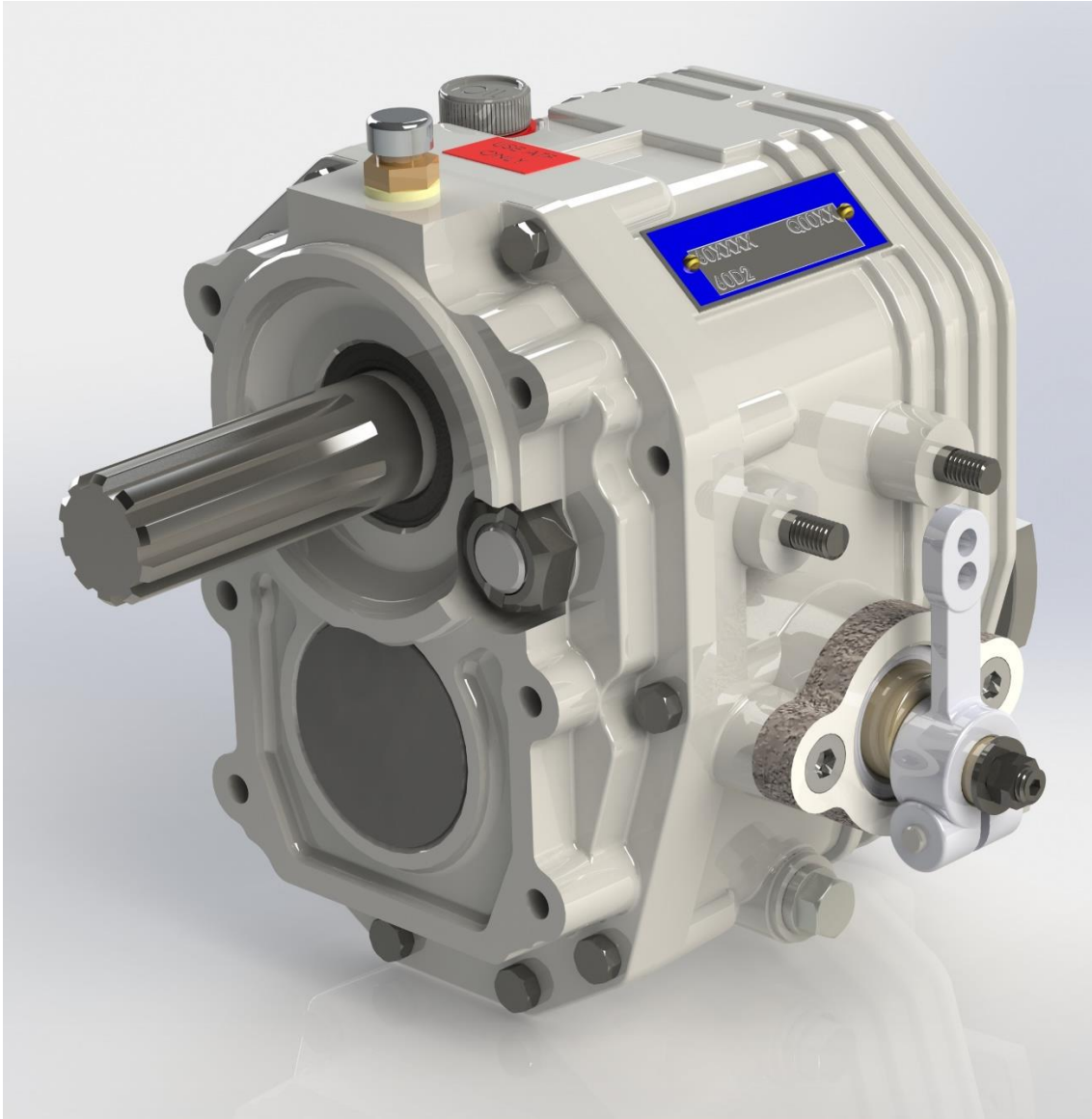


PRM 60 WORKSHOP MANUAL





NEWAGE

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PRM60 Manual

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PRM Newage Ltd operates a policy of product improvement and therefore reserves the right to change specifications without prior notification. Whilst every effort is made to ensure complete accuracy of the information in this manual no liabilities for inaccuracies or the consequences thereof can be accepted by the manufacturer or the distributor who supplied the manual.

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

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FOREWORD

Provided it is correctly installed, aligned and maintained, the PRM 60 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. PRM Newage 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 PRM Newage Ltd. or an authorised distributor/dealer 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 PRM Newage 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. Pressurise the Case, and check for oil leaks.
3. Check drag torque in ahead, neutral and astern.
4. Run Gearbox in neutral, ahead and astern in load conditions.
5. Check force to engage and disengage ahead and astern Gear.
6. Check noise levels.
7. Check Output Nut torque.
8. Check coupling concentricity.

IMPORTANT NOTICE: ONLY REMOVE BREATHER, DIP STICK, OIL DRAIN PLUG OR OIL LEVEL PLUG ONCE THE GEARBOX IS AT AMBIENT TEMPERATURE. REMEMBER HOT OIL CAN CAUSE BURNS – WORK SAFELY.

IDENTIFICATION PLATE INFORMATION

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.

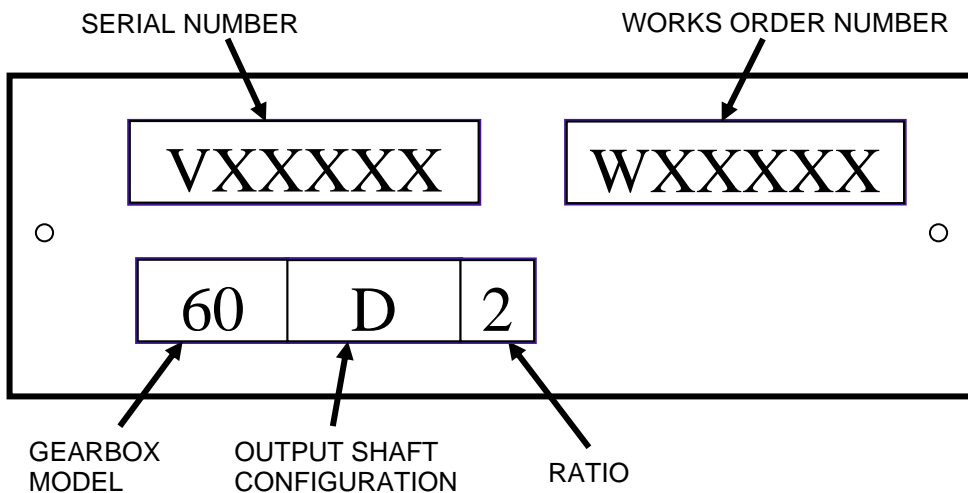


Figure 1 - Example of Serial Plate

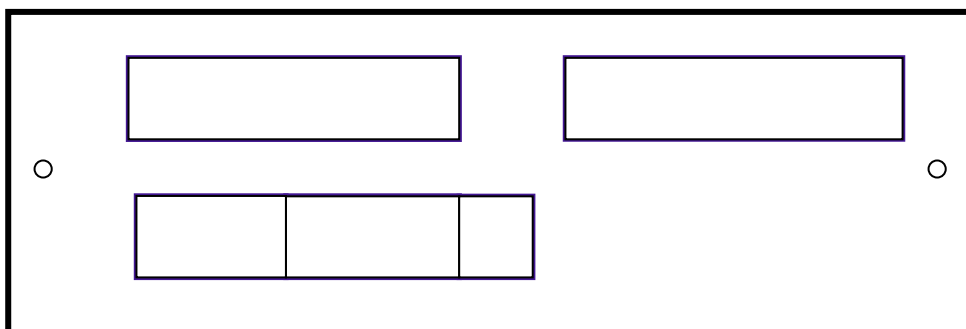
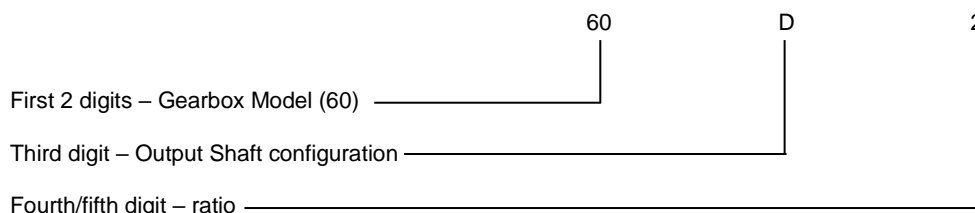


Figure 2 - Blank Serial Plate

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.

SERVICE CLASSIFICATION DEFINITIONS

PLEASURE Limited to craft used exclusively for pleasure boating; operation at full Engine throttle should not exceed 5% of total time, with balance of usage at 90% of full throttle Engine speed, or less. Maximum operation 500 hours per year. The selection of PRM 60 according to this classification for any commercial boat is not approved by PRM Newage Limited.

LIGHT COMMERCIAL PRM Newage Limited recommends that when considering the use of the PRM 60 in boats of whatever hull form used in light commercial applications, and in displacement and semi-displacement hull boats for pleasure applications, these boats should be classed as light commercial duty and the Gearbox selected accordingly. Maximum operation – 2000 hours per year.

IMPORTANT NOTE: It is essential for the Engine, Transmission model, reduction ratio and Propeller size to be correctly matched so that the Engine can attain its rated speed appropriate to the relevant service classification without labouring.

