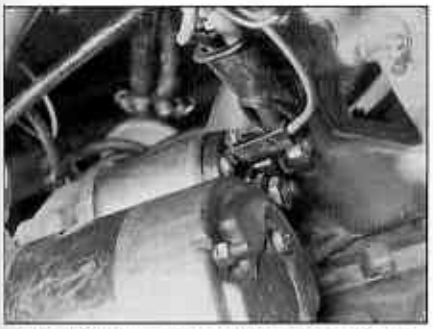
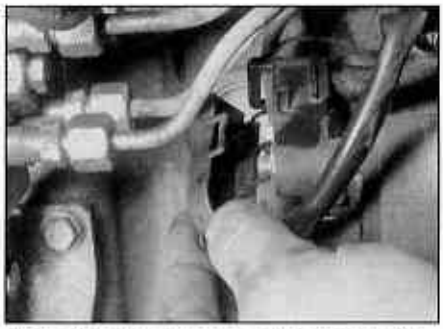
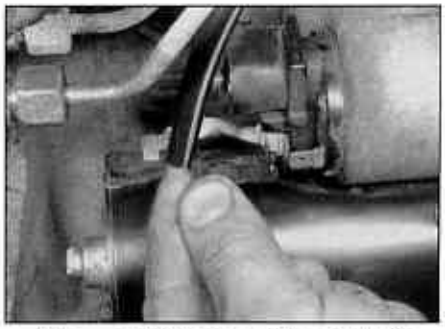


8.4a Starter motor wiring connections (petrol engine)



8.4b On diesel engines, raise the plastic cover . . .



8.4c . . . and disconnect the solenoid trigger wire

8 Starter motor - removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 Apply the handbrake then jack up the front of the vehicle and support on axle stands (see *Jacking and Vehicle Support*).

3 On petrol engines, unscrew and remove the starter motor mounting bolt located at the top of the transmission bellhousing. Access is gained from behind the battery.

4 Working beneath the vehicle, raise the plastic cover then disconnect the wiring from the solenoid located on top of the starter motor **(see illustrations)**.

5 Unscrew the nut and disconnect the positive cable from the solenoid terminal **(see illustration)**.

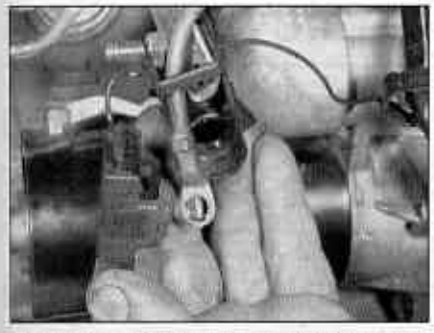
6 Unscrew the mounting bolts (noting the location of the support bracket on petrol engines), then withdraw the starter motor from the transmission **(see illustrations)**.

Refitting

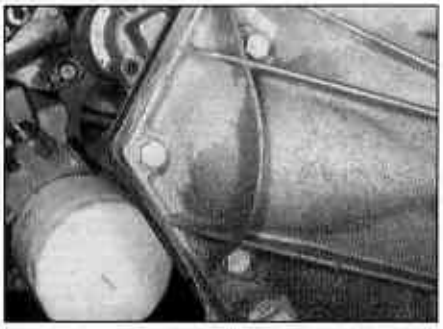
7 Refit the starter motor by following the removal procedure in reverse.

9 Starter motor - testing and overhaul

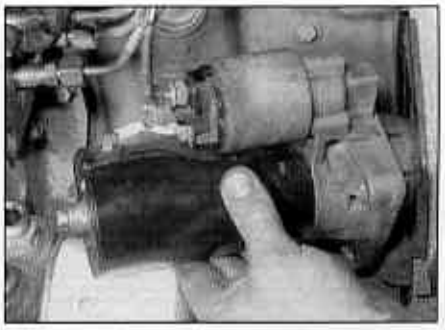
If the starter motor is thought to be suspect, it should be removed from the vehicle and taken to an auto-electrician for testing. Most auto-electricians will be able to supply and fit brushes at a reasonable cost. However, check on the cost of repairs before proceeding as it may prove more economical to obtain a new or exchange motor.



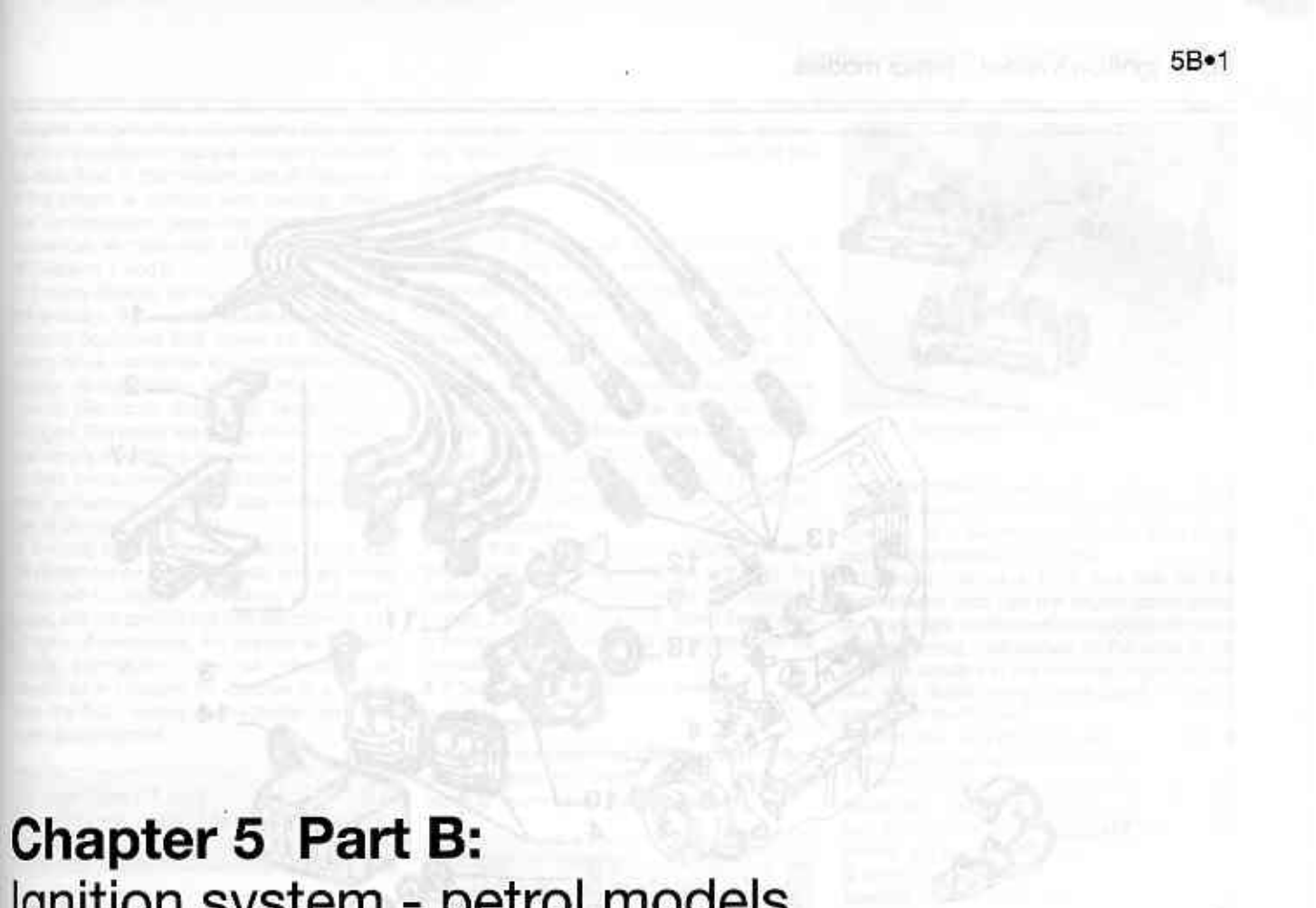
8.5 Disconnecting the battery cable from the starter motor



8.6a Starter motor mounting bolt locations (diesel engine)



8.6b Removing the starter motor (diesel engine)

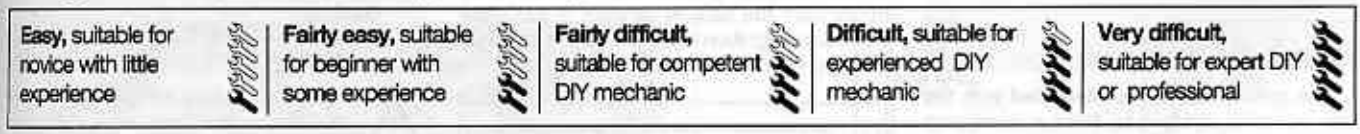


Chapter 5 Part B:
Ignition system - petrol models

Contents

General information 1
Ignition HT coil - removal, testing and refitting 3
Ignition system - check ..... See Chapter 1A
Ignition system - testing 2
Ignition timing - checking and adjustment 4
Spark plugs - renewal ..... See Chapter 1A

