

JP2M - Reduction gearbox oil change					REF:	Roger - 05	
	1		1 hr		Medium	Weather	Any

Aim:

To drain and refill the reduction gearbox lubricating oil.

Periodicity:

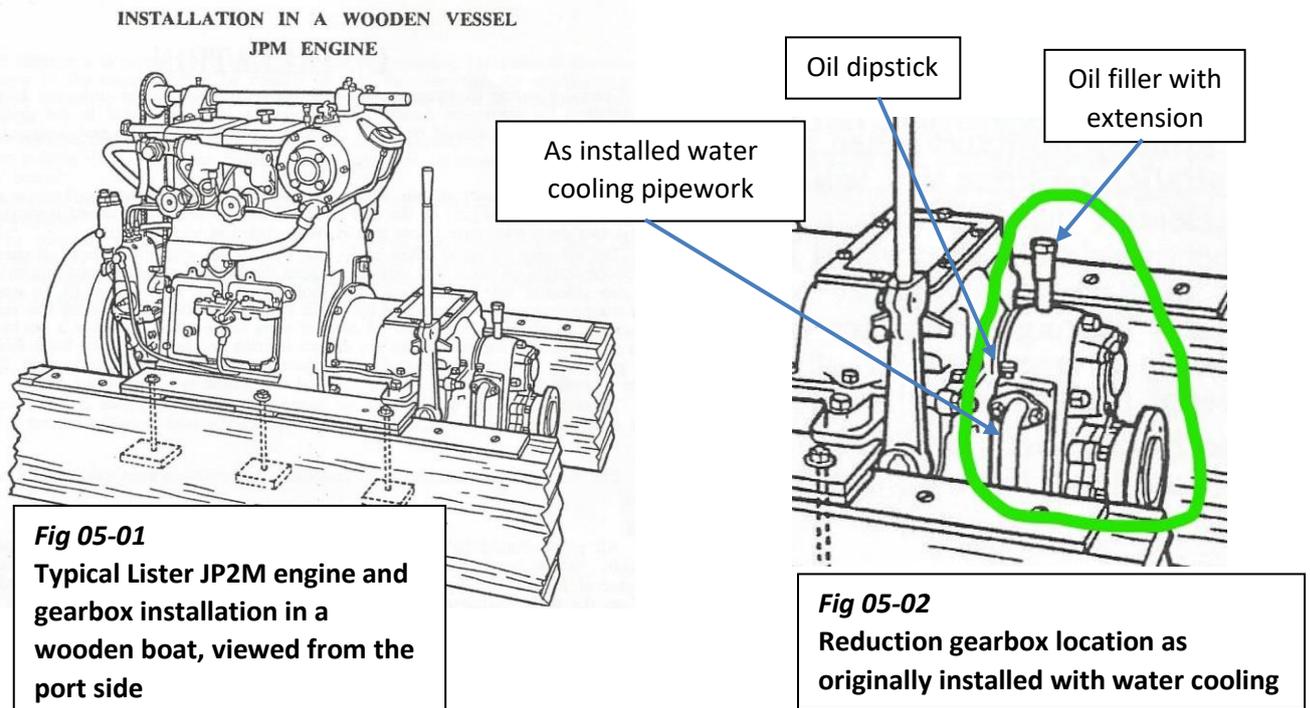
Annual.

Reason:

The gearbox oil needs changing every 450 hours but for simplicity, Roger’s is changed annually.

Overview:

The gearbox is bolted to the rear of the forward/reverse gearbox, see **Figs 05-01** and **05-02**.



The gearbox input is taken from the output of the forward/reverse gearbox and as the name implies, reduces the revolutions per minute by 2:1. Originally, the gearbox was water cooled but as can be seen from **Fig 05-02** compared with the present arrangement, the cooling water has been disconnected because the water jacket is badly cracked and leaks. The cooling water input to the engine now runs over the oil filler, by-passing the gearbox.