1. GENERAL DATA

1.1 Specifications

Gear ratios – ahead

1.52:1 2.00:1 2.50:1

Gear ratio – astern

2.05:1 – common

POWER RATING

MODEL	AHEAD RATIO	PLEASURE		LIGHT COMMERCIAL	
		BHP	kW	BHP	kW
60D1.5	1.52:1	0.98	0.73	0.80	0.60
60D2	2.00:1	0.85	0.63	0.68	0.51
60D2.5	2.50:1	0.85	0.63	0.58	0.43
	Max. Input Power	35	26	28	21

NOTE: These powers are expressed in BHP and kW per 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 5000 rev/min.

Input rotation:

For Engines of left-hand (anti-clockwise) rotation as viewed looking on the Flywheel from behind the Engine.

Output rotation:

Right-hand (clockwise) in ahead direction. **IMPORTANT: RIGHT HAND PROPELLER REQUIRED.**

Approximate dry weight:

10 kg (22lbs) excluding Adaptor Flange.

Oil capacity:

Approximately: 0.20 litres (0.35 pints)

Working oil temperature:

The normal operating temperature should be in the range 50°C to 95°C continuous.

Engine Mounting Adaptors:

Available in SAE5 and Velvet Drive (Borg Warner).

Input Drive Couplings:

Flexible centre damper plate SAE 6.5" or SAE 7.5".

Input Shaft:

28.5mm diameter with 10 tooth spline to DIN5464.

Propeller thrust:

Ahead and astern thrust is carried by Output Shaft Bearings of ample capacity for the approved rating.

Output flange:

102mm diameter, with 4 holes 10.5mm diameter on 82.5 pitch circle diameter.

Installation angle:

The maximum fore and aft installation angle at rest is 15°.

2. INTRODUCTION

Prior to installation of the PRM 60 read and follow the instructions within this manual. Failure to do so will make the warranty void. PRM will not be responsible for poor installation, wrong handling or deficient maintenance. It is the responsibility of users to install guards and safety devices within maybe required by Health and Safety directives within different countries.

The PRM 60 marine transmission is a simple, lightweight, mechanically operated gearbox for use in pleasure craft. Ahead and astern is selected by engaging a Cone Clutch which requires no adjustment. The PRM 60 can only be installed onto Engines that **rotate left hand (anti-clockwise)** as viewed when standing behind the gearbox Output Coupling facing towards the Engine Flywheel.

3. CONSTRUCTION

3.1 Gearcase

The Gearcase is made from heavy duty aluminium alloy rigidly designed and externally ribbed for efficient heat dissipation. The Case assembly comprises two halves vertically split to facilitate servicing.

3.2 Gear train

The Helical Gear train is manufactured from high grade Steel with all Gears being case hardened for long life. All Shafts are supported on Ball Bearings which are amply proportioned to absorb all the thrust from the Propeller.

4. OPERATION

4.1 Output Rotations

With the Control Lever in the mid, or neutral position no power is transmitted to the Propeller as the Cone Clutch is not engaged with either ahead or astern Gears. Moving the Lever forward i.e. towards the Engine selects ahead, and rearwards i.e. towards the Propeller selects astern. In ahead the Output Shaft rotates in the opposite direction to the Input Shaft (which rotates as Engine). It is therefore necessary to fit a right hand Propeller.

4.2 Lubrication

All lubrication is supplied by internal splash with oil cooling being by radiation through the Gearbox Case.

4.3 Approved oils and oil filling

The Gearbox is supplied direct to the distributor/ customer without oil and therefore prior to start up it must be filled with oil. Unscrew the Oil Level Plug located on the side of the Gearbox. Unscrew the Oil Filling Plug located on the top of the Gearbox. Fill the Gearbox with ATF DEXTRON II, III, or IV to GM specification or engineering approved equivalent until oil starts draining from the Level Hole. Refit the Oil Level Plug. Check the oil on the Dipstick. Refit the Oil Filling Plug. The oil is approximately 0.2 litres.



**CAUTION: Do not mix different brands, types or grade of oil.
DO NOT OVERFILL THE GEARBOX AS THIS AFFECTS THE GEARBOX PERFORMANCE.**

5. INSTALLATION

5.1 General

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 firing in the cylinders; diesel Engines which have high compression ratios, usually generate stronger vibration pulses than petrol (gasoline) 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. PRM Newage 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.2). 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. 2), 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. 3). 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. 3). Rotate the Flywheel through one complete revolution and note the deviation, this should not exceed 0.125mm (0.005in.) total indicator reading.

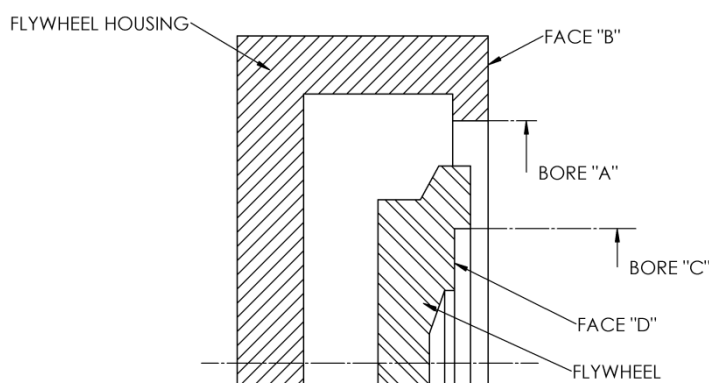
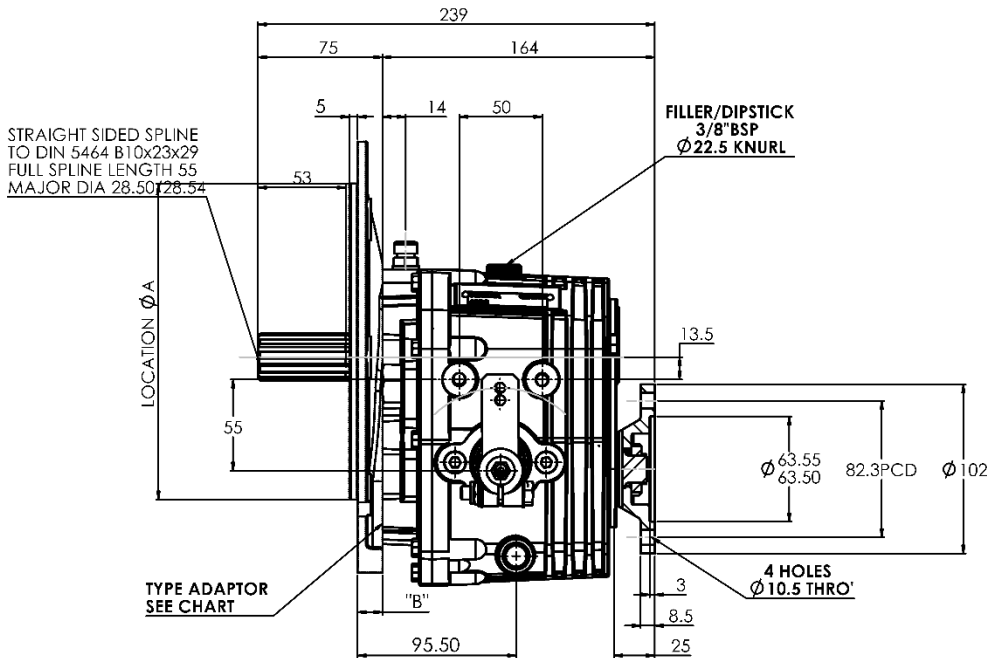
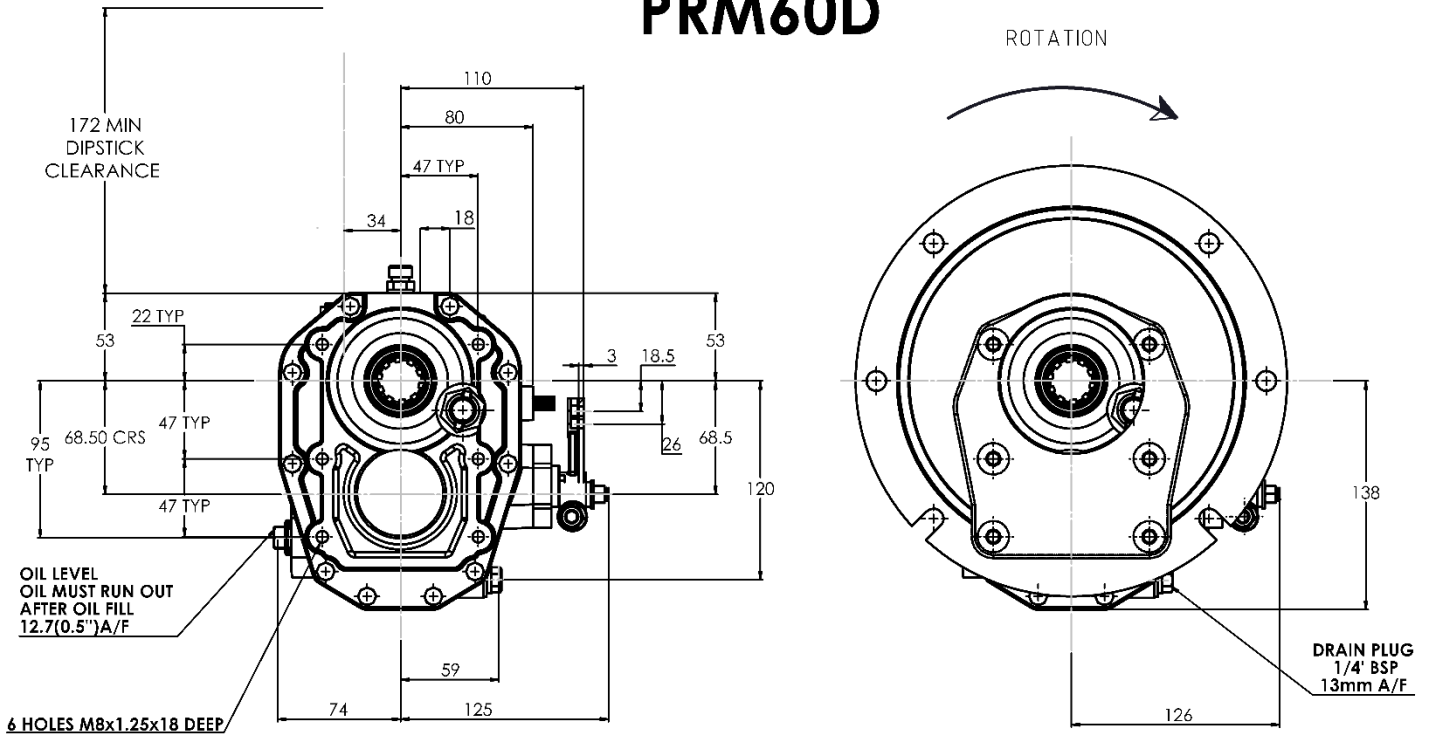


