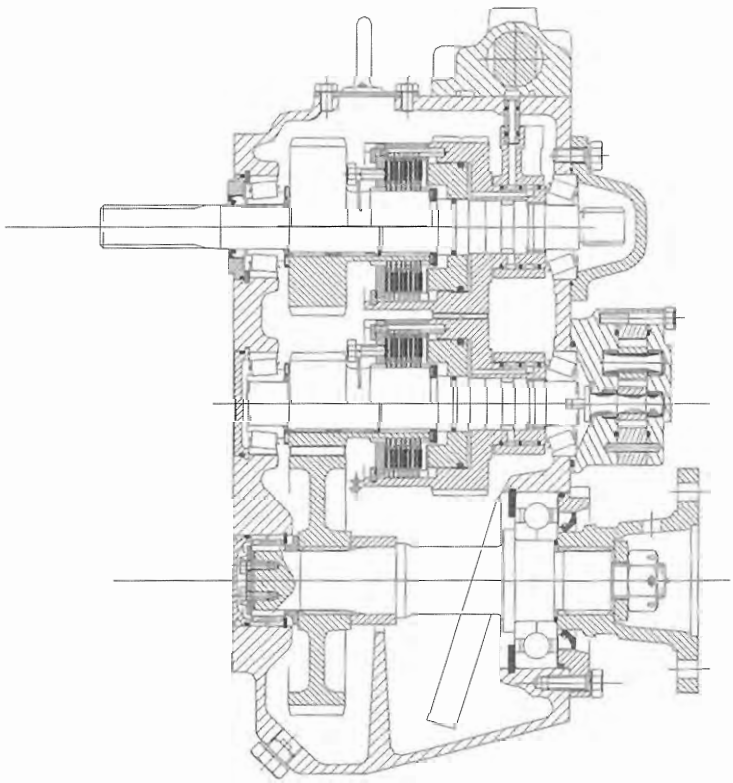


Fig. 1 PRM500 Sectional View

FOREWORD

Provided it is correctly installed, aligned and maintained, the PRM500 gearbox should have a long and trouble-free life. This workshop manual contains important instructions to ensure that this is so, and it is of the utmost importance that these are carefully followed. Newage Transmissions Ltd. can accept no responsibility under warranty or otherwise for any loss or damage resulting from failure to observe these instructions.

To avoid prejudicing your rights under warranty, do not undertake any repair or other work on the gearbox during the warranty period without first contacting Newage Transmissions Ltd. or an authorised distributor for advice. In the event of failure, you should do this via the engine distributor who supplied the gearbox, or his local dealer; if this is not possible, you should notify the local Newage distributor/dealer or Newage Transmissions Ltd. direct, quoting the serial number.

CLAIMS UNDER WARRANTY

Claims for replacement of parts under warranty must always be submitted with the gearbox serial number to the distributor who supplied the gearbox; if this is not possible, application may be made to the nearest distributor, who must, however, be advised of the supplier's name and address.

SERVICE PARTS

The comprehensive illustrated parts list gives full information and ordering procedure.

PRE-DELIVERY TEST

Before it leaves the factory, every gearbox is subjected to a final test and inspection which includes the following:-

1. Flush clean.
2. Fill with oil to correct level.
3. Pressurise the case, and check for oil leaks.
4. Check for noise levels.
5. Check for drag in neutral.
6. Check input spline dimensions.
7. Check bolt torques.
8. Check coupling concentricity.
9. Check for conformance to customer spec.
10. Record time to working temperature
11. Record gearbox temperature (Deg. C).
12. Record valve block force N to F (lbf).
13. Record valve block force N to R (lbf).
14. Record oil pressure @ 2000rpm (lb/sq.in) in forward, neutral and reverse.

IDENTIFICATION PLATE

Every PRM gearbox is fitted with an identification plate on the top half of the gearcase before it leaves the factory; an example of such a plate is shown below.

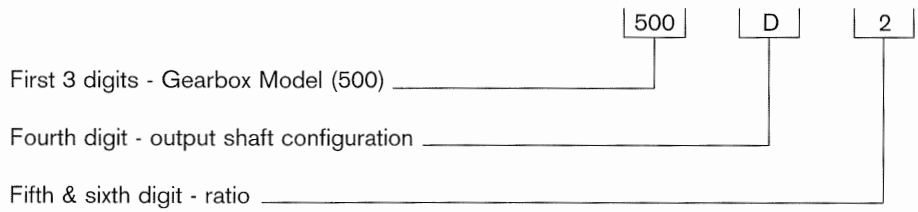
NEWAGE	PRM	COVENTRY
123456		R1234
500D2		
MADE IN ENGLAND		

NEWAGE	PRM	COVENTRY
MADE IN ENGLAND		

Please complete the above box with serial number and specification of your own gearbox.

It will be noted that there are two lines of numbers.

The top line is the gearbox serial number, and should always be quoted when ordering spare parts; the lower line is the gearbox specification, in the example given this translates as follows:-



NOTE: **Throughout this manual, engine, gearbox and propeller rotation are always described as seen looking forward from the propeller to the engine.**

1. GENERAL DATA

1.1 Specifications

Gear ratios

1.459:1, 1.935:1, 2.565:1, or 2.904:1

POWER RATING

GEAR RATIOS	PLEASURE		LIGHT COMMERCIAL		HEAVY COMMERCIAL	
	BHP	kW	BHP	kW	BHP	kW
1.459:1, 1.935:1	6.38	4.76	6.19	4.62	5.90	4.40
2.565:1, 2.904:1	6.19	4.62	5.90	4.40	5.90	4.40

NOTE: These powers are expressed in BHP and kW per 100 rev/min engine speed, and are measured at the engine flywheel. Ratings have been established to ensure the long trouble-free life of the gearbox which should not therefore, be used at powers in excess of those shown.

Input speed:

Maximum operating speed 4000 rev/min continuous
4500 rev/min intermittent

SERVICE CLASSIFICATION DEFINITIONS

Pleasure: limited to planing hull pleasure craft with a maximum of 500 hours operating time per year, of which not more than 5% should be at full engine throttle, with the balance of usage at 90% or less of full throttle. The use of PRM marine gearboxes according to this classification in any commercial boat, or in sport-fishing charter boats or long-range pleasure cruisers, is not approved.

Light commercial: planing or semi-displacement craft used in pleasure or commercial application may qualify for light commercial rating if annual usage is less than 1500 hours and full throttle operation is limited, with most operating time at partial throttle.

Heavy commercial: all displacement and semi-displacement craft used for commercial applications should be classified as heavy commercial duty. In this type of vessel (such as trawlers, purse seiners, lobster and crab boats, tugs, ferries, offshore supply boats etc.) the gearbox is expected to work at full governed engine speed. The power setting of the engine must be known and must be within the permitted heavy commercial rating of the gearbox.

IMPORTANT NOTE

1. It is essential that the engine, transmission model, reduction ratio and propeller size are correctly matched so that the engine can attain its rated speed appropriate to the relevant service classification without labouring.

2. It is also necessary to ensure the torsional compatibility of the complete propulsion system from engine through to propeller, since disregarding this may result in gear noise, particularly at low speed operation and may even result in damage to the engine as well as to transmission components.

Newage Transmissions Limited will provide all possible information and assistance to help find solutions to potential torsional problems, but it is the ultimate responsibility of the person assembling the drive and driven equipment to ensure that they are torsionally compatible.

Input rotation:

May be either clockwise or anti-clockwise (see section 2)

Output rotation:

Clockwise or anti-clockwise as required (see section 4)

Approximate dry weight:

500D 68kg (150lb) (excluding drive coupling, adaptor flange and oil cooler)
Additional weight - Power Take-off 6.9kg (15.2lb)

Oil capacity:

500D 2.5 litres (4.40 pints) (plus the amount required to fill the cooling circuit)

Operating pressure:

Minimum:- 1800kPa (265 lb/in2)
Maximum:- 2180kPa (320 lb/in2)

} Oil pressures should be measured at a gearbox temperature of 70°C and an input speed of approximately 1500rpm.

NOTE: Pressure may vary at different operating speeds; it is likely that, on start up, when the gearbox is cold, significantly higher pressures may occur.

Operating oil temperature:

The normal operating temperature should be in the range 50°C to 80°C with a maximum of 90°C permissible for very short periods only.

Transmission cooling:

An oil cooler is necessary to ensure that correct operating temperatures are maintained and the gearbox is provided with two 3/8 inch BSP connectors on the valve block to allow it to be fitted. The size of the cooler depends on a number of factors including the engine horse power, operating speed, duty cycle, inlet water temperature and ambient temperature.

Suitable coolers are available from Newage Transmissions Ltd.

Engine mounting adaptors:

Available in SAE 2,3,4 and Velvet Drive (Borg Warner) also available.

Input drive couplings:

Flexible drive couplings are available to suit flywheels of 10" and 11.5" nominal diameter to SAE J620C, and to other dimensions.

Gearcase:

Heavy duty cast iron for use in the marine environment, constructed in two halves for ease of servicing; ribbed internally for rigidity and strength.

Input shaft:

29mm diameter with 16/32 DP Involute spline.

Propeller thrust:

Ahead and astern thrust is carried by output shaft bearings of ample capacity for all Newage approved ratings.

Output flange:

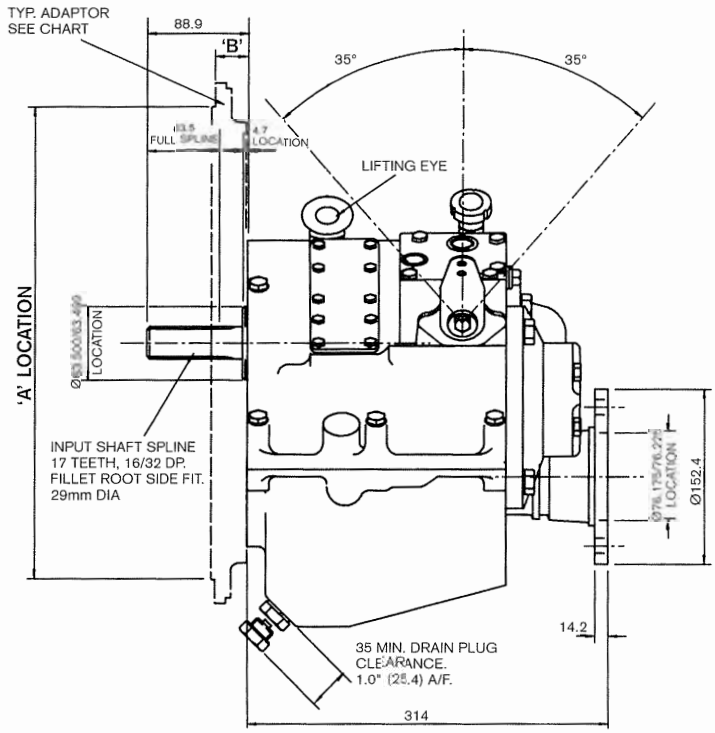
152mm (6 in.) diameter, with 6 holes 13mm (0.512 in.) diameter on 121mm (4.5 in.) pitch circle diameter, and female spigot, 76.2mm (3.00in) diameter.

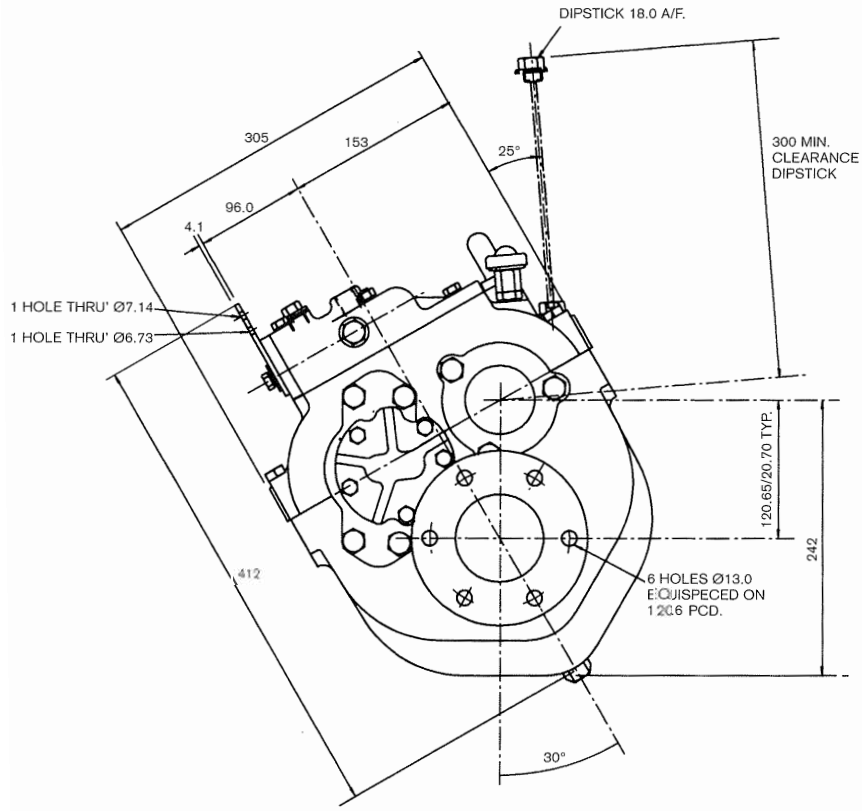
Installation angle:

The maximum fore and aft installation angle at rest is 17°.

BASIC INSTALLATION DETAILS - PRM500

ADAPTORS	Ø 'A'	'B'
	mm	mm
SAE2	447.68	15.88
SAE3	409.55	15.75
SAE4	361.95	19.05
B/W	209.52	28.57





INSTALLATION ANGLE

The maximum fore and aft installation angle permissible at rest is 17°.

IMPORTANT NOTE

Fig. 2

2. INTRODUCTION

Newage Transmissions Ltd. PRM500 marine transmission are oil-operated gearboxes of the counter-shaft type with separate oil-operated multi-disc clutches (which need no adjustment) for both ahead and astern drive. This design permits full power to be transmitted in astern as well as ahead, and also allows right-hand or left-hand propeller rotation in ahead drive, with identical ratios in ahead and astern.

The PRM500 can be fitted to both left-hand (anti-clockwise) and right-hand (clockwise) rotating engines (see section 3.3)

NOTE: throughout this manual, engine, gearbox and propeller rotations are described as seen when standing behind the boat, i.e. facing forwards towards the transmission and engine.

3. CONSTRUCTION

3.1 Gearcase

The gearcase has been kept free from hydraulic pipes, cylinders and associated components. The only items mounted externally are the oil pump, valve block, oil cooler and operating lever.

A magnetic drain plug is provided at the front of the gearcase; this can be removed if required to allow suitable pipework to be connected to a hand-operated drain pump.

Connections are provided on the valve block for the oil cooler and pressure gauge.

3.2 Gear train

The transmission comprises an input shaft assembly, a layshaft assembly and an output shaft.

The input shaft, which is supported by a taper roller bearing at either end, incorporates a drive pinion of the required ratio, running on needle roller bearings, an emergency operating device (see section 6.4), the forward drive clutch assembly (when used with a right-hand propeller), the clutch gear and a hydraulically actuated piston to operate the clutch.

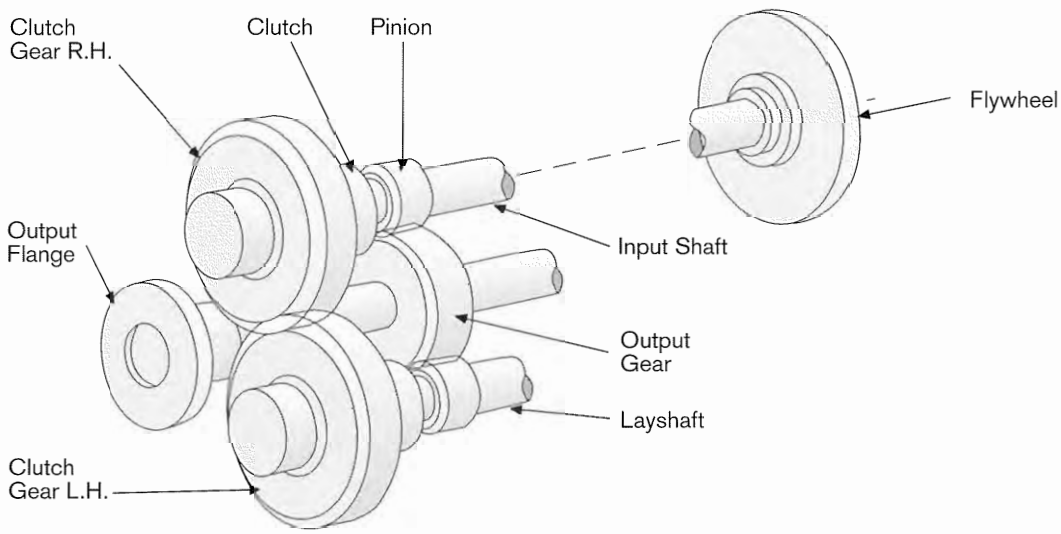


Fig.3 Internal layout, PRM500D

The layshaft is similarly supported by taper roller bearings and also incorporates a drive pinion of the same ratio, also running on needle roller bearings, the reverse drive clutch assembly (when used with a right-hand propeller), a clutch gear of the opposite hand rotation to that on the input shaft, and a hydraulically actuated piston which operates the clutch.