Degrees of difficulty

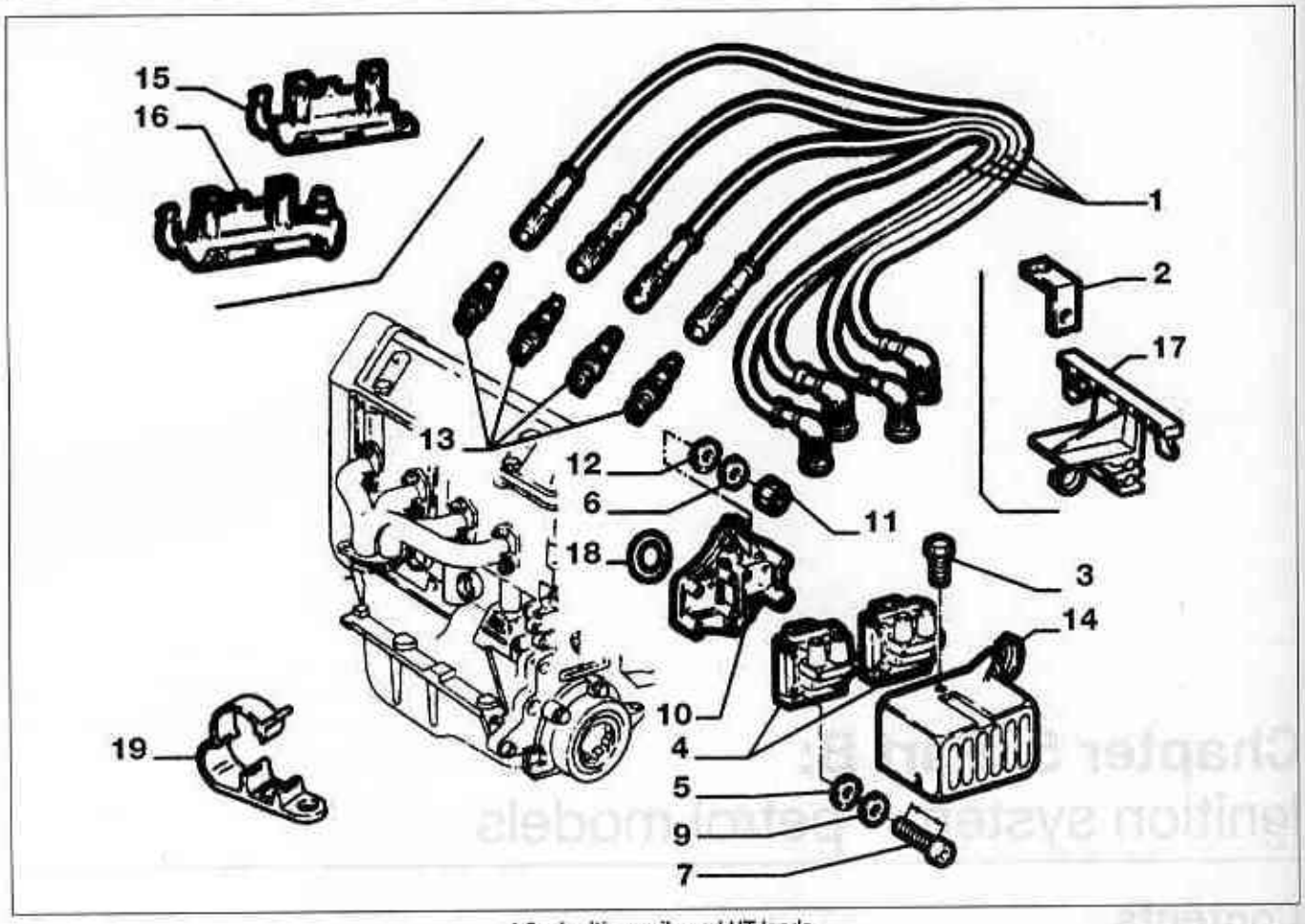


5B

Specifications

General

System type	Weber-Marelli static (distributorless), wasted spark ignition system controlled by engine management ECU
Firing order	1-3-4-2 (No 1 cylinder at timing belt end of engine)
Ignition timing at idle speed (non-adjustable, for reference only):	
8-valve engines:	
Single-point injection engine with manual transmission	10° ± 3° BTDC
Single-point injection engine with automatic transmission	8° ± 3° BTDC
Multi-point injection engine	13° ± 3° BTDC
16-valve engines	8° ± 3° BTDC
Ignition coil winding resistance (at 20°C):	
Primary	0.495 to 0.605 ohms
Secondary	6660 to 8140 ohms



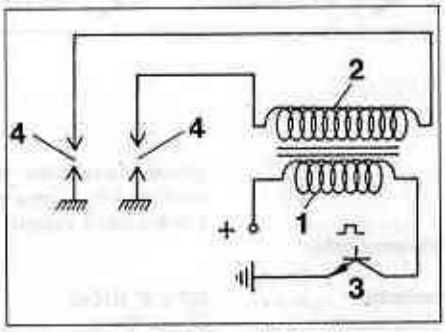
1.2a Ignition coils and HT leads

1 HT leads
2 Support
3 Cover mounting bolt
4 Ignition coils
5 Washer
6 Washer
7 Coil mounting bolt
9 Washer
10 Coil mounting bracket
11 Nut
12 Washer
13 Spark plugs
14 Coil cover
15 HT lead support
16 HT lead support
17 HT lead support
18 Seal
19 Bracket

1 General information

The ignition system is integrated with the fuel injection system to form a combined engine management system under the control of one ECU (see the relevant part of Chapter 4 for further information).

The ignition side of the system is of the static (distributorless) type, consisting only of two twin-output ignition coils located on the left-hand side of the cylinder head. Each ignition coil supplies two cylinders (one coil supplies cylinders 1 and 4, and the other cylinders 2 and 3) **(see illustrations)**. Under the control of the ECU, the ignition coils operate on the wasted spark principle, ie. each spark plug sparks twice for every cycle of the engine, once on the compression stroke and once on the exhaust stroke. The spark voltage is greatest in the cylinder which is under compression, the other cylinder having a very weak spark which has no effect on the exhaust gases. The ECU uses its inputs from the various sensors to calculate the required ignition advance setting and coil charging time.



1.2b Ignition coil circuit

1 Primary windings
2 Secondary windings
3 Power module (inside ECU)
4 Spark plugs

2 Ignition system - testing

Warning: Voltages produced by an electronic ignition system are considerably higher than those produced by conventional ignition systems. Extreme care must be taken when working on the system with the ignition switched on. Persons with surgically-implanted cardiac pacemaker devices should keep well clear of the ignition circuits, components and test equipment.

1 If a fault appears in the engine management (fuel injection/ignition) system first ensure that the fault is not due to a poor electrical connection or poor maintenance; ie, check that the air cleaner filter element is clean, the spark plugs are in good condition and correctly gapped, that the engine breather hoses are clear and undamaged, referring to

Chapter 1A for further information. Also check that the accelerator cable is correctly adjusted as described in the relevant part of Chapter 4. If the engine is running very roughly, check the compression pressures and the valve clearances as described in the relevant parts of Chapters 1 and 2.

2 If these checks fail to reveal the cause of the problem, the vehicle should be taken to a suitably equipped Fiat dealer for testing. A wiring block connector is incorporated in the engine management circuit into which a special electronic diagnostic tester can be plugged. The tester will locate the fault quickly and simply alleviating the need to test all the system components individually which is a time consuming operation that carries a high risk of damaging the ECU.

3 The only ignition system checks which can be carried out by the home mechanic are those described in Chapter 1A, relating to the spark plugs, and the ignition coil test described in this Chapter. If necessary, the system wiring and wiring connectors can be checked as described in Chapter 12, Section 2, ensuring that the ECU wiring connector(s) have first been disconnected.

3 Ignition HT coil - removal, testing and refitting

Removal

1 On 8-valve engines, unscrew the bolt and remove the plastic cover from the left-hand end of the cylinder head **(see illustration)**. On 16-valve engines, remove the air cleaner, resonator and inlet air duct as described in Chapter 4B.

2 Identify the two HT leads for position then disconnect them from the coil HT terminals **(see illustration)**.

3 Disconnect the LT wiring plug.

4 Unscrew the mounting bolts and remove the relevant ignition coil from the end of the cylinder head.

Testing

5 Testing of the coil consists of using a multimeter set to its resistance function, to check the primary and secondary windings for continuity and resistance. Compare the results obtained to those given in the Specifications at the start of this Chapter. Note the resistance of the coil windings varies slightly according to the coil temperature; the results in the Specifications are approximate values for the coil at 20°C.

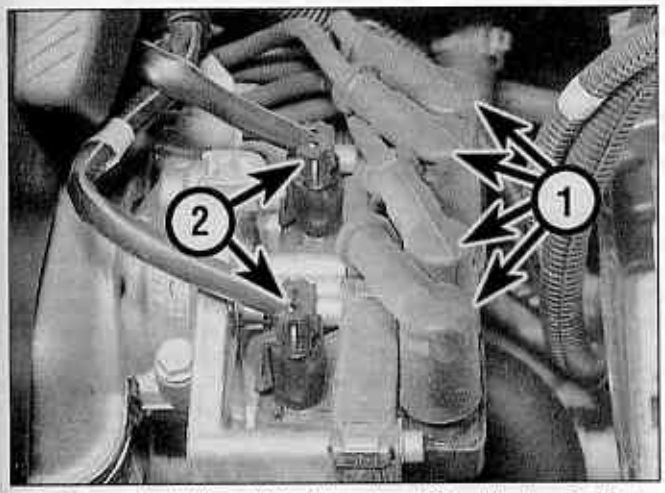
6 Check that there is no continuity between the HT lead terminals and the coil body/mounting bracket.

