
ROLLS-ROYCE AUTOMATIC GEARBOX

SECTION 5 — AIR PRESSURE CHECK AND INVESTIGATION

The air pressure test assists diagnosis by indicating which unit is exhibiting excessive oil leakage and in some cases can be used to check unit functioning. The tests can only be made after removal of the gearbox sump, side cover and control valve unit, which should follow investigation of the possible causes listed in the Fault Diagnosis Section.

Removal of the control valve unit and reverse clutch oil pipe reveals the oil passages to which the air pressure should be applied. Using the tool (J-4353-1) connected to a compressed air supply of approximately 80 lb./sq. in. apply air pressure to the oil passages referring to Figure 35 for identification of the oil passages. Excess oil should be blown out into a cloth before close examination.

Front servo

The front servo will apply the front band when air pressure is applied to the front band apply passage. Small air leaks are permissible only — through the servo to casing joint face — from the 4-3 timing valve exhaust hole — and from the front band release passage; no other leaks are permissible. Excessive leakage from the front band apply passage or from the compensator passage may cause slipping on 2-3 up-change or when starting from rest.

As the front servo is returned by spring pressure to the released position, application of air pressure to the front band release passage will not actuate the servo or band, but it will indicate excessive leakage. Slight leakage past the piston ring gaps is permissible. Excessive leakage will cause slipping on 3-4 up-change and if it

is very excessive will cause missing of second and fourth gears. On early servos a sticking quick-release valve may cause slipping in range '3'.

Air pressure applied to the G1 to 4-3 timing valve passage should give slight leakage only from the front band apply passage. If the valve is sticking, slipping may occur on the 2-3 up-change, 4-3 down-change, or intermittently in all ranges. In some instances a rough 4-3 down-change may occur.

Rear servo

The rear servo will actuate the rear band when air pressure is applied intermittently to the rear band release passage. Air will escape through the piston ring gaps but leakage should not be sufficient to impair operation. A small amount of air may escape from the compensator passage and from the servo to casing face joint but there should be no other leakage. Excessive leakage will cause slipping on 2-3 up-change or a rough 3-2 closed-throttle down-change.

When air pressure is directed into the compensator passage a feed into both front and rear servos, tending to tighten the bands, should be indicated by slight leakage past the piston ring gaps of both servos. Excessive leakage will cause slipping on heavy throttle up-changes.

Other possible rear servo defects are faulty restrictor valve, exhaust valve sticking open or servo piston sticking when applying; these cannot be diagnosed by the air pressure check but will give such incorrect operation as rough 3-2 closed-throttle down-change, or slow band apply when selecting drive from Neutral.

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Front epicyclic unit

The front unit contains the front clutch which can be felt or heard to operate when air pressure is applied intermittently to the front clutch apply passage. Excessive air leakage will indicate either faulty clutch piston seals, or a faulty oil delivery sleeve; the latter can be checked more accurately by removing the servos to enable a closer inspection of the source of leakage. Leakage from the oil delivery sleeve may affect front or rear unit operation, or both.

It may be possible to rectify leakage from the oil delivery sleeve if it is due to loose bearing cap set-

screws or bad fitting of the cap to the sleeve, but any other fault will require removal of the gearbox to permit removal and investigation of the front unit or oil delivery sleeve.

A sufficient loss of oil pressure or any other fault which causes the clutch to slip will cause slipping on 1-2 and 3-4 up-changes; if very excessive, second and fourth gears will be missed.

A locked front unit due to faulty gears will prevent a forced 4-3 down-change and missing of first and third gears; this will not be shown up by the air pressure check.