The output shaft runs on amply proportioned bearings, arranged in such a way that propeller thrust can be satisfactorily absorbed; it also carries the output gear and incorporates the output flange.

3.3 Oil pump

A cast iron gear-type pump externally mounted at the rear of the gearcase and driven by the layshaft, supplies oil at high pressure for actuating the clutch assemblies, and at lower pressure for lubrication. It should be noted that pressure may vary at different operating speeds. It is also likely that, on start up, when the gearbox is cold significantly higher pressures may occur.

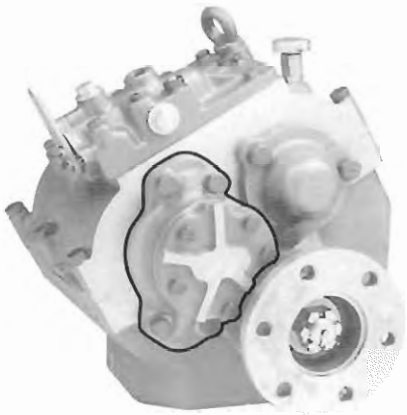


Fig. 4
Pump mounting position
anti-clockwise engines

Fig. 4
Pump mounting position
clockwise engines

NOTE: Unless otherwise specified at the time of ordering, it will be assumed an anti-clockwise rotating engine is being used and the oil pump will be mounted accordingly.

If a clockwise rotating engine is specified when the order is placed, the pump will automatically be mounted in the appropriate position.

3.4 Valve block

The valve block is located on the top of the gearcase and contains the main control valve, integral with which is the high pressure valve controlling the supply of oil to the clutch assemblies. Oil which is surplus to clutch operation requirements is used for lubrication purposes.

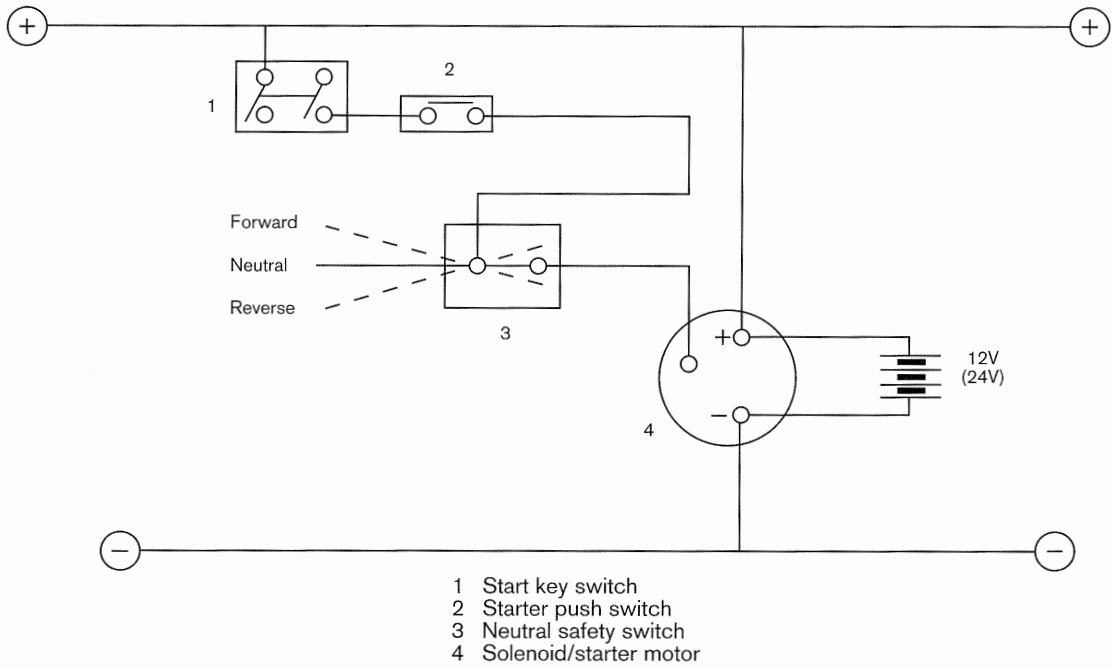
The control valve is fitted with a spring-loaded neutral detent which provides a positive neutral position ensuring correct selection of either ahead or astern drive.

3.5 Neutral safety switch

A neutral safety start switch, which prevents the engine from being started unless the gearbox is in neutral, is available as an optional extra.

This device is of obvious benefit, since it will help prevent accident or damage caused by a boat moving ahead or astern on engine start-up in a crowded marina or other area. Newage Transmissions Ltd. strongly recommends the use of this device.

When fitted, the switch is located on the valve block (See item C27 on the parts list) and should be wired into the starter circuit as shown in Fig. 5.



1 Start key switch
2 Starter push switch
3 Neutral safety switch
4 Solenoid/starter motor

Fig. 5 Wiring diagram, neutral safety start switch

4. OPERATING SYSTEM

4.1 Output rotations

With the control lever at the mid-point of travel or neutral position and the engine running, the splined input shaft and the clutch gear rotate at engine speed. The clutch gear is in constant mesh with the clutch gear on the layshaft which is therefore also driven at engine speed, but in the opposite rotation. Since neither clutch is engaged, the drive pinions do not rotate.

When the control lever is moved to the 'ahead' position the hydraulic system is actuated and oil is directed at high pressure to the clutch on the appropriate shaft; the clutch engages and engine drive is directed to the forward drive pinion. The pinion turns the gear on the output shaft and the propeller shaft and propeller are rotated in the direction corresponding to ahead movement of the vessel.

Similarly, when the control lever is moved to the 'astern' position, the clutch on the opposite shaft is engaged and drive applied to the reverse pinion. This turns the output shaft gear in the opposite direction; and the propeller shaft and propeller rotate in the direction corresponding to astern movement of vessel.

GEARBOX OUTPUT ROTATION

Engine rotation anti-clockwise

	PRM500D
Lever Backward	↻
Lever Forward	↺

Engine rotation clockwise

	PRM500D
Lever Backward	↺
Lever Forward	↻

NOTE: (i) **Rotations are as seen looking from the propeller forward to the gearbox.**

(ii) **Anti-clockwise engines are the most common, and the standard gearbox build therefore assumes an anti-clockwise input.**

4.2 Hydraulic system

Oil is pumped from the gearbox sump through the internal supply pipe to the control block. This incorporates a high pressure valve which ensures that the correct operating pressure is maintained.

When the operating lever is moved, oil is delivered under pressure to a feeder on either the input shaft or the layshaft and thence to a piston which actuates the appropriate clutch for either ahead or astern drive.

Excess oil is then used for lubricating the gearbox and PTO if fitted.

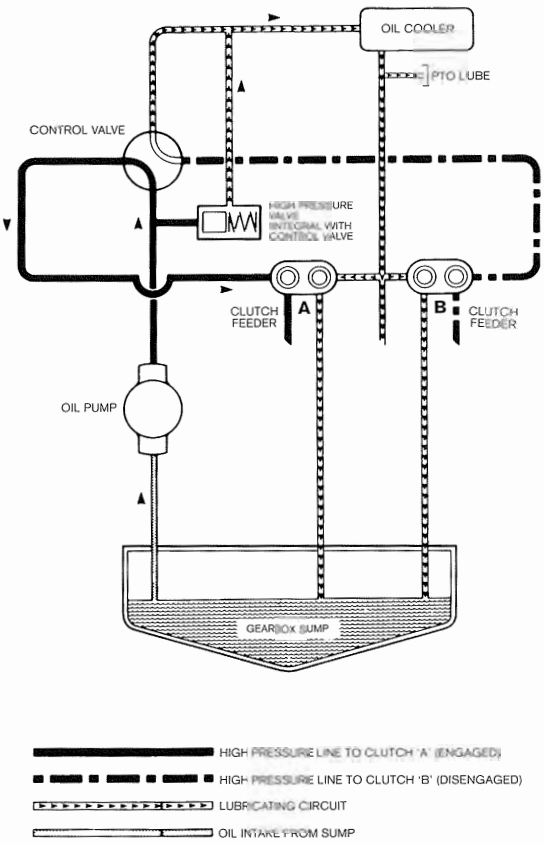


Fig. 6 Hydraulic and lubricating oil circuits

4.3 Lubrication

Lubrication oil is delivered via the internal supply to the control block. Irrespective of whether ahead or astern is engaged, oil is diverted from the discharge side of the pressure relief valve to an external oil cooler. After passing through the cooler, the oil is directed through channels in the valve block and thence through the layshaft and drive shaft to lubricate the clutch assemblies.

4.4 Approved oils

TEMP	TYPE OF OIL
Below Zero	10W30 or 20W engine oil to AP1 designation CD
0°C to 30°C	10W30 or 15W40 engine oil to AP1 designation CD
Above 30°	10W30 or 40W engine oil to AP1 designation CD
Note: Gearboxes are despatched from the factory without oil.	

It is essential that only good quality engine oil, supplied by a recognised and well known manufacturer, is used in the PRM500. Do not mix different brands, types or grade of oil.

NOTE: This oil specification also applies to gearboxes fitted with the electronic trolling valve (available 1996).

CAUTION: Failure to comply with the above oil types may result in the forfeiture of warranty cover since no claims under warranty will be entertained if oil of the wrong specification is used.

5. INSTALLATION

5.1 General

The Newage PRM500 marine gearbox is supplied with a choice of adaptor plates to SAE2, SAE3, SAE4, and Velvet Drive (Borg Warner) specifications enabling it to be fitted to engines having flywheel housings of equivalent specification.

Drive is transmitted from the engine to the gearbox via a flexible centre drive plate (damper plate) which bolts to the engine flywheel. The gearbox input shaft is driven from the centre spline.

These drive plates have a degree of torsional flexibility, the purpose being to reduce engine torsional or cyclic vibrations and prevent them being passed to the transmission.

The strongest engine vibrations are usually those caused by the firing cycle. Diesel engines which have high compression ratios, usually generate stronger vibration pulses than petrol (gasolene) engines; and it is often the case that of two engines of roughly equivalent size, the one having the greater number of cylinders will tend to run more smoothly than the one with fewer cylinders, although this is by no means always the case.

In all marine installations, correct alignment of the engine, gearbox and propeller shaft is extremely important - misalignment can cause noise, vibration and premature failure - and it is strongly recommended that all the procedures detailed in this manual are carefully followed.

CAUTION: It is particularly important to ensure the torsional compatibility of the complete propulsion system from engine through to propeller since disregarding this may result in gear noise at low speed operation and in extreme cases damage or failure of components.
Newage Transmissions Ltd. will provide all possible information and assistance to help find solutions to potential torsional problems, but it is the ultimate responsibility of the person assembling the drive and driven equipment to ensure that they are torsionally compatible.

5.2 Checking the engine flywheel housing

Attach a dial test indicator, calibrated in units of 0.025mm (0.001in.) or smaller, to the flywheel so that the measuring stylus of the indicator is perpendicular to the bore of the flywheel housing (bore A on Fig.7). Rotate the flywheel and check the deviation on the indicator over one complete revolution: this should not exceed 0.152mm (0.006in.) total indicator reading.

With the dial test indicator still attached to the flywheel, re-position the stylus so that it is perpendicular to the face of the flywheel housing (face B on Fig. 7). Rotate the flywheel and check the deviation over one complete revolution; again, this should not exceed 0.152mm (0.006in.) total indicator reading.

5.3 Checking the engine flywheel

Attach a dial test indicator, calibrated to 0.025mm (0.001in.) or less, to the engine flywheel housing so that the measuring stylus of the indicator is perpendicular to the bore of the register in the flywheel (bore C on Fig. 7). Rotate the flywheel through one complete revolution and note the deviation, this should not exceed 0.125mm (0.005in.) total indicator reading.

With the dial test indicator still attached to the flywheel housing, reposition the stylus so that it is perpendicular to the face of the flywheel register (D on Fig. 7). Rotate the flywheel through one complete revolution and note the deviation, this should not exceed 0.125mm (0.005in.) total indicator reading.

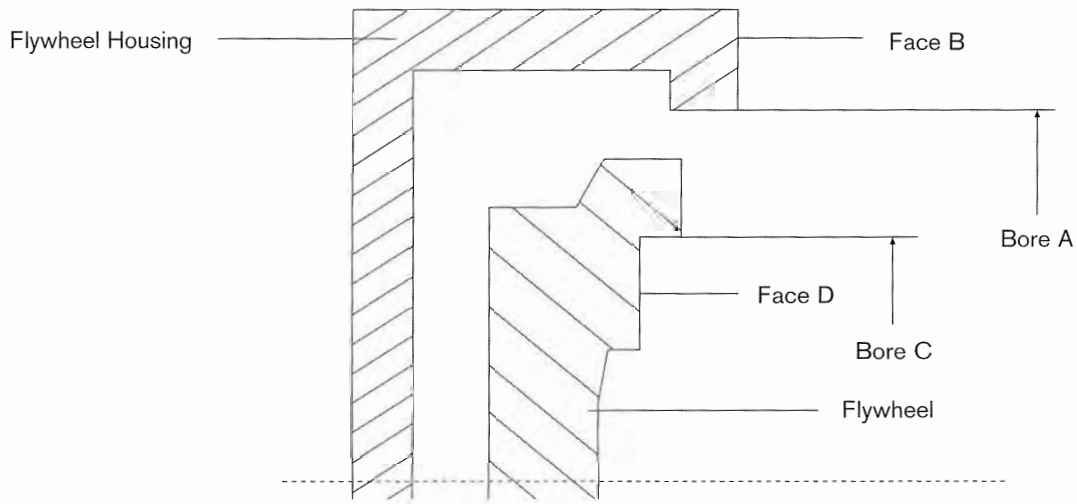


Fig. 7 Checking the flywheel and flywheel housing

5.4 Mounting the gearbox to the engine

CAUTION: Failure to carry out the following mounting instructions correctly can cause vibration that could result in component or gearbox failure.

1. Taking care to ensure correct alignment, bolt the adaptor flange to the front of the gearbox; the maximum misalignment allowable between the adaptor and the gearbox is 0.002in (0.05mm).

2. Using an alignment mandrel if available, mount and bolt the flexible input coupling to the flywheel via the holes provided. If the flywheel and couplings are to SAE standard, the outside diameter of the coupling should be a close fit in the flywheel register.

   If no mandrel is available, tighten the mounting bolts just sufficiently to prevent free movement, assemble the gearbox to the coupling, and rotate the engine two or three revolutions by hand to align the plate. Tighten up two or three opposite bolts, using the inspection window provided in the gearbox adaptor flange.

3. Remove the gearbox and fully tighten the flexible input coupling bolts.

4. Offer up the gearbox and adaptor to the input coupling and engine flywheel housing at the correct attitude to provide the output shaft offset and insert the gearbox input shaft into the centre of the coupling (it may be necessary to rock the shaft slightly to ensure that the shaft enters). Press the assembly fully into position, align the mounting holes in the adaptor flange with those on the flywheel housing and tighten fully.
   See torque chart page 34.

5.5 Oil Cooler

All Newage PRM500 gearboxes must be fitted with an oil cooler to maintain correct working temperature (50-80°C). To permit a suitable cooler to be fitted, two 3/8 in. BSP connections are provided on the valve block. Note: these are blanked off with plastic "Redcap" plugs on delivery from the factory.

CAUTION: Failure to correctly install an oil cooler into the lubrication circuit can result in damage to the gearbox see Fig. 8 below and page 17, Fig. 9 and 10 for correct circuit. After a gearbox failure it is extremely important to flush cooler and hoses completely to remove any contamination. Failure to do so could result in the new/repaired gearbox failing prematurely.

The gearbox oil cooler is normally mounted on the gearbox adaptor flange or the bulkhead of the boat, and then connected into the cooling system on the engine; one method of arranging the engine and gearbox cooling circuit is shown below.

