

CHAPTER 7

AUTOMATIC TRANSMISSION

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7:1 Description

Automatic transmission is supplied as an optional extra to take the place of the usual clutch and gearbox. The assembly is shown in **FIG 7:1** and consists of a torque converter and hydraulically controlled automatic epicyclic gearbox with three forward speeds and one reverse. In all gears the drive is through the torque converter which results in maximum flexibility, especially in top gear. The gears are selected automatically as the hydraulic control system engages clutches in various combinations. The hydraulic control system and the torque converter assembly are supplied with pressure fluid from a pump mounted within the transmission case. A manually controlled mechanical parking pawl is incorporated so that the transmission output shaft can be locked when the vehicle is stationary.

The torque converter consists of an impeller connected through a drive plate to the engine crankshaft, a turbine which is splined to the transmission input shaft and a stator connected to the unit by a one-way clutch. The impeller, driven by the engine, transmits torque by means of the transmission fluid to the turbine which drives the automatic gearbox. The stator redirects the flow of fluid as it leaves the turbine so that it re-enters the impeller at the most effective angle.

When the engine is idling, the converter impeller is being driven slowly and the energy of the fluid leaving it is low, so little torque is imparted to the turbine. As the throttle is opened impeller speed increases and the process of torque multiplication begins. As the turbine picks up speed and the slip between it and the impeller reduces, the torque multiplication reduces progressively until, when their speeds become substantially equal, the unit acts as a fluid coupling. In this condition, the stator is no longer required to redirect the fluid flow and the one-way clutch permits it to rotate with the impeller and turbine.

The maintenance and adjustment procedures which can be carried out by a reasonably competent owner are given in this chapter. More serious performance faults which require special equipment for correct analysis, adjustment of the governor or clutches, partial or complete dismantling to replace worn or failed internal components dictate that the services of a fully equipped specialist should be enlisted. Quite apart from the specialised knowledge which is required, test equipment and a large number of special tools are essential. It should be noted that the torque converter is supplied as an assembly only, no internal parts being available separately.