Figure 3 - Checking the Flywheel and Flywheel Housing

BASIC INSTALLATION DETAILS – PRM 60

PRM60D

ROTATION



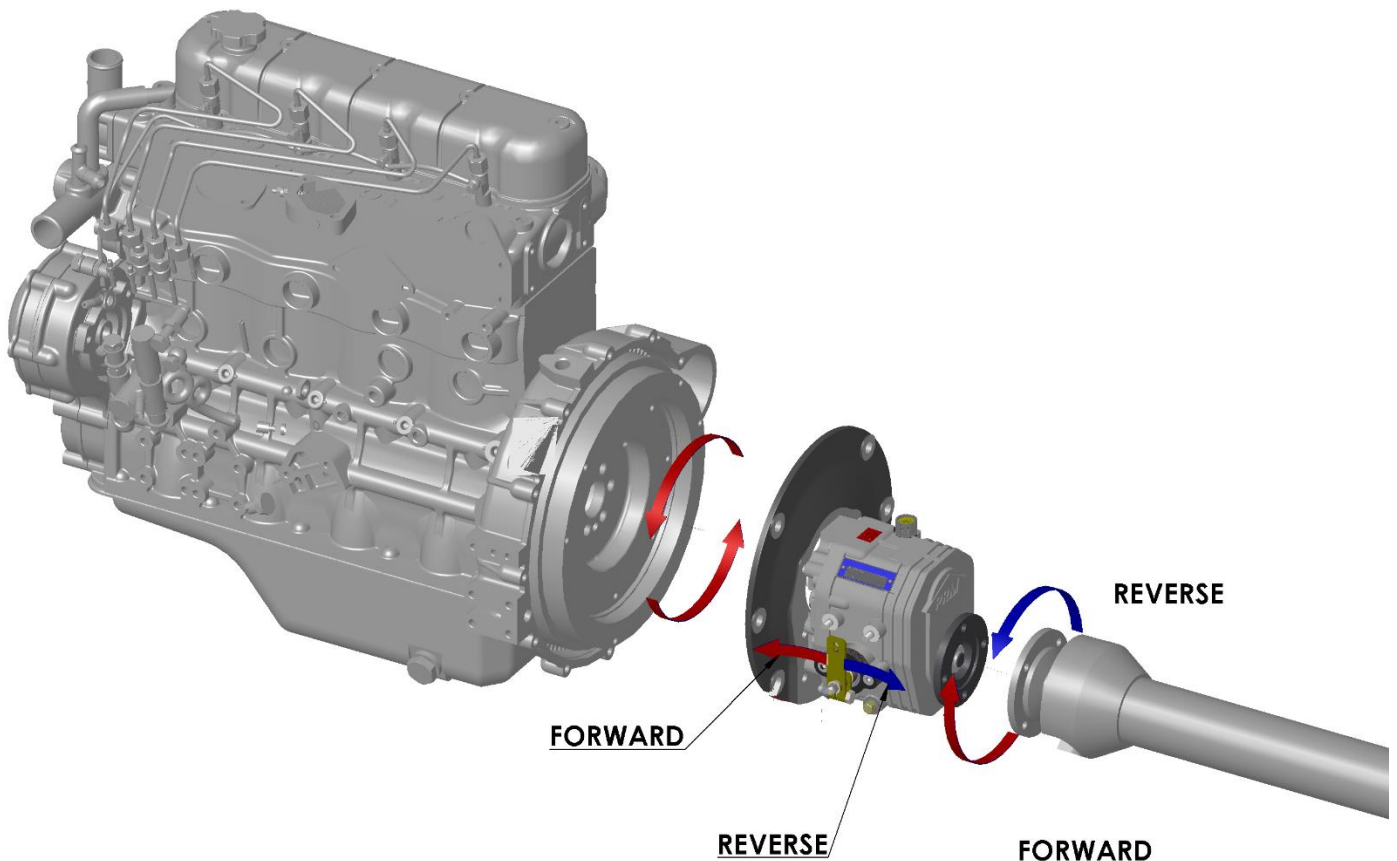
ADAPTORS	ØA	B
SAE5	314.33 (12.375")	16.0(0.63")
B/W	209.55(8.250")	15.0(0.591")

NOTE: MOVE GEAR SELECTOR LEVER FORWARD i.e. TOWARDS GEARBOX INPUT FOR AHEAD AND REARWARDS FOR ASTERN

INSTALLATION ANGLE
The maximum fore and aft installation angle permissible at rest is 15°

IMPORTANT NOTE
All information given in this manual is correct at the time of going to press. However, in the interests of technical progress, design specifications are subject to change without notice. Accordingly, data given herein should be regarded as a general guide only and does not form part of any contract. Any specific performance requirements must be made known to us in writing with customer orders for goods. Illustrations are approximate only and do not form part of any contract with us. Certified installation drawings are available on request. All goods are supplied in accordance with our standard terms and conditions of sale.

Figure 4 – Intallation Details



5.4 Mounting the Gearbox to the Engine

1. Mount the Drive Plate to the Flywheel, using an alignment mandrel if available, and bolt to the Flywheel. Where components to SAE standard are used, the outside diameter of the Drive Plate should be a close fit in the register on the Flywheel.
If a mandrel is not available, tighten the 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 align the Plate. Tighten up two or three opposite Bolts. Remove the Gearbox and fully tighten all the Drive Plate Bolts.
2. Apply a layer of water-repellent grease to the Input Shaft spline and then offer the Gearbox and Adaptor up to the Drive Plate and Flywheel Housing. Insert the Gearbox Input Shaft into the centre of the Drive Plate (it may be necessary to rock the Shaft slightly to ensure the Splines align). Press the assembly fully into position, align the holes in the Adaptor with those on the Flywheel Housing and tighten fully. See fastening torque chart 10.2.

5.5 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.