NOTE: cooling water must pass through gearbox cooler before engine cooler.

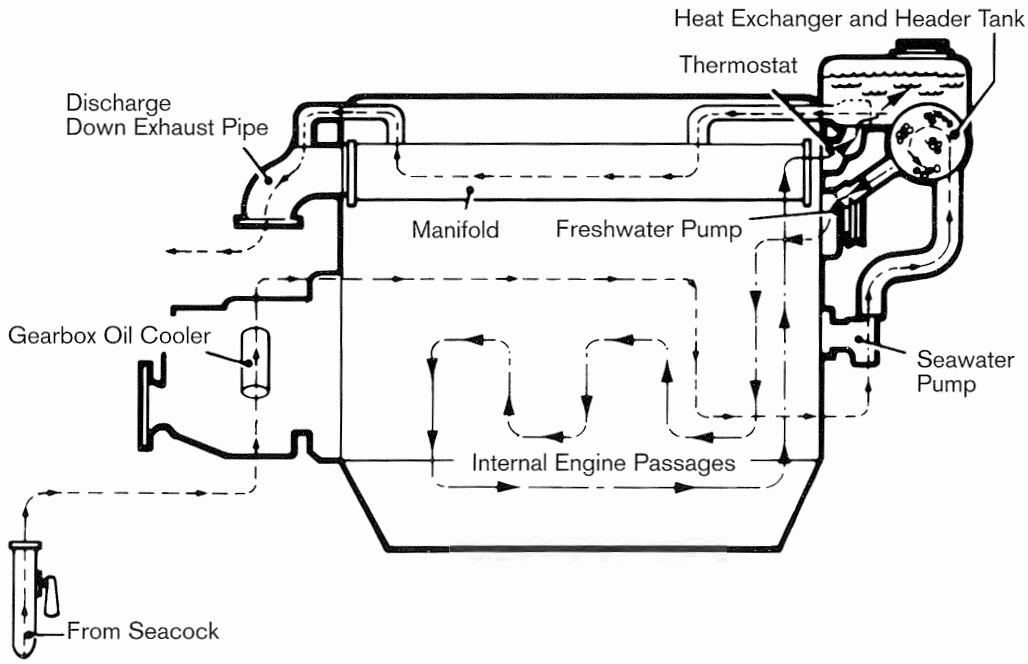


Fig. 8 Engine and gearbox cooling circuit

CAUTION: Remove the "Redcap" plugs from the valve block and gearbox prior to the installation of the cooler. Connect suitable hoses to the connections on the oil cooler and valve block, which can then be incorporated into the engine cooling system as outlined above.

CAUTION: Operating oil temperature should not exceed 90°C any circumstances. If the checks listed in the fault-finding chart have been carried out without any fault being found and the gearbox consistently runs at a temperature higher than 80°C, Newage strongly recommends that a larger capacity oil cooler be fitted.

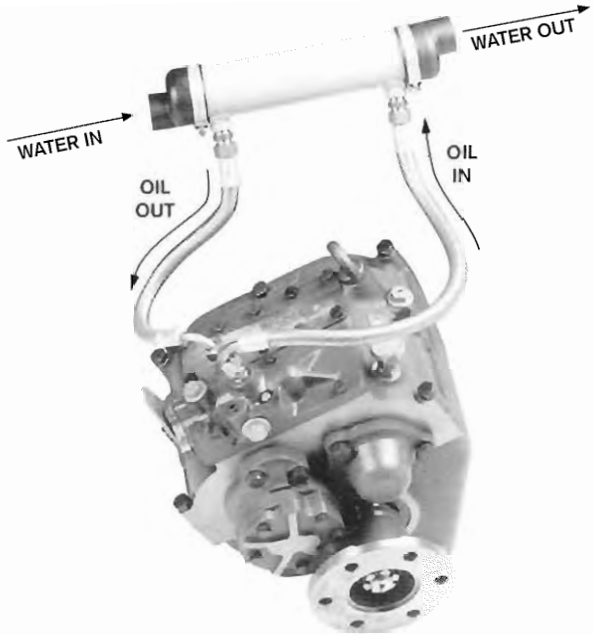


Fig. 9 Oil cooler connections

5.5.1 PRM500 Oil Cooler with power take-off

Oil returned from the cooler to the valve block is first passed through the power take-off unit to provide lubrication. The method of connecting the cooling system is as follows:

a) remove "Redcap" seals from the valve block.

b) connect the valve block outlet to oil cooler inlet.

c) connect the oil cooler outlet to the PTO inlet.

d) complete the circuit by connecting the PTO outlet to the valve block inlet.

The oil cooler can now be connected to the engine cooling system as outlined at Fig. 8.

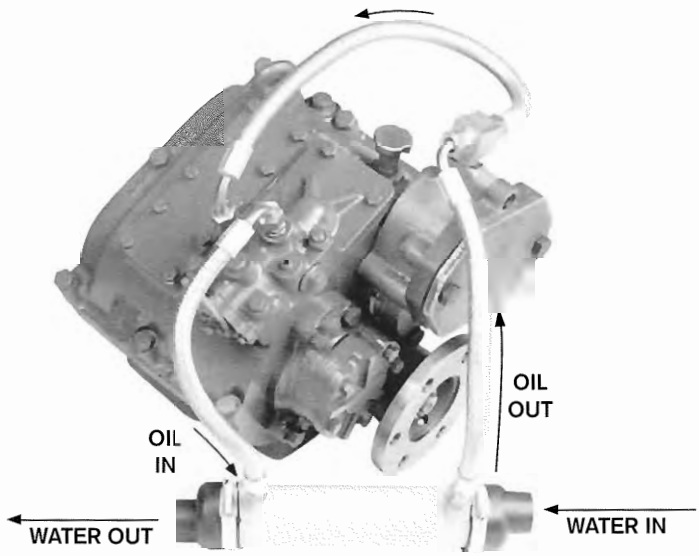


Fig. 10 Oil cooler connections PRM500 with power take-off

5.6 Alignment to propeller shaft

CAUTION: Alignment between the propeller shaft and the mating flange on the gearbox output shaft is extremely important since excessive vibration and stress may lead to premature failure if correct alignment is not achieved.

In the majority of boats whose hulls are rigid enough to prevent excessive flexing in heavy sea conditions, (which could cause the engine and transmission to shift relative to the propeller shaft), it is generally considered preferable to couple the propeller shaft direct to the gearbox output flange by means of a rigid coupling.

The two main conditions when a flexible coupling should be used are:

a) in boats whose hulls are not sufficiently rigid to prevent the flexing referred to above,

b) in cases where the engine is mounted on flexible mounts.

In both instances, the flexible coupling helps to isolate engine vibration or other movement from the propeller shaft thus enabling correct alignment with the propeller shaft and stern tube to be maintained.

Whether a solid or flexible coupling is used, it is extremely important that the following points are carefully checked:

i) the coupling should be a tight press fit on the shaft and the keyway accurately made to the correct size, and

ii) the two halves of the coupling should be carefully aligned. This should be done by bringing the two flanges close enough together so that a feeler gauge can be used to check the vertical and horizontal alignment.

iii) alignment should only be carried out with the boat afloat. The maximum permissible misalignment being 0.05mm.

Since the propeller shaft line is normally fixed in the boat, alignment is usually obtained by adjusting engine mount shims on the mounts themselves.

NOTE: Whenever possible, the engine and gearbox should be installed whilst the hull is afloat, otherwise there is a danger of the hull distorting because of insufficient support over its surface. If the engine and transmission are fitted before the hull is in the water, the installation should be very carefully re-checked for alignment after launching.

In designing PRM500, SAE standards were adhered to as far as possible. However, other manufacturers of similar sized transmissions have a different, but common, output coupling spigot, which is not to SAE. This spigot size has become the industry standard and most proprietary flexible output couplings are made to suit.

5.7 Installation angle

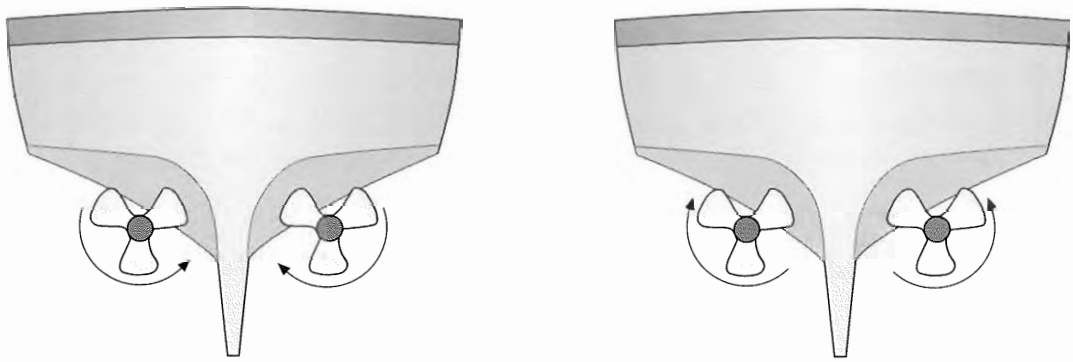
The transmissions should normally be installed so that the maximum fore and aft angle relative to the water line does not exceed 17° with the boat at rest. Please consult Newage Transmissions Ltd. if installation angles greater than this are required.

5.8 Twin installation

The rotation of the propeller, even in a single engine installation, tends to have a slight "turning" effect on the handling of the boat, but this can normally be corrected with very slight adjustments on the rudder.

In twin installations, the turning effect on the handling of the boat will be much more pronounced if both propellers rotate in the same direction. It is therefore desirable that "handed" (i.e. counter-rotating) propellers be fitted. For this reason PRM gearboxes are capable of providing either hand of output rotation with any of the available gear ratios.

It is also preferable for the starboard (right-hand) propeller to rotate clockwise and the port (left-hand) anti-clockwise rather than the other way about. In the latter case, when the propeller blades are at the lowest point of their rotational arc they tend to create a vacuum which affects the other propeller by reducing the flow of water to it. When the boat is making a tight turn with one gearbox in "ahead" and the other in "astern", the thrust side of one propeller will be acting diametrically opposite to the other, causing the boat to be deflected off line which delays completion of the manoeuvre.



NORMAL APPLICATIONS **SPECIAL APPLICATIONS**

Fig. 11 Propeller rotation twin installations

When connecting remote control units for twin engine/gearbox installations, please remember that moving the gearbox operating lever forwards will produce output rotation as engine (generally left-hand, or anti-clockwise).

Therefore, in order to ensure that the propeller shafts counter-rotate outwards in "ahead", the operating cables should be connected so that the operating lever on the starboard gearbox moves back when the remote control operating levers are in the "ahead" position providing right-hand rotation.

PORT ENGINE LEVER FORWARD
LH PROPELLER ROTATION

STARBOARD ENGINE LEVER BACK
RH PROPELLER ROTATION

Fig. 12 Operating lever position, twin installations

5.9 Remote control operating systems

The PRM500 can be used with remote control operating systems which links the engine throttle to the gearbox operating lever e.g. Morse Controls single lever type.

The following points should be noted:

i) The gearbox operating lever is provided with a positive neutral position, which greatly assists the setting up of the remote control unit.

CAUTION ii) care should be taken to ensure that the cable moves the gearbox operating lever approximately 2mm short of its maximum forward or backward travel to prevent the lever being brought hard up against the end stop with every gear shift.

The control equipment should in all cases be connected in accordance with the manufacturer's recommendations.

6. OPERATION

6.1 First time usage

CAUTION: Before starting the engine fill the gearbox to the correct level with a suitable oil (refer to recommended list, section 4.4 Page 14). Note: screw dipstick fully down when checking oil level.

Ensure the gearbox is in neutral, (it is recommended that the optional neutral safety switch be wired into the starter circuit to avoid uncontrolled boat movement on start up). Start and run the engine for a short time so that the oil circulates through the cooling circuit. Stop the engine and allow the oil to settle, re-check the level and top up to the maximum mark on the dipstick.

CAUTION: Using the gearbox with insufficient oil will lead to low pressure, unsatisfactory operation, overheating and eventual failure. Equally, over-filling the gearbox may cause overheating and oil leaks; it is the duty of the owner/operator to make sure that the oil level is correct at all times.

6.2 Drive selection

The PRM500 has been designed and tested to ensure rapid shifts from ahead to astern or vice versa and can be operated at full horsepower ratings and speeds. In these circumstances the transmission will respond rapidly.

CAUTION: Full power reversals, however, do place abnormal, even if short-lived, loads on the gearbox, and operating life will be prolonged if full power reversals are reserved for emergency only. Newage Transmissions Ltd. recommend that when changing direction the engine speed be brought down to approximately 1000 rev/min. For this reason it is recommended that a proprietary single lever remote control operating system is fitted which links the engine throttle control to the gearbox operating lever.

6.3 Trailing (free wheeling) the propeller

The bearings used in the Newage PRM500 gearbox have been carefully selected to ensure that prolonged trailing (free wheeling) of the propeller will not have any detrimental effect on the transmission. This allows the propeller to turn freely with the engine shut down and makes the Newage PRM500 particularly suited for use in auxiliary sailboats, motor sailers or multi-engine installations where the boat may be operated with one or more engines shut down.

It is not therefore necessary to provide any propeller shaft locking device to protect the transmission, although in the case of sailing yachts and other high performance sailboats fitted with two bladed propellers, it may be desirable to fit a propshaft lock so that the propeller can be locked behind the dead-wood to reduce drag.

Where propellers are allowed to free-wheel they can be a useful source of free auxiliary power; if a flat pulley is fitted to the propeller shaft a small generator can be belt driven for charging batteries

CAUTION: Care must be taken not to apply excessive side-load which would cause vibration and misalignment.

6.4 Emergency operation

Included as standard in every Newage PRM500 gearbox is a a "Get You Home" device allowing the gearbox to be mechanically locked in 'ahead' drive in the unlikely event of hydraulic clutch failure.

WARNING: To operate first switch off the engine, select neutral on the operating lever, and disconnect the operating cable, then:

The method of operation is as follows:

1. Remove the 10 top cover securing screws (A7) and the top cover (A6) (located alongside the valve block).
2. Select the shaft which provides the appropriate propeller rotation (see note below) and rotate until a spring clip (A) holding the two screws (B) in position is accessible.
3. Remove the spring clip (A) and tighten the two clamping screws (B), thus mechanically locking the clutch pack in drive. **See drawing pages 42/44.**

CAUTION: Ensure that sufficient oil remains in the gearbox to avoid further damage and refit the top cover, tighten the bolts to correct torque (see chart page 34).

The engine can now be run, but to minimise the possibility of further damage being caused to the transmission, we recommend that engine speed is limited to 1/3 full throttle.

NOTE: Assuming an anti-clockwise rotating engine, the shaft to select is:

for left-hand propeller rotation, the left-hand shaft;
for right-hand propeller rotation, the right-hand shaft;
(as seen looking forward from the propeller to the gearbox).

WARNING: When emergency drive is engaged, neither astern nor neutral is available and there is no means of stopping the boat using the gearbox. You must therefore handle the boat with great care, particularly during docking.

CAUTION: Disconnection of the operating cable is very important in order to prevent accidental selection of direction whilst the clutch is mechanically locked. After emergency drive has been used, you must seek qualified assistance to check the transmission thoroughly before it is used again. Never use the top cover for topping up the oil.

7. ROUTINE MAINTENANCE

7.1 Initial maintenance (after 25 hours running)

WARNING: Hot oil can cause burns. Do not work on the gearbox with the engine running.

Drain all oil from the gearbox, the drain plug is located at the front of the casing in the centre of the transmission. This requires a 1" A/F spanner to remove, refit drain plug and washer and refill with one of the recommended lubricants (see page 14). Operate the engine and gearbox, allowing the oil to circulate, then stop the engine and allow to settle. Re-check the oil level and top up if necessary to the maximum mark on the dipstick. Note: dipstick has to be fully screwed in to check oil level.

7.2 Daily checks

1. Check the gearbox oil level.
2. Make visual inspection of the general condition of the transmission and check for oil leaks, especially at the output shaft seal and at gasket sealing surfaces.

7.3 Annual check

1. Check oil cooler connections.
2. Check propeller shaft alignment and correct if necessary.
3. Check remote control operating linkage is accurately adjusted to give correct travel on the gearbox operating lever.
4. Check that all fasteners are correctly tightened (see torque chart page 34).

7.4 Winter storage

Drain water from the transmission oil cooler to avoid freezing or the collection of harmful deposits.

7.5 Other maintenance operations

1. The gearbox oil should be changed at periods which correspond to the intervals at which engine oil changes are carried out.
2. The gearbox oil should also be changed if it has been contaminated by water or if the gearbox has suffered major mechanical damage.

