NEWAGE

PRM

MARINE GEARBOX

workshop manual

PRM HYDRAULIC MARINE GEARBOXES

PRM 140S
PRM 140T
PRM 140L

PRM 265S
PRM 265T
PRM 265L

WORKSHOP MANUAL

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FIFTH EDITION

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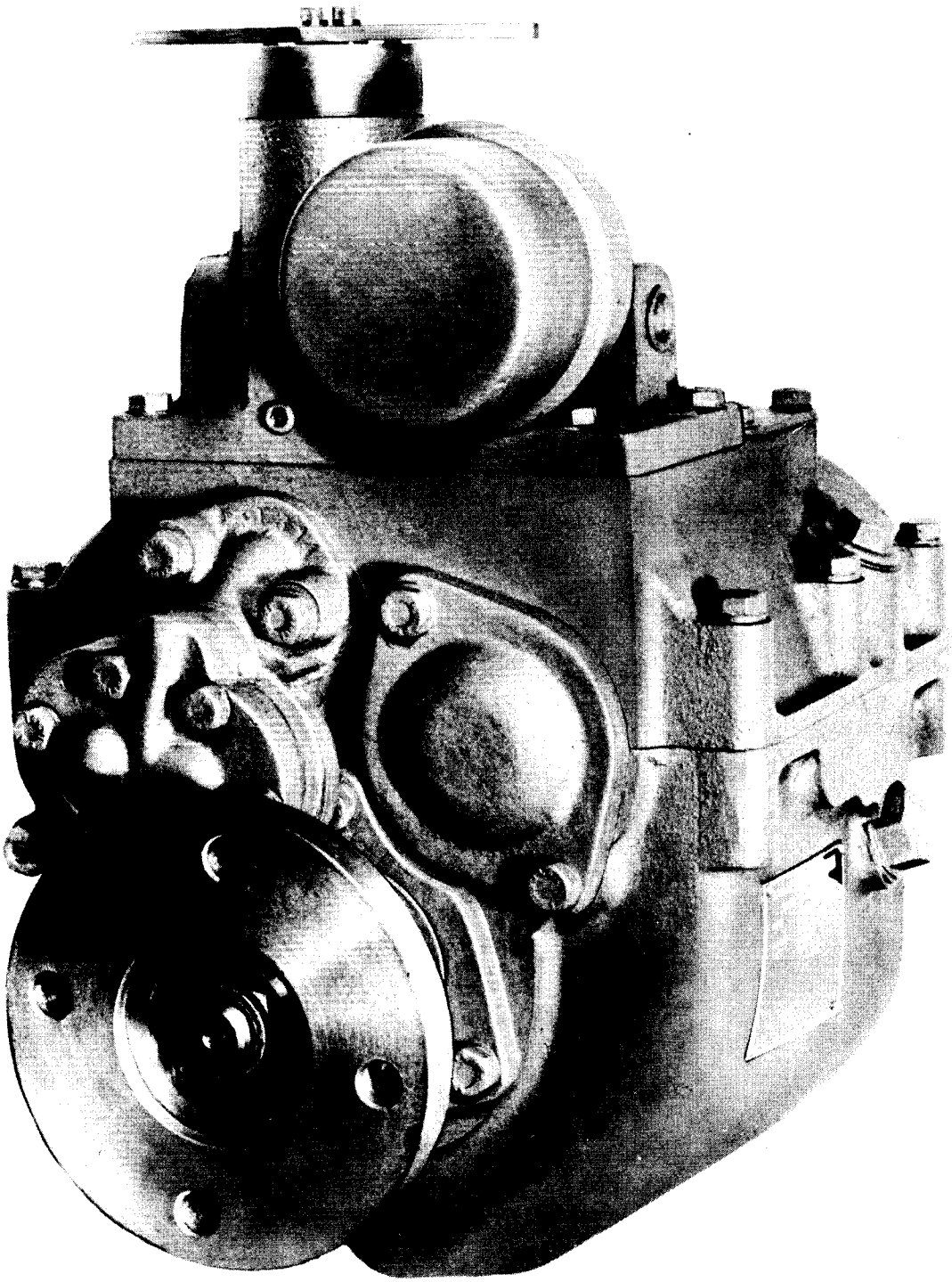


Fig. 1 - PRM Gearbox

FOREWORD

The workshop manual has been prepared to assist the operator or user of PRM marine gearboxes and also to enable the skilled service engineer to undertake more detailed maintenance and overhaul.

The manual is divided into three basic sections; operation, maintenance and service parts. Detailed breakdown of text and illustration references are shown on the contents page.

GENERAL INFORMATION

PRM hydraulic marine gearboxes will give trouble-free service provided they are correctly installed, aligned and maintained. In the event of failure, the engine distributor who supplied the gearbox, or his local dealer, should be informed; where this is not possible, Newage Engineers Limited, or the distributor for the area, should be notified. In all communications, verbal or otherwise,the model and serial number of the gearbox must be quoted in order to ensure correct identification and supply of parts.

CLAIMS UNDER WARRANTY

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

SERVICE PARTS

The comprehensive illustrated parts list at the end of the book gives full information and ordering procedures.

CONTENTS

ILLUSTRATIONS

GENERAL DATA

PRM140

Input Torque Capacity	140 lbf.ft (19.4 kgm) continuous, ahead or astern
Input Speeds	Up to 3,600 rev/min continuous, 4,000 rev/min intermittent.
Input Rotation	Accommodates either clockwise (right-hand) or anti-clockwise (left-hand) rotating engines.
Output Rotation	Either clockwise or anti-clockwise as required, irrespective of gear ratio or input rotation.
Gear Ratios	Direct drive (1:1), or integral reduction of 1.96:1 or 2.94:1.
Oil Capacity	
Positions VR and VL	2½ pints (1.4 litres) approximately
Positions HR and HL	3 pints (1.7 litres) approximately
Oil Pressure	
Working	180 - 210 p.s.i. (12.7 - 14.8 kg/cm^2)
In neutral	60 p.s.i. (4.2 kg/cm^2)
Oil Temperature (Working)	50^o - 80^{o}C dependent on ambient temperature. Maximum permissible working temperature 90^{o}C.
Thrust Capacity - (ahead and astern)	
Direct Drive	1700 lbf (771 kg) (7.6 kN)
2:1	1900 lbf (862 kg) (8.5 kN)
3:1	2700 lbf (1225 kg) (12.1 kN)
Approx. Dry Weight	
PRM140 (S & T)	120 lb (54 kg) approximately
PRM140L	130 lb (59 kg) approximately

Overall Dimensions	PRM140S		PRM140T		PRM140L	
	in.	mm	in.	mm	in.	mm
Length	13.875	352	14.475	368	15.685	398
Width	10.37	263	10.37	263	10.37	263
Height	16.68	424	16.68	424	16.68	424

Installation Angle	Maximum permissible water line installation angle (fore and aft) : 17^o.

PRM265

Input Torque Capacity	265 lbf.ft (36.5 kgm) continuous, ahead or astern
Input Speeds	Up to 2,500 rev/min continuous, 3,000 rev/min intermittent.
Input Rotation	Accommodates either clockwise (right-hand) or anti-clockwise (left-hand) rotating engines.
Output Rotation	Either clockwise or anti-clockwise as required, irrespective of gear ratio or input rotation.
Gear Ratios	Direct drive (1:1) or integral reduction of 1.459:1 1.96:1 or 2.94:1.
Oil Capacity	
Positions VR and VL	5½ pints (3.25 litres) approximately
Positions HR and HL	4½ pints (2.5 litres) approximately
Oil Pressure	
Working	180 - 210 p.s.i. (12.7 - 14.8 kg/cm^2)
In neutral	60 p.s.i. (4.2 kg/cm^2)
Oil Temperature (Working)	50^o - 80^{o}C dependent on ambient temperature. Maximum permissible working temperature 90^{o}C.
Thrust Capacity - (ahead and astern)	
Direct Drive	2200 lbf (998 kg) (9.8 kN)
1.5:1	2350 lbf (1066 kg) (10.4 kN)
2:1	2500 lbf (1134 kg) (11.1 kN)
3:1	3600 lbf (1633 kg) (16.0 kN)
Approximate Dry Weight	
PRM265 (S & T)	168 lb (76 kg)
PRM265L	178 lb (81 kg)

Overall Dimensions	PRM265S		PRM265T		PRM265L	
	in.	mm	in.	mm	in.	mm
Length	14.75	375	15.42	392	16.555	420
Width	11.75	298	11.75	298	11.75	298
Height	18.06	459	18.06	459	18.06	459

Installation Angle	Maximum permissible water line installation angle (fore and aft) : 17^o.

INTRODUCTION

PRM hydraulic marine gearboxes are compact, highly efficient and capable of transmitting full engine torque continuously both ahead and astern. Both clockwise and anti-clockwise rotating engines can be accommodated, and either clockwise or anti-clockwise output rotation can be provided, irrespective of the input rotation.

Note: **When describing engine rotation, face the end of the engine on which the transmission is to be mounted and describe the rotation accordingly. Similarly, describe the transmission output rotation as clockwise or anti-clockwise as seen when standing behind the gearbox output coupling facing towards the input or engine end of the transmission.**

CONSTRUCTION

The transmission comprises an input shaft assembly, a layshaft assembly and an output shaft. In all models except the PRM140T and PRM265T the input shaft is splined; the PRM140T and PRM265T incorporate a tapered input shaft.

The input shaft, which is supported by a roller bearing at the drive end and a ball race at the non-drive end, incorporates a drive pinion of the required ratio, an emergency drive engaging ring, forward drive clutch plate assembly, the clutch gear and hydraulically operated piston to actuate the clutch. The layshaft is supported by similar bearings and incorporates a drive pinion of the same ratio, the reverse drive clutch plate assembly, a clutch gear of opposite hand rotation to the one on the input shaft,and hydraulically operated piston to actuate the clutch.

The emergency drive engaging ring forms part of the layshaft assembly where the gearbox is fitted to an installation which includes an engine of left-hand crankshaft rotation and a left-hand propeller, or a right hand rotating engine together with a right hand propeller. With twin-engine installations which include one right-hand propeller and one left-hand propeller, the drive ring is fitted to the input shaft in one gearbox and to the layshaft in the other gearbox.

The output shaft is supported by a roller bearing at the forward end and a ball race capable of accepting thrust at the output end, and carries the appropriate size output gear, and the output flange.

Sealing arrangements for the PRM140 include a 54 millimetre bore seal, with 9½ millimetre retainers on the output shaft, and a 25 millimetre bore seal on the input shaft. Seals of similar type are fitted on the PRM265, the bore of the output shaft seal bearing being 68 millimetres with 9½ millimetre retainers and the bore of the input shaft seal being 30 millimetres. A magnetic drain plug is fitted at the front of the gearbox casing; this can be removed for connection of suitable pipework to the two-way tap and the hand-operated sump drain pump provided on most engines.

The gearbox casing has been kept free from hydraulic pipes, clyinders and associated components, and the only items mounted externally are the oil pump, oil filter and hydraulic control valves and operating lever.

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

Oil pump

A cast iron gear-type pump externally mounted at the rear of the gear case and normally driven by the layshaft supplies oil at high pressure for actuation of the clutch assemblies. For continuous lubrication of the clutches and for circulation through the oil cooler, the pressure is reduced.

When the transmission is used with anti-clockwise engines the oil pump is mounted in a standard position as illustrated in Fig. 1 whether a clockwise (right-hand) or anti-clockwise (left-hand) output rotation in ahead drive is required. If the transmission is to be used with clockwise rotating engines, the oil pump has to be mounted in a position 180° from normal.

Note: **This is normally done in the factory when the gearbox is assembled.**

Valve block

The valve block, located on top of the casing, contains the main control valve, a high-pressure relief valve, and two pressure differential valves, all of which are accessible cartridge-type units. The high pressure relief valve is integral with the control valve, which controls the operation of the clutch assemblies. One of the

pressure differential valves protects the oil cooler and the other diverts lubricating oil, surplus to clutch requirements, back to the sump.

The turret, or drum, section of the valve block houses the control valve and is fitted with a spring-loaded neutral detent. This detent also ensures positive selection of either the forward or reverse operating position, and an added feature is the provision of an end stop to safeguard against possible overshoot of the operating lever. The lever has two-cable entry positions, one at each end.

A cartridge-type 15 micron by-pass filter, mounted on the valve block, provides continuous filtration of the circulating oil.

INSTALLATION POSITIONS

In their standard versions PRM gearboxes are built so that the input shaft is the right-hand one of the two top shafts (as seen looking on the gearbox from behind). In order to provide a vertical offset between input and output shaft centres, the gearbox is mounted to the engine tilted at an angle to port; this is the standard installation position, and is referred to as **VR mounting.** Unless we are specifically notified to the contrary when orders are placed all gearboxes are automatically built for VR mounting.

For installation reasons it may occasionally be desirable for the output shaft to be offset horizontally rather than vertically.

If a left-hand (port) offset is required, **HR mounting** should be specified; again the right-hand top shaft is used as the input, but the gearbox is mounted at an angle of tilt to starboard such that the required offset is achieved. The standard breather is blanked off and an alternative air filter is fitted; the dipstick is re-positioned on the port side of the gearcase. In the case of the PRM265 (but not the PRM140) the interior of the gearbox is also modified by the provision of baffle plates and an extended oil intake pipe.

For the relatively few cases where installation requirements dictate the use of twin engines with horizontally offset shafts, twin gearboxes can be used, one built for HR mounting, the other for **HL mounting.** In this case, the left hand shaft is used as the input, the gearbox being mounted at an angle of tilt to port such as the horizontal offset to starboard is obtained. A special oil intake pipe is fitted, the standard breather is blanked off and replaced by an alternative air filter, and the dipstick is positioned on the starboard side of the gearcase.

The remaining installation position, **VL mounting** is no longer offered but since some earlier transmissions may have been built to this specification, a brief description is in order. The input shaft is the left-hand of the two top shafts, and the gearbox is tilted to starboard so that there is a vertical offset between the input and output shaft centres. A standard air filter is used, but the dipstick is positioned on top of the gearcase on the port side.

Installation procedures

"S" and "T" version transmissions are usually mounted to the flywheel housing provided by the engine manufacturer by means of adaptor flanges, of which SAE2 and SAE3 are most commonly used with the PRM265, whilst SAE4 and SAE5 are most often used with PRM140. However, special flywheel housings to which the gearbox can be fitted direct without the need for an adaptor can also be supplied for certain specific engines.

"L" version gearboxes are provided with a mounting flange already fitted.