Difficulty level:

The gearbox sits just above a steel sump under the engine and the drain plug cannot be seen without a mirror. Fortunately, the brass plug needs a ½”W socket which is larger than the numerous other nuts and bolts in the area. It is not possible to use a normal ring spanner because of the limited clearance between the plug and sump wall. However, a ½”W socket and short ratchet handle will just go in. Therefore, although the task is not technically difficult, it is best carried out by someone with experience of working in cramped and awkward spaces and without sight of the job, in other words by feel.

Duration:

Once the tools have been assembled, the job should not take more than an hour by one person.

Equipment needed:

1 litre of 75W80 gear oil in a container with a pouring spout.

A small funnel if the oil container has not got a pouring spout.

A disposable container to catch the waste oil.

The oil vacuum pump.

Blue paper.

½”W socket from the red toolbox.

½” drive ratchet handle from the red toolbox.

5/8”W ring spanner.

Special notes/risk assessment:

Authority: Permission to carry out the work must be obtained from the **Conservation Manager**.

Access: Entry into the engine room is awkward and the towpath may be wet. There is a possible crush injury between the hull and bank; therefore, take care not to let any body part drop between the two.

Entry and exit: Once the hatch is open, ensure that the rung ladder is secure. Holding onto the roof rail above the opening, enter the space forward, taking care on the ladder. Leave the engine room backwards, using the ladder and rail as for entry.

Engine room: The engine room floor is uneven and slippery. Space is very limited and there are many trip hazards and sharp edges. Take care not to damage pipework and fittings anywhere and especially around the gearboxes.

Environment: The waste oil may spill into the sump beneath the engine which must be cleared. The waste oil should be placed in a suitable container for disposal at the local recycling centre along with any contaminated paper. **Do not contaminate the bilge or canal with oil.**

Tools: Apart from the vacuum pump, fresh bottle of oil and waste oil container, all the tools are on the boat. If any are missing or defective, work must not proceed until a replacement is found: faults must be reported.

PPE: The job could be messy so suitable clothing should be worn. Disposable latex or similar disposable gloves should be worn.

Preparation: Read the whole of this document before proceeding; if in doubt, ask the **Conservation Manager**.

Gearbox function:

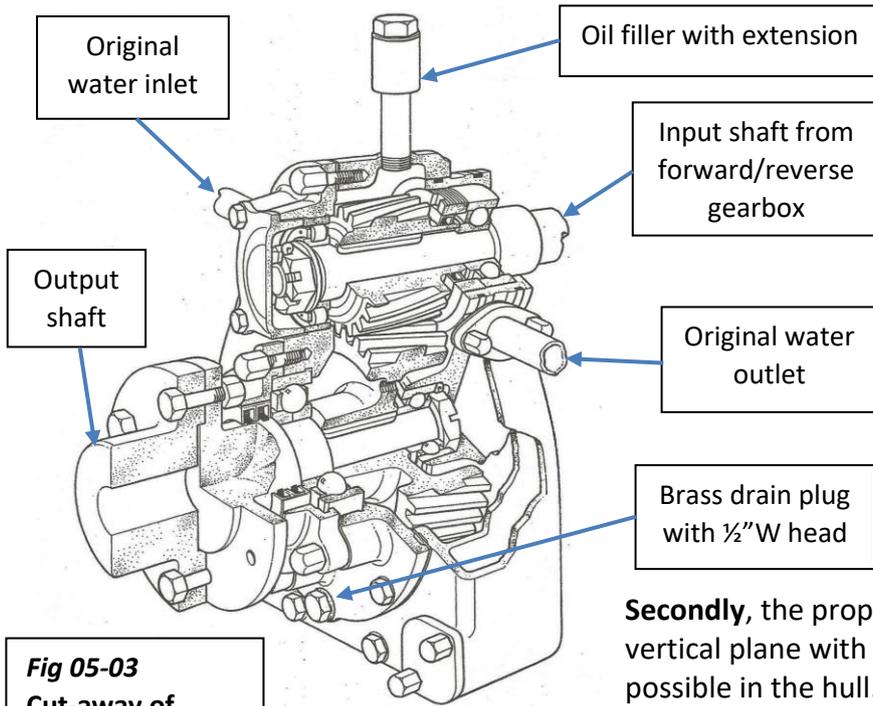


Fig 05-03 shows a cutaway drawing of the reduction gearbox. The purpose of the gearbox is twofold.