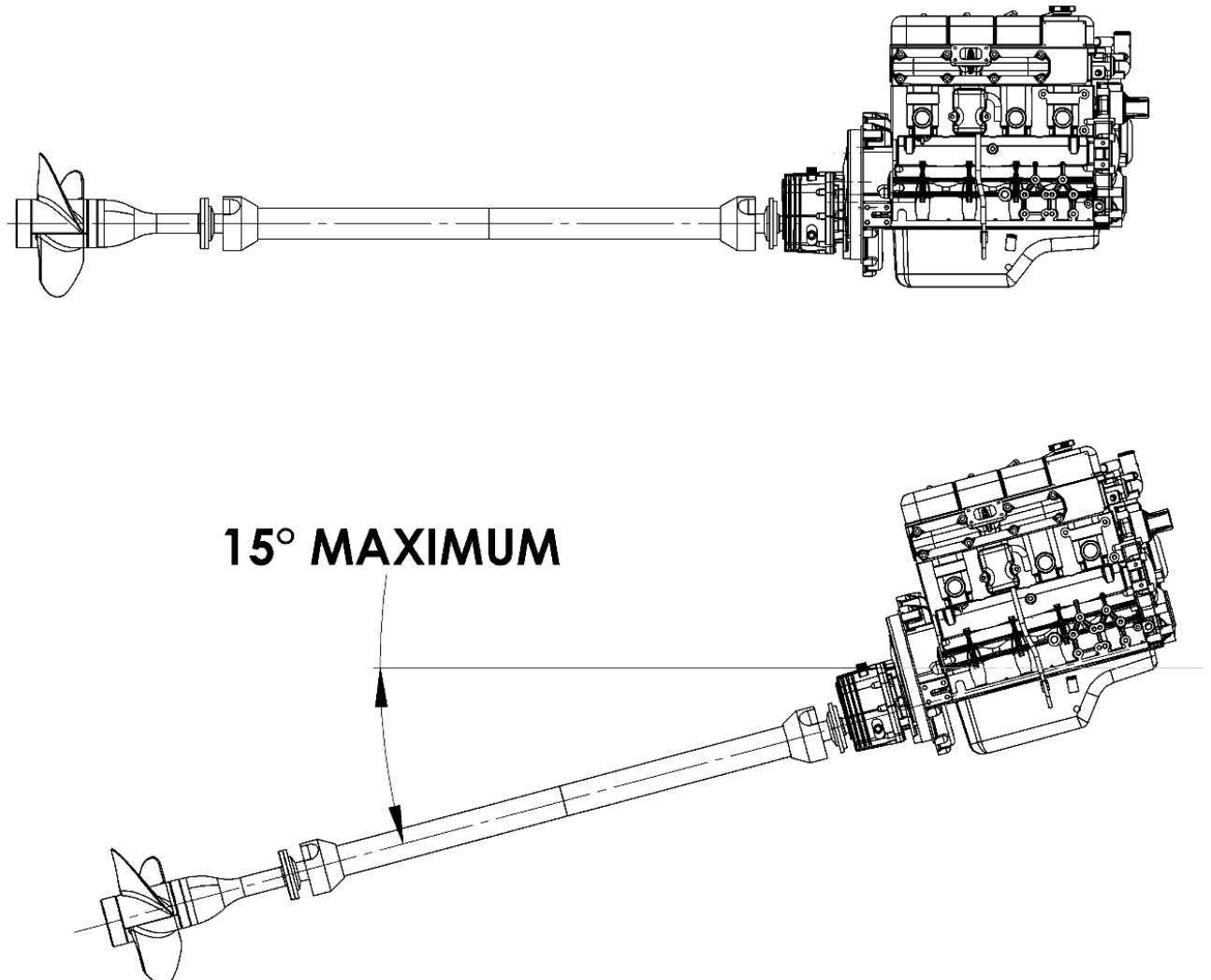
Since the Propeller Shaft line is normally fixed in the boat, alignment is usually obtained by adjusting Engine Mount Shims on the Mount themselves.

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 an insufficient support over its surface. If the Engine and Transmission are fitted before the hull is in water, the installation should be very carefully re-checked for alignment after launching.

In designing PRM 60, 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.

5.6 Installation angle

The Transmissions should normally be installed so that the maximum fore and aft angle relative to the water line does not exceed 15° with the boat at rest. Please consult PRM Newage Ltd. if installation angles greater than this are required.



5.7 Remote control operating systems

The Engine must be at idle before changing direction, therefore the PRM 60 should be used with remote control operating systems which must be of the single Lever type of remote control, i.e. Morse MT3 or SL3 which controls both

the Engine throttle and Gear selection. The stroke of the Lever between forward and reverse selection must not be less than 60mm lower hole and 70mm upper hole. Make sure the Lever forward position corresponds to the forward movement of the vessel.

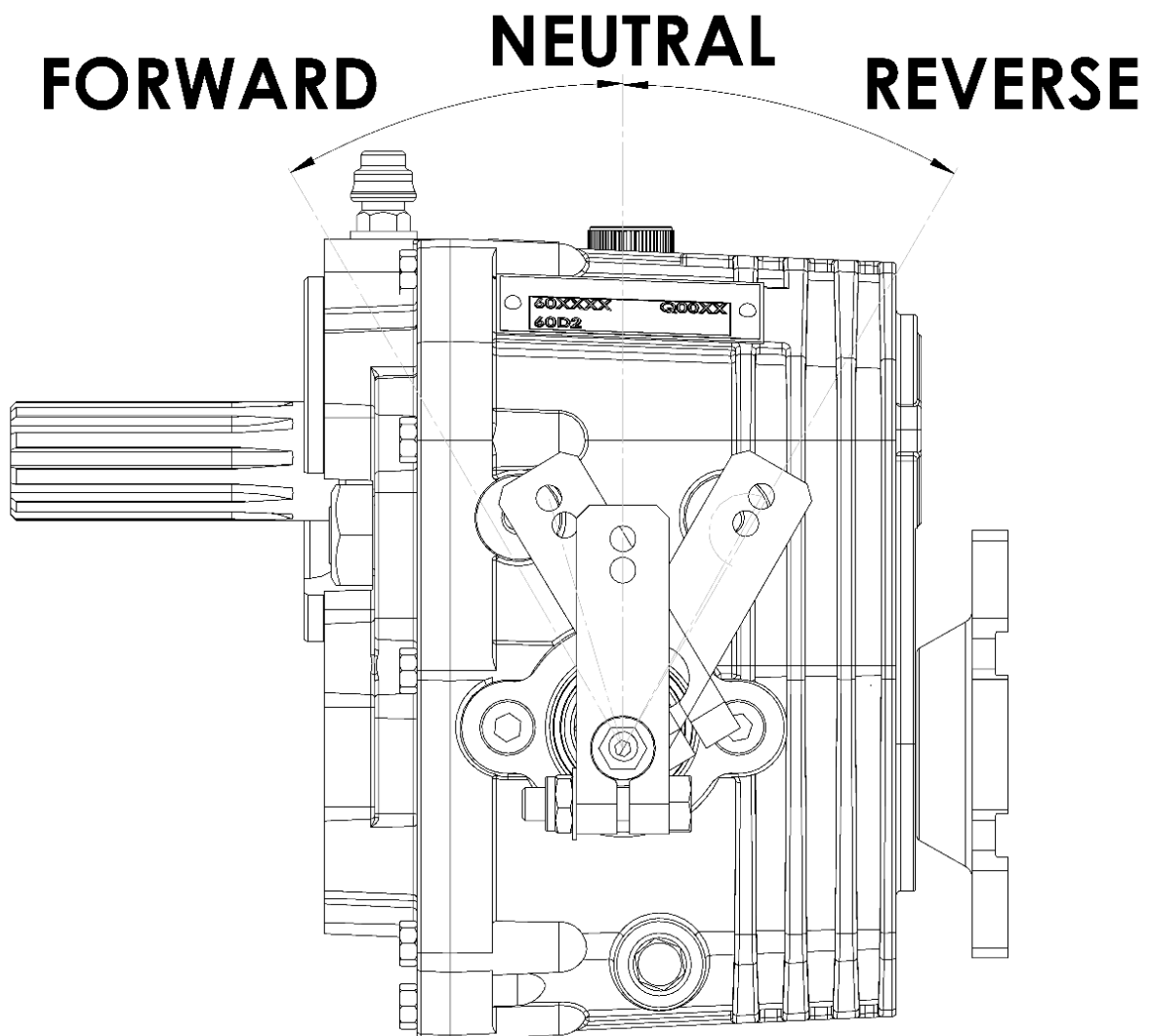
The following points should be noted:

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



ii) **CAUTION: CARE SHOULD BE TAKEN TO ENSURE THAT THE FLEXIBLE CABLE IS CAPABLE AND CAN MOVE THE FEARBOX LEVER FREELY TO THE FULL EXTENT OF ITS TRAVEL BOTH FORWARD AND BACKWARD AND THAT ITS NEUTRAL POSITION IS CORRECT FOR THIS TO TAKE PLACE.**