Before installing the transmission, check that it is correct for the installation position required. The mounting position is stamped on the gearbox serial number plate, but the prudent installer will also make a visual check of the input shaft, breather and dipstick by referring to the previous section, in case the gearbox has been modified after leaving the factory. Having done this, proceed as follows:—

PRM140S and PRM265S

1. Mounting the damping, or drive, plate to the engine flywheel, using an alignment mandril (If available) and secure. If a mandril is not available, tighten the drive plate bolts just sufficiently to prevent free movement, assemble the gearbox to the drive plate and rotate the engine two or three revolutions by hand to line up the plate. Tighten two or three opposite bolts through the flywheel housing inspection cover.
2. Remove the gearbox and fully tighten the drive plate bolts.

3. Taking care to ensure correct alignment, mount the adaptor flange or flywheel housing to the front of the gearbox.

4. Offer up the gearbox and adaptor (or gearbox and flywheel housing) assembly to the damping, or drive plate and engine flywheel housing (or back-plate) and enter the input shaft spline on the damping plate (it may be necessary to rock the gearbox slightly to ensure that the shaft enters). Press the assembly fully into position and bolt the adaptor to the flywheel housing (or the flywheel housing to the engine back-plate).

5. Mount an approved type oil cooler to the adaptor, remove the two "Redcap" plugs from the ends of the valve block and connect the cooler inlet and outlet oil connections to the block. Connect the appropriate water hoses, or pipes, to the cooler water connections, one at each end of the cooler.

6. If remote control of the gearbox is required, remove the operating lever from the valve block and connect up the control equipment in accordance with the manufacturer's instructions.

7. Connect the output flange via a suitable coupling to the propeller shaft.

8. If the oil pressure is to be indicated, an oil pressure gauge should be connected to the valve block in the positions shown in Figs. 2 and 3.

9. Check the gearbox for oil, and if necessary, fill with one of the recommended lubricants to the 'High' mark on the dipstick.

10. Set the control lever to the neutral position and run the engine to allow the oil to circulate through the oil cooler. Stop the engine and again check the level when the oil has settled.

PRM140L and PRM265L

1. Mount the damping, or drive, plate to the engine flywheel, using an alignment mandril (if available) and secure. If a mandril is not available, tighten the drive plate bolts just sufficiently to prevent free movement, assemble the gearbox to the drive plate and rotate the engine two or three revolutions by hand to line up the plate. Tighten two or three opposite bolts through the flywheel housing inspection cover.

2. Remove the gearbox and fully tighten the drive plate bolts.

3. Offer up the gearbox assembly to the damping, or drive plate and engine flywheel housing and enter the input shaft spline in the opposite spline on the drive plate (it may be necessary to rock the gearbox slightly to ensure that the shaft enters). Press the assembly fully into position and bolt the mounting flange to the flywheel housing.

4. Mount an approved type oil cooler to the adaptor, remove the two "Redcap" plugs from the ends of the valve block and connect the cooler inlet and outlet oil connections to the block. Connect the appropriate water hoses, or pipes, to the cooler water connections, one at each end of the cooler.

5. If remote control of the gearbox is required, remove the operating lever from the valve block and connect up the control equipment in accordance with the manufacturer's instructions.

6. Connect the output flange via a suitable coupling to the propeller shaft.

7. If the oil pressure is to be indicated, an oil pressure gauge should be connected to the valve block in the positions shown in Figs. 2 and 3.

8. Check the gearbox for oil, and if necessary, fill with one of the recommended lubricants to the 'High' mark on the dipstick.

9. Set the control lever to the neutral position and run the engine to allow the oil to circulate through the oil cooler. Stop the engine and again check the level when the oil has settled.

PRM140T and PRM265T

1. Mount the driver half of the input coupling to the engine flywheel by using the outside diameter (8.5 in) (215.9 mm) for location.

2. Fit the flexible inner member into the centre of the driver half coupling.

3. Taking care to ensure correct alignment, bolt the appropriate adaptor flange or flywheel housing to the mounting face of the gearbox.

4. Fit the driven half coupling to the tapered input shaft of the gearbox using the key, washer and lock nut supplied.

5. Offer up the gearbox and adaptor flange or flywheel housing to the engine backend ensuring that driver and driven halves of the input coupling are correctly located.

6. Fit and tighten the bolts securing the adaptor flange or flywheel housing to the engine backend.

7. Mount an approved type oil cooler to the adaptor, remove the two "Redcap" plugs from the ends

of the valve block and connect the cooler inlet and outlet oil connections to the block. Connect the appropriate water hoses, or pipes, to the cooler water connections, one at each end of the cooler.

8. If remote control of the gearbox is required, remove the operating lever from the valve block and connect up the control equipment in accordance with the manufacturer's instruction.

9. Connect the output flange via a suitable coupling to the propeller shaft.

10. If the oil pressure is to be indicated, an oil pressure gauge should be connected to the valve block in the position shown on the installation details drawing (see pages 10 and 11)

11. Check the gearbox for oil, and if necessary, fill with one of the recommended lubricants to the 'High' mark on the dipstick.

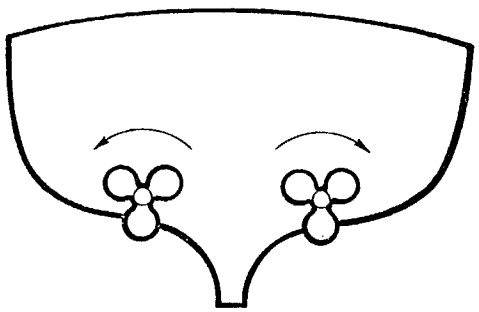
12. Set the control lever to the neutral position and run the engine to allow the oil to circulate through the oil cooler. Stop the engine and again check the level when the oil has settled.

Twin installations

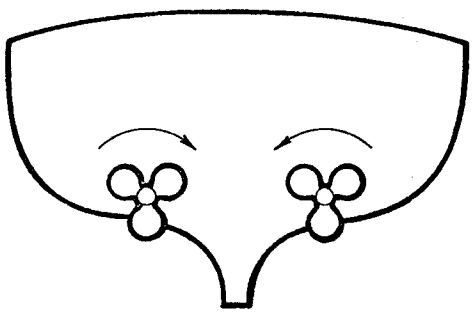
The rotating action of a propeller, even in a single installation, will have a slight "turning" effect on the handling of the boat, but this can be corrected by very small adjustments to the rudder.

In twin installations, the turning effect of the boat's handling 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, and it is for this reason that PRM gearboxes are capable of providing either hand of output rotation at any of the available gear ratios.

It is also preferable that the starboard (right hand) propeller should rotate clockwise and the port (left-hand) propeller anti-clockwise rather than the other way about since, in the latter case, when the propeller blades are at the lowest point of their arc of rotation they tend to create a vacuum which acts on the other propeller by reducing the flow of water to it. Furthermore, 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 one, causing the boat to be deflected from the line which it ought to follow and thus delaying completion of the manoeuvre.



Correct



Incorrect

Installation angle

The transmission and engine should normally be installed so that the maximum angle relative to the water line does not exceed 15^{o} with the boat at rest, or 17^{o} from all causes when under way. If installation angles greater than these are required our engineering department should be asked for its approval.

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

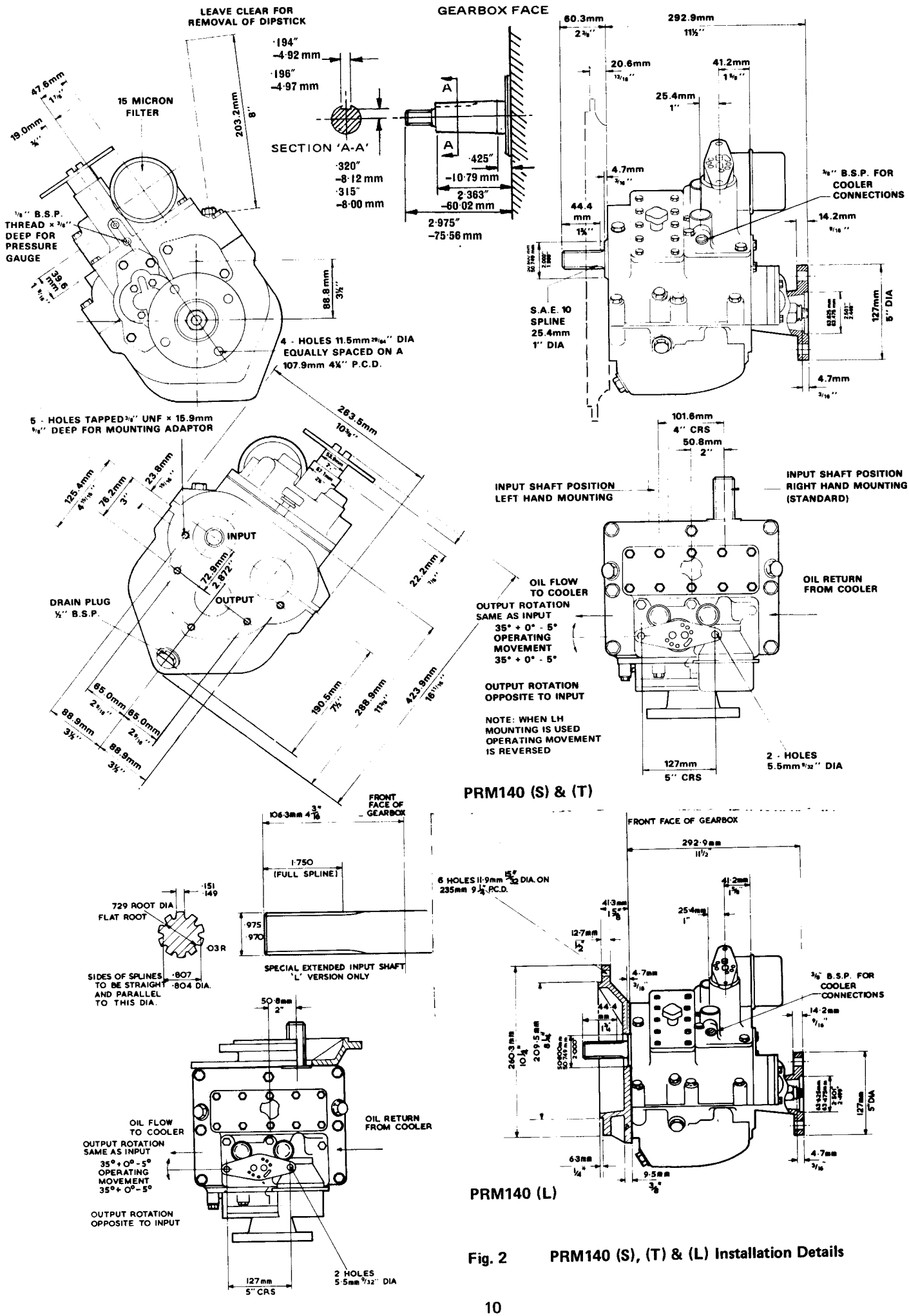


Fig. 2 PRM140 (S), (T) & (L) Installation Details

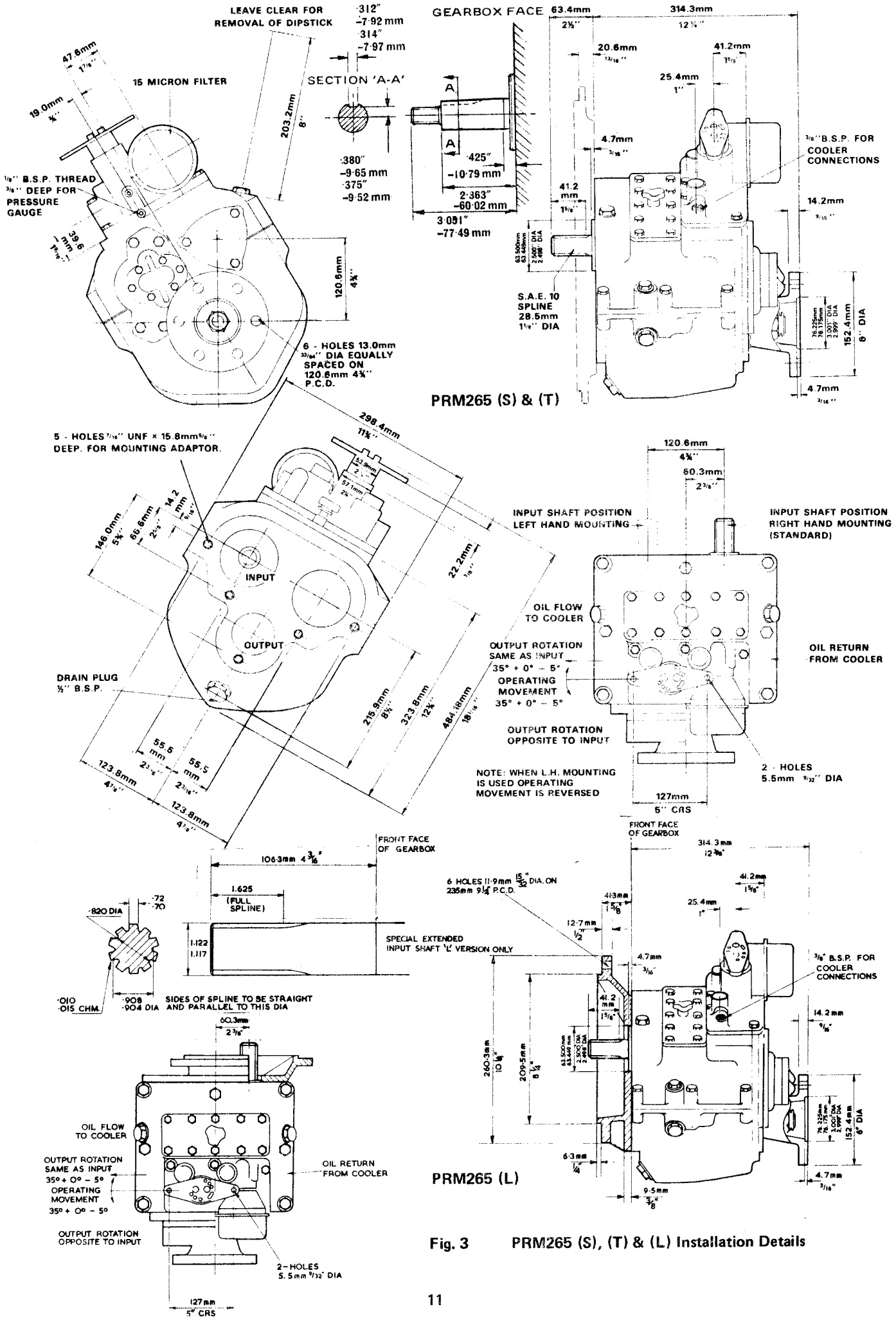
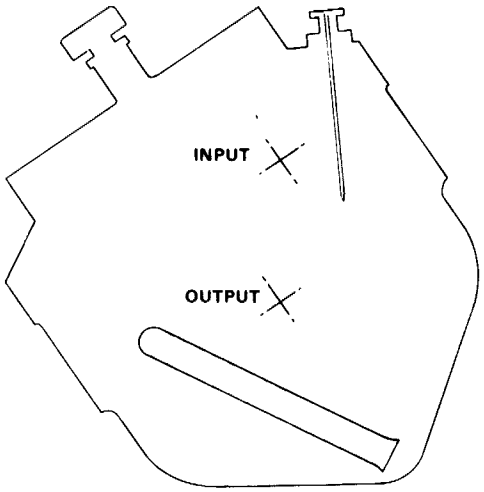
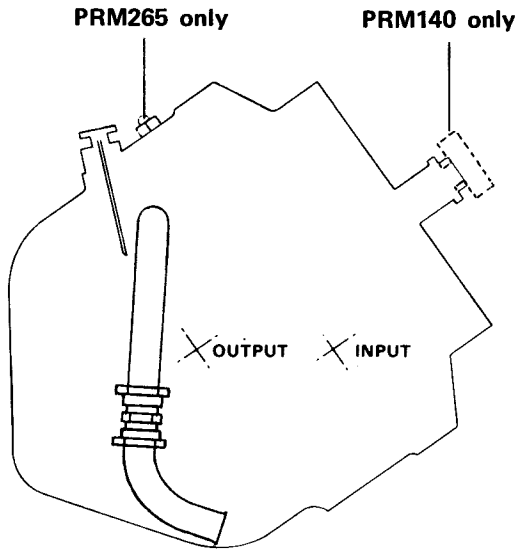