Firstly, the ratio is 2:1, that is the output shaft rotates at half the speed of the input from the forward/reverse gearbox allowing the propeller to rotate at the correct revolutions per minute.

Secondly, the propeller needs to rotate in a vertical plane with the propeller shaft as low as possible in the hull. The engine is installed low down but the crankshaft is still 300mm or so above the bottom of the boat.

The reduction gearbox output shaft is about 150mm lower than the input shaft which brings it into line with the propeller shaft.

Fig 05-03
Cut-away of reduction gearbox, starboard side

Method – Part 1; removal of most of the oil:

It is possible to remove all but about 100ml of oil with the vacuum pump.

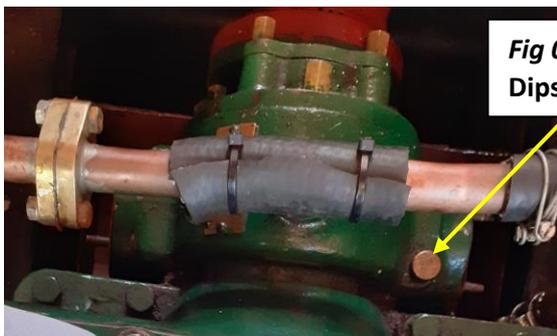


Fig 05-04
Dipstick

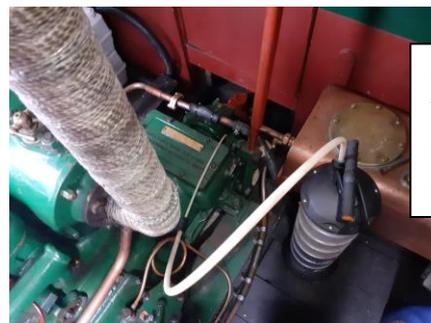


Fig 05-05
Vacuum pump in position

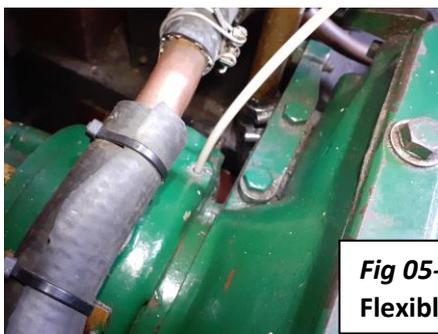


Fig 05-06
Flexible hose in position

Fig 05-04 shows the position of the gearbox dipstick. **Fig 05-05** shows the vacuum pump in position ready to pull out the gear oil and **Fig 05-06** shows the vacuum pump flexible hose inserted into the dipstick hole.

By wriggling the thin hose as far down into the box as possible, most of the oil can be extracted.



Fig 05-07
Vacuum pump

Bung with hose

Vacuum release button

Fig 05-07 shows the vacuum pump. The flexible hose is fitted with a bung which goes into the hole in the lid; the hole has a pouring lip. A vacuum is created by inserting the flexible hose into the oil and pumping the 'T' handle. Gear oil is more viscous than engine oil so will flow slowly into the translucent flask – note that each moulded rib on the flask represents one litre of fluid. The vacuum is released by pressing the stainless steel button on the lid. Note that the bung cannot be removed until the vacuum is released.

Method - Part 2; removal of the remainder of the oil:

Position a suitable container under the gearbox as shown in **Fig 05-08**. If most of the oil has been removed with the vacuum pump, a container such as a small aluminium foil food tray needs to be positioned under the gearbox. If the vacuum pump hasn't been used, a similar larger container of about 750ml capacity needs to be put in place.