8. FAULT FINDING

The following fault finding chart is designed to help diagnose some of the problems which might be encountered. It assumes that the installation and operating instructions in this manual have been followed and we advise that these are checked before proceeding to fault finding.

To avoid prejudicing warranty rights, no repair or other work should be done on the gearbox during the warranty period without first contacting Newage Transmissions Ltd. or an authorised distributor or dealer for advice.

SYMPTOM	CAUSE	REASON	REMEDY
No drive ahead or astern	No oil pressure	Damaged oil pump	Remove oil pump and replace complete.
		Broken input drive plate	Replace input drive plate
		Broken input shaft	Replace input shaft
		Broken output shaft	Replace output shaft
Intermittent or complete loss of drive	Oil leaks	Damaged oil seals or gaskets	Check leakage area and replace relevant gasket or seal. Re-fill to correct level on dipstick.
Propeller speed does not increase with engine speed ahead or astern	Low oil pressure to both clutches	Damaged or worn oil pump	Replace oil pump complete.
		Remote control cable not allowing correct gearlever movement	Remove cable and operate lever by hand adjust cable if necessary.
		Pressure relief valve defective	Remove valve block and replace spring.
Propeller speed does not increase with engine speed in one direction only	Low oil pressure to one clutch	Piston rings worn	Remove appropriate clutch shaft replace worn feeder or piston rings.
		Feeder worn	
		Damaged 'O' ring in hydraulic circuit	Check 'O' rings in feeder connectors and piston
		Blocked hydraulic feed in valve block	Remove valve block and examine.
		Damaged clutch plates	Remove and examine appropriate clutch and replace if necessary.
Excessive noise from gearbox at low speeds	Engine idle speed too low	Faulty adjustment	Increase idling speed
	Torsional vibration	Torsional incompatibility of driveline components	If not cured by increasing engine idling speed refer to engine supplier.
Excessive noise throughout operating range	Defective input coupling	Input coupling worn or damaged	Remove, examine and replace input coupling if necessary
	Propeller shaft misalignment	Hull flexing or faulty installation	Check the alignment of the propeller shaft coupling. If necessary rectify by adjusting shims under the engine mounts or engine mounts themselves
Excessive vibration throughout operating range	Propeller out of balance	Propeller damaged or badly machined	Check pitch, weight, diameter and balance of propeller.
	Engine/gearbox misalignment		Remove transmission and check flywheel face is flat or flexible coupling is correctly aligned (see section 5.3)
		Defective bearing	Isolate defective bearing and replace.

SYMPTOM	CAUSE	REASON	REMEDY
Excessively high oil temperature	Power too high	Incorrect engine rating for gearbox	Re-assess engine power
	Defective oil cooler or cooler too small	Damaged or blocked oil cooler, incorrectly specified cooler size	Replace oil cooler or re-specify cooler size
	Oil level too high/low		Fill to correct oil level on dip stick
	Incorrect oil type		Fill with correct oil type
	Defective oil pressure relief valve	Damaged or collapsed relief valve spring	Remove and examine valve spring. Replace if necessary.
	Slipping clutches	Worn clutches, low oil pressure	Replace defective clutch, see remedy for low oil pressure
Oil level needs constant topping up	Oil leaks	Defective oil seals, 'O' rings, or gaskets	Clean the outside of the gear box particularly around output shaft and valve block, inspect for leaks.
		Defective oil cooler and hoses	Check for traces of water in the gearbox oil or oil in the cooling water system. Replace cooler or hoses as necessary.
Excessive internal pressure	Escape of pressure from gearbox when dipstick is removed	Defective breather causing leaks past oil seals	Contact distributor or factory for advice.
Difficult to move single lever control	Control lever on valve block too stiff	Defective valve or detent spring	Contact distributor or factory for advice.
	Faulty installation	Remote control operating cable badly installed or kinked	Check the installation and eliminate all tight bends in the cable.
No neutral	Control system not moving gear lever correctly	Incorrect control cable set-up	Check cable installation.
	Seized or dragging clutch	Clutches badly worn or seized causing permanent engagement of a direction	Check clutch and replace as necessary.

WARNING: Before carrying out any service work always ensure that the engine is switched off and disconnect the operating cable from the gearbox.

CAUTION: The above operations should be carried out by suitably qualified personnel and strictly in accordance with the procedures detailed in the workshop manual.

9. SERVICING AND REPAIRS - GENERAL

WARNING: Do not carry out any servicing or repair work without first switching off the engine and disconnecting the control cable.

Before removal of the gearbox for repair or overhaul carefully study the following procedures. Use proper hand tools, slings or hoists for the job - WORK SAFELY

Keep all work areas, tools and gearbox clean. Wipe up any spilled oil or fluids to prevent accidents. Wear correct safety equipment i.e. safety glasses and safety shoes to guard against personal injury.

Remember HOT OIL CAN CAUSE BURNS - WORK SAFELY - USE COMMON SENSE.

Drawings showing all internal components are contained in the parts lists. See page 35.

9.1 Seals

Remove oil seals carefully to prevent damage if they are to be re-used, however it is best to replace these items. Carefully examine all cast iron piston rings for wear and corresponding wear/damage in the bores. Take care not to break these rings.

9.2 Bearings

If removing taper roller bearings for re-use keep them in matched sets and protect all bearings from contamination.

9.3 Cleaning

WARNING: If using cleaning solvents these can be toxic, flammable, a skin irritant or give off harmful fumes. Avoid prolonged contact, vapour inhalation, or smoking. Failure to take care can result in injury or death.

Rinse all metal parts in solvent to remove dirt, grease and oil.

Be careful to remove solvent from items before re-fitting.

9.4 Inspection

9.4.1 Gearcase

Inspect for cracks. Check sealing surfaces for any scratches, damage etc. which will lead to oil leaks. Check all threads for damage.

9.4.2 Gears

Inspect for any chipped broken or cracked gear teeth, also for any excessive wear, i.e. gear pitting.

9.4.3 Bearings

Inspect for any damage, pitting or over-heating.

9.4.4 Clutch plates

Inspect all clutch plates for signs of overheating and/or distortion. Check friction surfaces for wear. Replace if oil grooves have worn away.

9.4.5 Clutch components

Inspect clutch components for wear, damage, overheating or debris. Check all oil feed holes are clear.

9.4.6 Threaded parts

Inspect for stripped or damaged threads.

10. SERVICING AND REPAIR PROCEDURES

CAUTION: When re-assembling the gearbox all threaded fasteners must be tightened to the torques listed in table, page 34 to prevent premature failure.

The servicing, repair and replacement of input shaft and layshaft assemblies and components is simplified by the fact that the gearcase is constructed in two separate halves, the top half being easily removable to give access to the two top shafts.

Some servicing operations can be carried out with the gearbox still mounted to the engine (provided, of course, that the engine compartment is sufficiently large to allow this); examples are the replacement or repair of the valve block and the oil pump. To repair or replace the input shaft, layshaft or output shaft, however, you will need to remove the gearbox from the engine.

If the details outlined below are carefully followed no difficulty will be found in stripping and rebuilding the gearbox. It is most important that all components are perfectly clean and in good condition before re-assembly.

CAUTION: The input shaft and layshaft are supported by taper roller bearings. Each time a shaft is stripped for inspection, component repair or replacement it will be necessary to recalculate the number of shims required to load the bearings correctly. Shimming procedures are described in section 10.8.

10.1 Valve block

The complete valve block is easily removed for inspection and servicing with the gearbox still in the boat, as follows:-

1. Disconnect the control cable(s) from the lever (C4) on the valve block.

2. Disconnect the oil cooler pipes and the wiring from the neutral switch (C28) if fitted.

3. Remove the 5 bolts (C18/20/26) and one nut (C23) together with washers (C19/24) securing the valve block to the gearcase.

4. To remove the control valve (C11) and piston (C14), simply remove the two cap screws (C6) and withdraw the valves from the valve block (C16).

CAUTION: Take care not to lose the detent ball and springs (C12/13).

5. Inspect the seal (C8) seal bore in (C5) and bearing (C10), and replace if worn, damaged or defective. Check that the valve spring (C15) has retained its correct free length (62mm) if not replace it.

6. To assemble and refit the valve block, simply reverse the above procedure. It will be necessary to lightly grease the seal bore (C5) and seal diameter of valve (C11) to avoid damaging the seal (C8) when re-fitting.

10.2 Oil pump assembly

The oil pump assembly can be removed with the gearbox in position on the engine.

1. Note the mounting position of the pump (for refitting). See section 3.3 Fig. 4.

2. Remove the four bolts and washers (A14/4) securing the oil pump to the main case and withdraw the pump assembly complete with 'O' rings and shims.

3. Inspect the 'O' rings (B2/3) and replace if necessary. If in good condition store carefully until required for refitting.

If the pump is damaged in any way, the complete pump assembly (B1) must be replaced.

CAUTION: If a new pump assembly is fitted the clutch shaft must be reshimmed. See section 10.8.

10.3 Removing the transmission from the boat

CAUTION: Before commencing work see section 9. The following instructions must be complied with to avoid damage to the gearbox.

1. Ensure that the gearbox operating lever (C4) is in the neutral position and disconnect the operating cable or cables, and disconnect the wiring from the neutral safety switch, if fitted.

2. Drain the gearbox oil into a suitable container and disconnect the oil cooler pipes.

3. Unscrew and withdraw the bolts connecting the gearbox output flange from the flexible coupling or mating half coupling on the propeller shaft.


CAUTION: Sling ropes around the gearbox securely to provide support while it is
WARNING being removed from the engine.

4. Remove the bolts securing the adaptor flange to the flywheel housing.

5. Slacken the bolts which secure the flexible drive coupling to the flywheel.

6. Withdraw the gearbox, if necessary rocking the unit slightly in order to disengage the input shaft spline from the internal spline in the coupling, and lift clear.

10.4 Removing the input shaft and layshaft assemblies

1. Remove the gearbox from the boat as described in section 10.3.

2. Undo the 4 bolts (A14) securing the oil pump and withdraw the oil pump, shims and 'O' rings, noting the position of the pump for refitting. (Note: keep the pump shims with the pump assembly).

3. Remove the 3 bolts (A11) securing the shaft end cover (A10) and remove. (Note: keep the shims and 'O' rings with the cover).

4. Remove the 5 bolts (C18/20/26) and 1 nut (C23) retaining the valve block and remove it.

5. Remove the 7 bolts and washers (A3/A4) securing the gearcase top half (A1) and lift clear.

6. Lift the input shaft assembly oil seal housing (D2) and thrust washer (D4) from the gearcase.

7. Lift the layshaft assembly and front end cover (E2) from the gearcase.

10.5 Servicing input shaft and layshaft assembly components

See pages 42/44 for assembly drawing.

10.5.1 Input shaft oil seal

In the event of an oil leak caused by a damaged seal, remove the input shaft oil seal housing (D2) from the shaft and, using a hardwood drift and hammer, remove the seal from the housing.

Fit a new seal (D1) in the housing (D2) and refit the housing.

10.5.2 Drive end bearing

To renew a damaged or worn bearing:-

1. Support the relevant shaft in a vice and remove the oil seal housing (D2) (this applies only to the input shaft).

2. Using a pulley extractor with its jaws located behind the pinion, withdraw the clutch pinion (D9/E7), thrust washer (D6/E4), thrust bearing (D7/E5) and end bearing (D5/E3). Check that needle bearings (D10/E8) and spacers are in good condition.

3. Refit the needle bearings, spacers and clutch pinion to the shaft.

4. Replace the thrust washer and thrust bearing, inspecting for wear and replacing where necessary.

5. Locate the new bearing (D5/E3) on the shaft and, using either a hand press or a hardwood drift and hammer, gently drive the assembly into position. Take care not to damage the bearing rollers or raceways during this operation. Note:- if the bearing is correctly located a small amount of pinion end float will be detected i.e. between 0.13 to 0.45mm.

6. Reposition the oil seal housing (D2) on the shaft (input shaft only).

NOTE: if new bearings are fitted, they must be re-shimmed as described in section 10.8.

10.5.3. Clutch assemblies

Clutch plates which have discoloured and/or distorted by overheating or if the groove pattern on the friction plates have been worn away they need to be changed as follows, these instructions apply to both directional clutches:-

1. Remove the drive pinion (D9/E7) and bearing (D5/E3) as previously described.

2. Remove spacer, needle roller bearing, spacer, needle roller bearing.

3. Remove the large circlip (D15/E13).

4. Withdraw the complete clutch assembly from the shaft noting the position of the pull off springs and clutch pins.

5. Remove the small snap ring (D12/E10), thrust bearing, and thrust washer and inspect for wear or damage and replace where necessary.

To rebuild the clutch assembly, the procedure is as follows:

6. Position shaft upright and locate the 3 clutch pins (D18/E16) into the clutch gear (D31/E29).

7. Replace thrust washer, thrust bearing and the small snap ring.

8. Fit the clutch end plate (D21/E19) into the clutch gear and fit pull-off springs over the clutch pins. Then, starting with one of the driver clutch plates (D20/E18) build up the replacement clutch onto the clutch end plate.

9. Replace the clutch end cover (D16/E14) onto the clutch pack, locating the 3 pins and ensuring that one of the tapped holes in the clutch end plate aligns with the dimple on the body of the clutch gear.

10. Replace the large circlip.

11. Replace the drive pinion into the clutch pack until it touches the thrust bearing.

12. Replace needle roller bearing, spacer, needle roller bearing and spacer.

13. Replace the thrust bearing, thrust washer and bearing inner cone on the shaft and gently drive the bearing into position

10.5.4 Drive pinion

It is advisable to renew both drive pinions simultaneously if one is worn or damaged. To ensure that the drive pinion of the correct ratio is used please refer to the parts list (page 35). If a different ratio from that originally supplied is required, the output gear will also need to be changed.

To replace the drive pinion, follow the procedure set out in section 10.5.2.

10.5.5 Rear end bearing, piston rings and feeder

1. Remove the rear end bearing (D26/E24) and feeder (D27/E25) using a pulley extractor with the jaws of the extractor located behind the feeder.

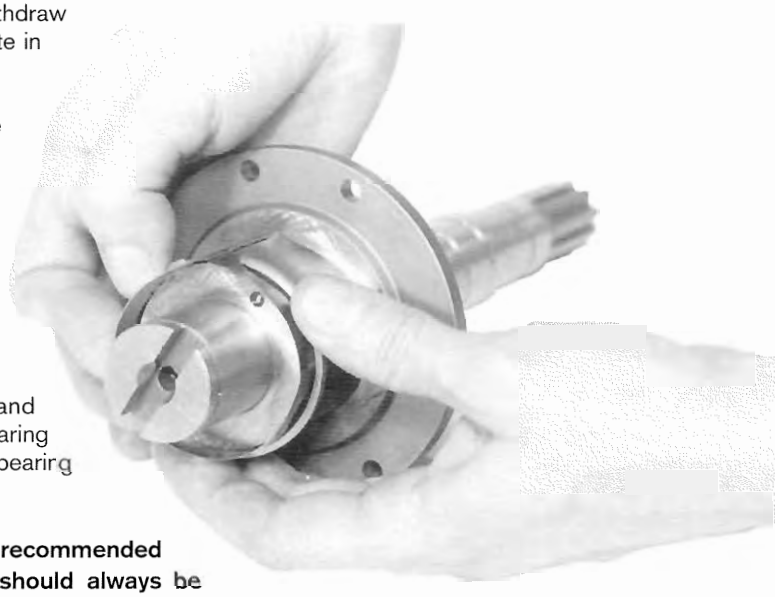
2. Remove the pistons rings from the shaft with the aid of a special piston ring extractor or a piece of thin steel. Raise one end of the top ring out of the groove and insert the steel strip between the ring and the shaft. Rotate the strip around the shaft applying slight forward pressure to the raised portion of the ring until it rests on the land above the groove, where it can be eased off. Repeat this with the other two rings.

3. Take out the new rings from the packing and clean off any grease or inhibitor.

4. If a ring loading tool is available, fit this around the shaft, load the rings onto the tool and locate in their approximate position. Gently withdraw the tool and allow the rings to locate in their respective grooves.

5. Where a loading tool is not available use a thin metal strip, long enough to lay along the shaft above the grooves. Expand each ring just sufficiently to allow it to be placed in its approximate position over the strip. Gently withdraw the strip and locate the rings in their respective grooves (see Fig. 13)

6. Compress each ring in turn and carefully fit the new feeders and bearing onto the shaft, and gently drive the bearing into position.