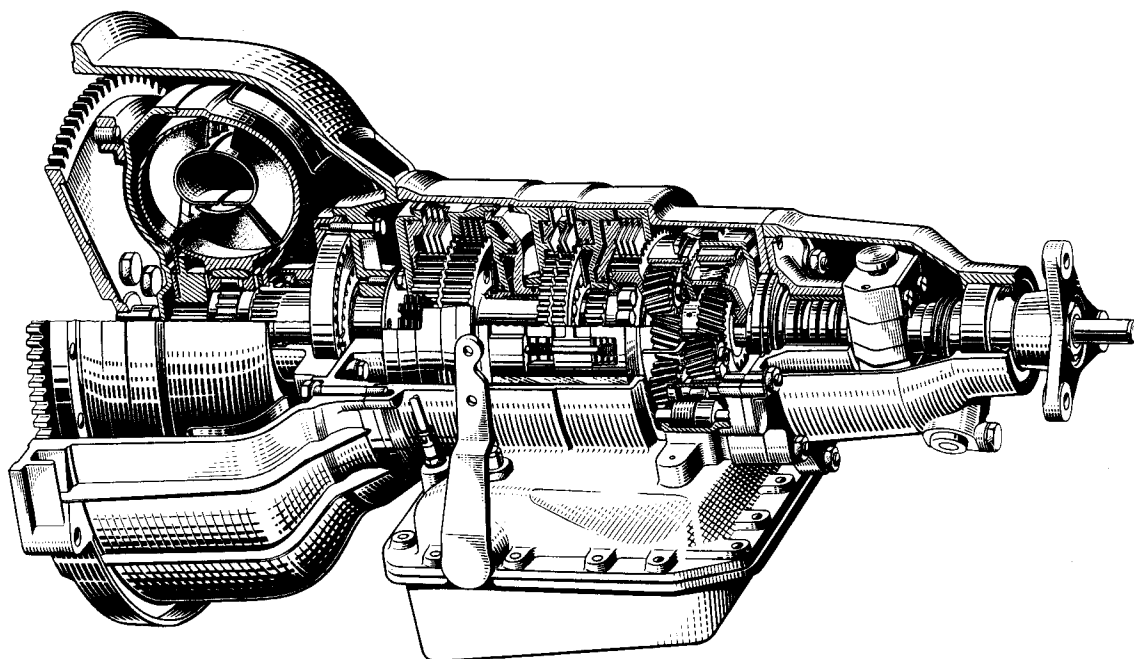


FIG 7:1 Cut-away view of automatic transmission assembly

7:2 Routine maintenance

Checking of the automatic transmission fluid level and the periodic changing of the fluid in the system should be carried out at the intervals recommended in the manufacturer's service schedule. Gearchange linkage and accelerator cable adjustments should be carried out whenever dictated by faulty performance, and after any servicing operation involving the detachment of any part of the linkage system. The procedures are described in **Section 7:3**.

Checking fluid level:

The fluid level must be checked either when the transmission is cold or when it is at normal operating temperature after a run of some miles.

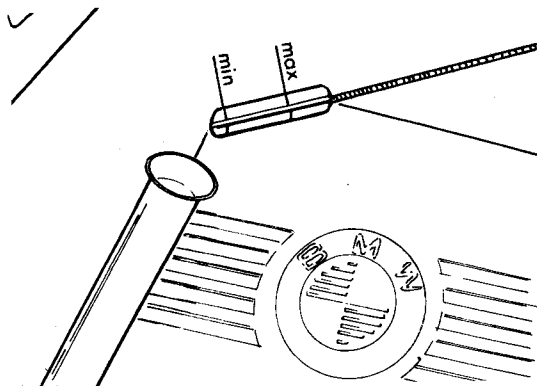


FIG 7:2 Transmission fluid dipstick markings

Apply the handbrake, start the engine, then move the selector lever through all gear ranges then leave it in the **P** (Park) position. Leave the engine idling while the fluid level is checked. Remove the automatic transmission dipstick, wipe it clean on a non-fluffy cloth and refit it fully. Remove the dipstick again and check the level of fluid against the appropriate marks shown typically in **FIG 7:2**. Top up through the dipstick tube if necessary to bring the fluid to the appropriate upper mark on the dipstick, according to fluid temperature. If the dipstick is not provided with two sets of markings, the fluid level should be at the **MAX** mark when the transmission is warm or approximately $\frac{1}{4}$ in above the **MIN** mark when the transmission is cold. In such cases, if topping up is carried out with the transmission cold it is recommended that a further check be made when the transmission is at normal operating temperature, as this provides a more accurate reading.

Do not overfill the transmission. Use Dexron Automatic Transmission Fluid. **Never use anything but the recommended fluid in the automatic transmission.**

Changing transmission fluid:

Place a suitable container beneath the transmission, then remove the drain plug and washer which may be located either at the lower rear or lower side of the transmission. Allow the oil to drain fully, then wipe clean and refit the drain plug and washer. Renew the washer if it is damaged in any way.

Examine the drained fluid to check for possible transmission internal faults. If the fluid has a burnt smell and black discolouration, burnt clutch friction linings