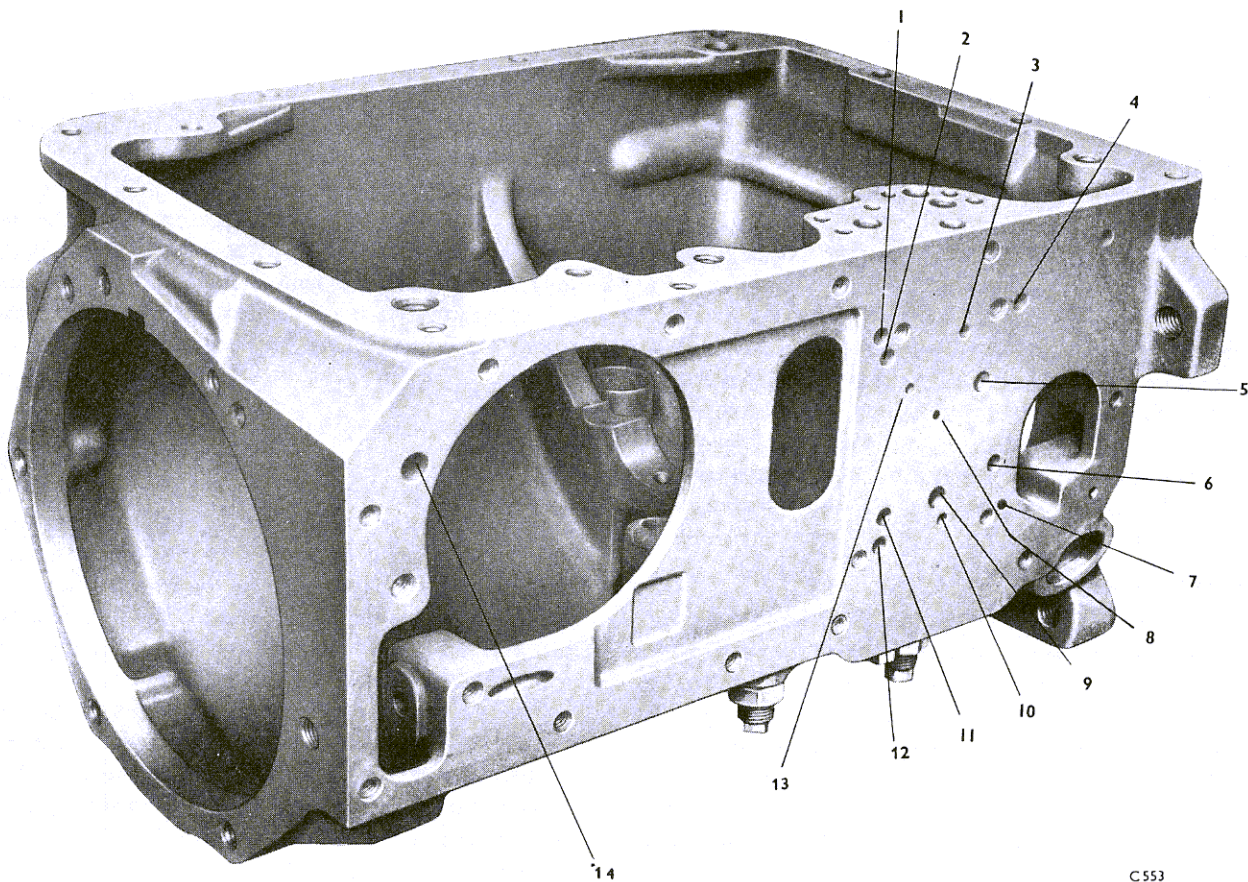


Fig. 35 Oil passage identification

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|--------------------------|-------------------------|-------------------------|
| 1 REAR BAND RELEASE | 6 FRONT BAND RELEASE | 10 PRESSURE GAUGE BLANK |
| 2 COMPENSATOR OIL | 7 T.V. OIL TO REGULATOR | 11 FRONT CLUTCH APPLY |
| 3 G1 TO 4-3 TIMING VALVE | 8 1-2 OIL TO REAR SERVO | 12 REAR CLUTCH APPLY |
| 4 FRONT BAND APPLY | 9 EXHAUST | 13 EXHAUST |
| 5 MAIN LINE PRESSURE | | 14 REVERSE CLUTCH APPLY |

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Rear epicyclic unit

The rear unit and its clutch can be checked in the same way as the front clutch by applying air pressure to the rear clutch apply passage. A slipping rear clutch will result in slipping on the 2-3 up-change and if both front and rear clutches are slipping as a result of leakage from the oil delivery sleeve, there may be no up-change above first.

Reverse epicyclic unit

The reverse unit clutch test is the same as for the front and rear clutches, the pressure being applied through the reverse clutch apply passage after removal of the reverse clutch oil pipe. Excessive leakage from around the clutch piston indicates faulty piston seals; this may cause slipping or 'no drive' in Reverse, and can only be rectified by removing and dismantling the gearbox to overhaul the reverse clutch.