7 Note that with the ignition switched on and the engine stationary, voltage will only be supplied to the ignition coils for approximately 2 seconds. However, when the engine is being cranked or running, voltage will be continually supplied.

8 If faulty, the coil should be renewed.

Refitting

9 Refitting is a reversal of the removal procedure ensuring that the wiring and HT leads are correctly reconnected **(see illustration)**.



3.2 HT terminals (1) and LT wiring plugs (2) on the two ignition coils

4 Ignition timing - checking and adjustment

1 The ignition timing is constantly being monitored and adjusted by the engine management ECU, and although it is possible to check the base ignition timing using a standard timing light it is not possible to adjust it.

2 For those wishing to check the ignition timing a stroboscopic timing light will be required, and it will need to be the type which

3.1 Removing the ignition coil cover

can determine the amount of advance from the TDC markings on the crankshaft pulley or flywheel. It is recommended that the timing mark is highlighted as follows.

3 Remove the plug from the top of the transmission then turn the engine slowly (raise the front right-hand wheel and engage 4th gear) until the timing mark scribed on the edge of the flywheel appears in the aperture. Highlight the line with quick-drying white paint - typist's correction fluid is ideal.

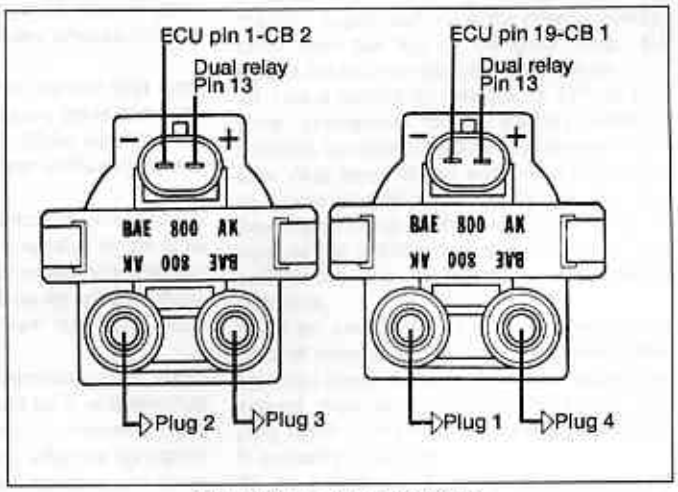
4 Start the engine and run it to normal operating temperature, then stop it.

5 Connect the timing light to No 1 cylinder spark plug lead (No 1 cylinder is at the timing belt end of the engine) as described in the timing light manufacturer's instructions.

6 Start the engine, allowing it to idle at the specified speed (Chapter 1A), and point the timing light at the transmission housing aperture. Adjust the timing light until the TDC marks are aligned with each other and read off the amount of advance.

7 If the ignition timing is incorrect, the car should be taken to a Fiat dealer who will be able to check the system quickly using special diagnostic equipment.

8 After making the check stop the engine, disconnect the timing light and refit the plug to the transmission.



3.9 Ignition coil connections

Chapter 5 Part C:
Preheating system - diesel models

Contents

Glow plugs - removal, inspection and refitting 2
Preheating system control unit - removal and refitting 3
Preheating system - description and testing 1

Degrees of difficulty

Easy, suitable for novice with little experience	**Fairly easy,** suitable for beginner with some experience	**Fairly difficult,** suitable for competent DIY mechanic	**Difficult,** suitable for experienced DIY mechanic	**Very difficult,** suitable for expert DIY or professional

Specifications

Torque wrench setting	Nm	lbf ft
Heater glow plugs	15	11

1 Preheating system - description and testing

Description

1 Each swirl chamber has a heater plug (commonly called a glow plug) screwed into it. The plugs are electrically-operated before and during start-up when the engine is cold.

2 Electrical feed to the glow plugs is controlled by a relay/timer unit. The coolant temperature determines the period of heating that takes place.

3 A warning light in the instrument panel tells the driver that preheating is taking place. When the light goes out, the engine is ready to be started. The voltage supply to the glow plugs continues for several seconds after the light goes out. If no attempt is made to start, the timer then cuts off the supply, in order to avoid draining the battery and overheating the glow plugs.

Testing

4 If the system malfunctions, testing is ultimately by substitution of known good units, but some preliminary checks may be made as follows.

5 Connect a voltmeter or 12-volt test lamp between the glow plug supply cable and earth (engine or vehicle metal). Make sure that the live connection is kept clear of the engine and bodywork.

6 Have an assistant switch on the ignition, and check that voltage is applied to the glow plugs. Note the time for which the warning light is lit, and the total time for which voltage is applied before the system cuts out. Switch off the ignition.

7 At an under-bonnet temperature of 20°C, typical times noted should be 5 or 6 seconds for warning light operation, followed by a further 10 seconds supply after the light goes out. Warning light time will increase with lower temperatures and decrease with higher temperatures.

8 If there is no supply at all, the relay or associated wiring is at fault.

9 To locate a defective glow plug, disconnect the main supply cable and the interconnecting strap from the top of the glow plugs. Be careful not to drop the nuts and washers.

10 Use a continuity tester, or a 12-volt test lamp connected to the battery positive terminal, to check for continuity between each glow plug terminal and earth. The resistance of a glow plug in good condition is very low (less than 1 ohm), so if the test lamp does not light or the continuity tester shows a high resistance, the glow plug is certainly defective.

11 If an ammeter is available, the current draw of each glow plug can be checked. After an initial surge of 15 to 20 amps, each plug should draw approximately 12 amps. Any plug which draws much more or less than this is probably defective.

12 As a final check, the glow plugs can be removed and inspected as described in the following Section.

2.3 No 4 glow plug showing the main supply lead and the interconnecting strap

2.5 Removing a glow plug

2 Glow plugs - removal, inspection and refitting

Removal

Caution: If the preheating system has just been energised, or if the engine has been running, the glow plugs will be very hot.

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 Remove the air inlet ducting from the front of the engine with reference to Chapter 4C, Section 2.

3 Unscrew the nut from the relevant glow plug terminal(s), and recover the washer(s). Note that the main supply cable is connected to Number 4 cylinder glow plug and an interconnecting strap is fitted between the four plugs **(see illustration)**.

4 Where applicable, carefully move any obstructing pipes or wires to one side to enable access to the relevant glow plug(s).

5 Unscrew the glow plug(s) and remove from the cylinder head **(see illustration)**.

Inspection

6 Inspect each glow plug for physical damage. Burnt or eroded glow plug tips can be caused by a bad injector spray pattern. Have the injectors checked if this sort of damage is found.

7 If the glow plugs are in good physical condition, check them electrically using a 12 volt test lamp or continuity tester as described in the previous Section.

8 The glow plugs can be energised by applying 12 volts to them to verify that they heat up evenly and in the required time. Observe the following precautions.

a) Support the glow plug by clamping it carefully in a vice or self-locking pliers. Remember it will become red-hot.

b) Make sure that the power supply or test lead incorporates a fuse or overload trip to protect against damage from a short-circuit.

c) After testing, allow the glow plug to cool for several minutes before attempting to handle it.

9 A glow plug in good condition will start to glow red at the tip after drawing current for 5 seconds or so. Any plug which takes much longer to start glowing, or which starts glowing in the middle instead of at the tip, is defective.

Refitting

10 Refit by reversing the removal operations. Apply a smear of copper-based anti-seize compound to the plug threads and tighten the glow plugs to the specified torque. Do not overtighten, as this can damage the glow plug element.

3 Preheating system control unit - removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 Unscrew the screws and remove the relay cover located at the left-hand end of the engine.

3 Disconnect the wiring then remove the control unit from the bracket.

Refitting

4 Refitting is a reversal of removal.

Chapter 6
Clutch

Contents

Clutch - adjustment 2
Clutch assembly - removal, inspection and refitting 7
Clutch cable - removal and refitting 3
Clutch hydraulic system - bleeding 4
Clutch master cylinder - removal and refitting 5
Clutch release mechanism - removal, inspection and refitting 8
Clutch slave cylinder - removal and refitting 6
General information 1

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

General

Type	Single dry plate with diaphragm spring, cable- or hydraulically-operated according to model
Clutch pedal travel (cable-operated mechanism)	140.0 ± 5.0 mm

Friction plate diameter

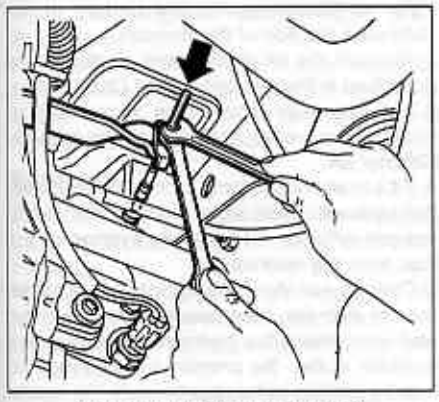
8-valve petrol engines	181.5 mm
16-valve petrol engines	190.0 mm
Diesel engines	200.0 mm

Torque wrench setting	Nm	lbf ft
Pressure plate retaining bolts	16	12

1 General information

Vehicles with manual transmission are fitted with a pedal operated single dry plate clutch system. When the clutch pedal is depressed, effort is transmitted to the clutch release mechanism either mechanically by means of a cable, or hydraulically by means of a master cylinder and slave cylinder. The release mechanism transfers effort to the pressure plate diaphragm spring, which withdraws the pressure plate from the flywheel and releases the driven plate.