NOTE: It is advisable and strongly recommended that piston seals and tab washers should always be replaced.

Fig. 13 Fitting piston rings

10.5.6 Clutch gear

The clutch gear is an interference fit on the shaft, and a power press is required to separate the gear from the shaft. Newage Transmissions Ltd. recommend therefore, that unless there is any damage to either the shaft or gear, the two are not separated.

CAUTION: It is advisable to renew both clutch gears simultaneously since damage to one will often result in damage to its mating gear.

10.6 Replacement of input shaft and layshaft assemblies

1. Position the input shaft assembly in the gearcase and ensure that the thrust washer (D4) is correctly located in the groove in the lower half of the gearcase. Verify that the seal housing (D2) is correctly located after first examining the 'O' ring and oil seal for wear or damage, replacing if required.
2. Position the layshaft in the gearcase and refit the end cover (E2) correctly in the groove in the lower half of the gearcase, replacing the 'O' ring (E1) if damaged.
3. Use a liquid gasket compound between the two case halves, and replace the top gearcase half, ensuring the feeder connectors (D28/E26) are located correctly. To simplify the operation wire placed in the feeder connectors and passed through the holes in the top half of the gearcase will ensure they are approximately located when the gearcase top half is lowered onto them. The connector 'O' rings (D29/E27) should be examined for damage or wear and renewed if necessary.
4. Replace the two front gearcase bolts and ensure the gearcase halves are square.
5. Secure the remaining gearcase bolts tightening them to the correct torque.
   (See torque tightening chart page 34)
6. Shim and refit the input shaft end cover (A10) replacing the 'O' ring if damaged.
7. Shim and refit the oil pump replacing the 'O' ring (B2) if damaged. Ensure the oil pump is fitted in the correct position, to suit the direction of rotation required. See section 3.3.
8. Refit the valve block assembly (C) replacing the gasket (C17).
9. Refit the bolts securing the adaptor plate to the gearbox.
10. Offer up the gearbox and the adaptor plate to the engine and secure.
11. Reconnect the oil cooler pipes and control cables.

NOTE: Shimming procedure is described in section 10.8

10.7 Servicing the output shaft assembly

Removal of the output assembly will necessitate removing the gearbox from the boat (see section 10.3). Then proceed as follows:-

1. Remove input shaft and layshaft assemblies as described in section 10.4.
2. Extract the split pin (F23) and slacken nut (F20) at the output coupling (F18) and remove coupling, washer (F19) and 'O' ring (F17).
3. Remove the output shaft end cover (F1), release tab washer (F4), slacken and remove retaining screws (F3), tab washer and bearing retaining washer (F5).
4. Remove four screws (F21) and remove rear seal housing (F15).
5. To remove the shaft, drive or press on the front end. The rear end bearings and oil seal can be removed leaving the output gear (F9) spacer (F8) circlip (F7) and needle bearing (F6) behind.
6. Having removed the output shaft from the gearbox, the output gear (F9) can be lifted from the gearcase.
7. Remove the circlip (F7) and the bearing (F6) can be removed from its bore using a press or pulley extractor.
8. Check both bearing and output gear for any defects or damage and replace if necessary.
9. If the new oil seal (F16) is damaged, press out from seal housing (F15) and renew.
10. If the rear bearing (F13) is damaged, it can be removed from the shaft using either a press or pulley extractors.

Note: Whenever the output shaft assembly is stripped, it is always advisable to renew all 'O' rings, oil seal, tab washer and circlips.

To re-assemble the output shaft assembly:

11. Refit circlip (F12) correctly in the bottom of the gearcase.
12. Press rear bearing (F13) onto the shaft until it seats on the shoulder provided on the output shaft.
13. Assemble the shaft from the rear. Feed spacer (F10), drive gear (F9) and spacer (F8) as it is pushed towards the input end.
14. Refit new 'O' ring (F14) and oil seal (F16) to oil seal housing (F15) and secure seal housing to the gearbox case, ensuring the housing is in the correct position so that it will not foul the input shaft end cover (A10).
15. The circlip (F7) should now be refitted into its groove in the front bore and the front bearing (F6) pressed into position.
16. Refit bearing retaining washer (F5), tab washer (F4) and tighten screws (F3) (see torque chart page 34), bend over tab washer and fit cover (F1) together with new 'O' ring (F2).
17. Refit the 'O' ring (F17), output coupling (F18), washer (F19) and nut (F20). Apply Loctite 270 to nut and tighten to correct torque. (See torque chart page 34)

10.8 Shimming procedures

The allowable end float on the taper bearing is 0.03 - 0.08mm (0.001 - 0.003in) clearance: this should be checked with the aid of a depth micrometer as follows:

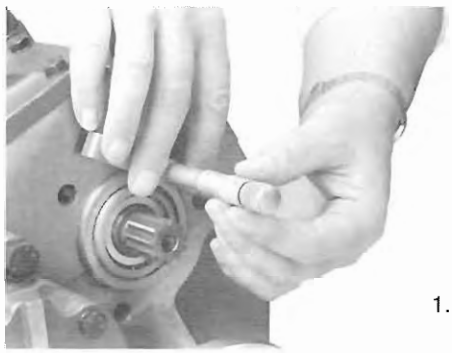


Fig. 14

1. Press the bearing outer cup firmly into position and measure between the face of the gearcase and the top of the bearing outer as shown in Fig. 14.

2. Measure the depth of the recess in the oil pump and in the output shaft end cover as in Fig. 15, and make up the difference between the two dimensions with shims.

If no depth micrometer is available, the following method may be used:-

1. Remove the 'O' ring from the oil pump or end cover.
2. Fit enough shims to cause the oil pump or end cover to stand proud.
3. Rotate the shaft, slowly tightening the securing bolts until the shaft starts to bind. Use feeler gauges or shims around the pump or end cover (Fig. 16) to ensure that the gap is uniform and that they are positioned squarely on the rear face of the gearcase.
4. Measure the gap by means of feeler gauges or shims, and deduct shims to this figure plus 0.075mm (0.003in) from the shims already installed.
5. Remove the requisite number of shims, tighten the oil pump or end cover, and test by rotating the shaft.
6. Remove the oil pump or end cover and refit with the 'O' ring installed.

Fig. 15

Fig. 16

NOTE: Shims are available in two thicknesses, 0.254mm (0.010in) and 0.05mm (0.002in). As an example of their use, if an end float reading of 0.584 (0.023in) is obtained, use two shims of 0.254mm (0.010in) and one of 0.05mm (0.002in), giving a final end float or clearance of 0.025mm (0.001in).

11. POWER TAKE-OFF UNIT

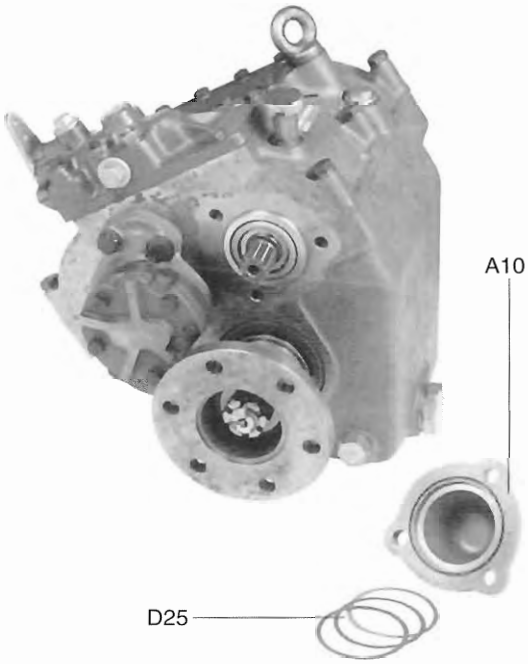


Fig. 17

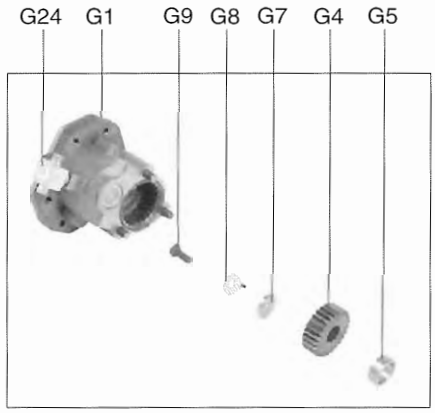


Fig. 18

11.1 To fit a P.T.O. unit to an existing gearbox

1. Remove end cover (A10) from rear face of gearbox, taking care not to lose shims. Replace the shims against the bearing outer race. (Use grease if required).
2. Fit spacer (G5) and drive gear (G4) to end of splined shaft, which protrudes from the rear of the gearbox.
3. Fit the spacer (G7) into recess in the gear and the locking tab into the hole in the face of the gear.
4. Tighten screw (G9) to 48 Nm (35.5 lbf.ft) and bend up the locking tab.
5. Pass the P.T.O. unit over the gear (G4) and push against rear face of the gearbox, ensuring that shims do not drop down and are located in recess in P.T.O. housing. Also ensure that the 'O' ring remains in the groove in the P.T.O. housing and does not become trapped.
6. Tighten bolts (G11/G20) into rear face of gearbox to 98 Nm (72.5 lbf.ft).
7. Fit oil pipe assembly (G23) as shown on the page 48 drawing, between the 'T' piece on the P.T.O. housing and the connector on the valve block.
8. Fit hydraulic pump to P.T.O. unit.

CAUTION: The P.T.O. shaft rotates opposite to the gearbox input shaft.

11.2 To repair an existing P.T.O. unit

1. Removal of the unit is the reverse of that described in (11.1) above.
2. The output gear assembly (G2) can be removed without removing the P.T.O. unit from the gearbox. Remove hydraulic pump from P.T.O. and slacken screws (G19/G20). Pull out housing (G13) and the gear (bearing assembly will remain with the housing).
3. To remove the output gear (G2), remove circlip (G21) and tap gear on the end face to remove from bearing (G12).
4. The bearing (G12) can be removed by removing circlip (G15) and pressing or drifting out bearing.
5. If needle bearing (G3) is worn or damaged, it is best replaced when the P.T.O. housing is removed from the gearcase.
6. If the drive gear (G4) is removed from the gearbox shaft, then tab washer (G8) MUST be replaced.
7. Assembly is the reverse of all that described in 11.2 above.

12. OPTIONAL TROLLING VALVE DESCRIPTION

This unit can be supplied as a factory fitted option or is available for retro-fitting.

12.1 Description

The Newage trolling valve is available as an option on the PRM500. This is electronically operated which allows variable speed of the propeller to zero whilst allowing a maximum engine speed of up to 1200 rpm. The trolling valve runs with the normal gearbox oil.