A tendency for the reverse clutch to stick in engagement, after moving the selector lever from Reverse, will prevent forward drive because the transmission will lock. It may be possible to rectify such a fault before detailed investigation by operating the transmission to free it and burnish the clutch surfaces, as described in the following paragraphs.

Free the reverse clutch by selecting Reverse and increasing engine speed; then select range '4'. When the change occurs, reduce engine speed to idling. Repeat this operation until the transmission is free.

If, after five attempts, the transmission is still not free, do not continue the procedure, as a more detailed investigation will be necessary to eliminate the fault.

When the transmission has been freed satisfactorily by running the engine, the clutch should be burnished by driving the car forward at 1 m.p.h. to 2 m.p.h.; select Reverse and when the change is nearly complete, again select forward drive.

Repeat this procedure five or six times and then select range '4' and drive at about 20 m.p.h. for a few minutes to cool the gearbox. Repeat this cycle five times and then road test.

Governor and parking bracket

The governor and parking brake bracket can be checked together for excessive leakage, after removing the governor feed pipe and refitting it so that the servo end of the pipe is swung clear of the gearbox. Air pressure can then be applied to the open end of the pipe.

With the governor weights pressed inward to close the ports, there will be some leakage past the piston ring gaps in the governor sleeve; air will escape from the sleeve and from the G1 and G2 passages and valves, but this should not be excessive.

There may also be slight leakage from the parking and reverse blocker pistons.

There should be little or no leakage from the bracket to casing face joint. Excessive leakage would prevent any up-change.

If the reverse blocker piston sticks in, due to insufficient governor pressure or for any other reason, reverse engagement above the maximum speed of 10 m.p.h. will be possible.

If the reverse blocker piston sticks out, due to leakage of main pressure into the governor passage (broken piston ring), it will prevent selection of Reverse below 10 m.p.h.

If the parking blocker piston sticks out, it will prevent engagement of the parking pawl when Reverse is selected for parking. Clashing when Reverse is engaged may be caused by incorrect operation of the parking pawl.

The governor valves should have no tendency to stick and if they are moved outwards during the air pressure check, there should be an increase in the air flow from the G1 and G2 passages and governor valve exhaust ports. Sticking valves or excessive leakage in the governor will cause such defective operation as high or low up-changes—slipping in '4' and '3' ranges or slipping with failure to drive in Reverse.

Other passages which may be checked during this diagnosis procedure are the main pump feed passages, the exhaust port for the control valve unit and the passage to the pressure gauge blank.

Air pressure applied to the main line passage will result in a large escape of air from between the front drum and front pump; this is normal and comes from the rear side of the front pump.

The exhaust port for the control valve unit should permit unrestricted flow into the inside of the main casing.

Pressure control valve

During removal of the pressure control valve (see Fig. 36), which is spring-loaded, care must be taken to ensure that the damper spring, reverse booster plug and throttle regulator plug do not fall out.

After thorough cleaning, compressed air applied into the passages of the regulator and reverse booster plugs should remove stickiness; the plugs should move freely in the bores. The plugs and damper spring should be assembled using petroleum jelly to retain them in position.

Before trying the control valve in the piston valve bore, it is recommended that oil is flushed through the bore by motoring the engine over by means of the starter. Do not introduce cleaning solution into the bore.

The piston valve should be tried for free movement in its bore before being refitted.

Control valve unit

The control valve unit cannot be checked satisfactorily in position, therefore, if the foregoing checks indicate satisfactory functioning of other units in the gearbox and the fault is shown by the Diagnosis Section to be attributable to the control valve unit, it should be removed (see Fig. 37), dismantled and overhauled as described in Chapter 3. It should be noted when removing that screws are tight, as leakage between the face joints may seriously affect valve operation.