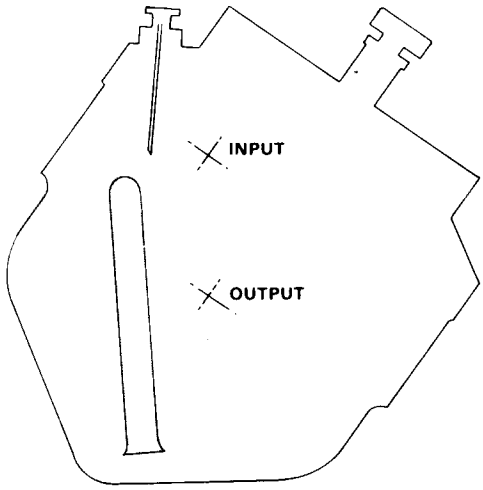
Fig. 3 PRM265 (S), (T) & (L) Installation Details



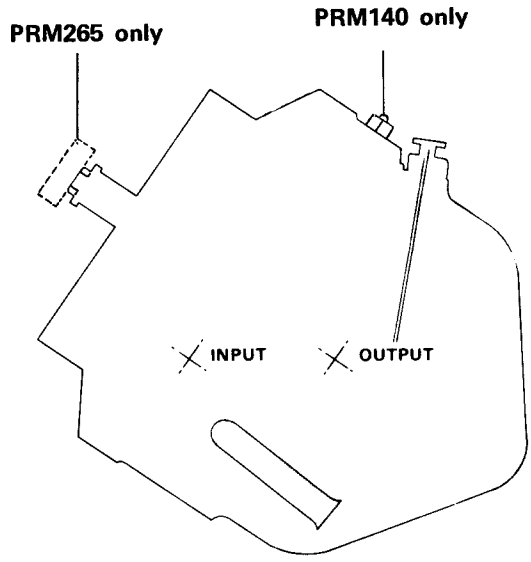
RIGHT HAND MOUNTING – VERTICAL (VR)
PRM140 & PRM265



RIGHT HAND MOUNTING – HORIZONTAL (HR)



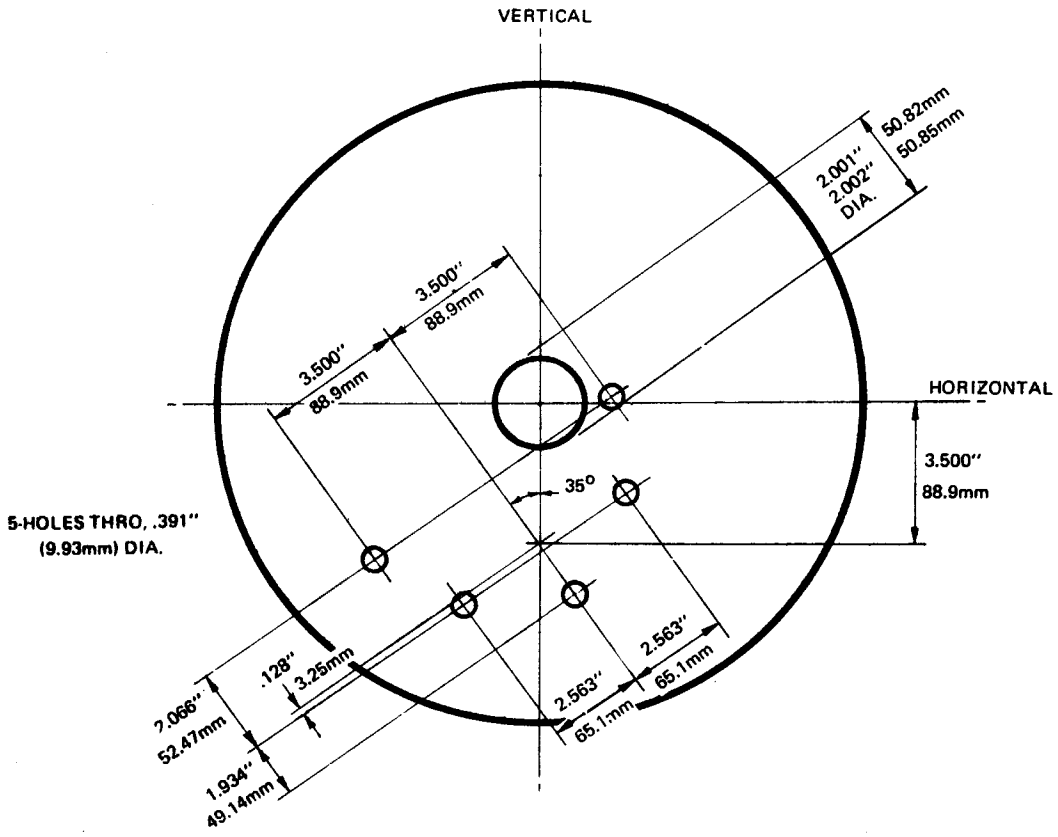
LEFT HAND MOUNTING – VERTICAL (VL)
PRM140 & PRM265



LEFT HAND MOUNTING – HORIZONTAL (HL)

Fig. 4 Basic Installation Positions

PRM140 (S) & (T)



PRM265 (S) & (T)

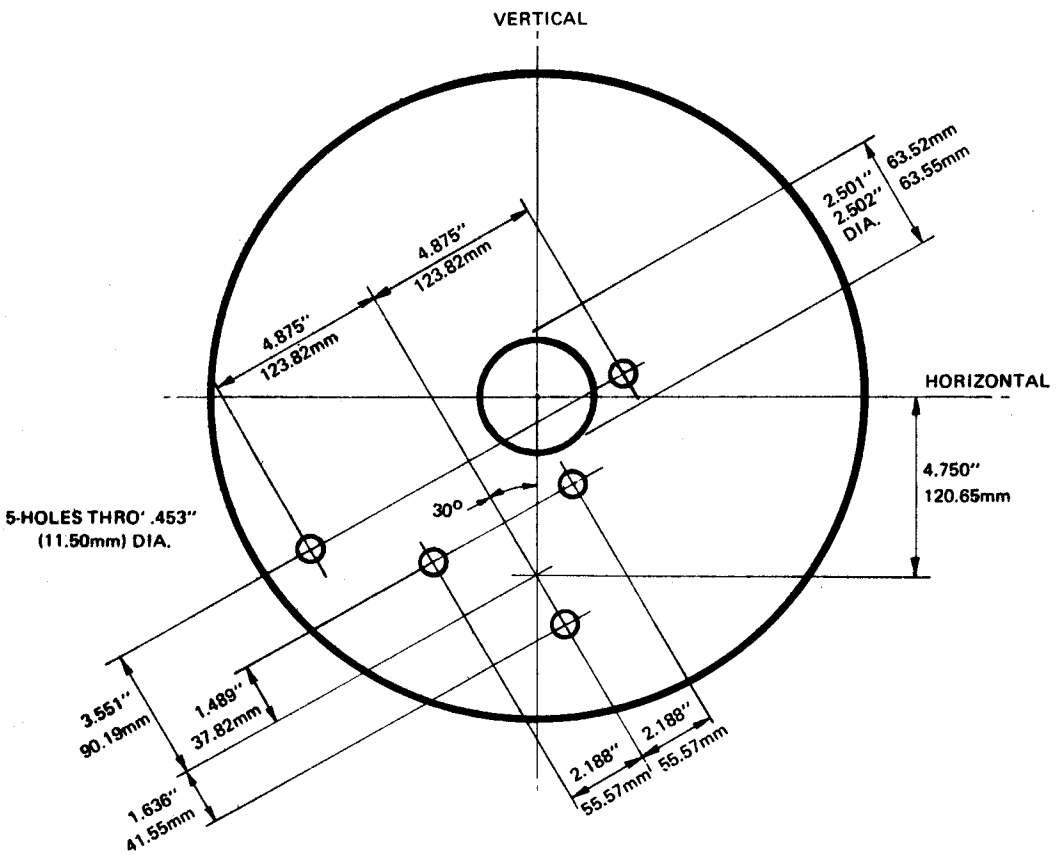


Fig 5 Adaptor Flange drilling details (Gearbox - adaptor)

RECOMMENDED LUBRICANTS

Climatic Conditions	Esso	Mobil	Shell	B.P.	Duckhams	Castrol
Above 90°F (32°C)	Esso Extra 20W/30 or Essofleet H.D.30	Delvac Oil 930	Rotella 30	Energol D.D.30	Duckhams Multrigrade Q20/50	Castrol C.R.30
90°F (32°C) down to 10°F (−12°C)	Esso Extra 20W/30 or Essofleet H.D. 20	Delvac Oil 920	Rotella 20/20W	Energol D.D.20W	Duckhams Multigrade Q20/50	Castrol C.R.20
10°F (−12°C) down to 0°F (−18°C)	Esso 10W or Essofleet H.D.10W	Delvac Oil 910	Rotella 10W	Energol D.D.10W	Duckhams Q5500	Castrol C.R.10

Propeller shaft couplings

It is generally considered preferable to couple the propeller shaft direct to the gearbox output flange by means of a rigid coupling, particularly in the majority of boats whose hulls have sufficient rigidity as not to allow flexing in heavy sea conditions, which could cause the engine and transmission to shift in relation to the propeller shaft.

Two of the main conditions when a flexible coupling should be used are:—

(a) in boats whose hulls are insufficiently rigid to prevent the flexing referred to above and

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

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

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

(i) the coupling should be a light 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 checked by feeler gauges above, below and on both sides of the coupling).

Coupling misalignment can cause vibration, gear noise and premature failure of oil seals or bearings. Since the propeller shaft line is normally fixed in the boat, alignment is usually obtained by adjusting engine mount shims or modifying the mounts themselves.

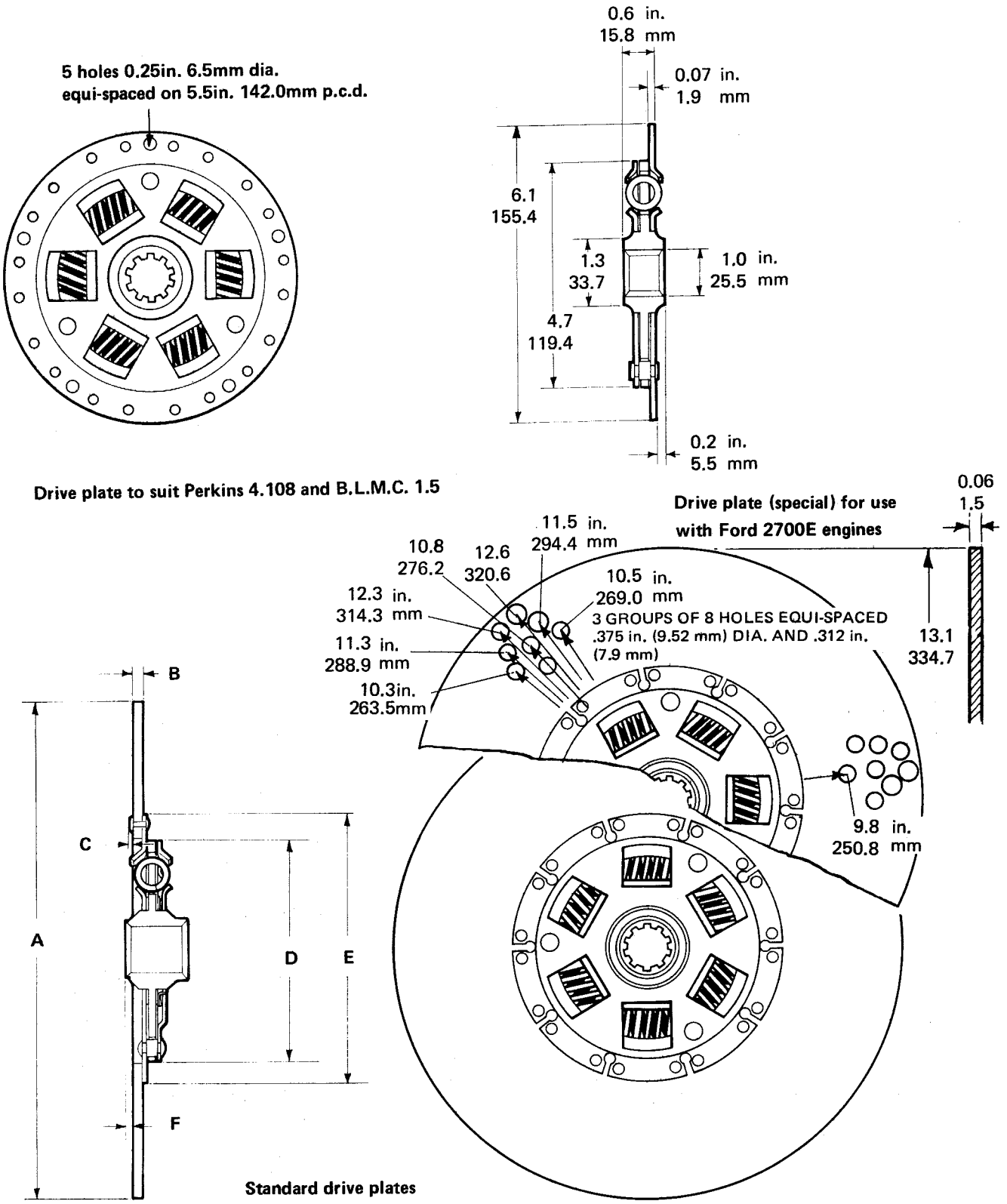
Spring drive plates and flexible input coupling

To transmit the drive from the engine to the gearbox either a spring drive plate (damper plate) or a flexible input coupling must be used. Each incorporates a degree of flexibility in order to damp down engine torsional or cyclic vibrations and prevent them being passed on to the transmission.