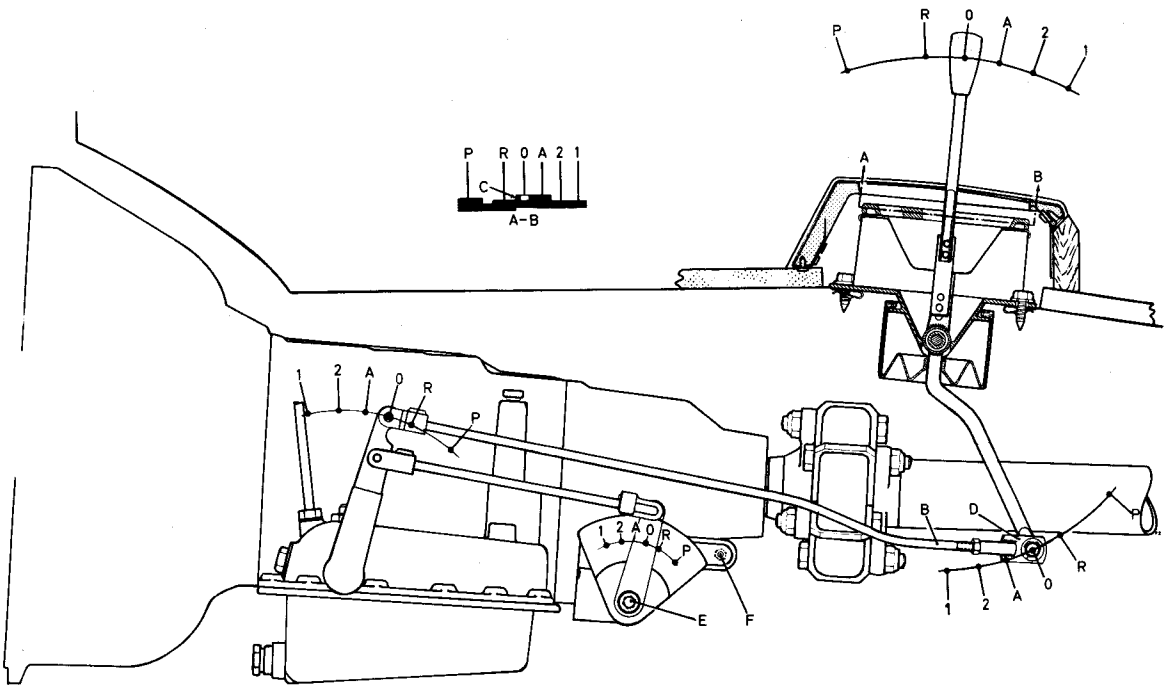


FIG 7:3 Selector linkage adjustment, ZF-3HP-20 transmission

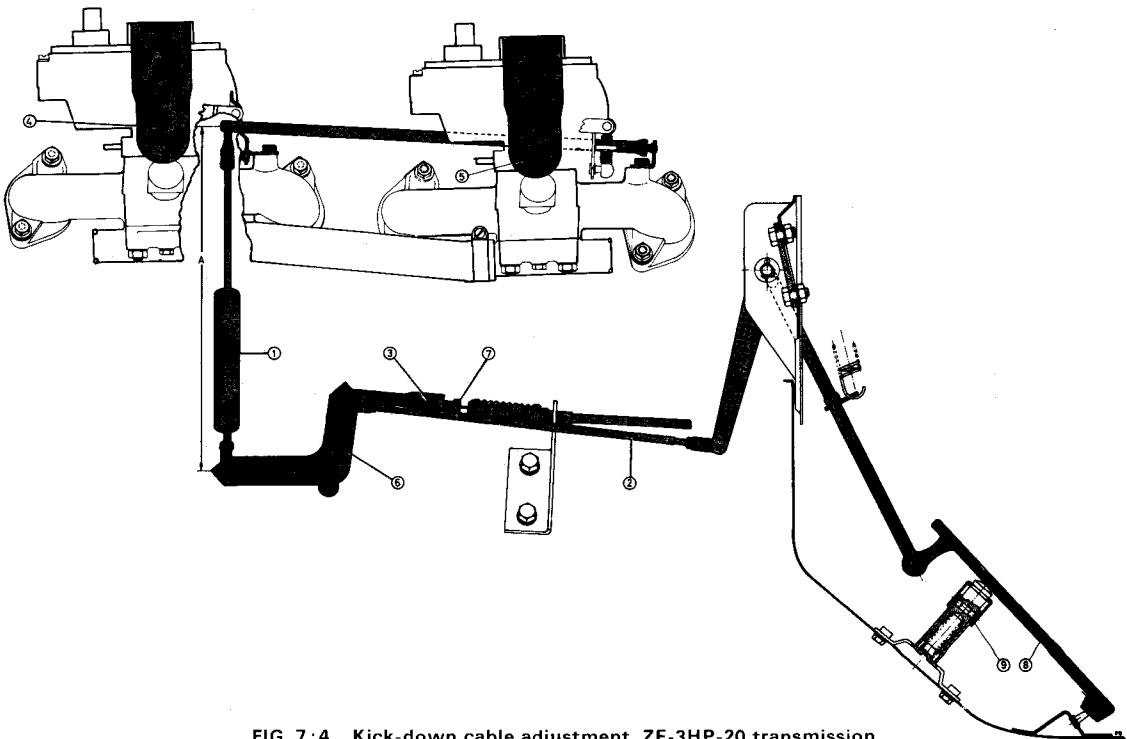


FIG 7:4 Kick-down cable adjustment, ZF-3HP-20 transmission



Add new fluid of the correct type through the dipstick tube to the correct level for cold transmission, as