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



6. OPERATION

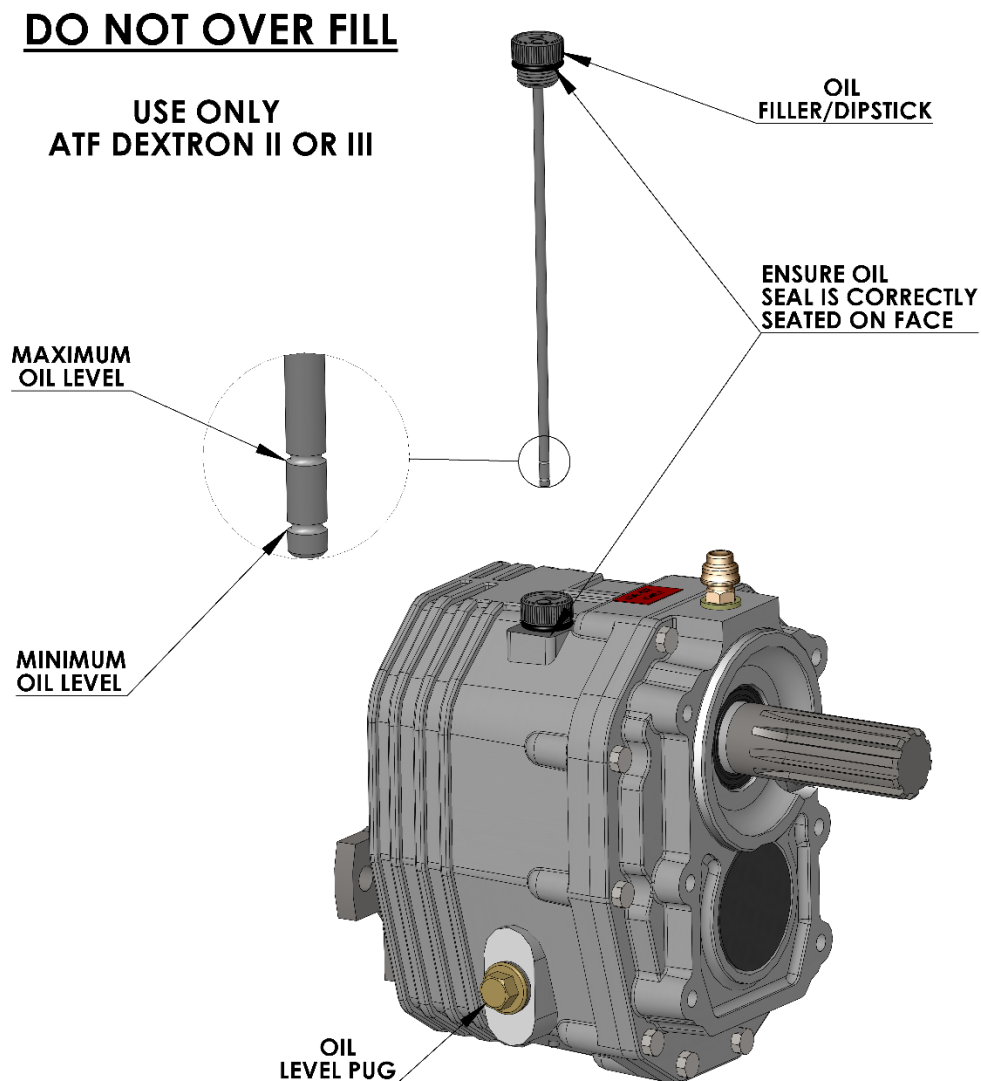
6.1 First time usage



CAUTION: Before starting the Engine fill the Gearbox to the correct level with a suitable oil (refer to recommended list, section 4.3).

Ensure the Gearbox is in neutral. Start and run the Engine for a short time so that the oil circulates through the Gearbox. Stop the Engine and allow the oil to settle for two minutes, re-check the level and top up to the marked oil level.

NOTE: The Dipstick should be secured firmly when checking the oil level.



6.2 Drive selection

The PRM 60 has been designed to operate with proprietary single Lever control systems which decreases the Engine speed to idle before opposite Gear selection can be made. It is most important that when changing direction a short pause is taken in neutral at Engine idle before selecting Gear. (see section 5.7)

6.3 Trailing (free wheeling) the Propeller

The Output Shaft can be rotated in neutral continually with the Engine shut down which makes the PRM 60 particularly suited for use in auxiliary sailboats, sailing yachts etc. Never put the Lever in the position corresponding to the direction of the vessel.

7. ROUTINE MAINTENANCE

7.1 Initial maintenance (after 25 hours running)

Drain all oil from the Gearbox, the Drain Plug is located on the side of the Transmission, below the Selector Lever. Refill with oil as stated in 4.3.

7.2 Daily checks

Check the Gearbox oil level on Dipstick.
Visually inspect for oil leaks and general condition of the Gearbox.

7.3 Six monthly check

Check the remote control operating Linkage is accurately adjusted to give maximum travel (stop to stop) in both directions.

7.4 Annual check

All above checks.
Propeller Shaft alignment inspection.
Change Gearbox oil and after 500 hours or annually which ever comes first.

7.5 Cone Clutch Adjustment

The Cone Clutch is self- adjusting and therefore needs no adjustment. Should Gear selection become difficult it is advisable to check the installation and operation of the Control Cable as described in 5.7. If this is correct then the Cone Clutch adjustment can be carried out as described in 9.7.6. If problems persist after the adjustment. It will be necessary to disassemble the Gearbox to investigate the condition of the Cone Clutch.

If the Cone Clutch shows signs of loss of coating, glazing and heat discoloration and the mating Gears shows signs of heavy groove indentations then the Cone Clutch and the Mating Gears must be replaced. If only the Gears are replaced then the adjustment of the Cone Clutch is not required. If the cone Clutch is replaced then adjustment needs to be carried out as described in 9.7.6.

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 without first contacting PRM Newage Ltd. or an authorised distributor or dealer for advice.

FAULT FINDING CHART

SYMPTOM	CAUSE	REASON	REMEDY
No drive ahead or astern		Broken Drive Plate Broken Input Shaft Broken Output Shaft	Replace Drive Plate Replace Input Shaft Replace Output Shaft
Propeller speed does not increase with Engine speed, ahead and astern		Remote control Cable or linkage not allowing F-N-R Lever to move correct distance Too much oil within Gearbox	Remove cable and operate Lever by hand to check movement. Adjust cable if necessary Recheck oil level and adjust.
Propeller speed does not increase with Engine speed in one direction only		Damaged Clutch Cones Too much oil within Gearbox Incorrect Lever setting	Remove and examine Clutch and replace if necessary Reset lever to end stops Recheck oil level and adjust.
Excessive noise from Gearbox at low speeds	Engine idle speed set too low Torsional vibration	Faulty adjustment Torsional incompatibility of elements in driveline	Increase idling speed If not cured by increasing Engine idling speed, refer to engine supplier
Excessive noise throughout operating range	Defective Input Coupling Propeller Shaft misalignment	Input Coupling worn or damaged Hull flexing or faulty installation	Remove, examine and replace if necessary Check the alignment of the Propeller Shaft Coupling; if necessary rectify by adjusting the Shims under the Engine mounts or the Engine mounts themselves
Excessive vibration throughout operating range	Propeller out of balance Engine/Gearbox misalignment Defective Bearing	Propeller damaged or badly machined Faulty installation Bearing worn or damaged	Remove the Propeller and check that the pitch, weight, diameter and balance of all the blades are equal and rectify if necessary Remove the Transmission and check that the Flywheel face is flat and that the Flexible Input Coupling is aligned correctly Isolate defective Bearing, remove and replace
Excessive oil temperature	Power too high Oil level too high/low	Incorrect Engine rating Incorrect oil type	Re-assess Engine power Fill with correct oil Fill to correct oil level on Dipstick
Oil level needs constant topping up	Oil leaks	Defective Oil Seal, Sealant or 'O' Ring	Clean the outside of the Gearcase, particularly around the ends of Shafts including the Output Shaft. Run the Engine and inspect the Gearbox for leaks. Replace seals as required Contact distributor or factory for advice
Escape of high pressure from Gearbox when Dipstick is removed	Defective Breather causing leaks past Oil Seals		
Difficulty in moving single Lever control	Faulty installation	Incorrect Selector adjustment Remote control operating cable kinked or frayed	Re check adjustment see 9.7.6 for procedure Check the installation and eliminate all tight bends in the cable



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: 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 and spilled oil or fluids to prevent accidents.
Wear correct safety equipment i.e. safety glasses and safety shoes to guard against personal injury/

Remember **WORK SAFELY – USE COMMON SENSE.**

Drawings showing all internal components are contained in the parts list.

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.

9.2 Bearings

If removing bearings for re-use keep them in a clean area to prevent dirt 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.

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 Threaded parts

Inspect for stripped or damaged threads.

9.5 Assembly



CAUTION: All threaded fasteners must be tightened to the torques listed in table 10.2, to prevent premature failure.

CAUTION: A new Drive Flange Nut must be fitted if this is removed. Prior to assembly oil all internal parts with clean Gearbox oil.

9.6 Disassembly of Gearbox

Drain oil and remove Adaptor Plate. Hold Output Coupling (23) securely whilst removing Locknut (36) , carefully remove the “staked” portion of locking device so as to avoid damaging the thread of the Output Shaft (14).

9.6.1 Selector assembly

Remove the Output Coupling (23) . Remove the two Socked Head Cap Screws (42) securing Selector Housing (19) . Withdraw selector assembly ensuring Selector Shoe (22) and Spring (15) do not fall into the Gearbox.

9.6.2 Gearcase assembly

Remove the external Locknut (25) securing Idler Shaft (7) into Gearcase (2). Remove then 10 off Bolts (56) securing both Gearcases (1, 2) and using a soft mallet lightly tap on the end of the Input Shaft (3) to separate the two Gearcase (1, 2) halves from sealant and Dowels (27). Remove the Front Cover (1). Withdraw the Idler Shaft (7) the Output Shaft assembly and the Input Shaft (3) .

9.6.3 Input Shaft

Removal of the Bearings (34, 38) may damage them, therefore it is good practice to replace these items if removed. (see 9.4.3)

9.6.4 Output Shaft

Carefully remove "staked" portion of locking device so as to avoid damaging the thread and remove Locknut (13) from Output Shaft (14) . Using a Bearing Puller remove the Bearing (33) on the output end of the Shaft (14).

Remove the following: Thrust Washer (8), Forward Output Gear (10) , Needle Bearing (37) (carefully checking for wear), Thrust Washer (9) , Cone Clutch (11) . Using puller remove the Bearing (33) on the Input end of the Shaft (14), Thrust washer (8), Output Reverse Gear (12) , Needle Bearing (37) (again carefully checking for wear), and Thrust Washer (9) . Save SHIMS for rebuild.

Note: Removal of Ball Bearings may result in damage, therefore replacement will be necessary.

9.6.5 Idler Shaft

Remove Locknut (25) and supporting Gear (6) on soft material i.e. wood or similar to prevent damage to Gear (6), using a soft mallet tap the Shaft (7) through the Gear (6) and remove Needle Bearing (4) . Check condition of 'O' Ring (55) on the Idler Shaft (7).

9.6.6 Selector

By hand remove Selector Shoe (22) and the Spring (15). Remove the Lever (44). Pass the Selector Control Body (18) through the Housing (19) and remove 'O' Ring (20) and Oil Seal (21) if replacing them.