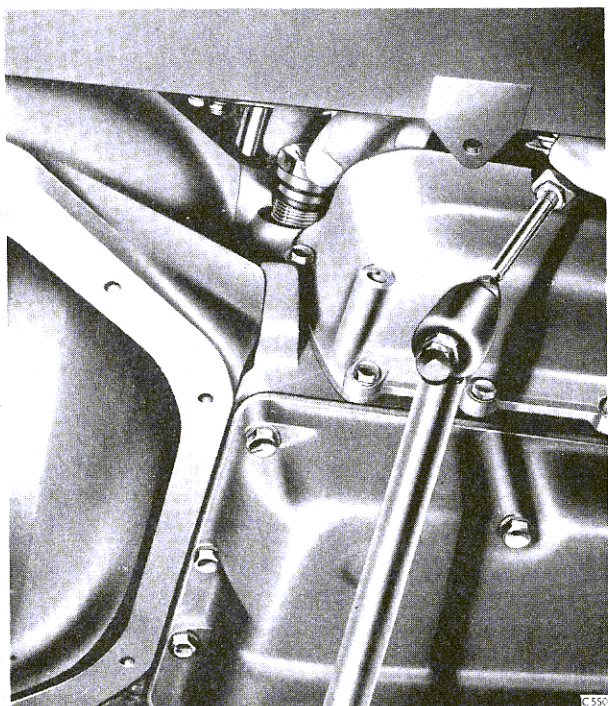


Fig. 36 Removing pressure control valve from beneath the car

Fluid coupling

Slipping or faulty gear changes are unlikely to be caused by the fluid coupling, except in the unlikely event of damaged torus members, which might cause slipping and overheating at all speeds. Temporary slipping on starting the car, without the recommended three minutes warming-up period, can result from a leaking torus check valve. This is because of insufficient oil in the fluid coupling, as a result of excessive drainage through the relief valve into the sump. Such a defect raises the oil level on the dipstick, which can therefore be used to check for the fault.

Check the oil level as previously described and wait ten minutes with the engine stopped. Note the level on the dipstick without running the engine; if it has increased more than half an inch, excessive leakage is confirmed and rectification is necessary.

Any fault associated with the fluid coupling will require removal of the gearbox before it can be rectified.

Noise

The source of any noise that occurs in the gearbox should be traced by reference to the phase of operation associated with the faulty unit. The method of testing to ensure this is described in the following paragraphs.

Planet gear noise will be heard as a low growl at idling, rising to a high pitched whine as speed is increased.

Front unit noise will be at a higher pitch than that of the rear unit, while reverse gear noise can be heard only when accelerating in Reverse. Tests should be made by accelerating through the gears in range '4' and noting the character of the noise at the change points. Noise in both first and second gears is caused by the rear unit.

Noise in both first and third is caused by the front unit.

Rear unit noise may be heard also when slowing down in Reverse.

Slight gear noise in Neutral, which disappears when drive is selected, is usually attributable to the rear unit.

Oil pump noise may be most pronounced at a certain engine or road speed. As the front pump is operating only when the engine is running and the rear pump only when the output shaft is turning, it is possible to diagnose which pump is defective by static and road tests.

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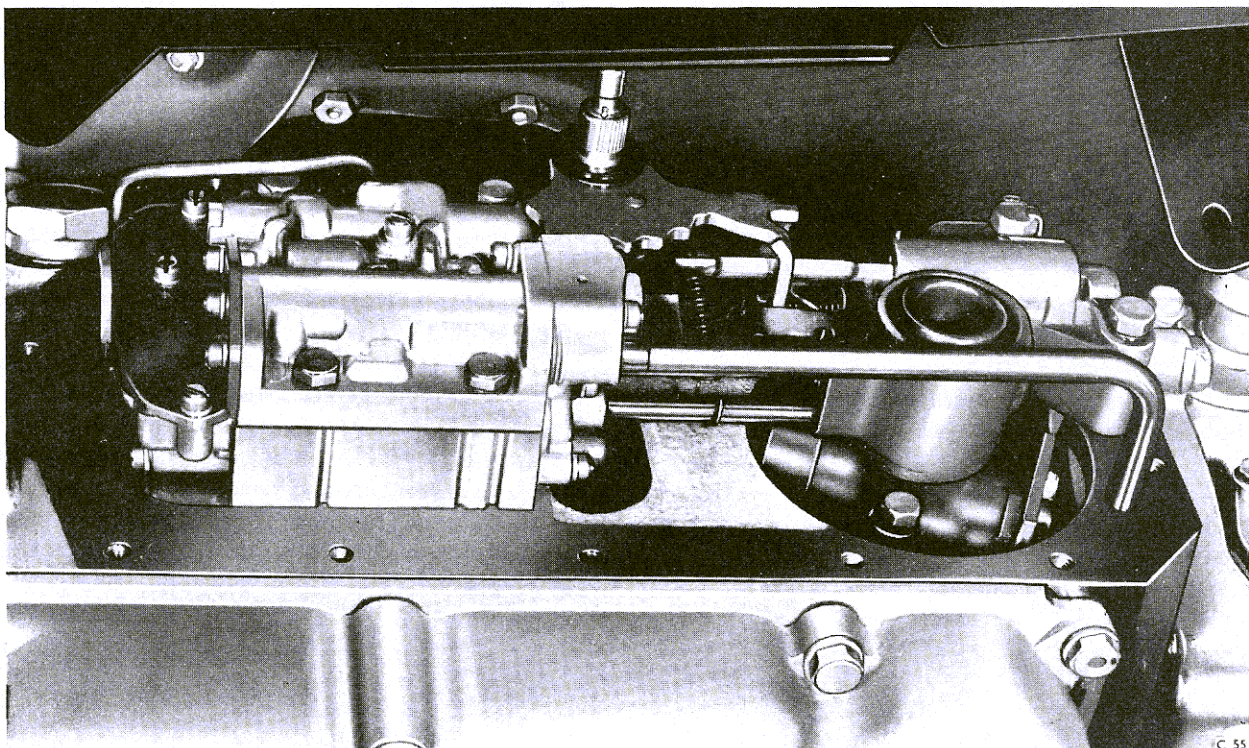