described previously. **Never re-use fluid drained from**



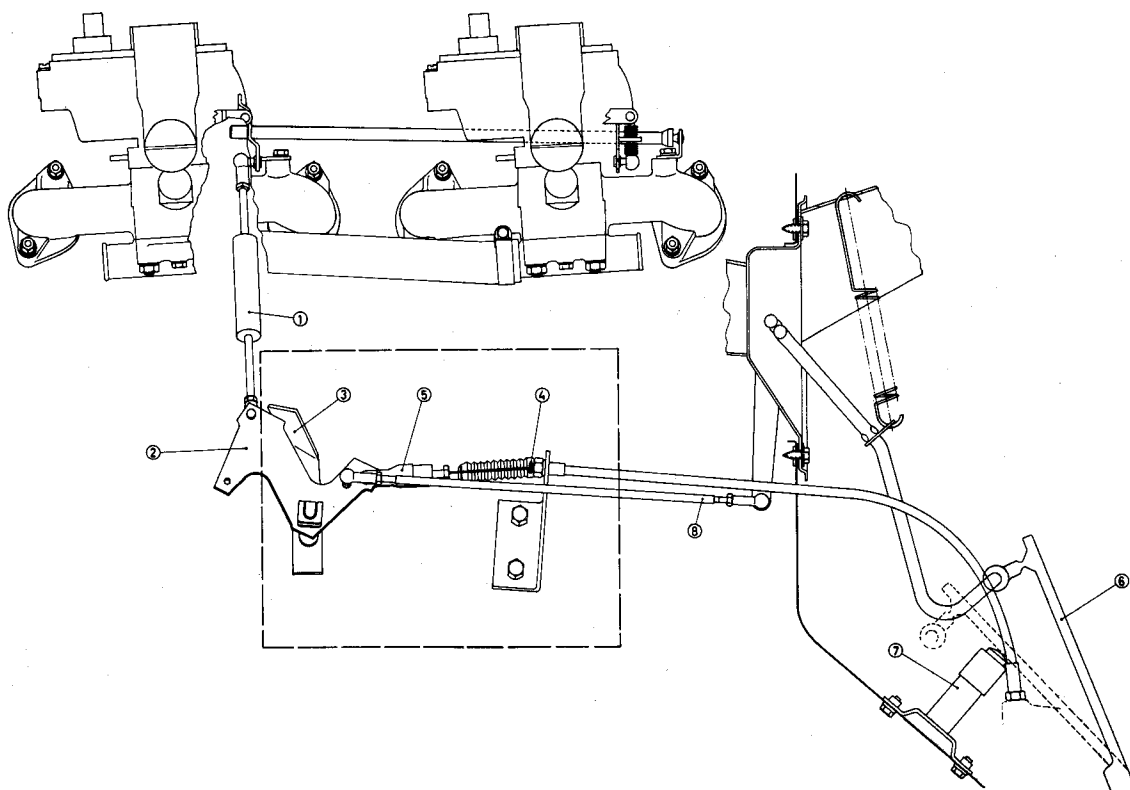


FIG 7:7 Kick-down cable adjustment, ZF-BW 65 transmission

the transmission. Always make sure that any containers or funnels used to handle transmission fluid are completely clean and dry before use.