9.6.7 Front Cover

If it is required to replace the Front Cover (1) then it will be necessary to remove the Oil Seal (24) . If the Bearings (38, 33) are to be re-used then care must be taken not to damage them on removal. It is recommended to fit a new Oil Seal (24).

Note: When re-fitting Oil Seal (24) set in 1.5mm from face as shown on page 18.

9.6.8 Gearcase

If it is required to replace the Gearcase (2) then again if the Bearings (33, 34) are to be re-used care must be taken in their removal. Remove Output Seal (40), two Studs (53), Dipstick (28), Drain and Oil Level Plugs (26) with Bonded Washers (31), Oil filling Plug (48) with Bonded Washer (54), and two Dowels (27) .

9.7 Re-assembly of Gearbox

(Note: coat all bearings with clean Gearbox oil prior to fitting).

9.7.1 Input shaft

Press the two Bearings (38, 34) onto the Input Shaft (3) taking care to position correctly as illustrated. Make sure Waved Washer (39) is correctly positioned into case before fitting the Input Shaft (3).

9.7.2 Output shaft (see 9.7.5 for Shimming procedure)

All of the following components are fitted in order over the output spline end of the Shaft (14).

Thrust Washer (9), Needle Bearing (37), Output Forward Gear (10) with cone towards the scroll, Thrust Washer (8) and the Bearing (33) (Press on).

Fit the following components from the opposite end of the Shaft (14) .

The Cone Clutch (11), Thrust Washer (9), Needle Bearing (37), Output Reverse Gear (12) , Thrust Washer (8), press on Bearing(33) (re-shim if components have been changed) (see 9.7.5). Fit Lochwasher (35) and Locknut (13) .



**CAUTION: Remember to tighten locknuts to recommended torque.
(SEE TORQUE CHART 10.2)**

9.7.3 Idler Shaft

Fit the Thrust Washer (5) onto the Idler Shaft (7), fit the two Needle Bearings (4) onto the Idler Shaft (7), fit the Idler Gear (6) onto the Needle Bearings (4), then fit the 'O' Ring (55) into the Shaft's (7) groove. Then apply grase on the the 'O' Ring (55). Feed the Idler Shaft assembly through the Front Cover (1) bore and fit the Locknut (25) and tighten to the recommended torque (see torque chart 10.2)

9.7.4 Selector Housing assembly

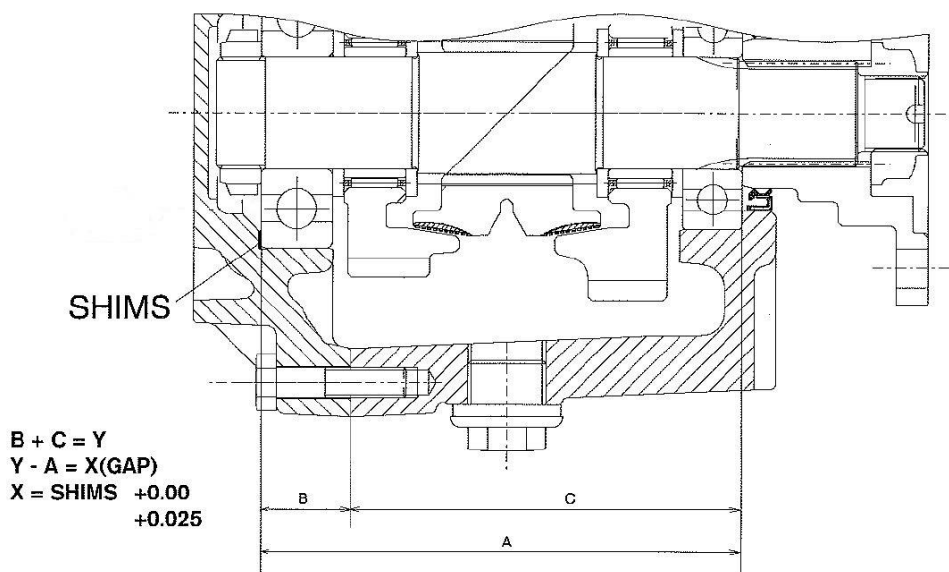
* Before proceeding with this assembly see Shimming procedure 9.7.6.

Press in Oil Seal (21) flush to the face of Selector Housing (19). Using tool number PR29418 insert into seal to expand it whilst assembling Selector Control Body (18) into the Selector Housing (19). This will displace the tool and allow the Control Body (18) to slide through the Seal (21). Fit the 'O' Ring (20) to Selector Housing (19) and smear grease onto the 'O' Ring (20), insert Spring (15) and Selector Shoe (22) into Selector Housing (19).

9.7.5 Shimming (Output Bearings)

The Output Bearings (33) must be shimmed zero to 0.025mm preload.
This is achieved as follows:

- | | |
|---|---------------|
| 1. Measure Shaft (14) over the Bearings (33). | Dimension A |
| 2. Measure Gearcase (2) bore depth to joint face. | Dimension C |
| 3. Measure Front Cover (1) bore depth to joint face. | Dimension B |
| 4. Add cover and case bore depths to give "bore face lengths". | Dimension Y |
| 5. Subtract bore face lengths from Shaft (14) lengths over Bearings (33) to achieve shim requirement. | Dimension Y-A |
| 6. Fit shims as required to within zero to 0.025mm preload. | |



Place the Shims into the appropriate bore of the Front Cover (1) so that they are located under the Bearing (33) . Locate both Input and Idler Shaft assemblies into the respective bores. Fit the two Dowels (27) and apply silicon sealant onto the joint face. Tighten the gearcase joint to the recommended torque (see torque chart 10.2). Fit Locknut (25) to the Idler Shaft (7), tighten to the recommended torque (see torque chart 10.2). Move the Cone Clutch (11) to the neutral position, and locate the assembled Selector Mechanism and secure with two Cap Screws (42) to recommended tightning torque(see torque chart 10.2). Ensure the Selector Shoe (22) is in the groove of the Cone Clutch (11), and the identification pip of the Selector Shoe (22) is uppermost. Secure Gear Selector Lever (44) to the Selector Body (18) using Bolt (45), Washer (46) and Nut (47) . Fit Oil Seal (21) to Gearcase (2) bore and Oil Seal (24) to the Front Cover (1) (see tool sheet). Assemble the Output Coupling (23) to the Output Shaft (14). Apply a countiniues bead of silicone sealant to the flat face of the Locknut (36) and hydraulic sealant to threads of the Shaft (14). Fit Locknut (36).



CAUTION: Remember to tighten Locknut (36) to the recommended torque and stake the nut into slot. When using sealants and locking compounds all surfaces should first be cleaned by degreasing.

Fit Drain and Oil Level Plugs (26) with Bonded Washer (31) to the sides of the Gearcase (2). Fit Oil Filling Plug (48) with

Bonded Washer (54). Fit Dipstick (28) and Breather (30) with Bonded Washer (52) . Finally adjust the gear Selector Lever (44) into the required position.

9.7.6 Cone Clutch Selection

With the Selector Lever (44) in neutral position manually rotate the Output Coupling (23). The eccentricity of the Cone Clutch (11) groove causes an axial shift on the Selector Shoe (22). The variable distance between the end of the Selector Shoe (22) and the Output Shaft (14) vertical centre line upon rotation provides MAX & MIN axial movement of the Selector Shoe (22). With no further rotation of the Output Coupling (23), screw the Dog Point Grub Screw (50) until contact is made with the bottom of the Selector Shoe (22). Fit the Nut (49) upto Selector Body (18), **not** allowing any rotation of the Dog Point Grub Screw (50). Unscrew the Dog Point Grub Screw (50) simultaneously with the Nut (49) attached until a 0.60mm gap is achieved between the Nut (49) and the Selector Body (18). With no further movement of the Dog Point Grub Screw (50) tighten the Nut (49) against the Selector Body (18) to 17 Nm (13lbf). This will give 0.60mm clearance between the bottom of the Selector Shoe (22) and the Dog Point Grub Screw (50) at max cone eccentricity.



CAUTION: This condition can only be maintained with the Clutch at the top dead centre. If this is not achieved the gear selection will be affected, creating difficulty in Gear engagement or disengagement.