12.2 Trolling valve installation data

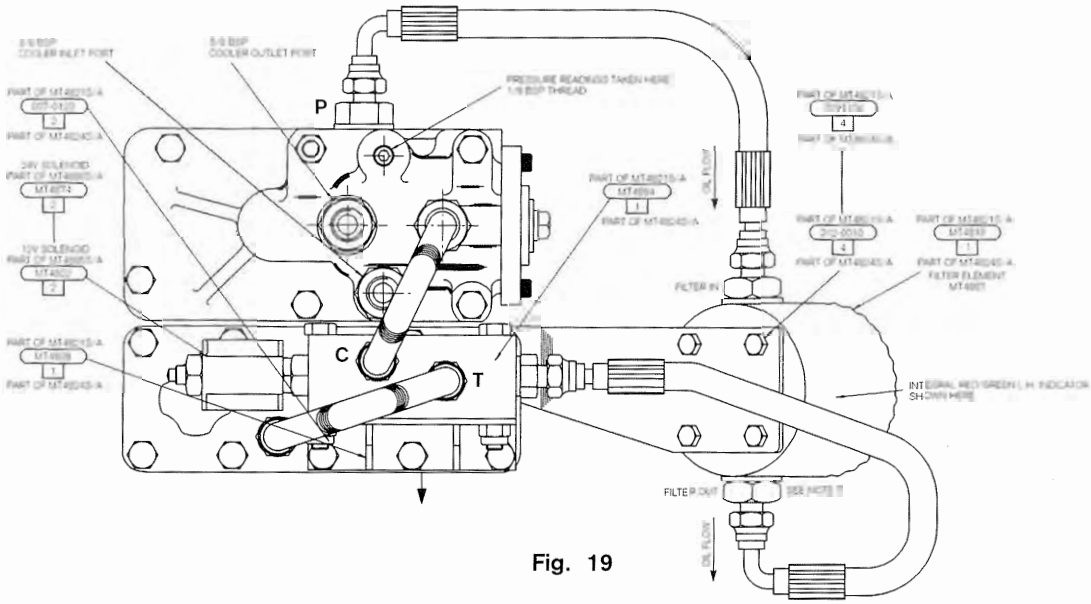


Fig. 19

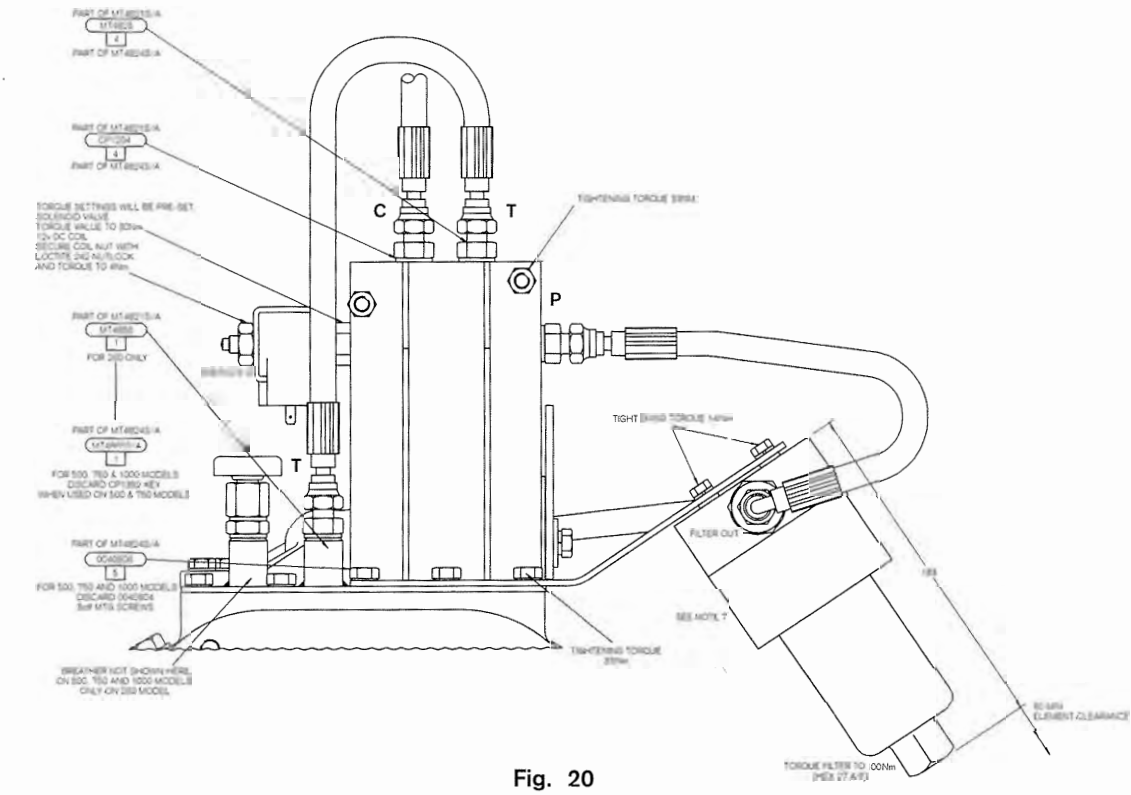


Fig. 20

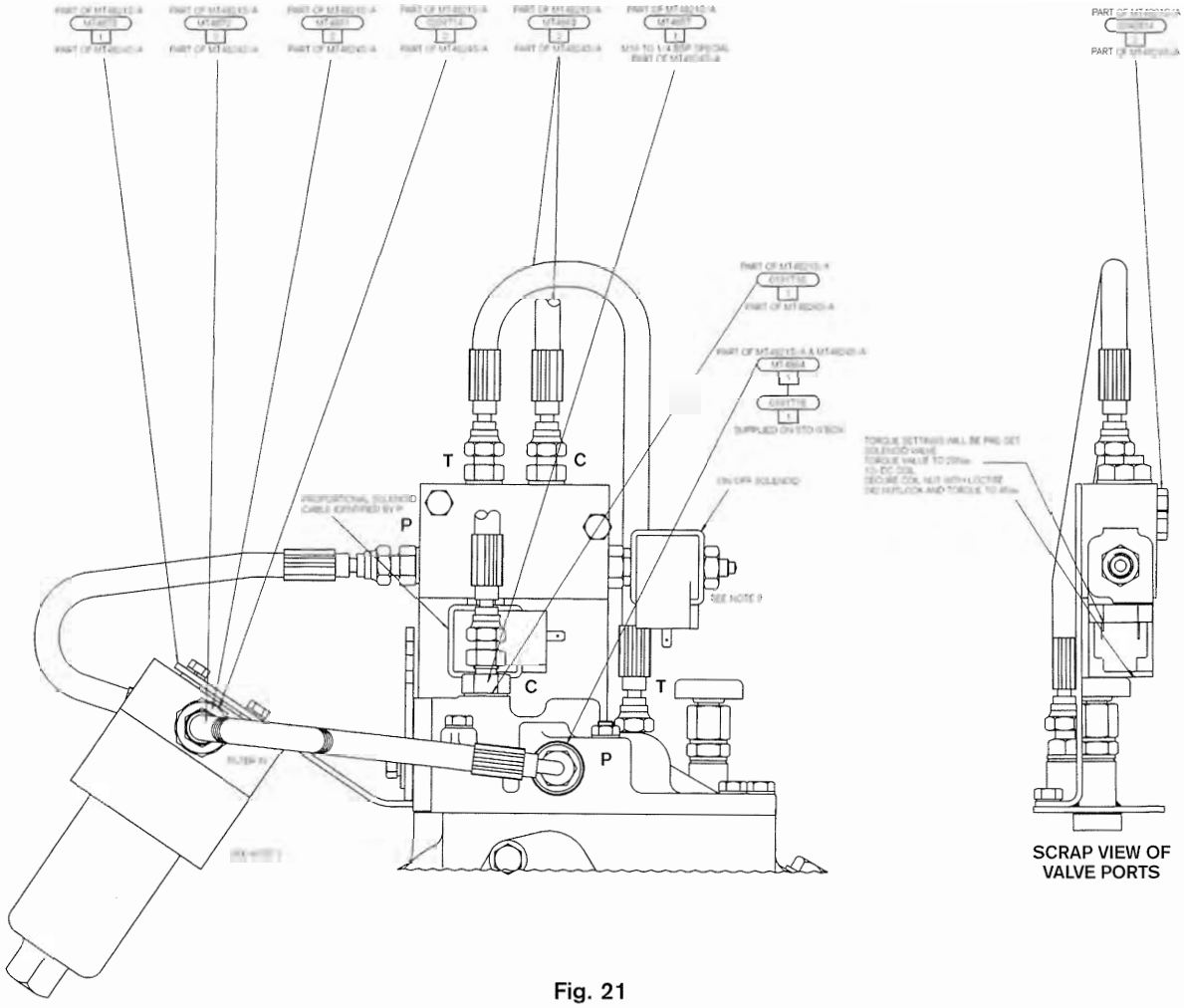
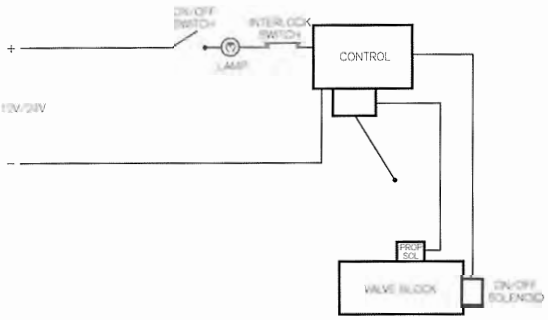
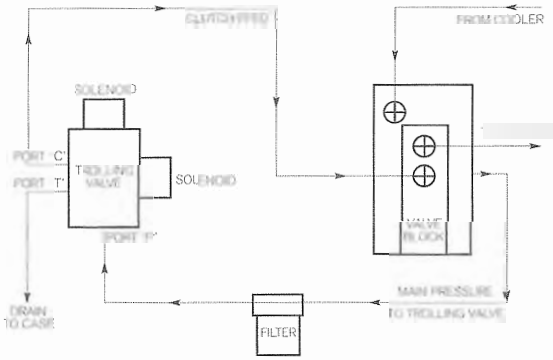


Fig. 21



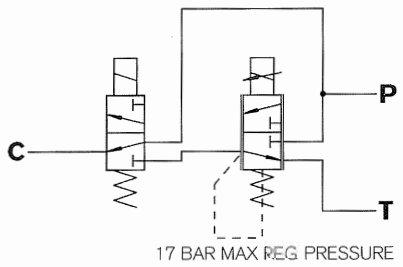
ELECTRICAL CIRCUIT

Fig. 22



TROLLING VALVE BASIC CIRCUIT DIAGRAM

Fig. 23



SCHEMATIC LAYOUT

Fig. 24

PART NUMBER	DESCRIPTION
MT4821S/A	TROLLING VALVE ASSEMBLY 260
MT4824S/A	TROLLING VALVE ASSEMBLY 500, 750, 1000
MT4885S/A12V	OPERATING LEVER ASSEMBLY
MT4886S/A24V	OPERATING LEVER ASSEMBLY

12.3 Trolling valve fitting instructions.

1. One 3m length 6 core cable to be supplied loose with one socket end connector and two Hirschman connectors on solenoid cables. If required one 3m 6 core extension cable can be supplied (Part No. MT4820).

2. Fuel rack switch to be left with bare wires. Customer to connect wires and supply mounting bracket.

3. When retrofitting trolling valve to a standard gearbox use MT1538 control valve within the valve block assembly.

4. Prior to retrofitting trolling valve to old gearbox, drain gearbox and cooler and clean drain plug. Refill with clean oil to the correct level. Run the gearbox to fill cooler circuit and re-fill accordingly.

5. The control lever is pre-set and should not require any adjustment.

6. Cooler pipe connections remain as standard gearbox.

7. The oil filter can be resited if necessary up to 1/2 metre from the gearbox. If this is desired the customer must supply the additional filter bracket. The filter must be installed vertically on the engine and gearbox installation with the bowl facing downwards. Replace 10 micron element after initial 50hrs operation and as determined by the filter indicator reading thereafter. The system must not be run with the filter indicator in the red.

8. If used with a clutch PTO, then the clutch pressure feed must be taken from the 1/8 BSP tapping in the valve block or port 'P' in the proportional valve. Under no circumstances should the PTO connection be taken from port 'C' clutch feed line. Any pipes left disconnected must be capped with plugs to prevent any contamination of the valve assembly.

9. The trolling valve system is failsafe and will return to full pressure in the event of electrical failure. In the event of mechanical failure eg. (sticking valve) the on/off solenoid on the side of the proportional valve can be manually moved by depressing the button in the centre of the solenoid. This will release the valve and return to full pressure.

10. The trolling valve system must not be operated above 1200 rpm engine speed. An interlock switch is provided to switch off the trolling valve should overspeed occur.

13. TOOL KIT

Dipstick	18mm A/F
Drain plug	1in.A/F
Output flange nut	11/8 in. A/F
Pump socket screws	5/16 in. A/F Hex key
Spanners	19mm A/F
	17mm A/F
	13mm A/F

13.1 Tightening torques. Note: These figures are for dry threads only.

RECOMMENDED TIGHTENING TORQUES		
	Nm	**lbf.ft**
Upper to lower gearcase bolts	56.0	40.3
Top cover to upper gearcase	28.0	20.6
Pump body to gearcase	56.0	41.0
Operating lever to selector valve	28.0	7.0
End plate to valve block	9.4	6.9
Valve block to upper gearcase	28.0	20.6
Upper/lower gearcase : stud	39.2	28.9
nut	56.0	40.3
End cover to gearcase	98.0	72.3
Oil seal housing to gearcase	56.0	41.0
Output bearing retaining bolts	11.7	8.6
Coupling to output shaft	340.0	250.0
Adaptor plate to gearcase : bolt/nut	98.0	72.3
stud	68.6	50.6
P.T.O. to rear gearcase	98.0	72.3

14. REPLACEMENT PARTS ORDERING

When ordering replacement parts the following should be quoted:

a) Gearbox model and serial number

b) Description(s) and part number(s) of the component(s) required

c) Quantity required

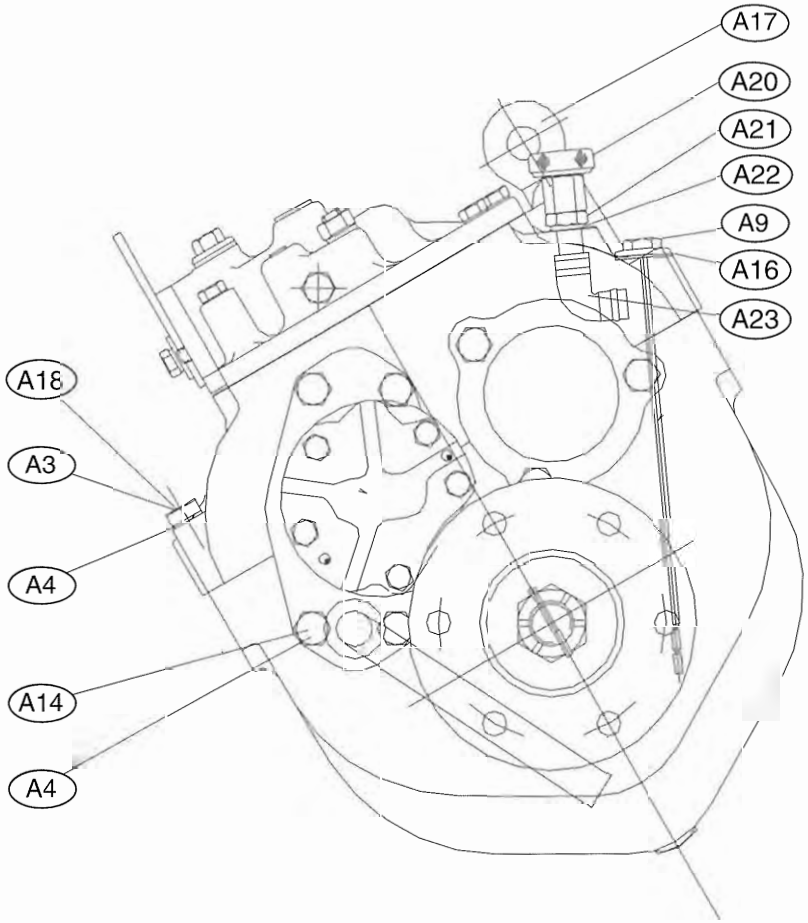
d) Orders and enquiries for replacement parts must be made through Newage distributor/dealer network

NOTE: Enquiries relating to a technical or service nature can be made direct to:

NEWAGE TRANSMISSIONS LTD.
BARLOW ROAD
COVENTRY CV2 2LD
ENGLAND

TEL: +44 (0)24 7661 7141
FAX: +44 (0)24 7661 1845
EMAIL: mail@newage-prm.co.uk
WEBSITE: http://www.newage-prm.co.uk

PARTS LIST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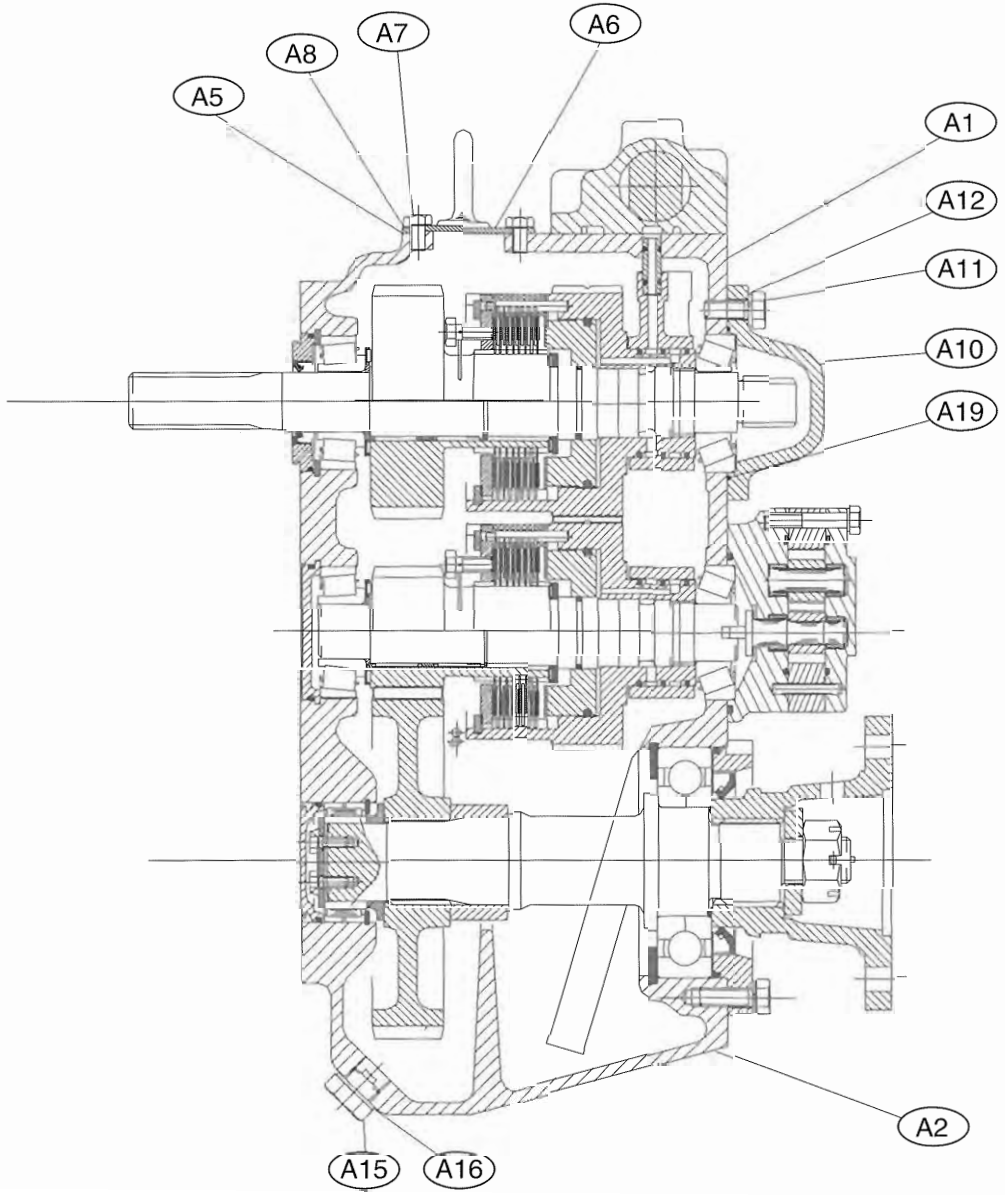
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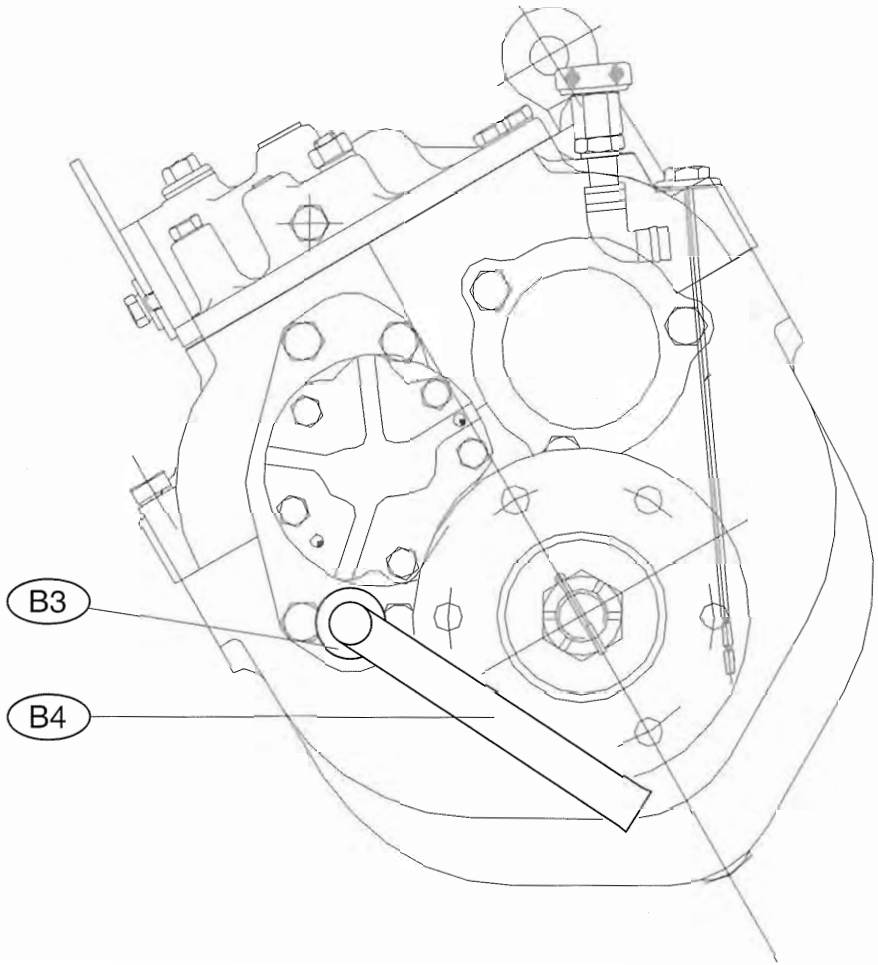
SECTION A - GEARCASE ASSEMBLY			
ITEM NO.	DESCRIPTION	PART NO.	QTY
A	Case sub-assembly	MT0316	1
A1	Gearcase - top - Not supplied separately	MT1517	1
A2	Gearcase - bottom - Not supplied separately	MT1530	1
A3	Bolt	0041014	6
A4	Washer	0191710	11
A5 *	Gasket (top cover)	MT343	1
A6	Top cover	MT1467	1
A7	Screw	0040804	10
A8	Washer	CP1223	10
A9	Dipstick	MT472	1
A10	End cover	MT1267	1
A11	Screw	0041208	3
A12	Washer (spring)	0191107A	3
A14	Bolt	0041010	4
A15	Drain plug	CP1331	1
A16	Washer (dipstick)	0201714	2
A17	Eyebolt	CP1339	1
A18	Bolt (not illustrated)	0041019	1
A19 *	'O' ring	0430771	1
A20	Breather	CP1383	1
A21	Locknut	CP1385	1
A22	Washer	CP1204	1
A23	Breather tube assembly	CP1382S/A	1