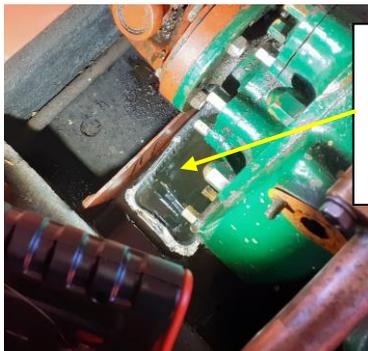


Fig 05-08
Disposable food tray in position as seen from above

The photographs below were taken with a camera in the large steel sump under the engine and gearboxes.

Without a mirror it isn't possible to see the drain plug so it has to be felt for by hand. Fortunately, the surrounding nuts and bolt heads are of a smaller diameter.

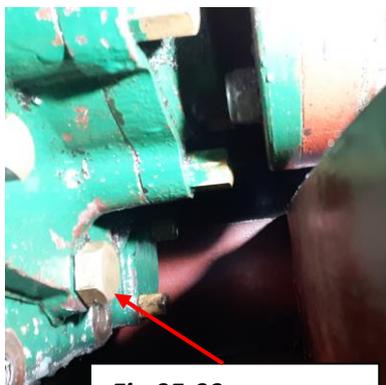


Fig 05-09
Brass drain plug



Fig 05-10
Socket on drain plug



Fig 05-11
Ratchet handle in position



Fig 05-12
Drain plug

Referring to **Fig 05-09**, feel for the plug. Fit the ratchet to the 1/2" W socket and locate the socket over the plug as shown in **Figs 05-10** and **05-11**. Unscrew the plug and remove it together with the socket and the ratchet, see **Fig 05-12**.

Once all the oil has drained, ensure that the plug is clean and replace it. It will be possible to start the plug in the thread **by hand**. To prevent a crossed thread **do not use the socket and ratchet until the plug has gone in by at least three full turns**.

After the drain plug has been nipped up, remove the socket and ratchet handle.

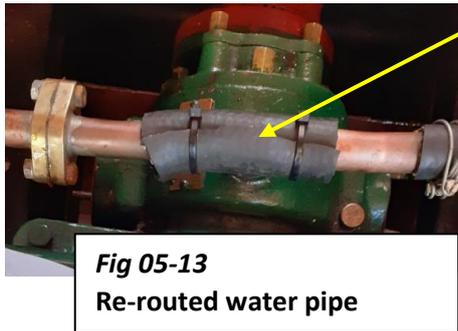


Fig 05-13
Re-routed water pipe

Filler beneath water pipe

The filler extension has been removed and is in the red toolbox, because the engine cooling pipework has been re-routed over the filler.

Move the water pipework forward slightly and using the 5/8" W spanner from the board, remove the filler plug see **Fig 05-13**.



Fig 05-16
Filling reduction gearbox

Remove the cap seal from the top of the new oil bottle and pull out the spout. The spout can be inserted into the filler hole and by squeezing the bottle, oil can be fed into the gearbox, see **Fig 05-16**. It takes about 650ml and the level needs to be monitored by



Fig 05-14
Dipstick

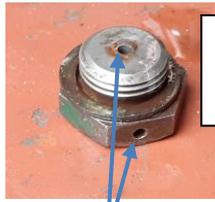


Fig 05-15
Filler plug

Breather holes

removing and checking the dipstick, see **Figs 05-04** and **05-14**. After filling the gearbox, clean the filler plug and ensure that the breather is clear, see **Fig 05-1**, and then replace.

Finally:

Clean and replace the tools. Replace the cap on the oil bottle and return to the workshop. Dispose of the used oil at the local recycling centre. Clean any oil from the steel sump under the engine and bag up the waste and contaminated paper. Dispose of the solid waste responsibly at the recycling centre.

Report the completed task to the **Conservation Manager**.