Where applicable, the hydraulic fluid employed in the clutch system is the same as that used in the braking system, hence fluid is supplied to the master cylinder from a tapping on the brake fluid reservoir. The clutch hydraulic system must be sealed before work is carried out on any of its components and then on completion, topped up and bled to remove any air bubbles.



2.5 Clutch cable adjustment

2 Clutch - adjustment 

Note: *This procedure applies to models fitted with a cable-operated clutch release mechanism. No adjustment is possible on models with the hydraulically-operated system.*

1 The clutch adjustment is checked by measuring the clutch pedal travel. If a new cable has been fitted, settle it in position by depressing the clutch pedal at least thirty times.

2 Ensure that there are no obstructions beneath the clutch pedal then measure the distance from the centre of the clutch pedal pad to the base of the steering wheel with the pedal in the at-rest position. Depress the clutch pedal fully to the floor, and measure the distance from the centre of the clutch pedal pad to the base of the steering wheel.

3 Subtract the first measurement from the second to obtain the clutch pedal travel. If this is not with the range given in the Specifications at the start of this Chapter, adjust the clutch as follows.

4 The clutch cable is adjusted by means of the adjuster nut on the transmission end of the cable. Access to the nut is from under the vehicle. Apply the handbrake then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*).

5 Working under the left-hand side of the engine compartment, slacken the locknut from the end of the clutch cable. Adjust the position of the adjuster nut, then depress the clutch pedal ten times and re-measure the clutch pedal travel. Repeat this procedure until the clutch pedal travel is as specified **(see illustration)**.

6 Once the adjuster nut is correctly positioned, and the pedal travel is correctly set, securely tighten the cable locknut then lower the vehicle to the ground.

3 Clutch cable - removal and refitting

Note: *This procedure applies to models fitted with a cable-operated clutch release mechanism.*

Removal

1 Remove the battery and tray as described in Chapter 5A. If necessary, also remove the inlet air ducting for improved access as described in the relevant part of Chapter 4.
2 Unscrew the adjustment locknut and adjuster nut from the end of the cable fitting, then release the inner and outer cables from the transmission housing. Note the position of the damper block.
3 Working inside the vehicle, unhook the inner cable from the top of the clutch pedal.
4 Returning to the engine compartment, unscrew the nuts securing the outer cable to the bulkhead, then withdraw the cable assembly from the engine compartment.

Refitting

5 Apply a smear of multi-purpose grease to the cable end fittings, then pass the cable through the bulkhead. Refit and tighten the nuts.
6 Inside the vehicle hook the inner cable onto the top of the clutch pedal.
7 In the engine compartment, attach the outer cable to the transmission housing and refit the damper block and nuts to the inner cable end.
8 Adjust the cable as described in Section 2.
9 Refit the air ducting and battery with reference to Chapters 4 and 5A.

4 Clutch hydraulic system - bleeding

Note: *This procedure applies to models fitted with the hydraulically-operated clutch release mechanism.*

Warning: Hydraulic fluid is poisonous; thoroughly wash off spills from bare skin without delay. Seek immediate medical advice if any fluid is swallowed or gets into the eyes. Certain types of hydraulic fluid are inflammable and may ignite when brought into contact with hot components; when servicing any hydraulic system, it is safest to assume that the fluid IS inflammable, and to take precautions against the risk of fire as though it were petrol that was being handled. Hydraulic fluid is an effective paint stripper and will also attack many plastics. If spillage occurs onto painted bodywork or fittings, it should be washed off immediately, using copious quantities of fresh water. It is also hygroscopic - it can absorb moisture from the air, which then renders it useless. Old fluid may have suffered contamination, and should never be re-used. When topping-up or renewing the fluid, always use the recommended grade, and ensure that it comes from a new sealed container.

General information

1 Whenever the clutch hydraulic lines are disconnected for service or repair, a certain amount of air will enter the system. The presence of air in any hydraulic system will introduce a degree of elasticity, and in the clutch system this will translate into poor pedal feel and reduced travel, leading to inefficient gear changes and even clutch system failure. For this reason, the hydraulic lines must be sealed using hose clamps before any work is carried out and then on completion, topped up and bled to remove any air bubbles.
2 To seal off the hydraulic supply to the clutch slave cylinder, fit a proprietary brake hose clamp to the flexible section of the hose located over the transmission and tighten it securely. It will be necessary to remove the battery and battery tray to access the hose.
3 The most effective way of bleeding the clutch hydraulic system is to use a pressure brake bleeding kit. These are readily available in motor accessories shops and are extremely effective; the following sub-section describes bleeding the clutch system using such a kit. The alternative method is to bleed the system by depressing the clutch pedal - refer to Chapter 9, Section 11, for details of this method.

Bleeding

4 Remove the protective cap from the bleed nipple on the slave cylinder. Access can be improved by removing the battery and tray with reference to Chapter 5A.
5 Fit a ring spanner over the bleed nipple head, but do not slacken it at this point. Connect a length of clear plastic hose over the nipple and insert the other end into a clean container. Pour hydraulic fluid into the container, such that the end of the hose is covered.
6 Following the manufacturer's instructions, pour hydraulic fluid into the bleeding kit vessel.
7 Unscrew the vehicle's fluid reservoir cap, then connect the bleeding kit fluid supply hose to the reservoir.
8 Connect the pressure hose to a supply of compressed air - a spare tyre is a convenient source.
Caution: Check that the pressure in the tyre does not exceed the maximum supply pressure quoted by the kit manufacturer, let some air escape to reduce the pressure, if necessary. Gently open the air valve and allow the air and fluid pressures to equalise. Check that there are no leaks before proceeding.
9 Using the spanner, slacken the bleed pipe nipple until fluid and air bubbles can be seen to flow through the tube, into the container. Maintain a steady flow until the emerging fluid is free of air bubbles; keep a watchful eye on the level of fluid in the bleeding kit vessel and the vehicle's fluid reservoir - if it is allowed to drop too low, air may be forced into the system, defeating the object of the exercise. To refill the vessel, turn off the compressed air supply, remove the lid and pour in an appropriate quantity of clean fluid from a new container - do not re-use the fluid collected in the receiving container. Repeat as necessary until the ejected fluid is bubble-free.
10 On completion, pump the clutch pedal several times to assess its feel and travel. If firm, constant pedal resistance is not felt throughout the pedal stroke, it is probable that air is still present in the system - repeat the bleeding procedure until the pedal feel is restored.
11 Depressurise the bleeding kit and remove it from the vehicle. At this point, the fluid reservoir may be over-full; the excess should be removed using a *clean* pipette to reduce the level to the MAX mark.
12 Tighten the bleed pipe nipple using the spanner and remove the receiving container. Refit the protective cap.
13 On completion, assess the feel of the clutch pedal; if it exhibits any sponginess or looseness, further bleeding may be required.
14 Where removed, refit the battery and tray.
15 Finally, road test the vehicle and check the operation of the clutch system whilst changing up and down through the gears, whilst pulling away from a standstill and from a hill start.

5 Clutch master cylinder - removal and refitting

Note: *This procedure applies to models fitted with the hydraulically-operated clutch release mechanism.*
Note: *Refer to the warning at the beginning of Section 4 regarding the hazards of working with hydraulic fluid.*

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).
2 Remove the air cleaner and air ducting as described in the relevant Part of Chapter 4.
3 For improved access on petrol engine models, remove the alternator as described in Chapter 5A.
4 Fit a brake hose clamp to the hose between the hydraulic fluid reservoir and the clutch master cylinder. Alternatively syphon all the fluid from the reservoir.
5 Disconnect the fluid supply hose at the master cylinder, then unscrew the union nut and disconnect the hydraulic pipe from the cylinder outlet. Be prepared for some fluid loss by placing some rags beneath the master cylinder.

6 Working inside the vehicle, extract the split pin and remove the washer securing the master cylinder pushrod to the clutch pedal. Disconnect the pushrod from the pivot.
7 Have an assistant support the master cylinder in the engine compartment, then unscrew the mounting bolts. Withdraw the master cylinder from the engine compartment.
8 It is not possible to obtain an overhaul kit from Fiat however some motor factors may be able to supply one. Follow the instructions with the repair kit if obtained.

Refitting

9 Refit the clutch master cylinder by following the removal procedure in reverse, noting the following.

a) Apply a little high-melting point grease to the clutch pedal pivot.
b) Tighten the mounting bolts and union nut securely.
c) Fit a new split pin to the pushrod.
d) Where removed, refit the alternator as described in Chapter 5A.
e) On completion bleed the clutch hydraulic system as described in Section 4.

6 Clutch slave cylinder - removal and refitting

Note: *This procedure applies to models fitted with the hydraulically-operated clutch release mechanism.*
Note: *Refer to the warning at the beginning of Section 4 regarding the hazards of working with hydraulic fluid.*

Removal

1 Remove the battery and battery tray as described in Chapter 5A.
2 Fit a brake hose clamp to the hose leading to the clutch slave cylinder.
3 Unscrew the union nut and disconnect the hydraulic pipe from the slave cylinder. Be prepared for some fluid loss by placing rags beneath the cylinder.
4 Unscrew the mounting bolts and release the slave cylinder pushrod from the release arm on the transmission, then remove the unit from the engine compartment **(see illustration)**.
5 It is not possible to obtain an overhaul kit from Fiat however some motor factors may be able to supply one. Follow the instructions with the repair kit if obtained.