* Part of gasket/seal kit MT0434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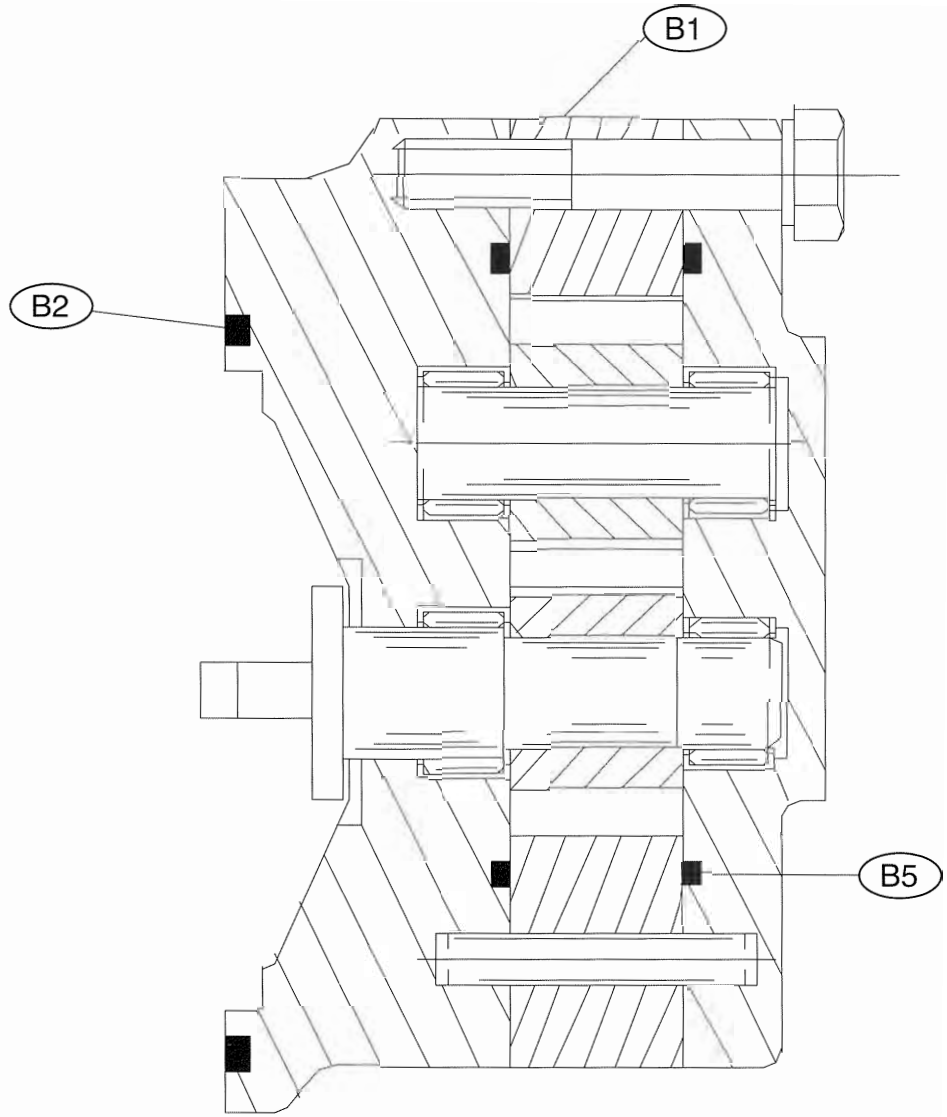
B1
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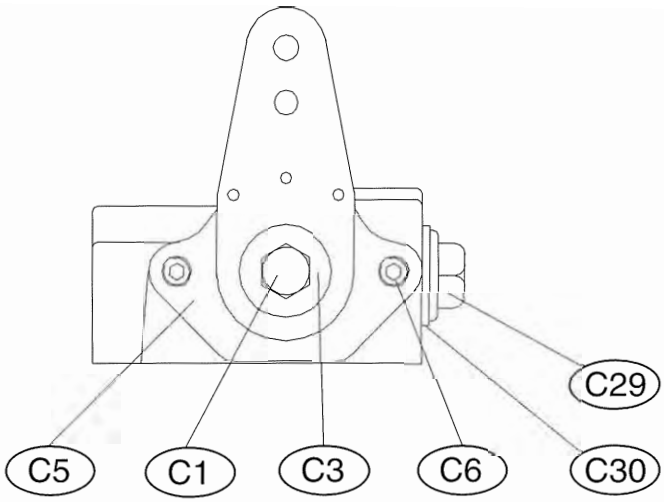
SECTION B - OIL PUMP ASSEMBLY			
ITEM NO.	DESCRIPTION	PART NO.	QTY
B1	Oil pump (Kit)	MT0412-KIT	1
B2 *	'O' ring	003383	1
B3 *	'O' ring	001254	2
B4	Oil pipe	MT736	1
B5 *	'O' ring	0430682	2

* Part of gasket/seal kit MT0434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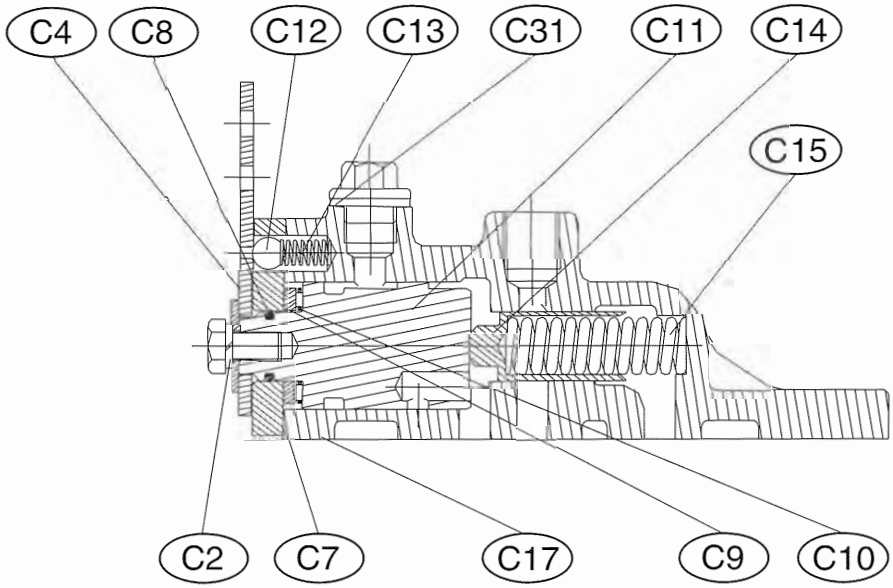
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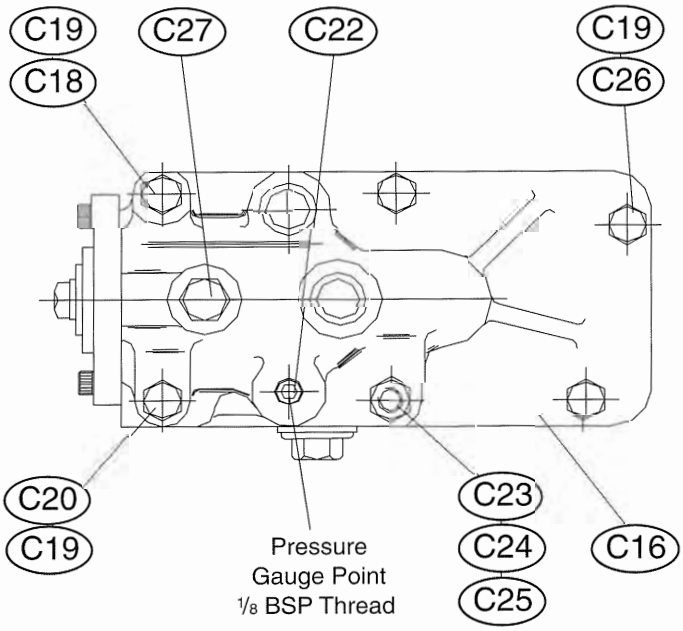
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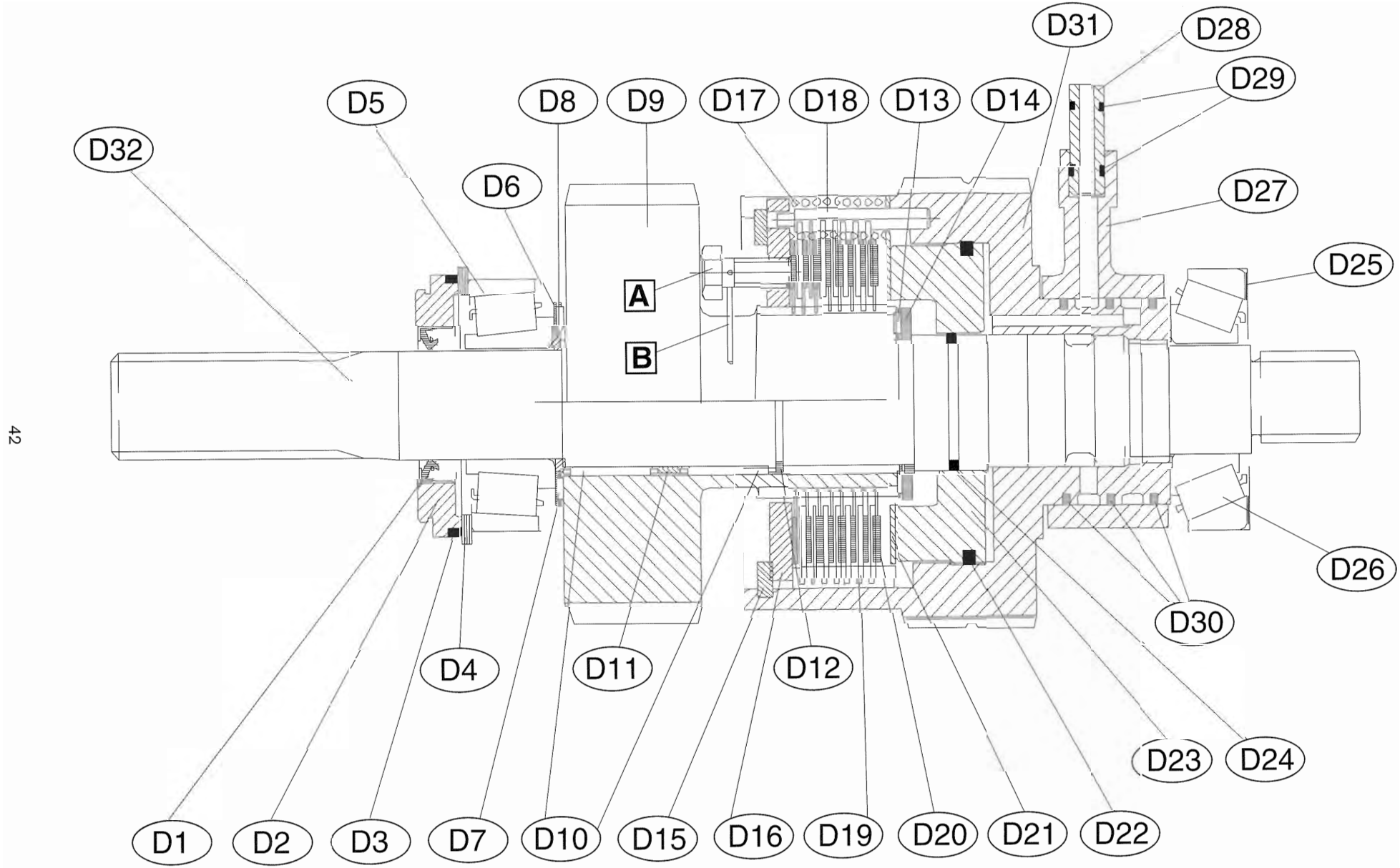
SECTION C - VALVE BLOCK ASSEMBLY			
ITEM NO.	DESCRIPTION	PART NO.	QTY
C	Valve block assembly	MT0354	1
C1	Screw	0040806	1
C2	Spring washer	0191105	1
C3	Washer	MT979	1
C4	Operating lever	MT977	1
C5	End cover	MT978	1
C6	Cap screw	0081220	2
C7 *	Gasket	MT1081	1
C8 *	Nu-lip seal	MT8082	1
C9	Thrust race	CP1308	1
C10	Thrust bearing	CP1307	1
C11	Control valve	MT4656	1
C12	Detent ball	CP1077	1
C13	Detent spring	MT305	1
C14	Piston	MT4751	1
C15	Valve spring 1800 Kpa (260 psi)	MT4772	1
C16	Valve block	MT4780	1
C17 *	Gasket	MT1073	1
C18	Bolt	0040812	1
C19	Washer	CP1223	5
C20	Bolt	0040815	1
C21	Redcap seal (transit only)	MT477	2
C22	Pressure plug	MT311	1
C23	Nut	0051001	1
C24	Washer	0191710	1
C25	Stud	MT1292	1
C26	Screw	0040808	3
C27	Plug	CP1360	1
or			
C27	Switch and ball assy	MT0214	1
C28	Bonded seal	0201715	1
C29	Plug (M18 pressure port)	0150318	1
C30	Bonded seal	0191718	1
C31	Bonded seal	0201715	1