7:3 Gear selector linkages

ZF-3HP-20 transmission:

Selector linkage adjustment:

The selector linkage, which incorporates a selector lever position indicating switch, is shown in FIG 7:3. Apply the handbrake and place the selector lever in the car to the **O** (Neutral) position. Working beneath the car, disconnect eye bolt **D** from the lower end of the selector lever. Slacken the securing locknut and turn the eye bolt until, when it is refitted to the end of the selector lever, the selector lever is moved to just touch stop **C** on the gate. From this position, shorten the overall length of selector rod **B** by turning eye bolt **D** by three complete turns. Tighten the locknut to secure this position, then reconnect the eye bolt to the lower end of the selector lever. This done, loosen screws **E** and **F** and move the selector lever position indicating switch forwards or back as necessary until the operating lever is centralised at the **O** (Neutral) position without strain. Without moving the switch from this position, tighten screws **E** and **F**. On completion, check the operation of selector mechanism through all lever positions.

Kick-down cable adjustment:

Refer to Chapter 2 and remove the air cleaner assembly. Refer to FIG 7:4. Slacken the connector locknuts and rotate tension element 1 until a total length (A) of 275 mm (10.83in) is achieved. Detach thrust rod 2 with kick-down cable 3. Have an assistant depress the throttle pedal 8 until it lightly contacts kick-down stop 9. Operate bellcrank 6 to fully open carburettor throttles 4 and 5. When doing this, make sure that tension element 1, which is spring-loaded, is not extended to the kick-down position. With the throttle linkage and accelerator pedal held in the correct positions, refer to FIG 7:5 and pull kick-down cable 3 to the full throttle position. The full throttle position occurs before the cable is pulled as far as possible to the kick-down position, and can be clearly determined by pulling the cable repeatedly. When in the full throttle position, the hole in the connector must align exactly with the hole in the bellcrank as shown. If not, adjust position by turning connector while holding bolt 7. When correct, attach the cable connector to the bellcrank.

With the throttle pedal and carburettor throttle valves still in the set positions previously described, refer to FIG 7:4 and slacken the locknut securing connector on thrust rod 2. Rotate the connector until thrust rod can be reconnected to bellcrank 6 without moving either bellcrank or throttle lever. Tighten the locknut to secure the