Refitting

6 Refit the clutch slave cylinder by following the removal procedure in reverse, noting the following.

a) Apply a little high-melting point grease to the tip of the slave cylinder pushrod.
b) Tighten the mounting bolts and union nut securely.
c) On completion bleed the clutch hydraulic system as described in Section 4.

7 Clutch assembly - removal, inspection and refitting

Warning: Dust created by clutch wear and deposited on the clutch components may contain asbestos, which is a health hazard. DO NOT blow it out with compressed air, or inhale any of it. DO NOT use petrol or petroleum-based solvents to clean off the dust. Brake system cleaner or methylated spirit should be used to flush the dust into a suitable receptacle. After the clutch components are wiped clean with rags, dispose of the contaminated rags and cleaner in a sealed, marked container.
Note: *Although some friction materials may no longer contain asbestos, it is safest to assume that they DO, and to take precautions accordingly.*

Removal

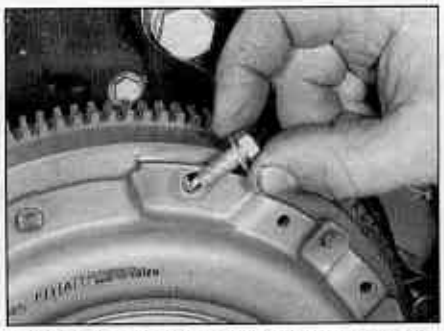
1 Unless the complete engine/transmission is to be removed from the car and separated for major overhaul (see Chapter 2D), the clutch can be reached by removing the transmission as described in Chapter 7A.
2 Before disturbing the clutch, use chalk or a marker pen to mark the relationship of the pressure plate assembly to the flywheel.
3 Working in a diagonal sequence, slacken the pressure plate bolts by half a turn at a time, until spring pressure is released and the bolts can be unscrewed by hand **(see illustration)**.
4 Prise the pressure plate assembly off its locating dowels, and collect the friction plate, noting which way round the friction plate is fitted **(see illustration)**.

Inspection

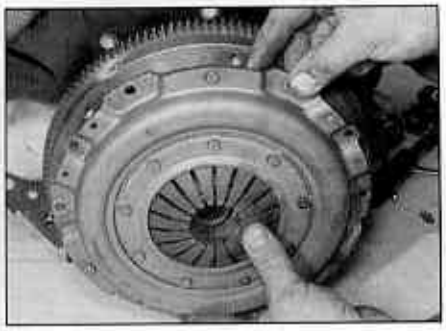
Note: *Due to the amount of work necessary to remove and refit clutch components, it is usually considered good practice to renew the clutch friction plate, pressure plate assembly and release bearing as a matched set, even if only one of these is actually worn enough to require renewal. It is also worth considering the renewal of the clutch components on a preventative basis if the engine and/or transmission have been removed for some other reason.*

6.4 Removing the clutch slave cylinder from the transmission

5 Separate the pressure plate and friction plate and place them on the bench.
6 When cleaning clutch components, read first the warning at the beginning of this Section; remove dust using a clean, dry cloth, and working in a well-ventilated atmosphere.
7 Check the friction plate facings for signs of wear, damage or oil contamination. If the friction material is cracked, burnt, scored or damaged, or if it is contaminated with oil or grease (shown by shiny black patches), the friction plate must be renewed.
8 If the friction material is still serviceable, check that the centre boss splines are unworn, that the torsion springs are in good condition and securely fastened, and that all the rivets are tight. If any wear or damage is found, the friction plate must be renewed.
9 If the friction material is fouled with oil, this must be due to an oil leak from the crankshaft rear (left-hand) oil seal, from the sump-to-cylinder block joint, or from the transmission input shaft. Renew the seal or repair the joint, as appropriate, before installing the new friction plate.
10 Check the pressure plate assembly for obvious signs of wear or damage; shake it to check for loose rivets or worn or damaged fulcrum rings, and check that the drive straps securing the pressure plate to the cover do not show signs (such as a deep yellow or blue discoloration) of overheating. If the diaphragm spring is worn or damaged, or if its pressure is in any way suspect, the pressure plate assembly should be renewed.



7.3 Removing the clutch pressure plate bolts



7.4 Removing the clutch pressure plate and friction plate

7.17 Using a clutch friction plate centralising tool

11 Examine the machined bearing surfaces of the pressure plate and of the flywheel; they should be clean, completely flat, and free from scratches or scoring. If either is discoloured from excessive heat, or shows signs of cracks, it should be renewed - although minor damage of this nature can sometimes be polished away using emery paper.

12 Check that the release bearing contact surface rotates smoothly and easily, with no sign of noise or roughness. Also check that the surface itself is smooth and unworn, with no signs of cracks, pitting or scoring. If there is any doubt about its condition, the bearing must be renewed.

Refitting

13 On reassembly, ensure that the bearing surfaces of the flywheel and pressure plate are completely clean, smooth, and free from oil or grease. Use solvent to remove any protective grease from new components.

14 Fit the friction plate so that its spring hub assembly faces away from the flywheel; there may also be a marking showing which way round the plate is to be refitted.

15 Refit the pressure plate assembly, aligning the marks made on dismantling (if the original pressure plate is re-used), and locating the pressure plate on its three locating dowels. Fit the pressure plate bolts, but tighten them only finger-tight, so that the friction plate can still be moved.

16 The friction plate must now be centralised, so that when the transmission is refitted, its input shaft will pass through the splines at the centre of the friction plate.

17 Centralisation can be achieved by passing a screwdriver or other long bar through the friction plate and into the hole in the crankshaft; the friction plate can then be moved around until it is centred on the crankshaft hole. Alternatively, a clutch-aligning tool can be used to eliminate the guesswork; these can be obtained from most accessory shops **(see illustration)**. A home-made aligning tool can be fabricated from a length of metal rod or wooden dowel which fits closely inside the crankshaft hole, and has insulating tape wound around it to match the diameter of the friction plate splined hole.

18 When the friction plate is centralised, tighten the pressure plate bolts evenly and in a diagonal sequence to the specified torque setting.

19 Apply a thin smear of molybdenum disulphide grease to the splines of the friction plate and the transmission input shaft, and also to the release bearing bore and release fork shaft.

20 Refit the transmission as described in Chapter 7A.

8 Clutch release mechanism - removal, inspection and refitting

Removal

1 Unless the complete engine/transmission is to be removed from the car and separated for major overhaul (see Chapter 2D), the clutch release mechanism can be reached by removing the transmission as described in Chapter 7A.

2 Unhook the release bearing from the fork and slide it off the guide tube **(see illustration)**.

3 Using circlip pliers extract the circlip from the top of the release fork shaft.

4 Note the position of the arm then slide it off the splines.

5 Using a small drift, tap out the upper release shaft bush from the transmission casing **(see illustration)**.

6 Lift the release shaft from the lower bush then remove it from inside the transmission casing.

7 Extract the lower bush from the casing.

Inspection

8 Check the release mechanism, renewing any worn or damaged parts. Carefully check all bearing surfaces and points of contact.

9 When checking the release bearing itself, note that it is often considered worthwhile to renew it as a matter of course. Check that the contact surface rotates smoothly and easily, with no sign of roughness, and that the surface itself is smooth and unworn, with no signs of cracks, pitting or scoring. If there is any doubt about its condition, the bearing must be renewed.

Refitting

10 Apply a smear of molybdenum disulphide grease to the shaft pivot bushes and the contact surfaces of the release fork.

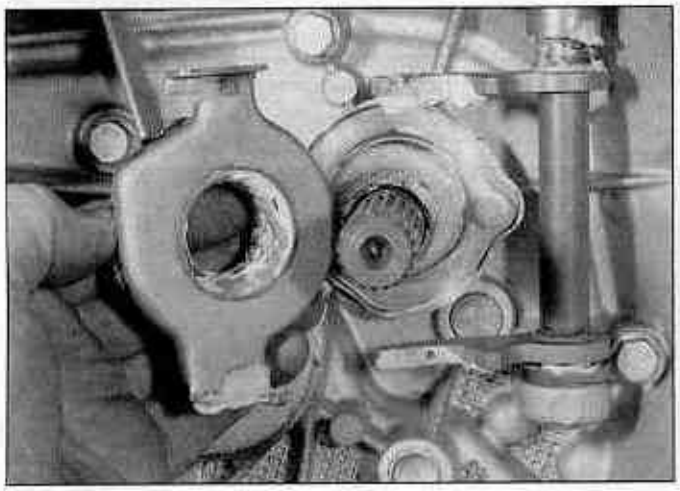
11 Tap the lower bush into the casing and refit the release fork and shaft.

12 Slide the upper bush down the shaft and tap it into the casing making sure that the ridge engages with the cut-out, then slide the arm on the splines the correct way round.

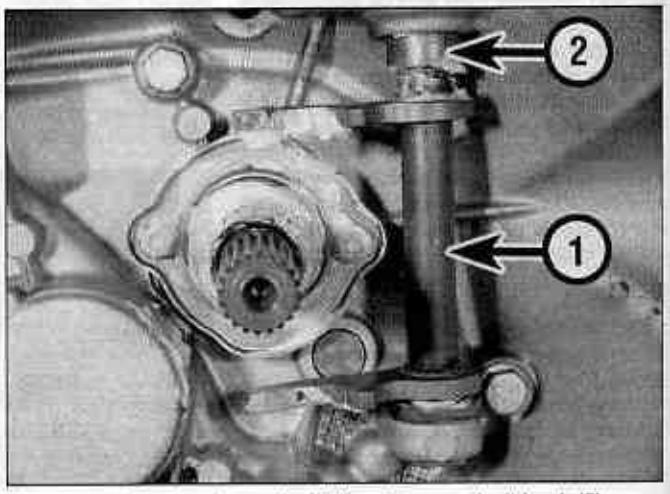
13 Refit the circlip in the shaft groove.