10. SPECIAL TOOLS

Oil seal to selector housing	PR29418
Oil seal to gearcase	PR29281
Oil seal to front cover	PR29283

10.1 Tool Kit

Socket size	13mm
	24mm
	30mm
Drain Plug	13mm A/F

10.2 Tightening torques

RECOMMENDED TIGHTENING TORQUES

Size	Grade	Type	Nm
M6	8.8	Bolt	12
M8	8.8	Nut	24
M8	8.8	Screw	30
M16	8.8	Binx Nut	56
M16	8.8	Special Nut	170 *
M25	8.8	Locknut	135

***NOTE: USE LOCTITE 243 ON THREADS AND STAKE NUT INTO KEYWAY.**

11. REPLACEMENT PARTS ORDERING

When ordering replacement parts the following should be quoted:

- Gearbox model and serial number
- Description(s) and part number(s) of the component(s) required
- Quantity required
- Orders and enquiries for replacement parts must be made through PRM Newage distributor/dealer network

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

**PRM NEWAGE LTD.
BARLOW ROAD
COVENTRY CV2 2LD
ENGLAND**

TEL: +44 (0)24 7661 7141

12.PARTS LIST

ITEM NO.	PART No	DESCRIPTION	QTY.
1	MT8600	FRONT COVER	1
2	MT8601	GEARCASE	1
3	MT8606-H MT8604-H MT8608-H	INPUT SHAFT (1.52:1), (2:1), (2.5:1) 60D MODELS	1
3	MT8691-H MT8692-H MT8693-H	SHORT INPUT SHAFT (1.52:1), (2:1), (2.5:1) 60DS MODELS ONLY	1
4	0562006	NEEDLE BEARING	2
5	MT8675	THRUST WASHER	1
6	MT8602-H	IDLER GEAR	1
7	MT8611	IDLER SHAFT	1
8	0592503	THRUST WASHER	2
9	0593003	THRUST WASHER	2
10	MT8677 MT8678 MT8679	OUTPUT WHEEL, FORWARD (1.52:1), (2:1), (2.5:1)	1
11	MT8688	CONE CLUTCH	1
12	MT8680	OUTPUT WHEEL, REVERSE	1
13	010N251	LOCKNUT	1
14	MT8610	OUTPUT SHAFT	1
15	0311042	SELECTOR SPRING	1
16	010-0210	SPRING DOWEL	1
17	MT8104	SELECTOR PIN	1
18	MT8616	SELECTOR BODY	1
19	MT8615	SELECTOR HOUSING	1
20	04303524	O' RING	1
21	0400255	OIL SEAL	1
22	MT8103	SELECTOR SHOE	1
23	MT8670	OUTPUT COUPLING	1
24	0400286	OIL SEAL	1
25	MT8674	BINX NUT	1
26	0150125	1/4" BSP LEVEL PLUG	1
27	0210614	DOWEL PIN	2
28	0970147	3/8" BSP FILLER/DIPSTICK	1
29	N/A	SERIAL PLATE	1
30	CP1003	SERIAL PLATE PINS	2
31	AM161	BALL BEARING	2
32	0512030	BALL BEARING	1
33	010W252	LOCKWASHER	1
34	MT8118	NUT	1
35	0563005	NEEDLE BEARING	2
36	0513010	BALL BEARING	1
37	0191245	WAVED WASHER	1
38	0400356	OIL SEAL	1
39	06905206	SHAMBAN END COVER	1
40	0081420P	CAP SCREW	2
41	CP1486	RED LABEL	1
42	MT8676	SELECTOR LEVER	1
43	0040809ZP	SET SCREW	1
44	0191007MZP	WASHER	1
45	04908025ZP	STUD M8 X 1.25	2
46	CP1489	1/4" BSP MAGNETIC DRAIN PLUG	1
47	0050810	NUT	1
48**	014D525	DOG POINT GRUB SCREW	1
49	04908025ZP	STUD	2
50	04301416	IDLER SHAFT 'O' RING	1
51	CP1204	BONDED WASHER	2
52	0040607ZP	BOLT	10
53	CP1488	BEATHER VALVE 1/8" BSP	1
54	CP1224	SEALING WASHER 1/8" BSP	1
55	CP1223	SEALING WASHER 5/16"	1