The strongest engine vibrations are caused by firing in the cylinders; diesel engines, which have high compression ratios, usually generate stronger vibration pulses than petrol (gasoline) engines. It is often the case that when comparing engines of roughly equivalent size, the engine with the greater number of cylinders will tend to run more quietly and smoothly than the one with fewer cylinders, although this is by no means always the case.

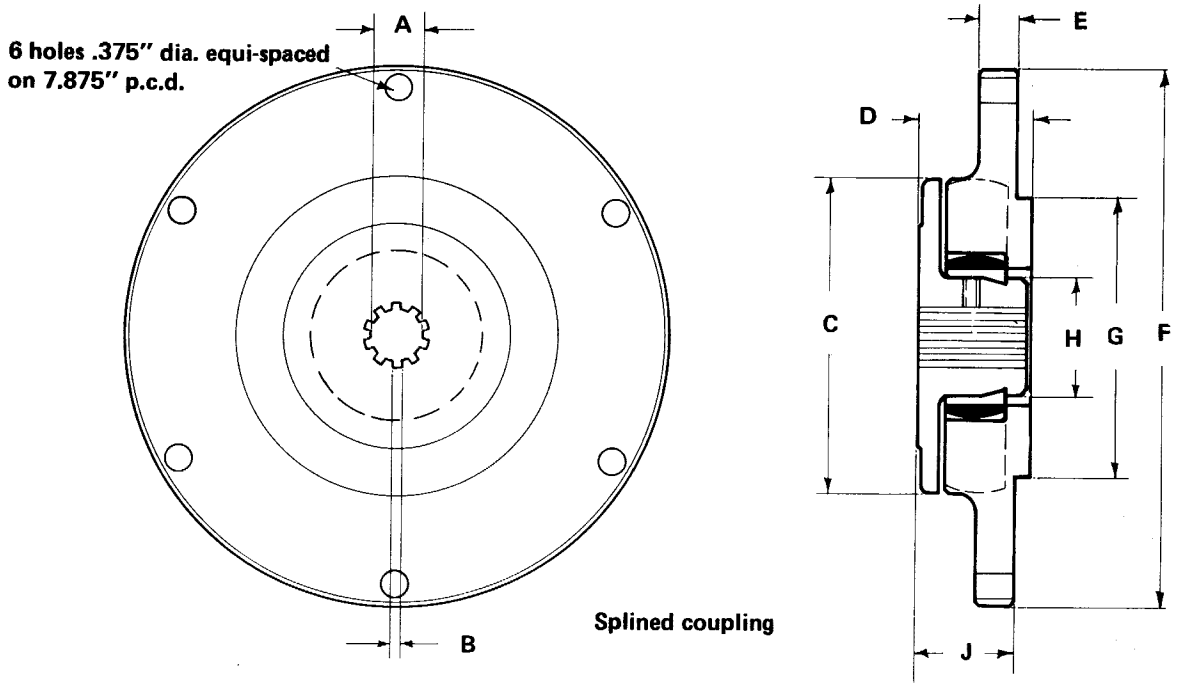
Spring drive plates supplied for use with PRM gearboxes are adequate to cope with the vibrations normally likely to be created by the engine, but gear rattle can sometimes occur at very low speeds. If this does happen, raising the idling speed slightly will usually eliminate this vibration.

Flexible input couplings are normally reserved for use in installations where really heavy duty operation, such as trawling, tug work and so on, is to be encountered; however, because they have better vibration damping characteristics than spring drive plates, they may also be used to advantage where excessive vibration is experienced.

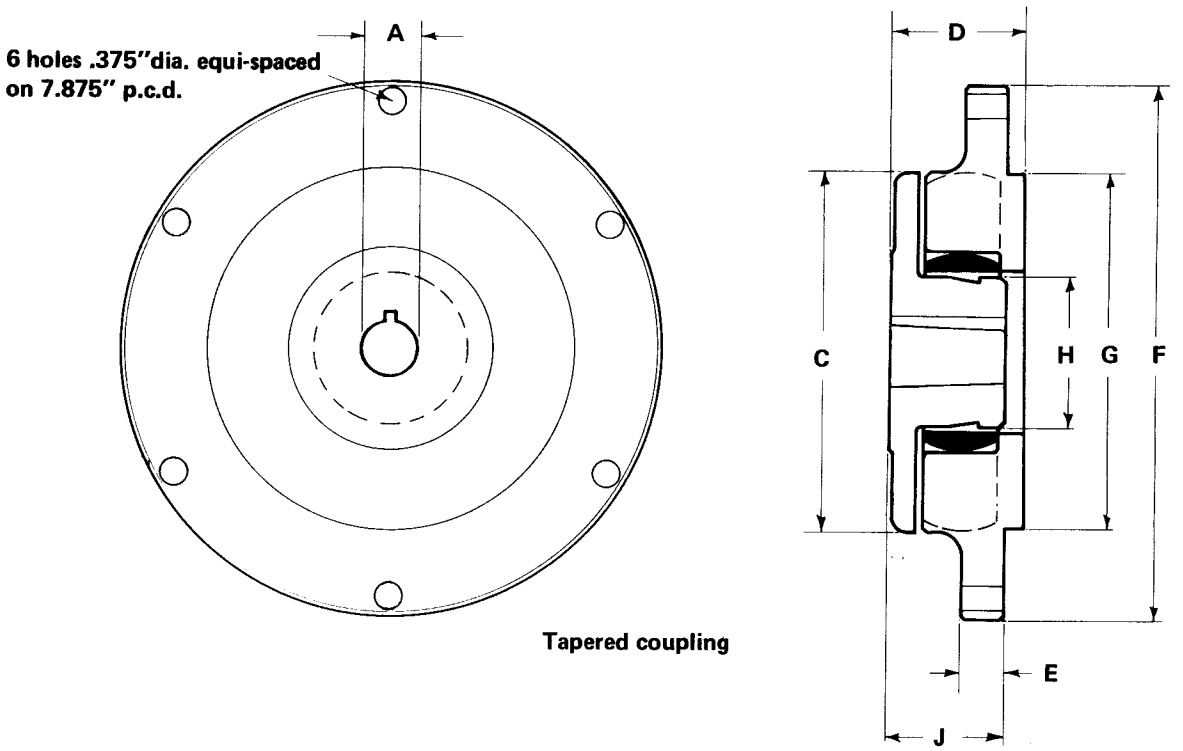


MODEL		A	B	C	D	E	F
PRM140	in	10.5	0.1	0.03	4.6	5.6	0.1
	mm	266.7	4.7	0.7	117.4	142.8	4.3
PRM265	in	11.5	0.1	1.7	5.5	6.5	0.3
	mm	292.1	4.7	45.0	139.7	165.1	9.1

Fig.6 Standard drive plates



MODEL		A	B	C	D	E	F	G	H	J
PRM140	in.	0.15	0.8	4.9	1.7	0.5	8.4	4.8	1.8	1.6
	mm	3.9	20.6	126.0	45.0	15.0	215.8	123.0	47.9	42.0
PRM265	in.	0.17	0.9	5.7	2.1	0.5	8.4	5.6	2.3	1.7
	mm	4.4	23.2	144.9	53.4	15.0	215.8	143.0	59.9	45.4



MODEL		A	B	C	D	E	F	G	H	J
PRM140	in.	0.9	—	4.9	1.7	0.5	8.4	4.8	1.8	1.6
	mm	24.3		126.0	45.0	15.0	215.8	123.0	47.9	42.0
PRM265	in.	1.1	—	5.7	2.1	0.5	8.4	5.6	2.3	1.7
	mm	29.5		144.9	53.4	15.0	215.8	143.0	59.9	45.4

Fig. 7 Flexible input couplings

Starting the engine

Before starting the engine ensure that the gearbox is in neutral. The neutral position is obtained when the operating lever is in the central position, which ensures that the flow of oil to the clutches is blocked at the control valve.

All PRM gearboxes are designed and tested to ensure that changes from "ahead" to "astern" or vice versa can be carried out at any engine speed up to the maximum recommended; however, transmisison life will be increased if engine speed is brought down to approximately 1000 rev/min when direction is being changed.

"Ahead" drive is obtained when, cable entry being from the starboard (right hand) side the operating lever is moved to the extreme forward position. If cable entry is from the port (left-hand) side, then ahead drive is obtained when the operating lever is moved to its extreme rear position.

"Astern" drive with starboard entry cable is obtained with the operating lever moved to the extreme rear position; conversely, with port entry cable astern drive is obtained with the operating lever in the extreme forward position.

All of the three positions for the operating lever, ahead, neutral and astern, are positively obtained by means of a spring loaded detent ball which enters a chamfered hole on the operating lever and gives a good "feel" to the operating mechanism.

Trailing (free-wheeling) the propeller

PRM gearboxes are designed and tested to ensure that prolonged periods of trailing (free-wheeling) the propeller are permissible without any detrimental effect to the transmission. It is not therefore necessary to provide any propeller shaft locking device.

OPERATION

With the control lever in the mid-point of travel or neutral position, and the engine running, the splined input drive shaft and clutch gear revolve at engine speed. The clutch gear, in continuous mesh with the clutch gear on the layshaft, drives the layshaft in the opposite direction, but the drive pinions do not rotate,

When the control lever is moved to the forward drive position, hydraulic action causes the clutch on the input drive shaft to engage and apply engine drive to the forward drive pinion. The pinion turns the gear on the output shaft and the propeller shaft and propeller rotate in the direction which corresponds with ahead movement of the vessel. Likewise when the control lever is operated to the reverse position the clutch on the layshaft engages and engine drive is applied to the reverse pinion. The pinion turns the gear on the output shaft in the opposite direction and the propeller shaft and propeller rotate in the direction corresponding to astern movement of the vessel.

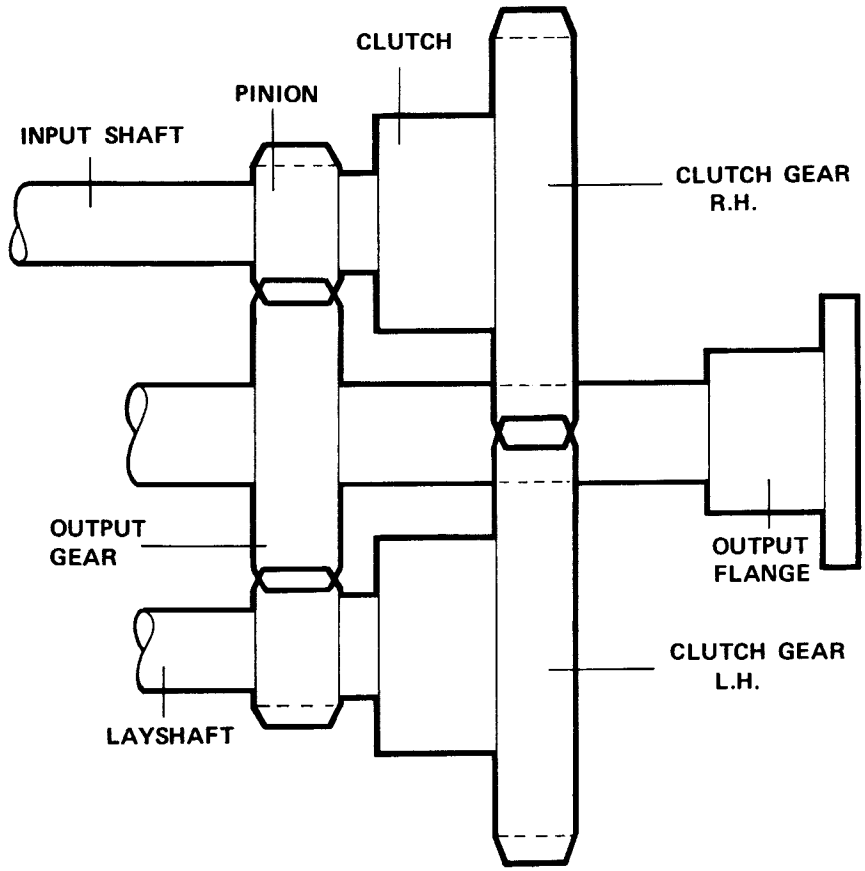


Fig. 8 Internal layout diagram – standard gearbox

Hydraulic action

The oil pump draws oil from the gearbox sump through the internal lubricating pipe and delivers it to the valve control block. A high pressure relief valve in the control valve maintains pressure, and oil flows through an outlet in the control valve, on through a channel, or passage, in the control block and a feeder on either the drive shaft or layshaft, depending on the lever position, to the appropriate piston.

Operation of the piston then actuates the corresponding clutch assembly.

Excess oil passes the high pressure relief valve for lubrication purposes.