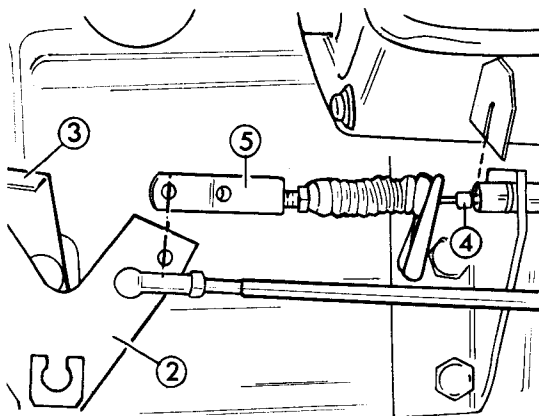


FIG 7:8 Detail of linkage framed by broken line in FIG 7:7

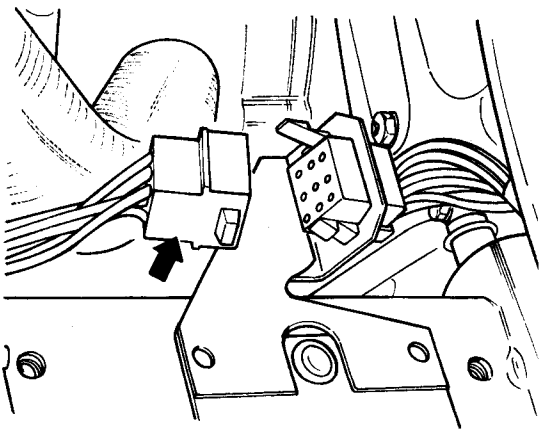


FIG 7:9 Wiring connector plug

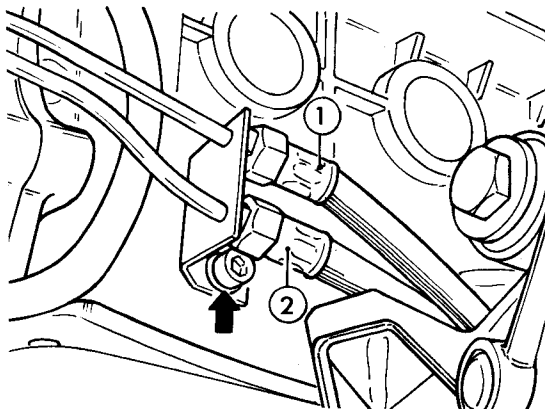


FIG 7:10 Fluid cooler pipe connections with mounting bracket

adjustment. The linkage should now be correctly adjusted. To check, press accelerator pedal 8 gently against kick-down stop 9. In this position, carburettor throttle valves 4 and 5 should be fully open, but the spring-loaded tension element 1 should not be extended at all. From this position, full pressure of the accelerator pedal against stop 9 will cause tension element 1 to extend and kick-down cable to move the mechanism in transmission case to the kick-down position. Road test the car and check that when driving with light throttle pressure a kick-down change from top to second, and from second to first, can be obtained when the throttle pedal is pushed fully to the floor into the kick-down position.

ZF-BW 65 transmission:

Selector linkage adjustment:

Refer to FIG 7:6. Apply the handbrake and place selector lever in position **O** (Neutral). Working from beneath the car, disconnect eye bolt **D** from lower end of selector lever. With the transmission selector lever properly engaged in the **O** position, slacken the locknut and turn eye bolt **D** until length of selector rod **S** is such that it moves the selector lever in the car to a position where it is just touching stop **C** on the gate. From this position, turn eye bolt **D** two or two-and-a-half turns inwards to shorten the overall length of rod **S**. The higher or lower number of turns is selected as necessary to ensure that the eye bolt is correctly angled when connected finally to the selector lever. Tighten the locknut to secure eye bolt adjustment and reconnect to selector lever.

Kick-down cable adjustment:

Run the engine until it reaches normal operating temperature. Refer to FIG 7:7 and disconnect upper ball end of tension element 1 from carburettor linkage. Check that idle speed is correct with carburettors properly synchronised as described in Chapter 2, then switch off engine. Disconnect kick-down cable clevis 5 from bellcrank 2. Slacken the locknuts and rotate the ball end connectors for tension element 1 until its overall length is such that when properly reconnected it pulls bellcrank 2 firmly into contact with the stop 3. Note that the tension element, which is spring-loaded, must not be extended at all under these conditions.

Refer to FIG 7:8. Pull back the rubber cover and retain in this position using a crocodile clip or similar. Clearance between cable nipple 4 and cable sleeve end must now be set to 0.25 to 0.50mm (0.0098 to 0.0197in). To do this, pull the cable away from the sleeve end and insert a slotted shim of the correct thickness as shown in the illustration. Under these conditions, the fixing hole in clevis 5 must be exactly aligned with the hole in bellcrank 2. If not, hold the hexagon on the cable and rotate the clevis as necessary. Note that there must be no slack in the kick-down cable. When correct, reconnect clevis to bellcrank and remove the shim.

Have an assistant depress throttle pedal 6 until it gently contacts kick-down stop 7 (see FIG 7:7). With this position held, slacken the locknuts and rotate thrust rod 8 until its length is such that the distance between cable nipple 4 and cable sleeve end is 37mm (1.4567in).