** USE LOCTITE THREAD SEALANT 542 ON THREAD

13. Exploded view and Cross- section

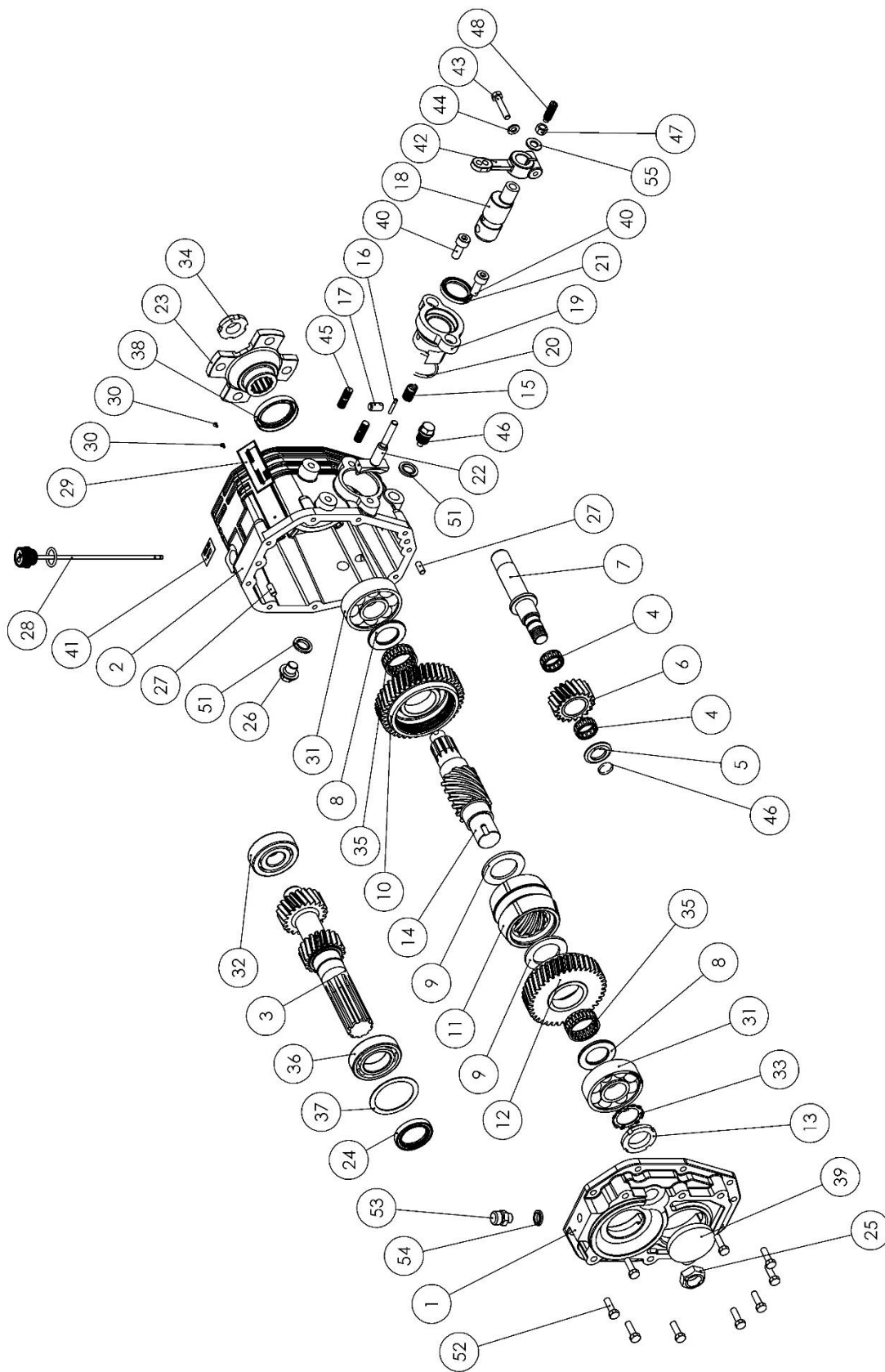
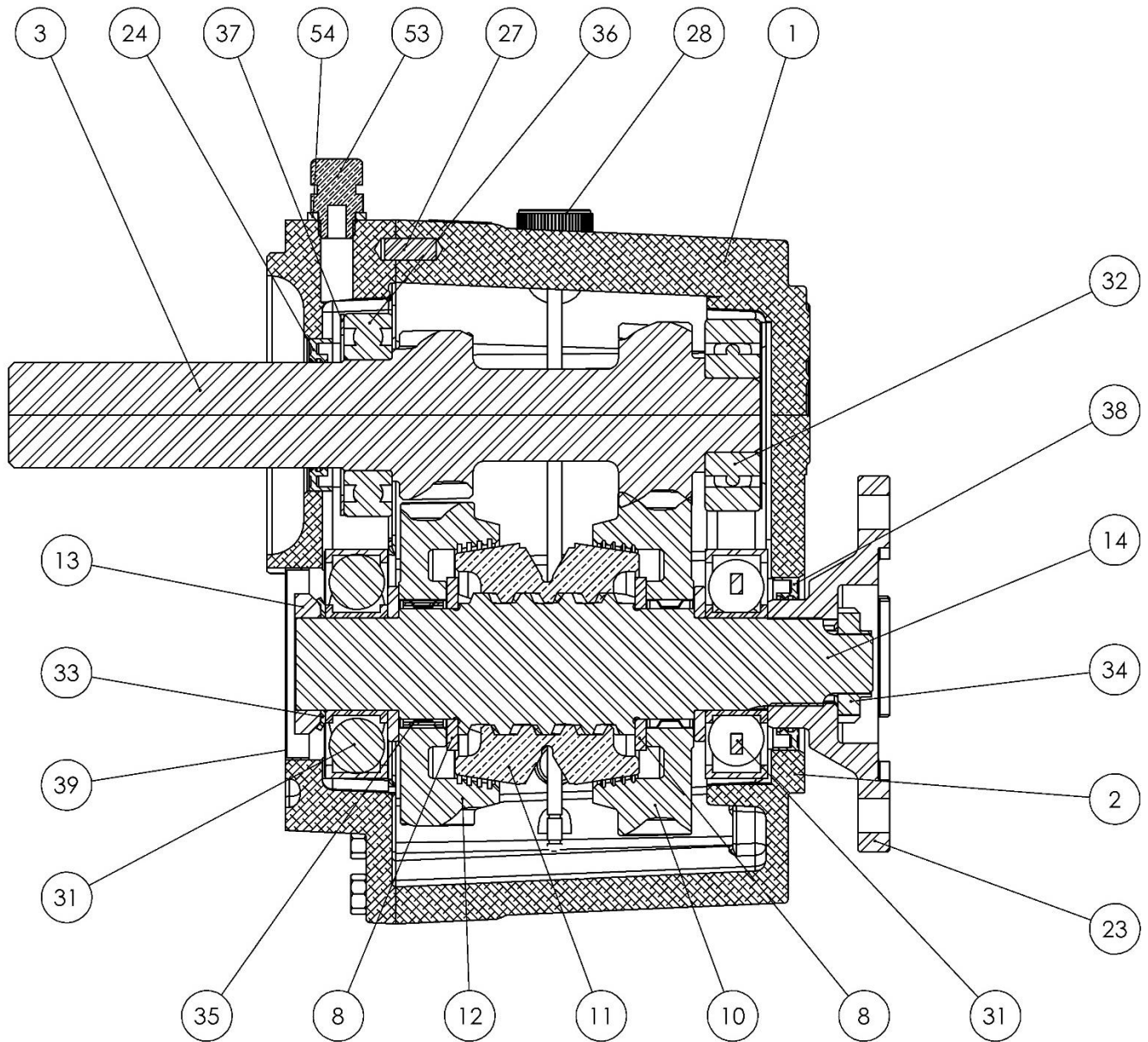
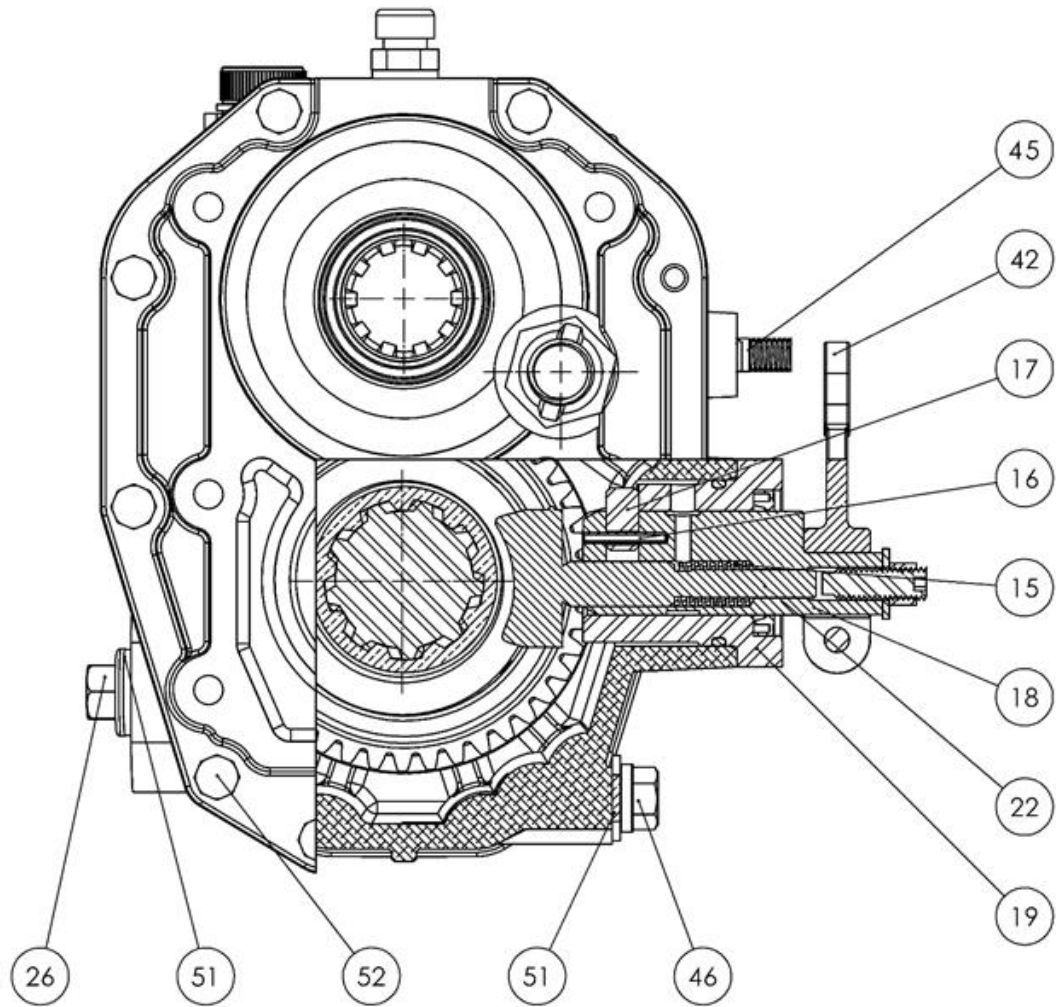
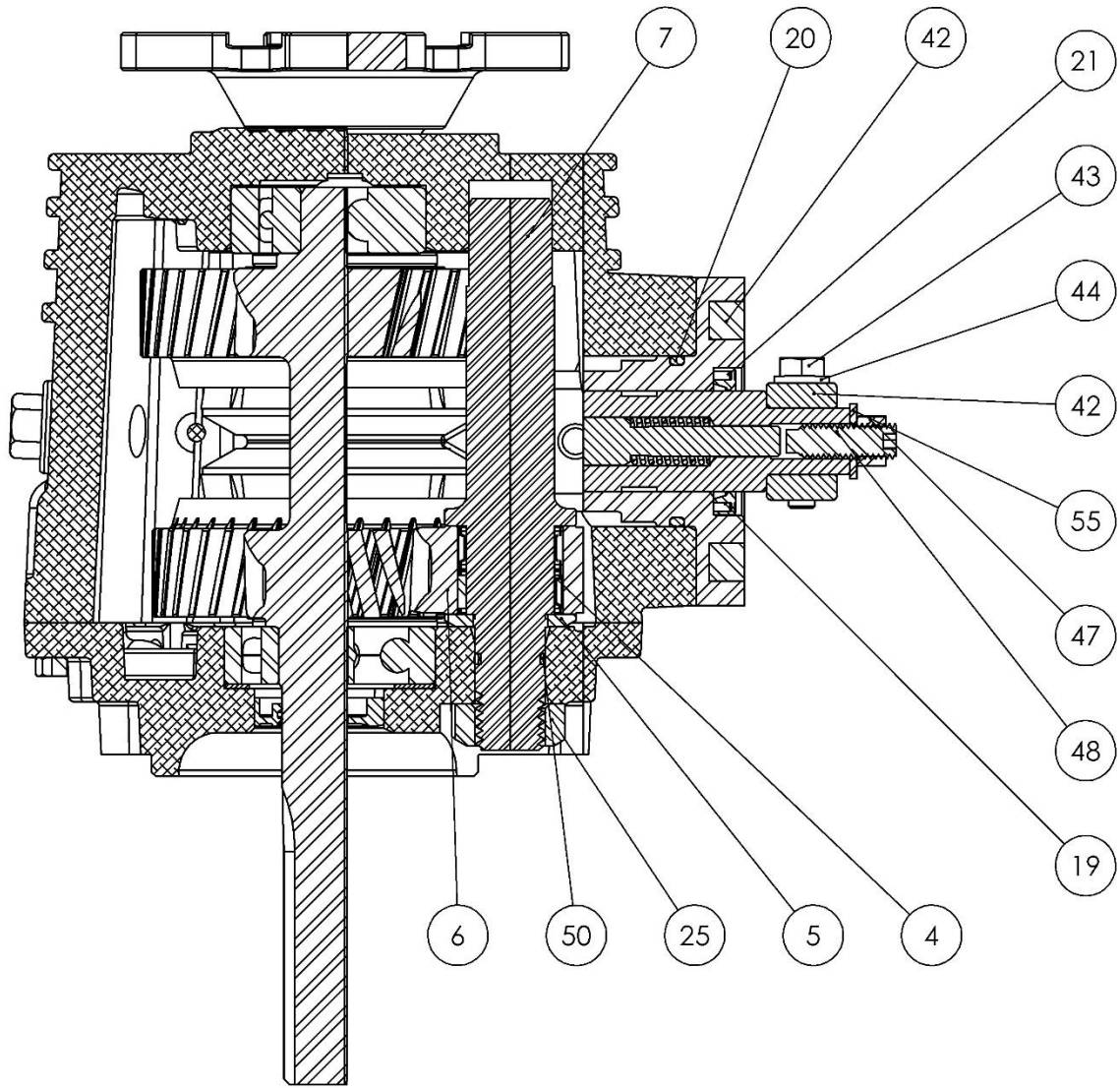


Figure 5 - Exploded view and cross-section







SPARES KITS

GEARS & CLUTCH KIT	INCLUDED COMPONENTS	DESCRIPTION	PRODUCT
MT8677-KIT (1.5:1)	MT8677	FORWARD GEAR	PRM60
	MT8680	REVERSE GEAR	
	MT8688	CONE CLUTCH	
MT8678-KIT (2:1)	MT8678	FORWARD GEAR	PRM60
	MT8680	REVERSE GEAR	
	MT8688	CONE CLUTCH	
MT8679-KIT (2.5:1)	MT8679	FORWARD GEAR	PRM60
	MT8680	REVERSE GEAR	
	MT8688	CONE CLUTCH	

NOTES

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