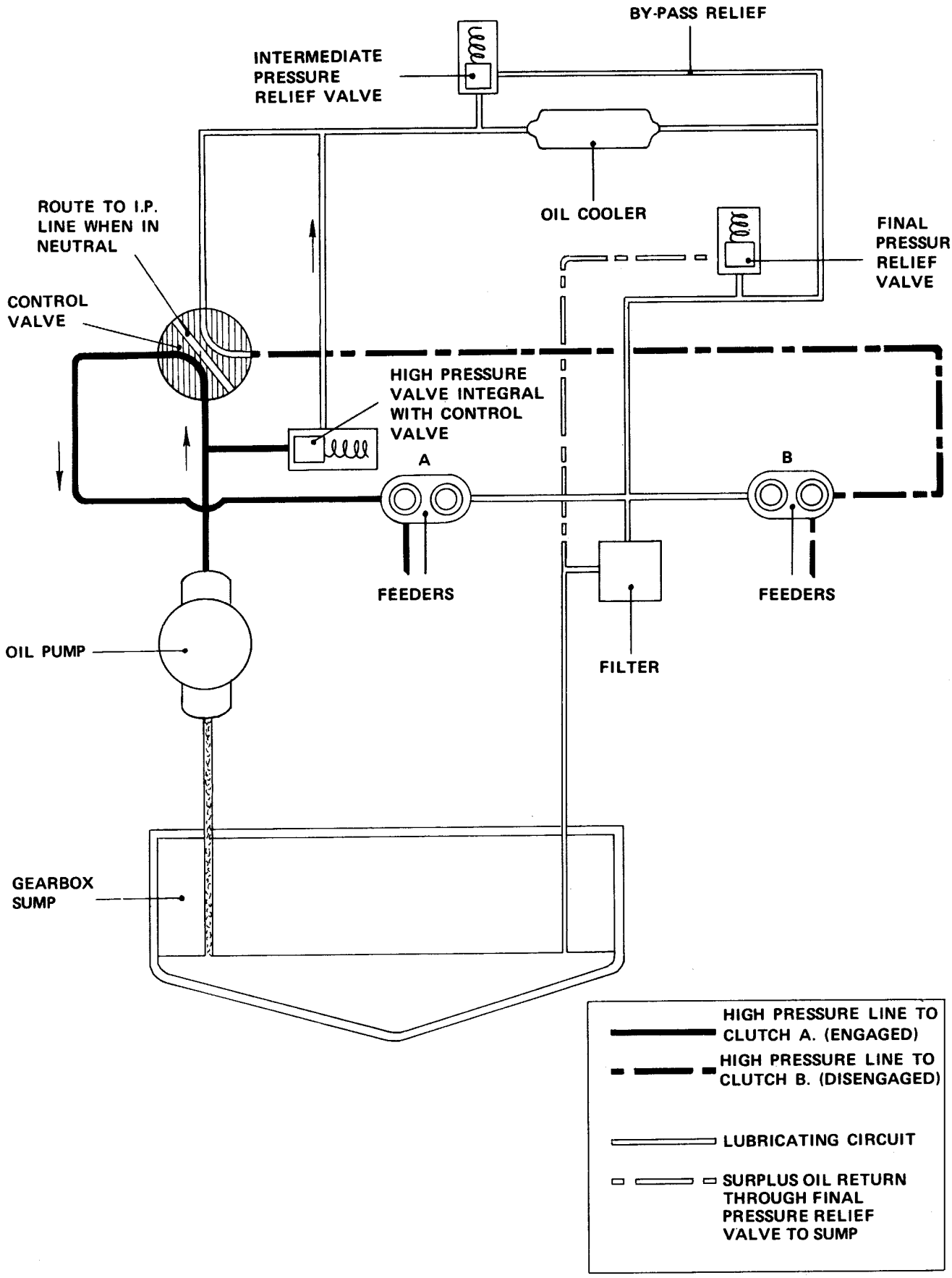


Fig. 9 Oil Flow Diagram

Lubrication

It will be seen from the oil flow diagram (Fig. 9) that oil for lubrication purposes is also delivered via the internal lubricating pipe to the control block. With the gearbox in neutral a subsidiary outlet in the control valve allows oil at reduced pressure to flow through the control valve and valve block to an external oil cooler which is protected by a differential pressure relief valve, or intermediate pressure relief valve. On returning from the cooler the oil is directed through channels in the valve block to the feeders and thence through the layshaft and drive shaft to lubricate the clutch assemblies.

With the gearbox in forward or reverse gear the oil is diverted via the high pressure relief valve in the control valve to the oil cooler and clutch assemblies.

Oil surplus to clutch requirements is pressurised by a second differential pressure relief valve, or final pressure relief valve, which opens and diverts the surplus oil back to the sump.

Emergency operation

A device is included in the gearbox which will permit the transmission to operate in the forward gear should hydraulic or clutch failure occur.

To lock the transmission in ahead drive simply remove the top cover, including fork, then replace the cover with fork in front of the emergency splined ring and move the cover back to align with the bolt holes.

The splined ring is thus removed to the engaged position.

Replace the cover bolts.

Note: **As this is purely an emergency 'get-you-home' device the engine should be set to only one third of full throttle to avoid the possibility of further damage due to lubrication difficulties. Permanent repairs should be undertaken as soon as possible after breakdown of the transmission and in all probability it will be necessary to strip the clutch assembly to dis-engage the mechanism, as described under "Service and Repairs".**

WARNING:

Under no circumstances must the access to the 'get-you-home' device be used to fill or top up the gearbox with oil.

ROUTINE MAINTENANCE

Initial servicing - after 25 hours running

Drain all oil from the transmission and refill with one of the recommended lubricants to the high level mark on the dipstick and operate the engine and transmission to allow the oil to circulate. Stop the engine and re-check the oil level when the oil has settled.

Daily

1. Check gearbox oil level.
2. Make a quick visual inspection of the general conditions of the transmission and to check for oil leakage at the output shaft oil seal, at gasket sealing surfaces or in the bell housing.
3. Listen for any unusual noises and check for their causes.

Annual

1. Check all oil cooler connections and hoses for leakage.
2. Check propeller shaft alignment.
3. Check that the remote control operating cable linkage (where fitted) is correctly adjusted to give correct amount of travel on the gearbox operating lever.

Winter storage

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

Other maintenance operations

1. Transmission oil should be changed at periods roughly corresponding with the intervals at which the engine oil is changed.
2. If the gearbox oil has suffered severe contamination by water, or if major mechanical damage has occured, it will be necessary to replace the external oil filter.

Gear rattle

Engine vibrations, caused by firings in the cylinders, can occasionally be transmitted to the gearbox, resulting in gear rattle; other factors influencing this include the inertia of the flywheel, the weight of the propeller shaft, alignment of the input coupling or drive plate on the flywheel, propeller shaft coupling alignment, and size and design of propeller.

If excessive rattle is experienced, action should be taken in the following order:—

1. Slightly increase the idling speed of the engine; in most cases this will eliminate the problem.
2. Check the alignment of the propeller shaft coupling by using feeler gauges on all four sides; rectify if necessary by adjusting the shims under the engine mounts or by adjusting the engine mounts themselves.
3. Remove the propeller and check that the pitch, weight, diameter and balance of all the blades are equal, and rectify if necessary.
4. Remove the transmission and check that the flywheel face is flat and that the drive plate or flexible input coupling is correctly aligned.
5. Check the gearbox for mechanical damage.

Oil pressures

The normal operating pressure of the hydraulic circuit is 180 – 210 psi (12.7 – 14.8 kg/cm^2). In order that this may be checked, connections are provided on the valve block to enable an oil pressure gauge to be fitted into the circuit.

Loss of oil pressure will result in the complete loss of drive through the gearbox, and if this does occur, the following checks should be made:—

1. Check for visible evidence of any oil leakage;
2. Check the oil level in the gearbox;
3. Remove the oil pump and check for damage, particularly to the pump spindle tang.

If these checks all prove negative, it is likely that the fault lies in the valve block. In this case, further advice should be sought from an authorised distributor or stockist.

SERVICE AND REPAIRS

The servicing or repair of components or assemblies on the input shaft or layshaft is simplified by the ease with which the shafts can be removed from the box without having to remove the complete unit from the installation.

This can be further simplified by fitting complete replacement shaft assemblies, and where skilled service personnel, or workshop facilities, or both, are not readily available, it may be found advantageous to adopt this procedure.

The maintenance of items on the output shaft, except for the rear oil seal, will require that the gearbox is removed from the boat.

A sectional arrangement of the gearbox is shown in Fig. 10, a dismantled input shaft assembly is illustrated, in Fig. 16, a layshaft assembly in Fig. 17 and the output shaft and the two halves of the gear casing in Fig. 15.

REMOVING THE INPUT SHAFT AND LAYSHAFT ASSEMBLIES

PRM140S, PRM140L, PRM265S and PRM265L

1. Drain the gearbox oil into a suitable container.
2. Remove the four bolts securing the oil pump to the casing and remove the pump.
3. Remove the two bolts (PRM140) or three bolts (PRM265) securing the drive shaft end plate or layshaft end plate (left-hand) mounting and remove the plate.
4. Disconnect the oil cooler pipes and the cable or cables from the control lever or control equipment.
5. Unscrew and withdraw the seven bolts and the one nut on the valve block which secure the top half of the casing. Lift off the casing complete with valve block assembly and top cover.
6. Slacken the flywheel damping plate securing bolts to allow slight movement of the plate when withdrawing the input shaft spline. On units incorporating 3:1 reduction it is recommended that all bolts except one are removed from the damping plate and the plate pivoted on this one bolt to enable the shaft to be lifted clear of the gear on the output shaft.
7. Raise the shaft, and if necessary gyrate a little to withdraw the spline from the opposite spline on the damping plate.
8. Once the spline is clear, lift the complete shaft assembly from the casing. Lift and remove the layshaft assembly and the front end cover from the casing.

PRM140T and PRM265T

1. Drain the gearbox oil into a suitable container.
2. Disconnect the oil cooler pipes and the cable or cables from the control lever or control equipment.
3. Remove the gearbox and adaptor flange from the engine backend.
4. Remove the lock nut and washer from the end of the input shaft and draw the driven half coupling hub from the tapered shaft by means of the hub-extractor.
5. Remove the four bolts securing the oil pump to the casing and remove the pump.
6. Remove the two bolts (PRM140) or three bolts (PRM265) securing the drive shaft end plate or layshaft end plate (left-hand mounting) and remove the plate.
7. Unscrew and withdraw the seven bolts and the one nut on the valve block which secure the top half of the caisng. Lift off the casing complete with valve block assembly and top cover.
8. Lift the complete shaft assembly from the casing. Lift and remove the layshaft assembly and the front end cover from the casing.

INPUT CLUTCH SHAFT

Oil seal

In the event of an oil leak due to a damaged seal, remove the input end housing from the shaft, and with the aid of a hard wood drift and hammer force the seal from the housing.

Fit a new seal part no. MT165 (PRM140) or MT251 (PRM265) in the housing and replace the housing.

Drive end bearing

To renew a damaged or worn bearing proceed as follows:—

1. Support the shaft in a vice and then remove the input housing and seal assembly.
2. Using circlip pliers remove the bearing circlip and spacer located behind.
3. Withdraw the clutch pinion, spacer and bearing using pulley extractors with the jaws of the extractors located behind the pinion.
4. Refit the clutch pinion to the shaft first ensuring that the splined emergency drive ring is in position on the pinion (right-hand mounted box).
5. Replace the pinion spacer, locate a new roller bearing part no. T7023 (PRM140) or 0533026 (PRM265) on the shaft and gently drive, with a hard wood drift hammer, or handpress the assembly into position. If the outer cage separates from the inner be careful not to damage the rollers.
6. Replace the bearing spacer and refit the circlip and end housing, first ensuring the seal and 'O' ring are intact.

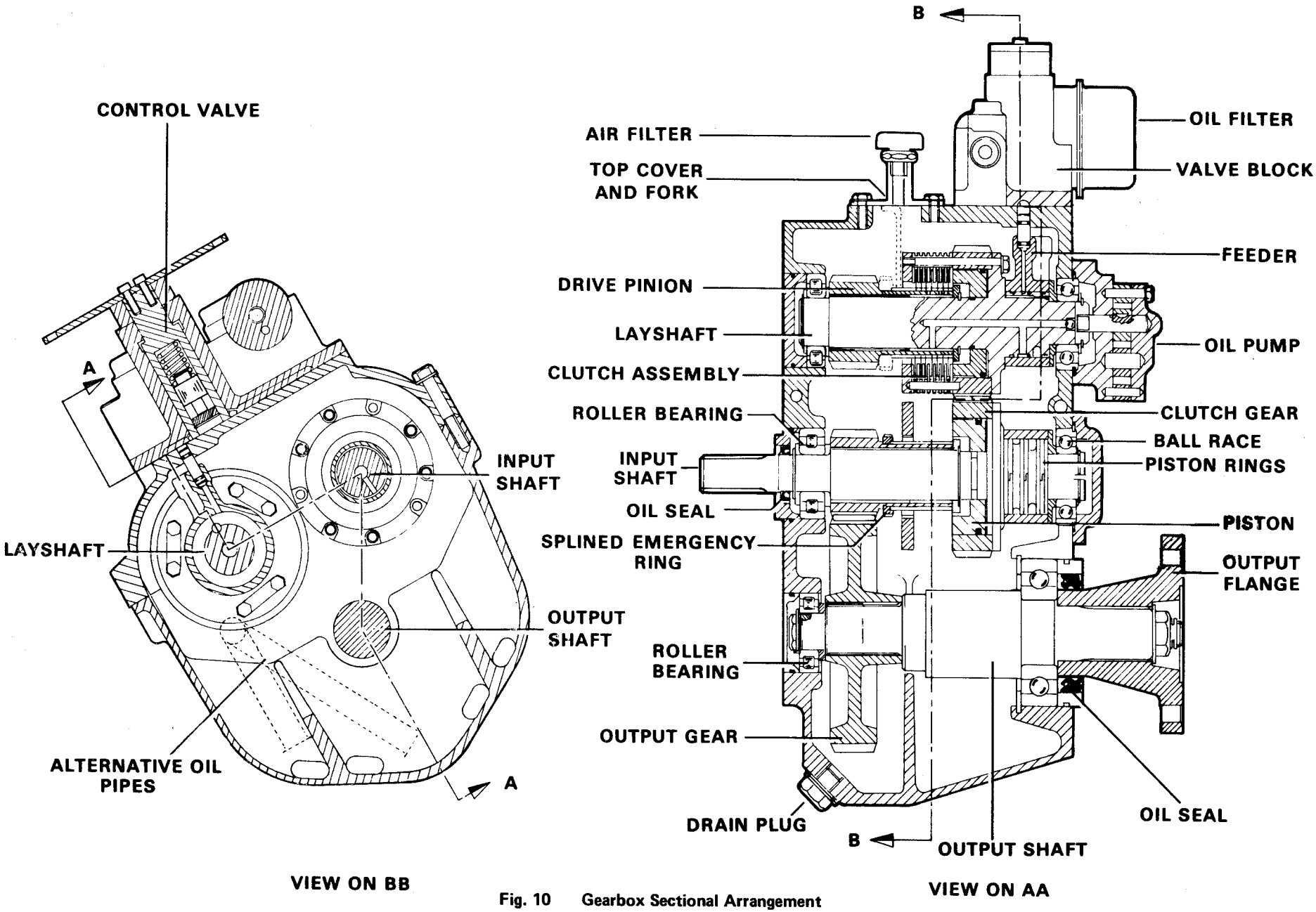


Fig. 10 Gearbox Sectional Arrangement

Clutch assembly

Clutch plates which are discoloured by overheating, or worn down to the extent of having lost their pattern of 'criss cross' grooves, will tend to slip. If either of these conditions arise the complete drive plate assembly will need to be replaced in the following way:—

1. Remove the drive pinion and bearing as described, unlock the six clutch securing bolts and remove the bolts and locking strips or unlock six nuts on transmissions fitted with studs, taking care not to lose any of the locating ferrules.
2. Withdraw the complete clutch from the shaft and observe the positions of the pull-off springs and pins.
3. Position the drive pinion on gear end face, on packing which will allow the shaft to pass through the pinion on assembly.
4. Load the clutch end cover and plate on to the pinion, first ensuring the splined ring is in position. If the pins have separated from the clutch end cover re-locate them.
5. Load a replacement clutch pack on to the end plate ensuring the opposite end plate is uppermost.
6. Replace the clutch springs on the retaining pins.
7. If the piston has separated from the clutch gear, replace, and re-position both components on the shaft.
8. Load the shaft through the pinion and re-locate the retaining pins in the clutch gear.
9. Replace the securing bolts and locating strips, or studs and nuts, and lightly tighten. Then, one at a time, remove each bolt, locate the associated ferrule, and replace the bolt. When all the bolts are replaced tighten with a torque spanner set to a torque of 9 lbf.ft (1.24 kgm) and close the locking strip tags. On gearboxes fitted with studs, part no. MT927, the torque spanner setting is 12 lbf.ft (1.66 kgm).
10. Place the thick spacer and bearing on to the shaft and gently drive the bearing into position.
11. Refit the second spacer, circlip and input end housing.