* Part of valve block gasket kit MT0392 or gasket/seal kit MT0434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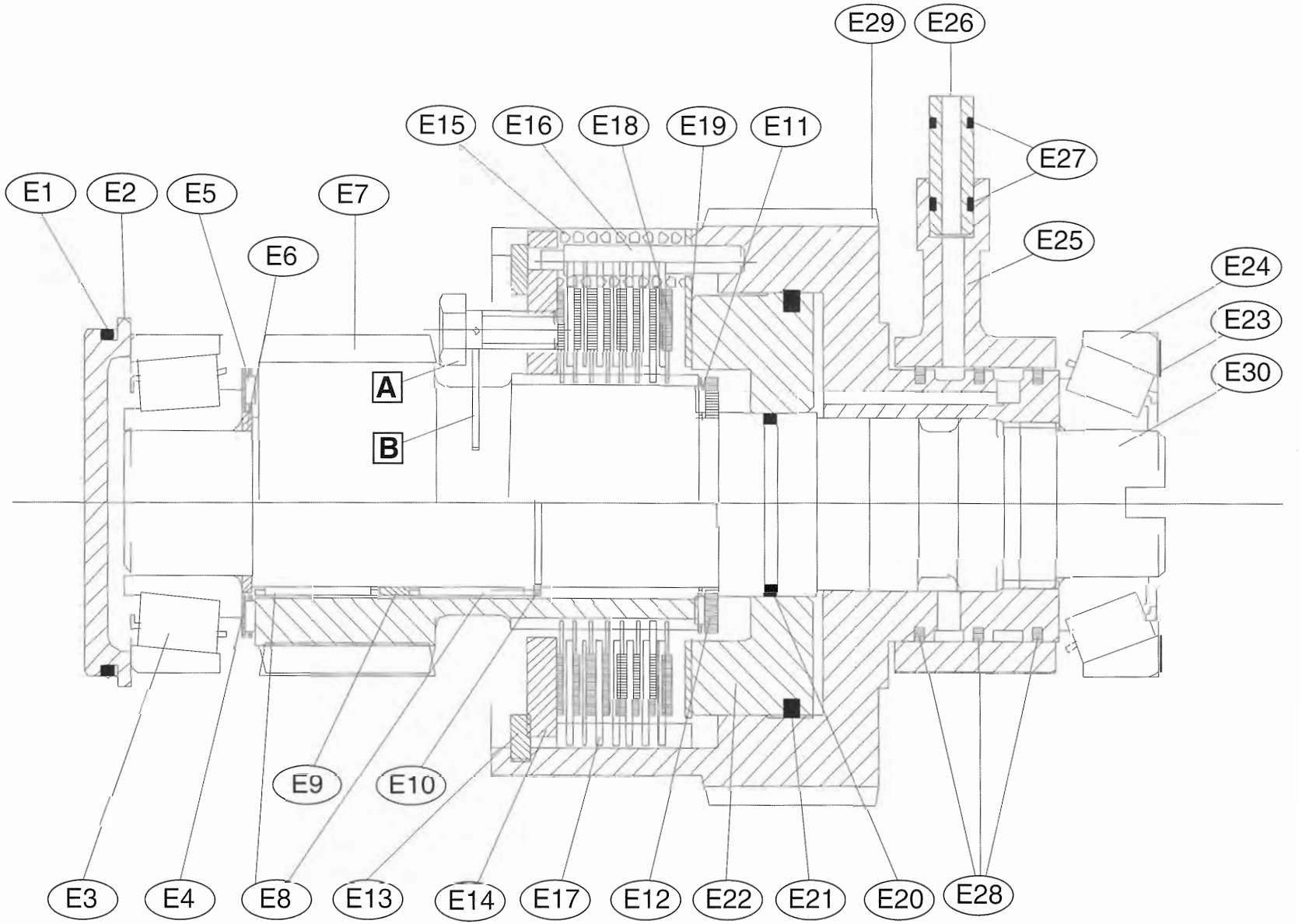
SECTION D - INPUT SHAFT ASSEMBLY			
ITEM NO.	DESCRIPTION	PART NO.	QTY
D1 *	Oil seal	MT251	1
D2	Oil seal housing	MT1514	1
D3 *	'O' ring	04306725	1
D4	Thrust washer	MT1516	1
D5	Bearing cup	055U044	1
	Bearing cone	055C019	1
D6	Thrust washer	0673801	1
D7	Thrust bearing	0603801	1
D8	Spacer	MT1471	1
D9	Pinion (1.5:1) 37T	MT1583 S/A	1
D9	Pinion (2:1) 31T	MT1475 S/A	1
D9	Pinion (2.5:1) 23T	MT1476 S/A	1
D9	Pinion (3:1) 21T	MT1477 S/A	1
D10	Needle roller bearing	0563501	2
D11	Spacer	MT1472	1
D12	Snap ring	0300350	1
D13	Thrust bearing	0603501	1
D14	Thrust washer	0673503	1
D15 •	Circlip	0251020	1
D16 •	Clutch end cover	MT1484S/A	1
D17 •	Spring	MT1067	3
D18 •	Clutch pin	MT1485	3
D19 •	Clutch plate - driven	MT982	7
D20 •	Clutch plate - driver	MT725/S	8
D21 •	End plate	MT983	1
D22 *	Piston 'O' ring	003504	1
D23	Piston	MT1264	1
D24 *	Piston 'O' ring	0421503	1
D25 **	Shim 0.002"	MT1077/02	AR
	Shim 0.010"	MT1077/10	AR
	Shim 0.031"	MT1077/31	AR
D26	Bearing	0540302	1
D27	Feeder	MT380	1
D28	Feeder connector	MT1057	2
D29 *	Feeder 'O' ring	000372	4
D30 !	Piston ring	MT292	3
D31	Clutch gear	MT4853	1
D32	Input shaft	MT4935	1

• Part of clutch pack kit MT0349
* Part of gasket/seal kit MT0434
! Part of piston ring kit MT0439
** Part of shim kit MT0068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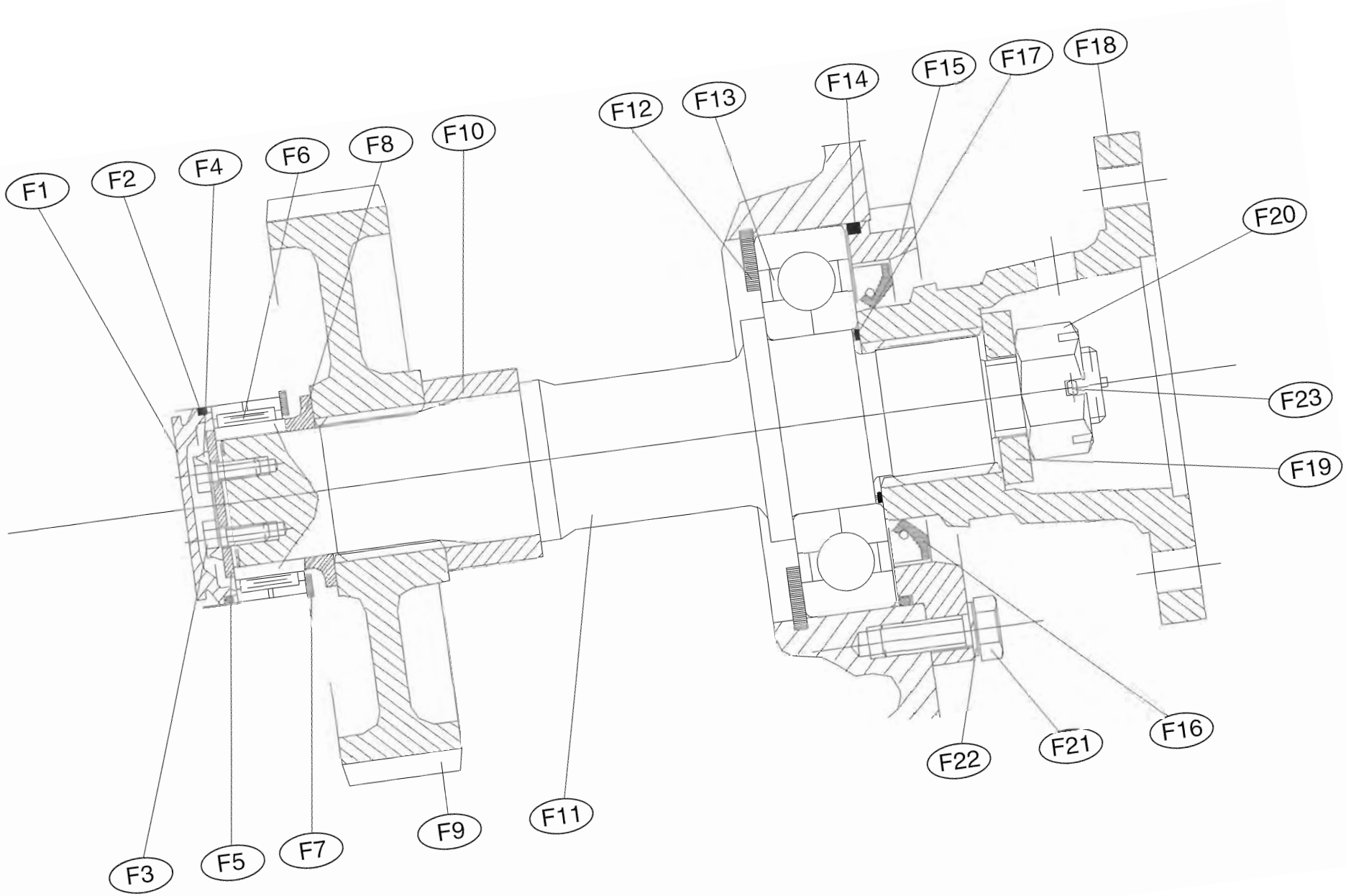
SECTION E - LAYSHAFT ASSEMBLY			
ITEM NO.	DESCRIPTION	PART NO.	QTY
E1 *	'O' ring	04306725	1
E2	End cover	MT1515	1
E3	Bearing cup	055U044	1
	Bearing cone	055C019	1
E4	Thrust washer	0673801	1
E5	Thrust bearing	0603801	1
E6	Spacer	MT1471	1
E7	Drive pinion (1.5:1) 37T	MT1583 S/A	1
E7	Drive pinion (2:1) 31T	MT1475 S/A	1
E7	Drive pinion (2.5:1) 23T	MT1476 S/A	1
E7	Drive pinion (3:1) 21T	MT1477 S/A	1
E8	Needle roller bearing	0563501	2
E9	Spacer	MT1472	1
E10	Snap ring	0300350	1
E11	Thrust bearing	0603501	1
E12	Thrust washer	0673503	1
E13 •	Circlip	0251020	1
E14 •	Clutch end cover	MT1484S/A	1
E15 •	Spring	MT1067	3
E16 •	Clutch pin	MT1485	3
E17 •	Clutch plate - driven	MT982	7
E18 •	Clutch plate - driver	MT725/S	8
E19 •	End plate	MT983	1
E20 *	Piston 'O' ring	0421503	1
E21 *	Piston 'O' ring	003504	1
E22	Piston	MT1264	1
E23 **	Shim 0.002"	MT1077/02	AR
E23 **	Shim 0.010"	MT1077/10	AR
E23 **	Shim 0.031"	MT1077/31	AR
E24	Bearing	0540302	1
E25	Feeder	MT380	7
E26	Feeder connector	MT1057	2
E27 *	Feeder 'O' ring	000372	4
E28 !	Piston ring	MT292	3
E29	Clutch gear	MT4854	1
E30	Layshaft	MT1500	1

• Part of clutch pack kit MT0349
! Part of piston ring kit MT0439
* Part of gasket/seal kit MT0434
**Part of shim kit MT0068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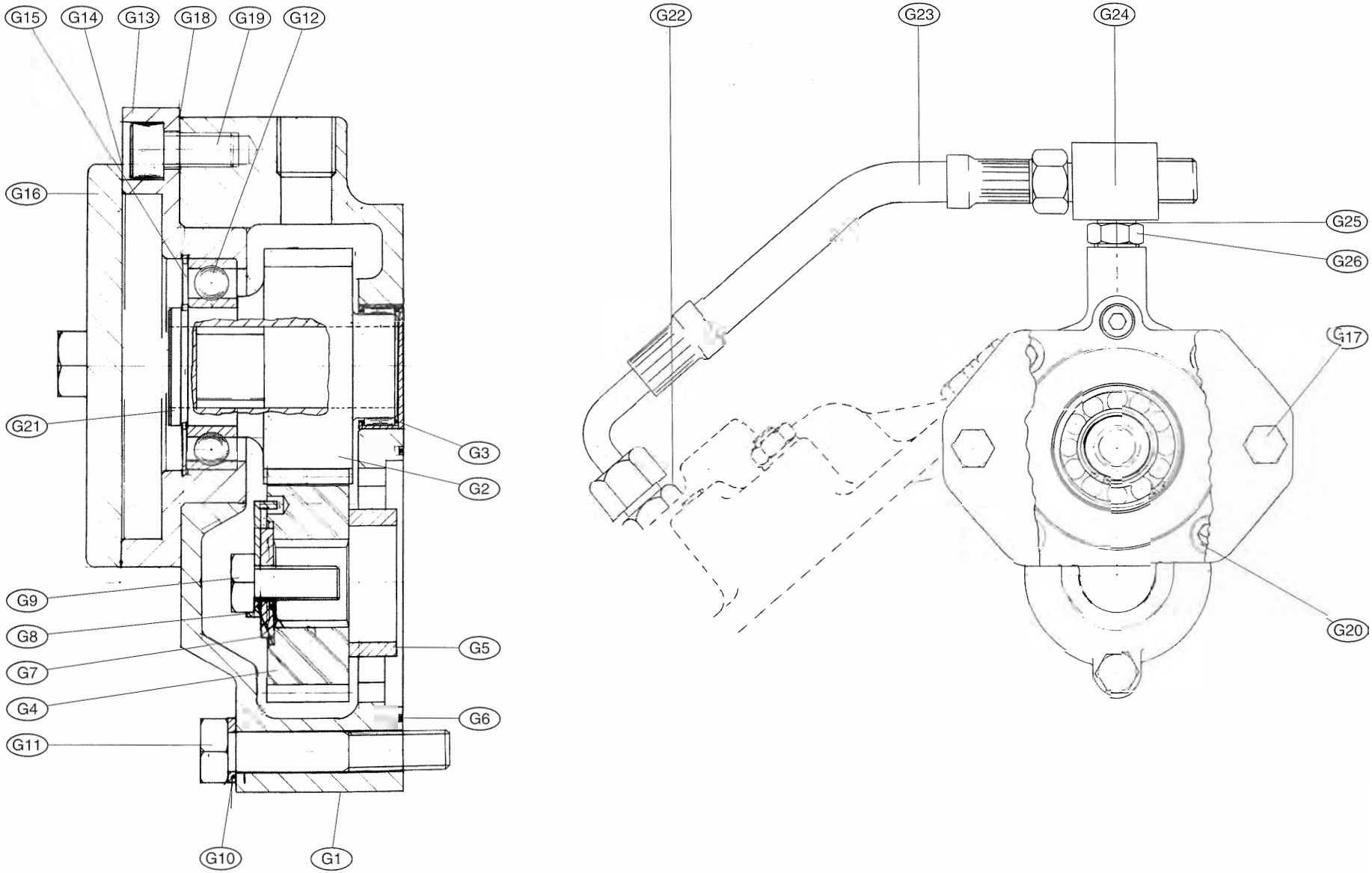
SECTION F - OUTPUT SHAFT ASSEMBLY			
ITEM NO.	DESCRIPTION	PART NO.	QTY
F1	End cover	MT1529	1
F2 *	'O' ring	04305725	1
F3	Screw	0040606	2
F4	Special tab	MT986	1
F5	Bearing retaining washer	MT984	1
F6	Needle bearing	0564001	1
F7	Circlip	0250620	1
F8	Spacer	MT987	1
F9	Output gear 1.459:1 (54T)	MT1585	1
F9	Output gear 1.935:1 (60T)	MT1254	1
F9	Output gear 2.565:1 (59T)	MT1419	1
F9	Output gear 2.904:1 (61T)	MT1316	1
F10	Spacer	MT717	1
F11	Output shaft	MT1423	1
F12	Circlip	CP1194	1
F13	Bearing	MT451	1
F14 *	'O' ring	004754	1
F15	End cover	MT1424	1
F16 *	Oil seal	MT252	1
F17 *	'O' ring	002123	1
F18	Output coupling	MT755	1
F19	Washer	MT1251	1
F20	Nut	MT1488	1
F21	Screw	0041009	4
F22	Spring washer	0191106	4
F23	Split pin	024M345	1

* Part of gasket/seal kit MT0434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G25
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G17
G20

SECTION G - POWER TAKE-OFF			
ITEM NO.	DESCRIPTION	PART NO.	QTY
G	Power Take-Off	MT0193	1
G1	PTO housing	MT1300	1
G2	Driven gear	MT1297	1
G3	Needle bearing	0563003	1
G4	Driving gear	MT1296	1
G5	Spacer	MT1589	1
G6 *	'O' ring	0430771	1
G7	Washer	MT1301	1
G8	Tab washer	MT1302	1
G9	Screw	0041008	1
G10	Spring washer	0191107	3
G11	Bolt	0041216	1
G12	Ball bearing	40M433	1
G13	Adaptor flange	MT1299	1
G14	Gasket 4 bolt	MT1307	1
G14	Gasket 2 bolt	MT5012	1
G15	Circlip	0250620	1
G16	Cover plate	MT1293	1
G17	Screw	0041208	2
G18	Gasket	MT1303	1
G19	Cap screw	0081520	1
G20	Cap screw	0081685	2
G21	Circlip	CM2067	1
G22	Adaptor	CP1255	1
G23	Oil pipe	MT766	1
G24	Tee piece	CP1367	1
G25	Washer	0201715	1
G26	Metering union	MT4583	1

* Part of gasket/seal kit MT0434

SERVICE NOTES

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NOTES

FROM **NEWAGE**

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