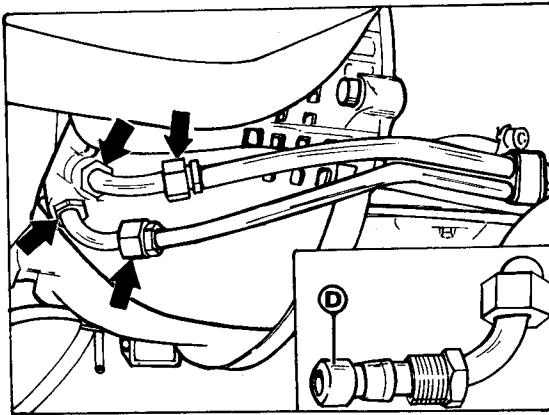


FIG 7:11 Fluid cooler pipe connections with sealing elements D

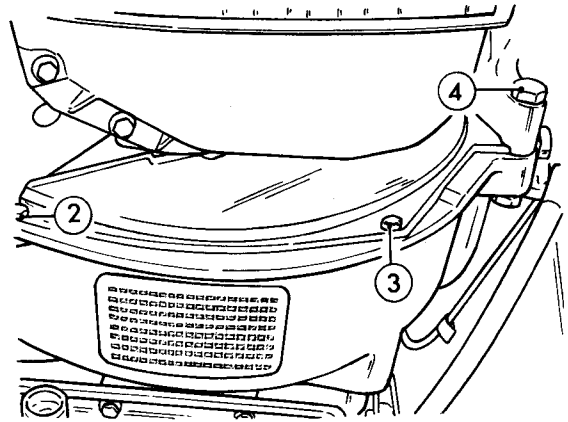


FIG 7:12 Detaching coverplate

Tighten the locknuts to secure the adjustment. Have the accelerator pedal pressed fully down to the kick-down position and check that nipple 4 is moved away from the cable sleeve end by a minimum of 43mm (1.6929in). On completion, remove the clip and reposition the rubber cover over the kick-down cable.

7:4 Transmission removal and refitting

Removal:

Raise and safely support the car on floor stands for access to the underside. Disconnect the battery negative cable. Disconnect the wiring connector plug shown in FIG 7:9. Refer to FIG 7:8 and disconnect kick-down cable clevis 5 from bellcrank 2. Disconnect the outer cable sleeve from the mounting bracket. Drain transmission fluid as described in Section 7:2.

Disconnect the fluid filler pipe bracket from the exhaust manifold then pull the filler pipe from the mounting hole in the transmission or unscrew the filler pipe from the transmission fluid pan, according to type. On the press-in type, check the 'O' ring in the housing and renew if necessary during reassembly.

Remove the entire exhaust system by disconnecting the front pipes at the exhaust manifold connections, detaching the pipe clip and removing the retaining rings from the rear silencer.

If fluid cooler hoses are attached at a mounting bracket as shown in FIG 7:10, detach feed hose 1 and return hose 2, then unscrew the bolt arrowed to detach the bracket. If fluid cooler pipes are connected as shown in FIG 7:11, disconnect the elbows at the points arrowed. Note that, from transmission number 16676 the holes for connecting the fluid pipes are cylindrical. Make certain that sealing elements D are in place, as if these are missing fluid will leak from the transmission.

Refer to FIG 7:12. Remove mounting bolts 2 and 3, then slacken bolt 4 and swing the cover plate downwards. Detach the protective screen if fitted, then remove the four bolts (see arrow in FIG 7:13) to separate torque converter from drive plate, turning the assembly for access to each bolt in turn.

Refer to FIG 7:6 and detach the selector rod from lower end of selector lever. Refer to Chapter 8 and