An alternative method involves the use of a hand press to assist in refitting the clutch, clutch pinion and bearing. When this method is adopted the complete clutch is loaded on to the pinion and the pinion and bearing are located on the shaft for pressing into position. Before using the press, great care should be taken to ensure that the whole shaft assembly is correctly aligned otherwise damage will result.

Clutch gear

To fit a new clutch gear, part no. MT333 (PRM140) or MT397 (PRM265), remove the clutch as described and then extract the piston retaining spacer and circlip, to allow the piston and clutch gear to be removed from the shaft.

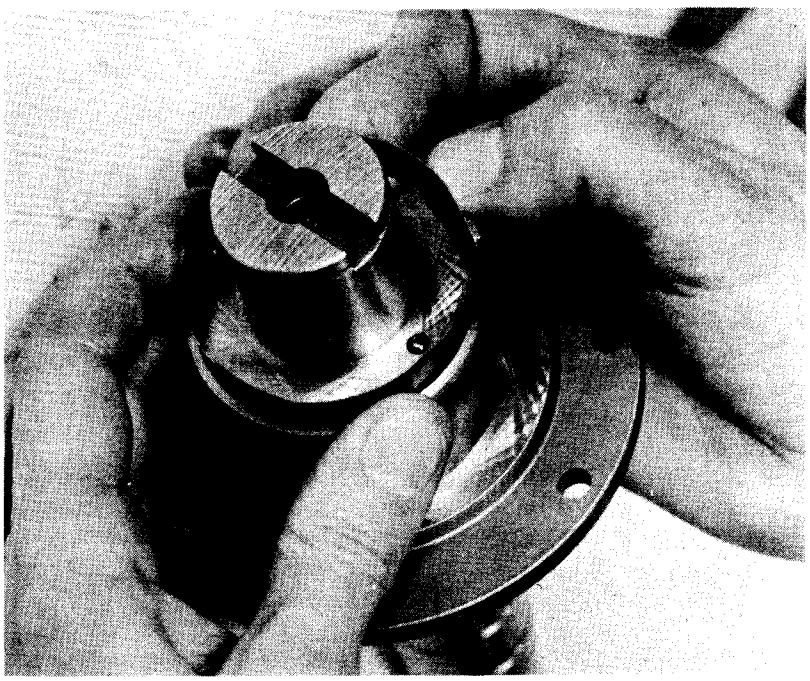


Fig. 11 Piston rings — fitting procedure

Separate the gear from the piston, ensure the inner and outer piston ring step joints are intact, then fit a new gear around the piston.

Refit the piston to the shaft. Replace the circlip and spacer and then re-assemble the clutch, drive pinion and bearing.

Note: To ensure quiet operation it is advisable to renew both clutch gears simultaneously.

Drive pinion

To renew a drive pinion, remove the drive end bearing and pinion with pulley extractors as described. If worn, the emergency drive spline ring should also be renewed and, as with the clutch gears, it is advisable to renew both pinions simultaneously.

Ensure the correct ratio pinion is selected by reference to the parts list at the end of this section. If a different ratio to the one being used is required both pinions will have to be changed; also the output gear.

Non-drive end bearing

Remove the bearing circlip and spacer, and using pulley extractors withdraw the bearing from the shaft.

Fit a new ball race, part no. MT160 (PRM140) or MT404 (PRM265) to the shaft and refit the spacer and circlip.

Piston rings and feeder

Excessive wear or damage may necessitate renewal of the piston rings and feeder, and in this event the following procedure should be adopted.

1. Remove the non-drive end bearing and withdraw the spacer and the feeder.
2. Use a special piston ring extractor or a piece of thin steel such as a smoothly ground hacksaw blade to remove the rings from the shaft.
3. 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. It can then be eased off the shaft. Do likewise with the other two rings.
4. Remove the new rings, part no. CP1192 (PRM140) or MT292 (PRM265), from the packing and clean off any grease or inhibitor.
5. If available, fit a ring loading tool around the shaft, load the rings on the tool and locate in their approximate position. Gently withdraw the tool and allow the rings to locate in their grooves.
6. 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 sufficient to allow them to be placed in approximate position over the strip. Gently remove the strip and locate the rings in their respective grooves, (See Fig. 11).
7. Compress each ring in turn and carefully fit a new feeder, part no. MT315 (PRM140) or MT380 (PRM265), and spacer.

LAYSHAFT

Drive end bearing

The bearing fitted to the PRM140 layshaft is identical with the bearing on the input shaft and the same applies to the PRM265; renewal procedure is similar.

1. Remove the bearing circlip and spacer and withdraw the bearing.
2. Fit a new bearing to the shaft and refit the spacer and circlip.
3. Replace the end cover, first ensuring the 'O' ring is intact.

Clutch assembly — drive pinion and clutch gear

The procedures for renewing the clutch assembly, clutch gear and drive pinions are the same as those described for the input shaft.

Non-drive end bearing

As with the drive end bearings, the non-drive end bearings are identical with their counterparts on the input shaft and if damaged or worn should be renewed in the same way.

Piston rings and feeder

The same number and same size rings and feeder are fitted on the layshaft, as are fitted on the input shaft. The same renewal procedure therefore applies.

REPLACING THE INPUT SHAFT AND LAYSHAFT ASSEMBLIES

PRM140S, PRM140L, PRM265S, PRM265L

1. Locate the input shaft assembly in the casing and engage the spline with the spline on the engine damping plate. Tighten the damping plate bolts.
2. Locate the layshaft in the casing and ensure the end cover is positioned.
3. Fit the top half of the casing and secure.
4. Reconnect the oil cooler pipes.
5. Refit the oil pump and renew the 'O' rings if the existing ones are damaged. Replace the input shaft end plate.
6. Refill the box with one of the recommended lubricants, and check the oil level.
7. Reconnect the control cable, or cables, to the control equipment or control lever.
8. Run the engine, shut down and again check the oil level.

PRM140T and PRM265T

1. Locate the input shaft in the casing. Refit the layshaft assembly and ensure the end cover is positioned correctly.
2. Refit the valve block and secure the top casing.
3. Locate the drive shaft end plate or layshaft end plate (left-hand mounting) and secure.
4. Refit the oil pump and replace damaged 'O' rings.
5. Replace the driven half coupling hub on the tapered shaft, secure with locknut and washer.
6. Remount the gearbox and adaptor flange on to the engine.
7. Reconnect the oil cooler pipes and cable/s to the control lever or control equipment.
8. Refill with one of the recommended lubricants and check oil level.
9. Run the engine, shut down and re-check the oil level.

OUTPUT SHAFT

Removal of the output shaft will necessitate removing the gearbox from the installation in the following way:—

1. Drain the gearbox oil into a suitable container. Support the unit to take the weight off the drive shaft and output shaft, remove the output flange coupling bolts and disconnect the propeller shaft coupling.
2. Disconnect the cable from the control lever.
3. Obtain access to the damping plate through the flywheel housing or inspection cover on the adaptor plate; slacken the engine damping plate securing bolts and then remove the engine/adaptor plate mounting bolts.
4. Withdraw the input shaft spline from the damping plate spline and remove the unit from the installation.
5. Remove the oil pump, the input shaft end cover and then the top half of the casing.
6. Remove the input shaft and layshaft assemblies.
7. Remove the coupling and output shaft end housing securing bolts.
8. Release the rear bearing circlip; at this stage it will not be possible to remove the circlip from the shaft.

9. Drive the shaft forward to displace the end cover.

10. Unscrew the single setscrew (PRM140) or the two setscrews (PRM265) and remove together with the tab washer, PRM140 only, or shakeproof washers (PRM265) and bearing retaining washer from the front of the shaft.

11. Drive the shaft backwards; this will allow the front bearing and output gear (held by web in gearcase) to be removed from the shaft.

12. Withdraw the shaft with rear bearing oil seal, output end housing and output flange from the rear of the case.

13. Before re-assembling the shaft in the casing, ensure that the oil seals and 'O' rings are not damaged or worn, and follow the 'Front bearing and output gear' instructions when fitting the front bearing and output gear to the shaft.

14. Re-assemble the gearbox in the reverse order to that described above.

Front bearing and output gear

To renew a front bearing or output gear proceed as follows:—

1. Remove the bearing and output gear from the shaft with the shaft in the casing as described.

2. If the bearing is the defective component, ensure that output gear is not damaged and then place the output gear spacer and new bearing part no. 0532023 (PRM140) or 0533021 (PRM265) in position on the shaft.

3. If the output gear is the defective component, fit a new one of the same ratio as the one removed, unless different ratio drive pinions have been fitted, and ensure that the bearing is sound. Where the drive pinions have been changed, ensure the output gear ratio corresponds. Refer to Parts List for part numbers and ratios.

4. Refit the rear bearing circlip and then, with the shaft assembly carefully aligned, drive the shaft forward until the rear bearing is up to the circlip.

5. Stand, and support the casing on the output flange and, using a hard wood drift or soft metal sleeve of correct diameter, gently drive the inner race of the front bearing into position. Replace the bearing outer cage and secure with tabwasher (when fitted), washer(s) and screw or screws.

Oil seal

Providing there is sufficient space and clearance when the propeller shaft coupling is disconnected to allow the output flange to be withdrawn, the oil seal may be renewed without removing the gearbox from the installation.

1. Restrain the output flange from turning by 'barring' it with a lever locked against bolts palced in the coupling holes. Remove the flange locking nut and spacer.

2. Withdraw the flange with pulley extractors, remove the output end housing and extract the oil seal.

3. Examine the housing 'O' ring and if worn or damaged, renew.

4. Check the oil seal bearing surfaces for wear, and, if grooved, replace the output flange.

5. Fit a new seal, part no. MT349 (PRM140), or MT252 (PRM265), check the oil seal sleeve and refit the housing and seal to the output flange.

6. Locate the output flange on the shaft and, using a wooden drift and hammer, gently drive the flange into position.

7. Replace the spacer and locknut and tighten to a torque of 120 lbf.ft (PRM140) 250 lb.ft (PRM265).

Rear bearing

With the output shaft removed from the casing remove the flange and end housing and withdraw the bearing with pulley extractors. Fit a new bearing, part no. MT711 (PRM140), or MT451 (PRM265), ensure the seal is sound and re-assemble the flange and end housing.

VALVE BLOCK

The complete valve block can be removed for inspection by simply removing the five bolts and single nut.

Low pressure relief valves

The two low pressure relief valves can be withdrawn once the valve block is removed, by extracting the spring retaining rings from the valve bores.

Control valve

To remove the control valve, remove the valve block and then using an Allen key remove the two ¼ in. UNF lever retaining cap screws. Care should be taken not to lose or misplace the detent ball bearings and springs. Renew the 'O' ring part no. 0,01313 if damaged or defective.

High pressure relief valve

Removal of the high pressure relief valve is effected by simple withdrawing the circlip in the base of the control valve. Valve stop, valve and spring will then slide out.

SPARE PARTS ORDERING

When ordering spare 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.

NOTES:

1. **Individual items which form part of an assembly, or main components, are indented and may be supplied separately; if the assembly is ordered all components pertaining to that assembly are supplied. For example, if the 'clutched input shaft' assembly is ordered the shaft itself and every item called up and shown on the corresponding illustration will be supplied, with the exception of the end housing and oil seal. The same applies to the layshaft.**

2. **Clutch plate assemblies, i.e. end plates, driven plates and driver plates are supplied in sets.**

Orders and enquiries for spare parts should be addressed to:—

NEWAGE ENGINEERS LIMITED
TRANSMISSIONS DIVISION
BARLOW ROAD
COVENTRY CV2 2LD
ENGLAND

Telephone: (0203) 617141 **Telex 31333** **Cables 'SUPAGEARS' Coventry**

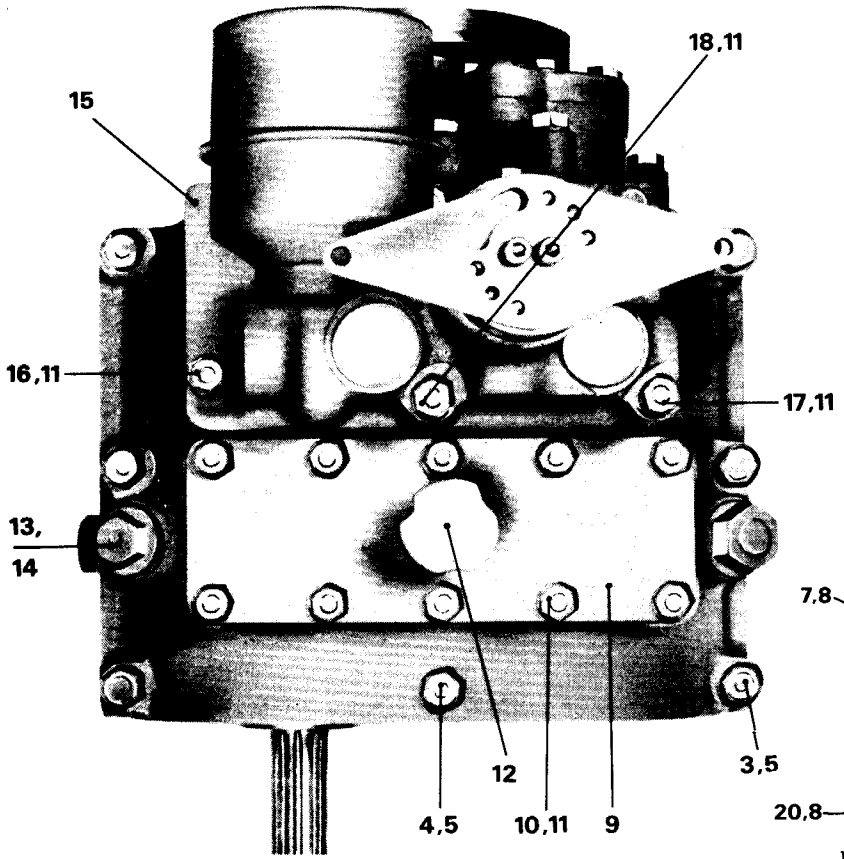
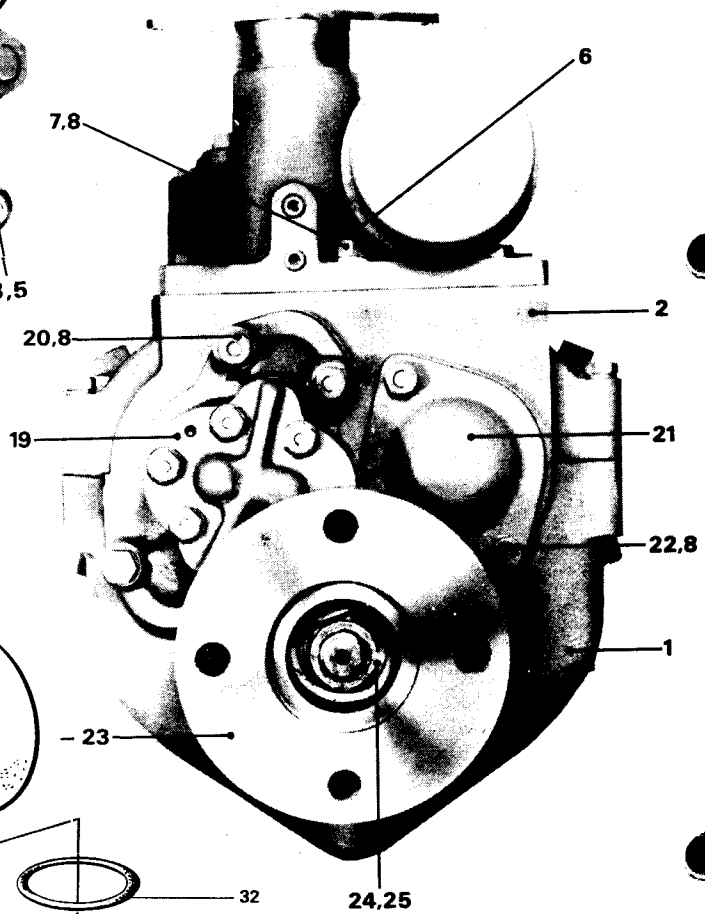