14 Slide the release bearing onto the guide tube and engage it with the fork.

15 Refit the transmission as described in Chapter 7A.



8.2 Removing the release bearing from the fork and guide tube



8.5 Clutch release shaft (1) and upper shaft bush (2)

Chapter 7 Part A:
Manual transmission

Contents

Gearchange lever and linkage - removal and refitting 2
General information 1
Manual transmission oil level check .....See Chapter 1A or 1B
Manual transmission oil renewal .....See Chapter 1A or 1B
Manual transmission overhaul - general information 4
Manual transmission - removal and refitting 3
Reversing light switch - testing, removal and refitting 5

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

General

Type	Transverse mounted, front wheel drive layout with integral transaxle differential/final drive. 5 or 6 forward speeds, 1 reverse speed
Designation:	
1108 cc petrol engine	C.514.5.10 (5-speed) or C.514.6.10 (6-speed)
1242 cc petrol engine	C.514.5.10/13 (5-speed)
Non-turbo diesel engine	C.514.5.13 (5-speed)
Turbo diesel engine	C.510.5.17 (5-speed)

Torque wrench settings

	Nm	lbf ft
Gear lever support nut	6	4
Gear lever to mounting	49	36
Reverse gear inhibitor cable to transmission	30	22
Reversing light switch	40	30
Selector rod-to-gear lever nut	17	13
Speedometer drive	12	9
Transmission-to-engine bolt/nut	85	63

7A

1 General information

The transmission is contained in a cast-aluminium alloy casing bolted to the engine's left-hand end, and consists of the gearbox and final drive differential.

Drive is transmitted from the crankshaft via the clutch to the input shaft, which has a splined extension to accept the clutch friction plate, and rotates in roller bearings at its right-hand end and ball bearings at its left-hand end (on 6-speed versions the left-hand extension rotates in a roller bearing). From the input shaft, drive is transmitted to the output shaft, which rotates in roller bearings at its right-hand end, and ball bearings at its left-hand end (on 6-speed versions the left-hand extension rotates in ball bearings). From the output shaft, the drive is transmitted to the differential crownwheel, which rotates with the differential case and gears in taper roller bearings, thus driving the sun gears and driveshafts. The rotation of the differential gears on their shaft allows the inner roadwheel to rotate at a slower speed than the outer roadwheel when the car is cornering.

The input and output shafts are arranged side by side, parallel to the crankshaft and driveshafts, so that their gear pinion teeth are in constant mesh. In the neutral position, the relevant input shaft and output shaft gear pinions rotate freely, so that drive cannot be transmitted to the output shaft and crownwheel.

Gear selection is via a floor-mounted lever and selector rod mechanism **(see illustration)**. The selector rod causes the appropriate selector fork to move its respective synchro-sleeve along the shaft, to lock the gear to the synchro-hub. Since the synchro-hubs are splined to the input and output shafts, this locks the gear to the shaft, so that drive can be transmitted. To ensure that gear-changing can be made quickly and quietly, a synchro-mesh system is fitted to all forward gears.

2 Gearchange lever and linkage - removal and refitting

Removal

1 Firmly apply the handbrake, then jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*).
2 Remove the exhaust system with reference to Chapter 4D.
3 Unbolt the exhaust heatshield and remove it from under the vehicle.
4 Disconnect the gearchange cable and rod from the transmission and from the body. Also disconnect the reverse inhibitor cable.
5 Unscrew the single screw and remove the centre console from inside the vehicle.
6 Unscrew the front mounting securing the gearchange lower cover to the body.
7 Under the vehicle unscrew the lower cover mounting bolts, then lower the assembly and remove from under the vehicle.
8 The gearchange lever may be removed by disconnecting the cables and removing the pivot bolt. Note the location of the spacers and washers to ensure correct reassembly. If necessary the bushes may be renewed by unscrewing the mounting nuts.
9 Reassembly is a reversal of dismantling but apply a little multi-purpose grease to the bearing surfaces.

Refitting

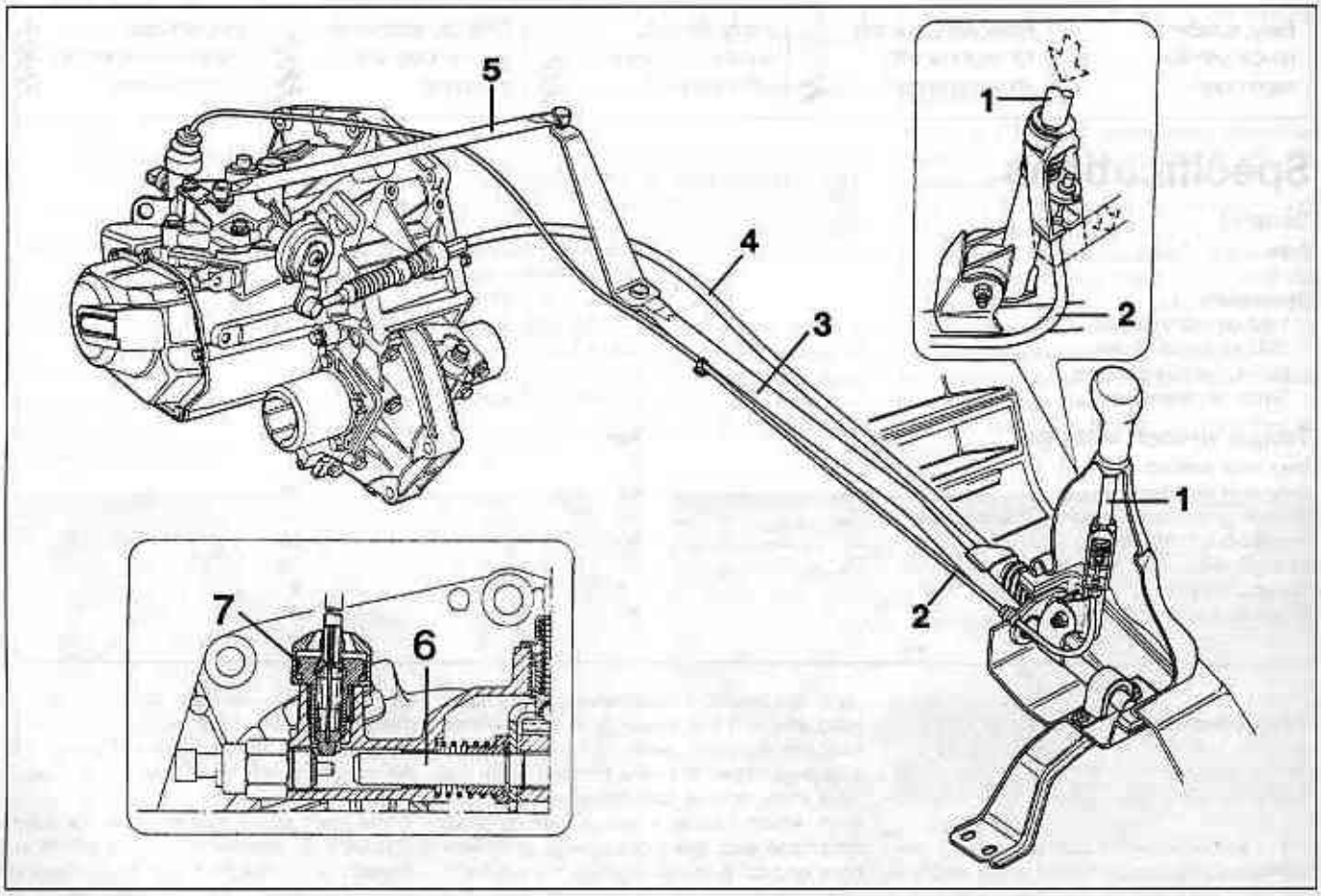
10 Refitting is a reversal of removal. Tighten all nuts and bolts securely.

3 Manual transmission - removal and refitting

Petrol models

Removal

1 Select a solid, level surface to park the vehicle upon. Give yourself enough space to move around it easily. Apply the handbrake then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*). Remove both front wheels.
2 Disconnect the wiring connectors from the anti-theft alarm located next to the battery, then unbolt and remove the alarm.
3 Remove the battery and mounting tray as described in Chapter 5A.
4 Disconnect the wiring from the reversing light switch on the front of the transmission.
5 Unscrew the nut and disconnect the earth cable from its stud.
6 On models with a cable operated clutch,



1.4 Gearchange lever and linkage

1 Gear lever sliding part
2 Reverse gear inhibition cable
3 Gear selector control rod
4 Gear engagement control cable
5 Gear selector link rod
6 Gear selector control rod
7 Reverse gear inhibition device

3.8 Unscrew the nut and disconnect the gear selector rod from the lever on the transmission

unscrew the locknut and adjusting nut from the end of the clutch cable and disconnect the cable from the transmission. Recover the damper block. On models with a hydraulically operated clutch, unscrew the mounting bolts, release the slave cylinder pushrod from the release arm on the transmission, then position the cylinder to one side.