Fig. 37 Side cover removed and selector lever moved to Reverse position prior to removal of control valve unit

The test should be started in Neutral and the throttle opened gradually while noting the engine speed at which noise, if any, is most pronounced. Select range '4' and drive the car on the road until the noise is most pronounced, then quickly switch off the engine and select Neutral to stop the front pump. If the noise still persists and was not noticeable when the car was stationary, the rear pump is suspect. There are two possible faults which can cause noise in the rear pump. Noise caused by the rear pump driving gear is a whine similar to axle noise and will usually be most noticeable above 20 m.p.h. If doubt exists, axle noise can be eliminated by disconnecting the gearbox output shaft, then with the selector in range '4', run the engine up to the speed at which noise was most noticeable.

The other possible cause of noise in the rear pump is inner gear noise, which is usually a low growl occurring at speeds above 35 m.p.h.

An important point to remember is that, in the tests for suspected noise in the rear pump, coasting with engine switched off should not exceed 25 m.p.h. and should be kept to the minimum necessary to confirm or eliminate the fault, as the low oil pressure possible with a faulty rear pump may cause incorrect operation or inadequate lubrication with possible damage to other units in the gearbox.

The fluid coupling is unlikely to cause noise or slipping unless it is damaged or incorrectly fitted. A metallic scraping noise would result from fouling of the rotating parts. Worn torus member splines may result in increased gear noise in Neutral.

Rectification of units

Removal, overhaul and refitting of all units is described in Chapter 3.

The units which can be removed and refitted without removal of the gearbox are as follows

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- 1 Pressure control valve.
- 2 Control valve unit (necessitates removal of side cover).
- 3 Parking brake bracket (necessitates removal of side cover and control valve unit).
- 4 Governor and rear oil pump (necessitates removal of side cover, sump control valve unit, parking brake bracket and both servos).
- 5 Front and rear servos (necessitates removal of sump and re-adjustment of bands).
- 6 Road wheel brake servo drive.
- 7 Speedometer drive.

The units which require removal of the gearbox before they can be rectified are as follows

- 1 Fluid coupling.
- 2 Front oil pump.
- 3 Front epicyclic unit.
- 4 Rear epicyclic unit.
- 5 Reverse epicyclic unit.

Towing

Towing or coasting with the engine switched off, should be confined to as short a distance as possible and to a speed not greater than 25 m.p.h.

Before attempting to tow, examine the gearbox for mechanical damage and leaks, and check the oil level. The car should not be towed if there is mechanical damage or if the oil level is low, but if satisfactory, the gearbox should be prepared for towing by slackening the rear band adjusting screw $4\frac{1}{2}$ turns and relocking the adjusting screw.

When towing, the selector lever should always be in Neutral, and, where possible, the towing speed maintained between 15 m.p.h. and 25 m.p.h.

An alternative method of preparing the car for towing is to disconnect and remove the rear half of the propeller shaft. This method is permissible if the gearbox is faulty and facilities for transporting the car are not available.