Fig.12 Gearbox top view

Fig. 13 Gearbox rear view



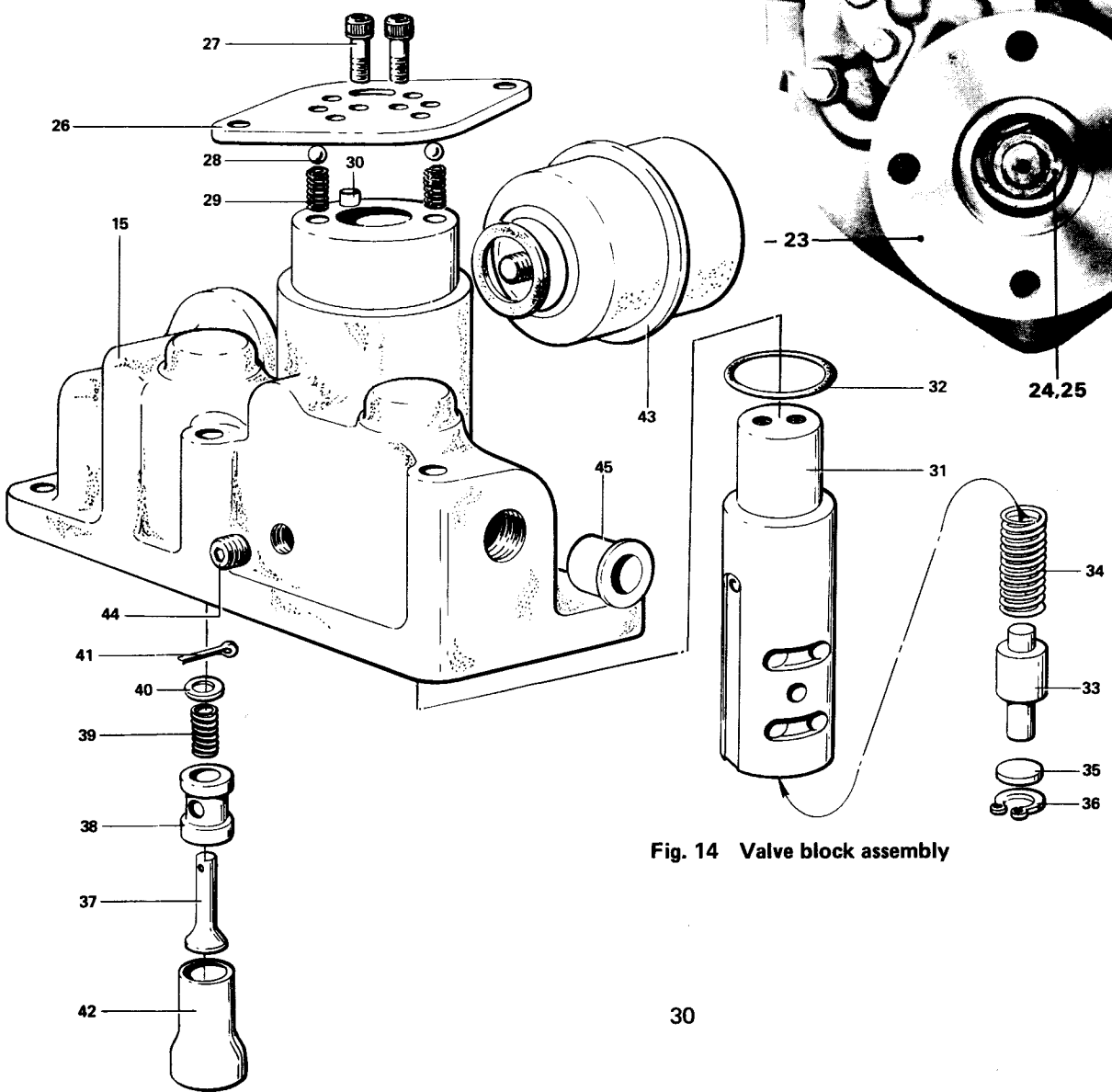


Fig. 14 Valve block assembly

PARTS LIST

Plate Ref.	Description	PRM140 Part No.	Qty	PRM265 Part No.	Qty
1	GEARCASE - Bottom	MT102	1	MT215	1
2	GEARCASE - Top	MT103	1	MT216	1
3	Bolt - gearcase	UBF113	6	UBF113	6
4	Bolt - gearcase	UBF173	1	UBF163	1
5	Washer - bolt	W108	8	W108	8
6	Stud - gearcase	MT310	1	MT373	1
7	Nut - stud - 3/8" UNF	UN505	1	UN505	1
9	TOP COVER	MT735	1	MT743	1
	Plug - breather (Horizontal mounted box)	CP1123	1	CP1123	1
10	Screw - cover	USF12	10	USF12	10
11	Washer - sealing	CP1223	15	CP1223	15
12	FILTER – AIR (Vertical)	CP1057	1	CP1057	1
	FILTER – AIR (Horizontal)	CP1057	1	CM2106	1
13	Plug - flanged	CP1189	3	CP1189	3
14	Washer - sealing	CP1068	3	CP1068	3
15	VALVE BLOCK	MT675	1	MT675	1
16	Screw - Valve block/gearcase	USF52	3	USF52	3
17	Bolt - valve block/gearcase	UBF132	1	UBF132	1
18	Bolt - valve block/gearcase	UBF142	1	UBF142	1
19	OIL PUMP ASSEMBLY (see Fig. 15)	MT479	1	MT480	1
20	Bolt - pump to casing	UBF93	4	UBF83	4
8	Washer - sealing	CP1224	6	CP1224	7
21	Endcover - input shaft	MT318	1	MT374	1
22	Screw - endcover	USF33	2	USF33	3
23	Flange - output	MT753*	1	MT755	1
24	Washer - plain	MT600	1	MT664	1
25	Nut - locking	MT689	1	MT690	1
26	LEVER - operating	MT678	1	MT678	1
27	Screw - lever	UFC410	2	UFC410	2
28	Detent ball	CP1077	2	CP1077	2
29	Detent spring	MT685	2	MT685	2
30	Stop pin - lever	CP1101	1	CP1101	1
	VALVE ASSEMBLY - control	MT699	1	MT699	1
31	CONTROL VALVE	MT676	1	MT676	1
32	'O' ring	0,01313	1	0,01313	1
33	RELIEF VALVE	MT302	1	MT302	1
34	Valve spring - relief	MT446	1	MT446	1
35	Valve stop - relief	MT308	1	MT308	1
36	Circlip	MT312	1	MT312	1
	VALVE ASSEMBLY - Pressure Differential	MT696	2	MT696	2
37	Valve - pressure differential	MT303	2	MT303	2
38	Seat - valve	MT304	2	MT304	2
39	Spring - valve	MT305	2	MT305	2
40	Washer - plain	W128	2	W128	2
41	Pin - split	40M244	2	40M244	2
42	Retaining sleeve	MT686	2	MT686	2
43	FILTER - OIL * note 2	MT926	1	MT926	1
44	Plug - pressure	MT311	3	MT311	3
45	Seal - Redcap - for transit only	MT477	2	MT477	2

NOTE: **The Part Number for the gearcase sub-assembly of horizontally mounted PRM265 gearboxes is MT874. This comprises the standard top half of the gearcase (MT215), a special lower gearcase (MT869, 1–MT848 oil shroud (fitted internally), 1–MT849 oil shroud (fitted internally), 2–0020204 screws and 2–CP1294 washers, in addition to the standard bolts, washer, studs and nuts used for securing the**

*** For gearboxes built before serial number 8454 call up MT279.**

If the output flange has a male spigot please use part no. MT754.

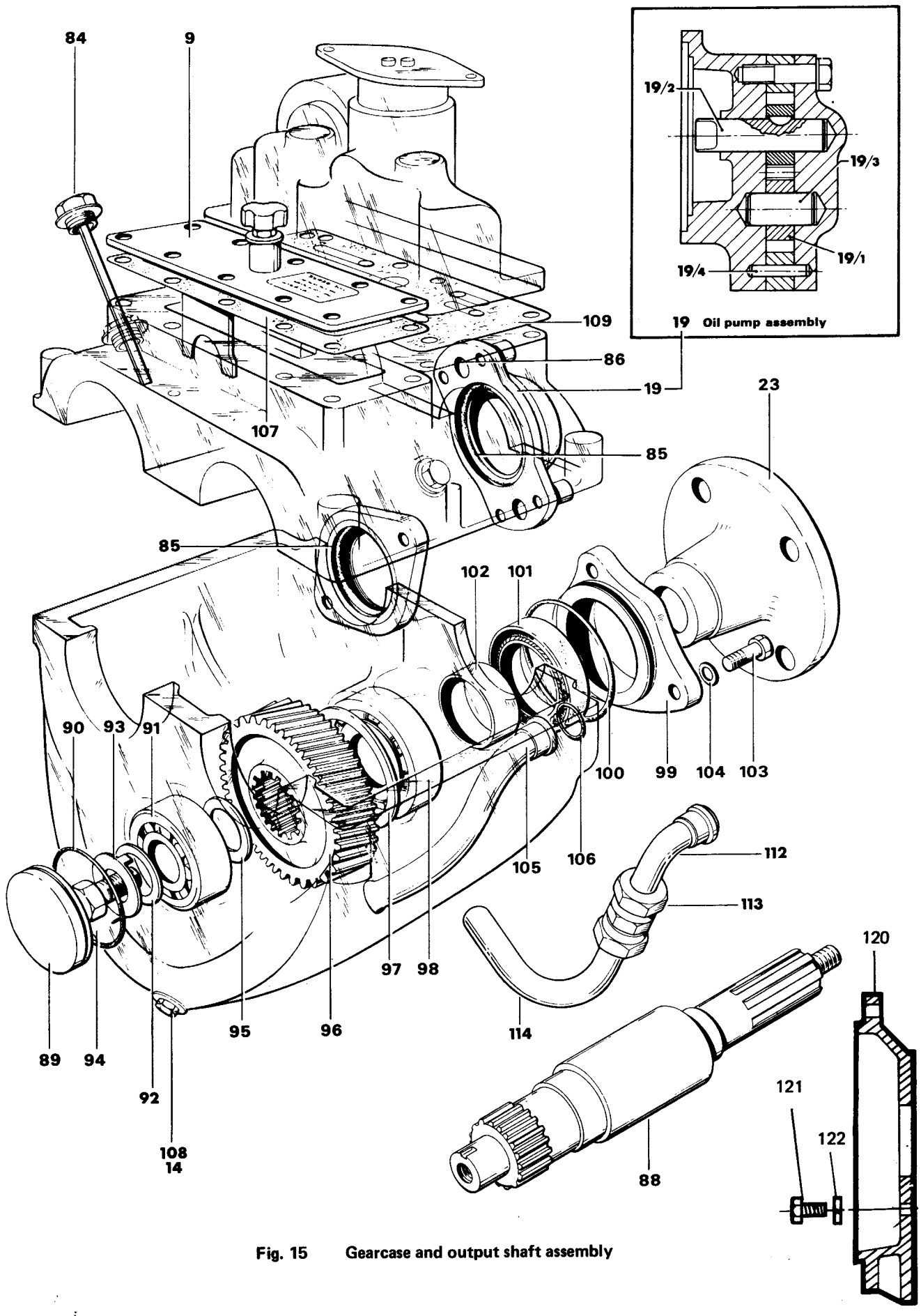


Fig. 15 Gearcase and output shaft assembly

PARTS LIST

Plate Ref.	Description	PRM140 Part No.	Qty	PRM265 Part No.	Qty
84	Dipstick/Filler - Vertical	MT471	1	MT472	1
	Dipstick/Filler - Horizontal	MT485	1	0800925	1
19	PUMP ASSEMBLY - Oil - Supplied complete	MT479	1	MT480	1
19/1	Gear - driven	MT323	1	MT379	1
19/2	Spindle - driver (Sub-Assembly)	MT903	1	MT904	1
19/3	Spindle - driven	MT325	1	MT378	1
19/4	Dowel	MT356	2	MT417	2
85	'O' ring	0,02873	2	0,03383	2
86	'O' ring - pump to casing	0,01254	1	0,01254	1
	'O' ring - valve block to casing	0,00623	1	0,00623	1
88	OUTPUT SHAFT	MT721	1	MT723	1
89	End cover	MT429	1	MT430	1
90	'O' ring	0,02063	1	0,02433	1
91	BEARING - Roller - forward	0532023	1	0533021	1
92	Washer - bearing retaining	MT428	1	MT423	1
93	Washer - Tab/shakeproof	MT425	1	MT489	1
94	Screw	USF33	1	USF12	2
95	Spacer	MT353	1	MT716	1
96	OUTPUT GEAR 3:1	MT327	1	MT720	1
	2:1	MT329	1	MT719	1
	1.5:1	–	–	MT893	1
	1:1	MT331	1	MT718	1
97	Circlip - bearing	CP1190	1	CP1194	1
98	BEARING - Ball - drive end	MT711	1	MT451	1
99	End housing - output	MT319	1	MT375	1
100	'O' ring	0,03504	1	0,04754	1
101	Seal	MT349	1	MT252	1
102	Spacer	MT715	1	MT717	1
103	Bolt - end housing	UBF53	3	UBF63	4
104	Washer	W108	3	W108	3
105	Oil pipe - standard	MT736	1	MT736	1
	Oil pipe - short	MT737	1	MT744	1
106	'O' ring	0,01254	1	0,01254	1
107	Joint - top cover	MT343	1	MT343	1
108	Plug - flanged - drain	CP1268	1	CP1268	1
14	Washer - sealing	CP1068	1	CP1068	1
109	Joint - valve block	MT313	1	MT313	1
114	Oil Pipe Extension*	–	–	MT907*	1
112	Oil Pipe*	–	–	MT908*	1
113	Adaptor*	–	–	CP1297*	1
119	'O' ring	0,01506	1	0,02123	1
120	Mounting flange	MT945	1	MT944	1
121	Screw	USF43	5	USF54	5
122	Washer	W108	5	W125	5