7 Unscrew and remove the reverse gear inhibiting device from the transmission. Tie the cable to one side out of the way.

8 Unscrew the nut and disconnect the gear selector rod from the lever on the transmission **(see illustration)**.

9 Pull out the clip then disconnect the gear engagement cable from the control lever and release the cable from the mounting bracket **(see illustrations)**.

10 Unscrew and remove the two upper transmission-to-engine mounting bolts. Unscrew the single bolt securing the starter motor to the transmission.

11 Remove the air cleaner and air ducting with reference to Chapter 4A or 4B. This is necessary in order to fit the engine hoist.

12 On 5-speed transmissions, trace the wiring back from the electronic speedometer sensor and disconnect the connector located on the left-hand side of the engine **(see illustration)**.

13 On 6-speed transmissions, unscrew the knurled nut and disconnect the speedometer cable from the top of the final drive housing.

14 Support the weight of the engine using a hoist attached to the engine lifting eyes, or alternatively use a trolley jack and block of wood beneath the engine.

15 Unscrew the Lambda/oxygen sensor from the exhaust downpipe and position it in a safe place to prevent damage.

16 Unscrew the nuts securing the downpipe to the exhaust manifold, then lower it and support on an axle stand. Recover the gasket.

17 Unbolt the support bracket from the engine and transmission. Recover the spacer plate.

18 Unbolt and remove the transmission lower cover.

19 Unscrew the remaining starter motor mounting bolts and support the starter motor to one side.

20 Loosen and remove the clips securing the left- and right-hand driveshaft gaiters to the transmission output shafts.

3.9a Remove the clip to release the gear engagement cable

21 Unscrew and remove the bolts securing the left-hand swivel hub assembly to the front suspension strut, then separate the components and support the swivel hub on an axle stand.

22 Move the swivel hub assembly outwards and disconnect the inner end of the driveshaft from the transmission output shaft. Support the shaft away from the transmission to prevent damage to the gaiters.

23 Working beneath the vehicle, unscrew the bolts securing the rear engine mounting to the underbody then unscrew the bolts securing the mounting to the transmission and withdraw the mounting assembly from under the vehicle.

24 Unscrew the bolts securing the left-hand engine/transmission mounting to the body then unscrew the bolts from the transmission and remove the mounting.

25 Support the weight of the transmission on a trolley jack then unscrew the remaining nut and bolt from the bellhousing and pull the transmission away from the engine. Lower it and remove from under the vehicle.

Warning: Support the transmission to ensure that it remains steady on the jack head. Keep the transmission level until the input shaft is fully withdrawn from the clutch friction plate.

Refitting

26 Refitting is a reversal of the removal procedure, but note the following points.

a) Apply a smear of high-melting-point grease to the clutch friction plate splines; take care to avoid contaminating the friction surfaces.

3.12 Electronic speedometer sensor fitted to 5-speed transmissions

3.9b Removing the gear engagement cable from the mounting bracket

b) Tighten all bolts to the specified torque.

c) Fit new clips to secure the driveshaft gaiters to the transmission output shafts.

d) Adjust the clutch cable (where applicable) as described in Chapter 6.

Diesel models

Removal

27 Select a solid, level surface to park the vehicle upon. Give yourself enough space to move around it easily. Apply the handbrake then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*). Remove both front wheels.

28 Unbolt the relay support then remove the battery and mounting tray as described in Chapter 5A.

29 On models with a cable operated clutch, unscrew the locknut and adjusting nut from the end of the clutch cable and disconnect the cable from the transmission. Recover the damper block. On models with a hydraulically operated clutch, unscrew the mounting bolts, release the slave cylinder pushrod from the release arm on the transmission, then position the cylinder to one side.

30 Unscrew the nut and disconnect the gear selector rod from the lever on the transmission.

31 Disconnect the gear engagement cable from the control lever then slide out the clip and release the cable from the mounting bracket.

32 Unbolt the electronic rev counter sensor from the upper rear of the bellhousing and position it to one side **(see illustration)**.

3.32 Electronic rev counter sensor located in the upper rear of the bellhousing

33 Remove the air cleaner front section and air ducting with reference to Chapter 4C. Also disconnect the injection pump vacuum pipe from the clips on the left-hand end of the cylinder head. This work is necessary in order to fit the engine hoist.
34 Support the weight of the engine using a hoist attached to the engine lifting eyes, or alternatively use a trolley jack and block of wood beneath the engine.
35 Unscrew the nuts securing the downpipe to the exhaust manifold, then lower it and support on an axle stand. Recover the gasket.
36 Unscrew the starter motor mounting bolts and support the starter motor to one side.
37 Disconnect the wiring from the reversing light switch on the front of the transmission.
38 Unscrew the nut and disconnect the earth cable from its stud.
39 Trace the wiring back from the electronic speedometer sensor and disconnect the connector located on the left-hand side of the engine. If a mechanical speedometer is fitted unscrew the knurled collar and disconnect the cable from the transmission.
40 Unbolt and remove the transmission lower cover.
41 Using an Allen key unscrew the bolts securing the inner end of the left-hand driveshaft to the transmission flange. Remove the bolts and recover the spacer plates. Support the driveshaft on an axle stand.
42 Unscrew and remove the bolts securing the left-hand swivel hub assembly to the front suspension strut, then separate the components and support the swivel hub on an axle stand.
43 Move the swivel hub assembly outwards and support the driveshaft away from the transmission.
44 Using an Allen key unscrew the bolts securing the inner end of the right-hand driveshaft to the intermediate shaft flange. Remove the bolts and recover the spacer plates. Support the driveshaft on an axle stand.
45 Remove the intermediate driveshaft with reference to Chapter 8.
46 Working beneath the vehicle, unscrew the bolts securing the rear engine mounting to the underbody then unscrew the bolts securing the mounting to the transmission and withdraw the mounting assembly from under the vehicle.
47 Unscrew the bolts securing the left-hand engine/transmission mounting to the body then unscrew the bolts from the transmission and remove the mounting.
48 Support the weight of the transmission on a trolley jack then unscrew the remaining nut and bolts from the bellhousing and pull the transmission away from the engine.

Warning: Support the transmission to ensure that it remains steady on the jack head. Keep the transmission level until the input shaft is fully withdrawn from the clutch friction plate.

Refitting

49 Refitting is a reversal of the removal procedure, but note the following points.

a) Apply a smear of high-melting-point grease to the clutch friction plate splines; take care to avoid contaminating the friction surfaces.
b) Tighten all bolts to the specified torque.
c) Fit new clips to secure the driveshaft gaiters to the transmission output shafts.
d) Adjust the clutch cable (where applicable) as described in Chapter 6.

4 Manual transmission overhaul - general information

Overhauling a manual transmission is a difficult and involved job for the DIY home mechanic. In addition to dismantling and reassembling many small parts, clearances must be precisely measured and, if necessary, changed by selecting shims and spacers. Internal transmission components are also often difficult to obtain, and in many instances, extremely expensive. Because of this, if the transmission develops a fault or becomes noisy, the best course of action is to have the unit overhauled by a specialist repairer, or to obtain an exchange reconditioned unit.

Nevertheless, it is not impossible for the more experienced mechanic to overhaul the transmission, provided the special tools are available, and the job is done in a deliberate step-by-step manner, so that nothing is overlooked.

The tools necessary for an overhaul include internal and external circlip pliers, bearing pullers, a slide hammer, a set of pin punches, a dial test indicator, and possibly a hydraulic press. In addition, a large, sturdy workbench and a vice will be required.

During dismantling of the transmission, make careful notes of how each component is fitted, to make reassembly easier and more accurate.

Before dismantling the transmission, it will help if you have some idea what area is malfunctioning. Certain problems can be closely related to specific areas in the transmission, which can make component examination and replacement easier. Refer to the *Fault Finding* Section at the end of this manual for more information.

5 Reversing light switch - testing, removal and refitting

Testing

1 The reversing light circuit is controlled by a plunger-type switch screwed into the front of the transmission casing. If a fault develops, first ensure that the circuit fuse has not blown.
2 To test the switch, disconnect the wiring connector, and use a multimeter (set to the resistance function) or a battery-and-bulb test circuit to check that there is continuity between the switch terminals only when reverse gear is selected. If this is not the case, and there are no obvious breaks or other damage to the wires, the switch is faulty, and must be renewed.

Removal

3 Access to the reversing light switch is best achieved from under the vehicle. Apply the handbrake then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*).
4 Disconnect the wiring connector, then unscrew it from the transmission casing.

Refitting

5 Refit the switch and tighten securely.
6 Reconnect the wiring then lower the vehicle to the ground.

Chapter 7 Part B:
Automatic transmission

Contents

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Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

General

Type	ECVT (Electronic Continuously Variable Transmission)
Ratios (at transmission):	
Lowest	2.503
Highest	0.497
Final drive	4.647:1

Torque wrench settings

	Nm	lbf ft
Earth cable	14	10
Control unit	5	4
Electro-magnetic clutch to flywheel	34	25
Transmission-to-engine bolt/nut	85	63

1 General information

1 The automatic transmission fitted is designated ECVT (Electronic Continuously Variable Transmission). The main components of the transmission are an electro-magnetic clutch, a variable-ratio coupling, a final drive/differential unit, and the associated control mechanisms **(see illustrations overleaf).**

2 The variable-ratio coupling consists of two pulleys and a flexible metal drivebelt. The effective diameter of the two pulleys can be varied to provide different transmission ratios between them.