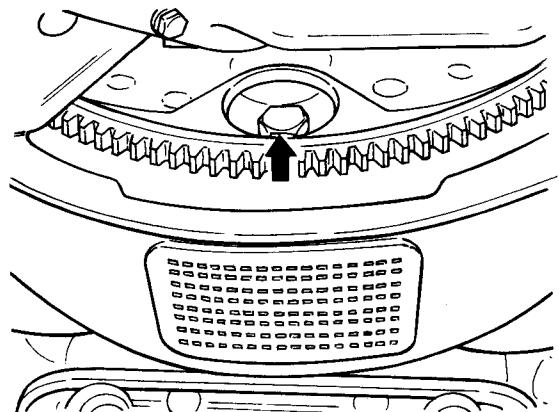


FIG 7:13 Torque converter mounting bolt

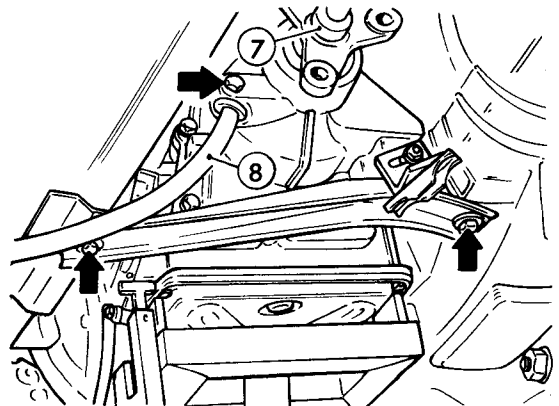


FIG 7:14 Removing components from rear of transmission

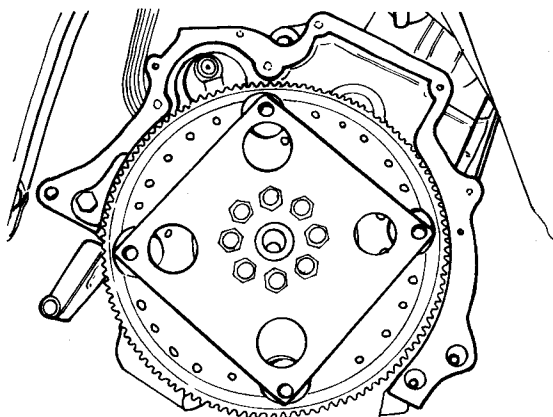


FIG 7:15 Drive plate and flywheel

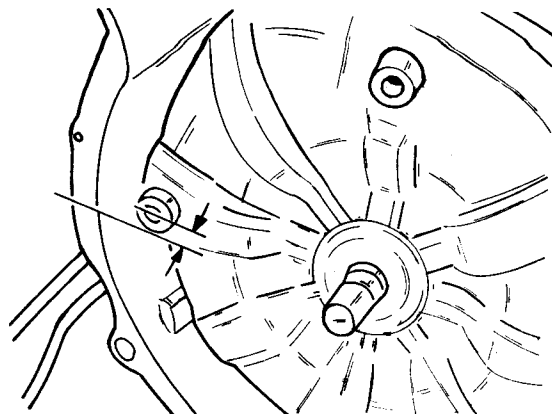


FIG 7:16 Torque converter installation

disconnect the propeller shaft from the rear of the transmission and the centre bearing from the underbody. Swing the propeller shaft clear of the work area and support carefully to prevent damage.

Support the weight of the transmission with a suitable jack and a support tool such as 7060-1 as shown in FIG 7:14. Pull off buffer 7, remove speedometer cable 8 and detach mounting crossmember from transmission and underbody. Lower the transmission slowly until the engine oil sump contacts the front axle crossmember. Remove all bolts securing transmission to engine crankcase noting the locations of cable and hose retainers which may be secured by some of the bolts. Pull the breather line from the transmission.

Raise the transmission, place a suitable piece of wood between the engine oil sump and front axle crossmember, then lower the transmission until the sump contacts the piece of wood. Carefully remove the transmission from the engine, pressing the torque converter into its housing at the same time to prevent it from falling.

Check the drive plate on the engine flywheel for cracking or other damage and renew if necessary. When removing the drive plate, the flywheel should be locked against rotation by using tool 7007 or similar as shown in FIG 7:15.

Refitting:

This is a reversal of the removal procedure, noting the following points:

Check that the torque converter is in the correct installed position, as shown in FIG 7:16. The position is correct when the drive plate mounting is below the edge of the housing. If not, insert both converter dogs into slots of the primary pump while turning the torque converter slightly. Make sure that the torque converter is firmly held in place as the transmission is installed to the engine crankcase. On completion, refill the transmission with fluid as described in Section 7:2, then adjust the gear selector and kick-down cable linkages as described in Section 7:3.

7:5 Fault diagnosis

As indicated earlier in this chapter, serious automatic transmission faults will require expert diagnosis and rectification. But the checks and adjustments described in this chapter can be used as a first step. Always begin by checking that the fluid level is correct. Drive faults may be cured by adjusting the selector linkage and kick-down cable. Remember also that the fuel and ignition systems must be correctly adjusted so that engine pick-up is smooth and progressive. If no improvement results from these measures, expert advice should be sought.