* **NOTE: Part Numbers MT907, MT908 and CP1297 replace MT736 on model PRM265 (HR) only.**

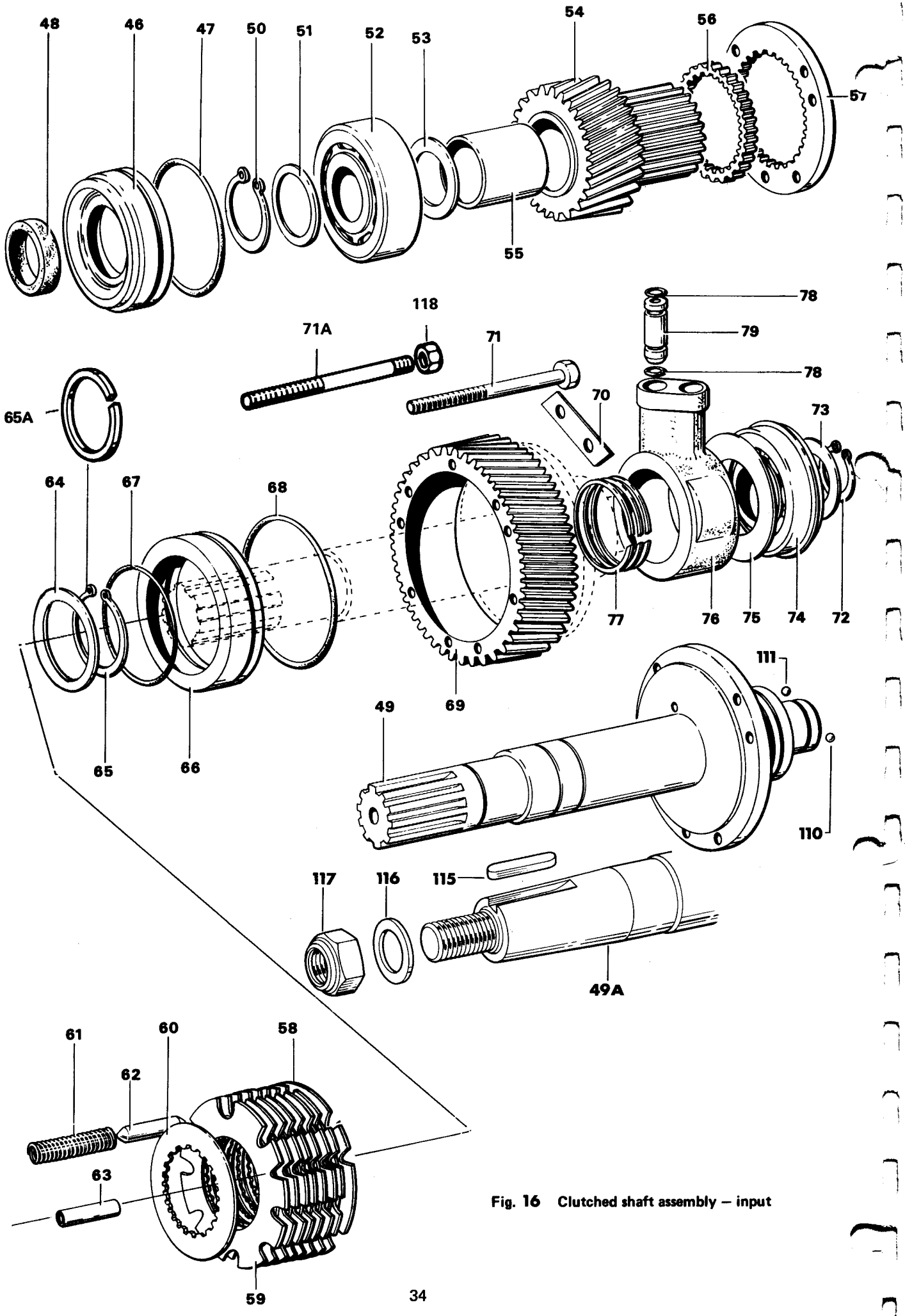


Fig. 16 Clutched shaft assembly – input

PARTS LIST

Plate Ref.	Description	PRM140 Part No.	Qty	PRM265 Part No.	Qty
46	End housing - input	MT317	1	MT382	1
47	'O' ring	0,02433	1	0,02874	1
48	Oil seal	MT165	1	MT251	1
	INPUT CLUTCH SHAFT ASSEMBLY - splined	MT875(rh)	1	MT872(rh)	1
		MT876(lh)	1	MT873(lh)	1
	INPUTCLUTCH SHAFT ASSEMBLY - tapered	MT749(rh)	1	MT745(rh)	1
		MT752(lh)	1	MT747(lh)	1
	INPUT CLUTCH SHAFT ASSEMBLY - long(splined)	MT949(rh)	1	MT951(rh)	1
		MT950(lh)	1	MT952(lh)	1
49	INPUT SHAFT - splined	MT340	1	MT390	1
49a	INPUT SHAFT - tapered	MT722	1	MT724	1
49b	INPUT SHAFT - long (splined)	MT946	1	MT947	1
110	Ball	CP1191	1	CP1191	1
111	Ball	CP1180	1	CP1180	1
50	Circlip	CP1096	1	CM2053	1
50a	Snap ring	–	–	0270350	1
51	Spacer	MT336	1	MT419	1
52	BEARING - ROLLER - drive end	T7023	1	0533026	1
53	Spacer	MT350	1	MT938	1
54	PINION - DRIVE - 3:1 ratio	MT732	1	MT739	1
	(Assembly) 2:1 ratio	MT733	1	MT740	1
	1.5:1 ratio	–	–	MT894	1
	1:1 ratio	MT734	1	MT741	1
55	Bush (fitted in assembly)	MT361	2	MT416	2
56	Splined ring*	MT334	1	MT395	1
57	CLUTCH END COVER - splined	MT727	1	MT729	1
	PLATE ASSEMBLY - CLUTCH - Supplied as a complete assembly	MT813	1	MT814	1
58	Clutch end plate	MT117	1	MT214	1
59	Clutch plate - driven	MT116	7	MT212	8
60	Clutch plate - driver	MT731	8	MT725	9
61	Spring - pull off	MT120	3	MT293	3
62	Pin - spring	MT357	3	MT418	3
63	Ferrule	MT730	6	MT936	6
64	Spacer	MT344	1	MT939	1
65	Circlip	CP1102	1	CM2067	1
66	PISTON	MT345	1	MT389	1
67	Step joint - piston ring	MT358	1	MT369	1
68	Step joint - piston ring	MT359	1	MT370	1
69	CLUTCH GEAR R.H.	MT333	1	MT397	1
70	Tab strip	MT351	3	MT411	3
71	Bolt - clutch securing	MT452	6	MT456	6
71a	Studs - clutch securing	–	–	MT927	6
72	Circlip	CP1096	1	CM2067	1
73	Spacer	MT336	1	MT385	1
74	BEARING - BALL - non-drive end	MT160	1	MT404	1
75	Spacer	MT337	1	MT384	1
76	FEEDER	MT315	1	MT380	1
77	Piston ring	CP1192	3	MT292	3
78	'O' ring	0,00372	4	0,00372	4
79	Connector - feeder	MT352	2	MT352	2
115	Key	MT760	1	MT761	1
116	Washer	CP1289	1	CP1288	1
117	Nut	UN521	1	UN544	1
118	H.T.S. nut	–	–	UN501	1

* **Required on MT872, MT875, MT749, MT949, and MT951**

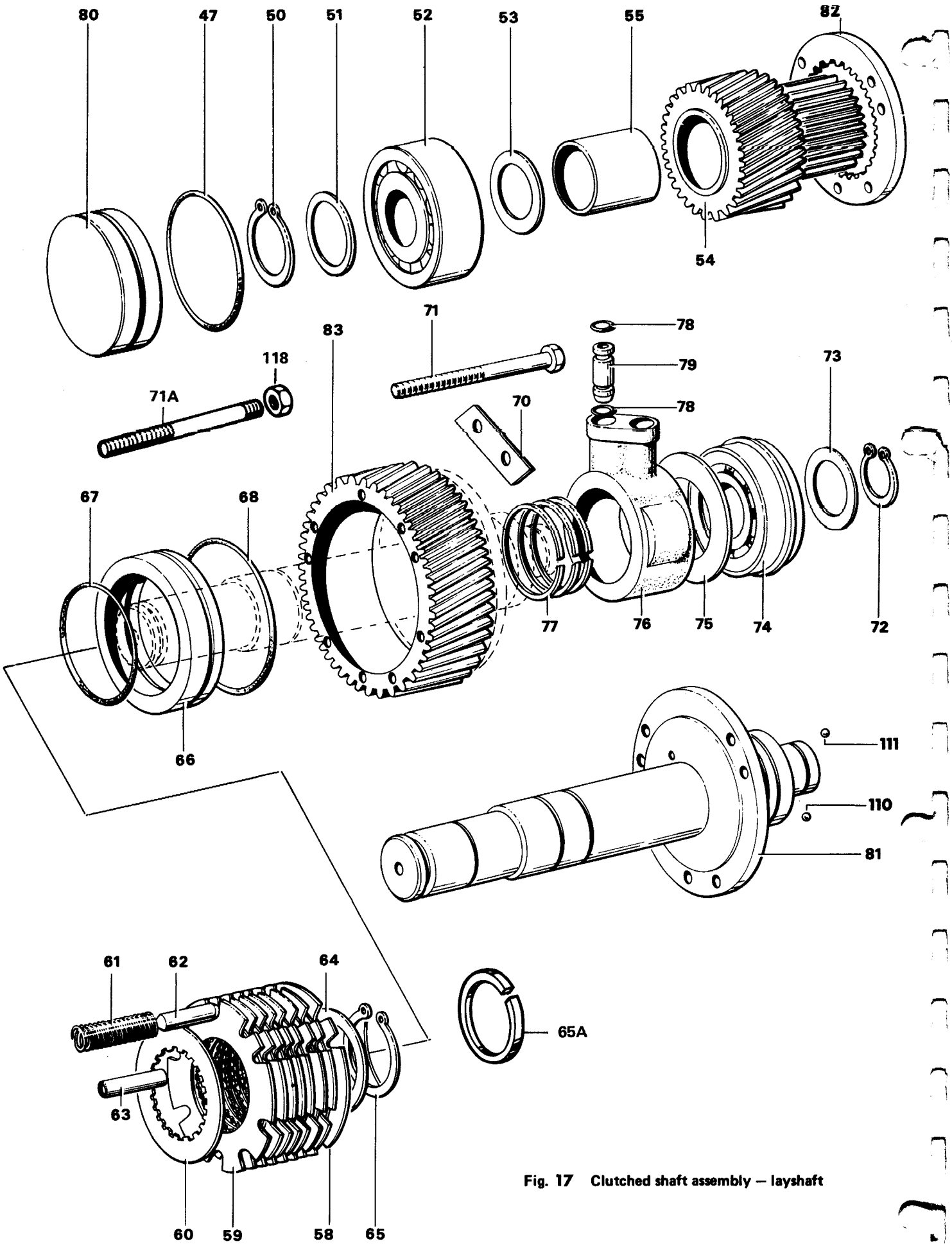


Fig. 17 Clutched shaft assembly – layshaft

PARTS LIST

Plate Ref.	Description	PRM140 Part No.	Qty	PRM265 Part No.	Qty
80	End cover	MT316	1	MT383	1
47	'O' ring	0,02433	1	0,02874	1
	CLUTCHED SHAFT ASSEMBLY –				
	IDLER				
	(R.H. output rotation)	MT750	1	MT746	1
	(L.H. output rotation)	MT751	1	MT748	1
81	LAYSHAFT	MT339	1	MT391	1
110	Ball	CP1191	1	CP1191	1
111	Ball	CP1180	1	CP1180	1
50	Circlip - bearing	CP1096	1	CM2053	1
51	Spacer	MT336	1	MT419	1
52	BEARING – ROLLER – drive end	T7023	1	0533026	1
53	Spacer	MT350	1	MT386	1
54	PINION – DRIVE – 3:1 ratio	MT732	1	MT938	1
	(assembly) 2:1 ratio	MT733	1	MT740	1
	1.5:1 ratio	–	–	MT894	1
	1:1 ratio	MT734	1	MT741	1
55	Bush (fitted in assembly)	MT361	2	MT416	2
	Splined ring *	MT334	1	MT395	1
82	Clutch end cover - splined	MT726	1	MT728	1
	PLATE ASSEMBLY – Clutch - Supplied as a complete assembly				
58	Clutch end plate	MT117	1	MT214	1
59	Clutch plate - driven	MT116	7	MT212	8
60	Clutch plate - driver	MT731	8	MT725	9
61	Spring - pull-off	MT120	3	MT293	3
62	Pin - spring	MT357	3	MT318	3
63	Ferrule	MT730	6	MT936	6
64	Spacer	MT344	1	MT939	1
65	Circlip	CP1102	1	CM2067	1
65A	Snap ring	–	–	0270350	1
66	PISTON	MT345	1	MT389	1
67	Step joint - piston ring	MT358	1	MT369	1
68	Step joint - piston ring	MT359	1	MT370	1
83	CLUTCH GEAR L.H.	MT332	1	MT396	1
70	Tab strip	MT351	3	MT411	3
71	Bolt - clutch securing	MT452	6	MT465	6
71A	Stud - clutch securing	–	–	MT927	6
72	Circlip	CP1096	1	CM2067	1
73	Spacer	MT336	1	MT385	1
74	BEARING – BALL – non-drive end	MT160	1	MT404	1
75	Spacer	MT337	1	MT384	1
76	FEEDER	MT315	1	MT380	1
77	Piston ring	CP1192	3	MT292	3
78	'O' ring	0,00372	4	0,00372	4
79	Connector feeder	MT352	2	MT352	2
118	HTS nut	–	–	UN501	1

* Required on MT751 and MT748

SPECIAL KITS OF PARTS

	PRM140	PRM265
'O' Ring Kit	MT877	MT878
To convert to 1 : 1	MT799	MT884
To convert to 1.5 : 1	–	MT919
To convert to 2 : 1	MT800	MT883
To convert to 3 : 1	MT801	MT885