3 During normal driving, the transmission automatically selects the ratio giving the best compromise between economy and speed. When the driver depresses the accelerator pedal to the floor, a kickdown effect is provided, and the transmission selects a lower ratio for improved acceleration.

4 The gear selector control resembles that fitted to conventional automatic transmissions. The control positions are as follows:

P (Parking) *The transmission is mechanically locked by the engagement of a pawl with a toothed segment on the driven pulley.*

R (Reverse) *Reverse gear is engaged.*

N (Neutral) *The transmission is in neutral.*

D (Drive) *Normal driving position. Transmission ratio is varied automatically to suit prevailing speed and load.*

L (Low) *Prevents the transmission moving into high ratios. Provides maximum acceleration and maximum engine braking.*

5 The engine can only be started in positions P and N. A warning buzzer sounds if the selector is in any position other than P when the ignition is switched off or when the driver's door is opened.

6 The electro-magnetic clutch consists of a driving element bolted to the engine flywheel, and a driven element splined to the transmission input shaft. The degree of coupling between the two elements is determined by the intensity of a magnetic field generated by a current passing through windings in the driven element. The magnetic field acts on a layer of metallic powder between the driving and driven elements. When no magnetic field is present, the powder is loose and the two elements are effectively

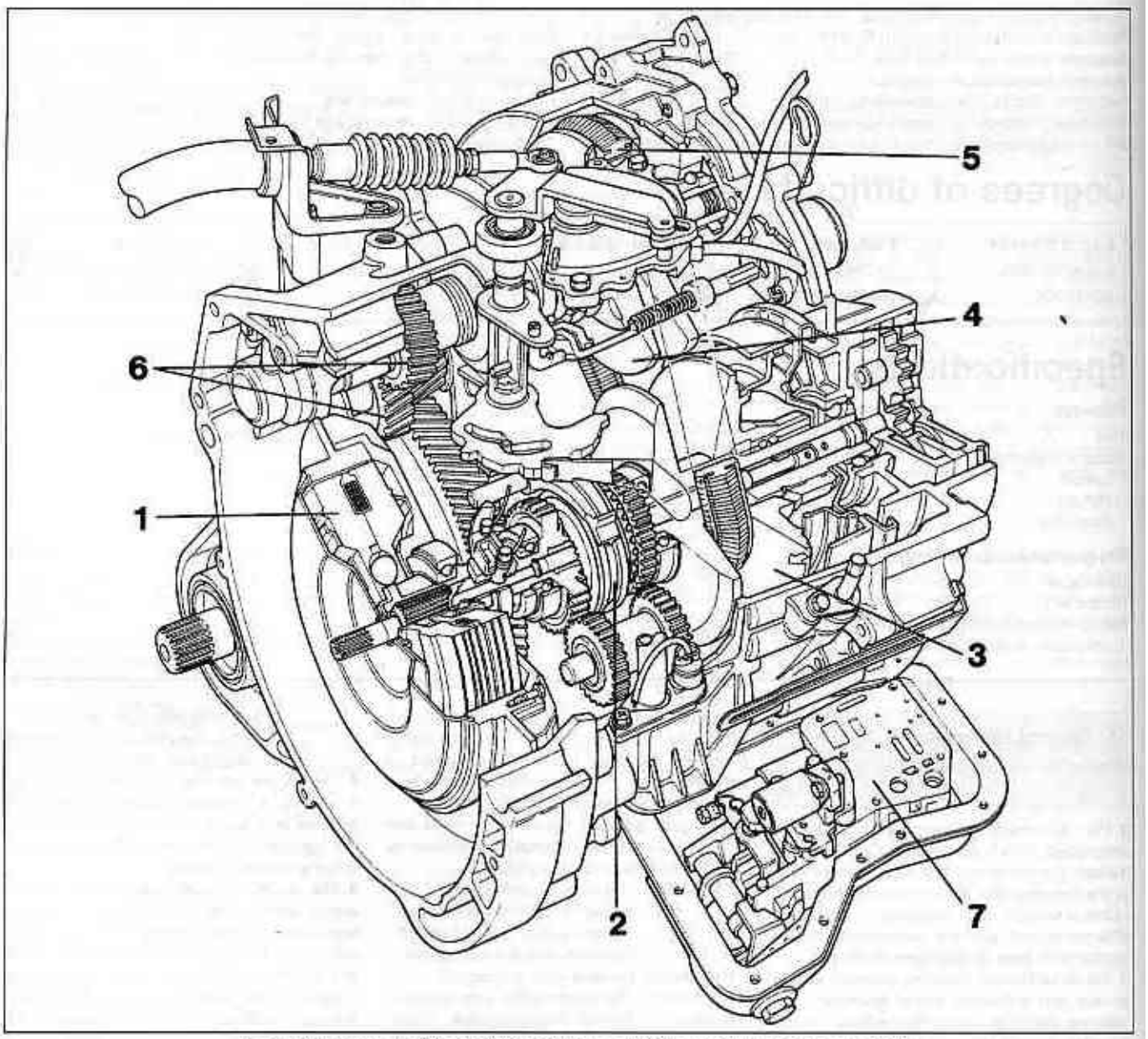
disconnected. As the magnetic field increases, the powder sticks together, and the coupling between the elements becomes increasingly rigid.

7 Selection of reverse, neutral and forward gears is by the movement of a sliding sleeve on a hub keyed to the drive pulley shaft. In forward gear, the sleeve engages with the gear on the end of the input shaft, which is then locked to the drive pulley shaft. When reverse is selected, the sleeve engages with reverse driven gear, which is in constant mesh with an idler gear driven by transfer gears from the input shaft gear. In neutral, the sleeve is in an intermediate position, and the two shafts are not connected.

8 The drive pulley and driven pulley both consist of fixed and moving halves. The movement of the drive pulley halves is controlled hydraulically, while the driven pulley halves move under the influence of a spring and the tension exerted by the drivebelt. As the drive pulley opens, the driven pulley closes, and vice-versa. In this way, the transmission ratio between the two pulleys can be varied. The ratios are continuously variable between preset limits; the difference between the lowest and highest ratios available is approximately 5:1.

9 Hydraulic pressure is generated by a gear-type pump inside the transmission. The pump driveshaft runs inside the input and drive pulley shafts, and is splined to the centre of the engine flywheel. This means that hydraulic pressure is only generated when the engine is running, which is why a car with this type of transmission cannot be push- or tow-started.

10 Application of hydraulic pressure to the pulley halves is via a control unit, which receives information on accelerator pedal position, transmission selector lever position, transmission ratio currently in use, and drive pulley speed. From this information, the control unit determines whether, and in which direction, to change the pulley ratios.



1.1a Cutaway view of the ECVT (electronic continuously variable transmission)

1 Electromagnetic clutch
2 Gear selector sleeve
3 Drive pulley
4 Driven pulley
5 Metal drivebelt
6 Final drive reduction gears
7 Hydraulic control unit

11 When reverse gear is selected, the control unit keeps the transmission in low ratio. If this were not the case, it would, in theory, be possible to drive as fast in reverse as in forward gear.

12 An electronic control unit supplies the current to energise the clutch. The control unit receives signals concerning engine speed, road speed, accelerator pedal position, and gear selector position. Sensors include the following.

a) Engine rpm sensor (from the injection/ignition control unit)
b) Accelerator pedal switch
c) Throttle valve position sensor
d) Selector lever position sensor
e) Vehicle speed sensor
f) Coolant temperature sensor
g) Air conditioning sensor
h) Brake switch
i) Torque signal

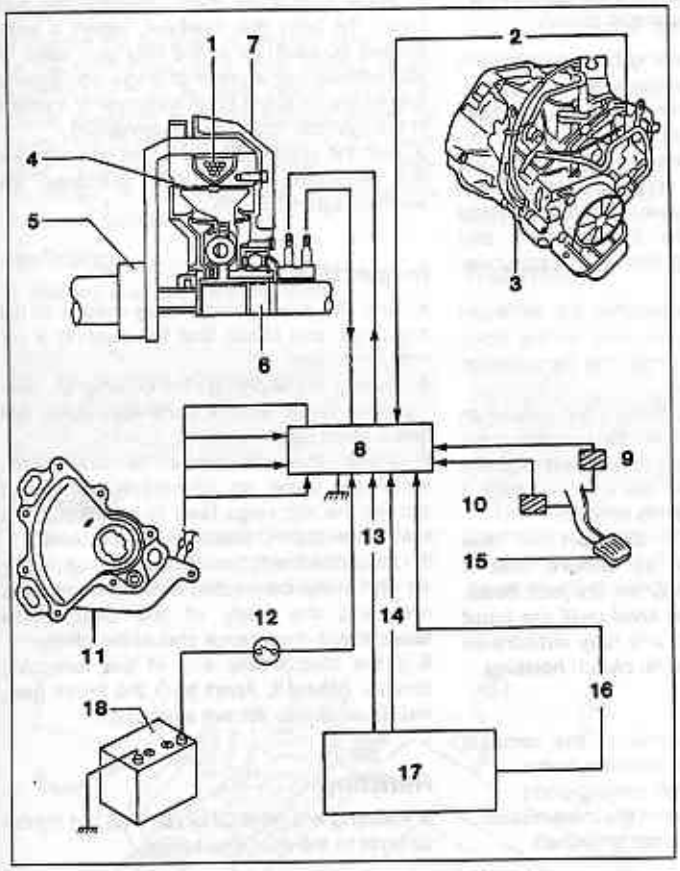
13 The final drive/differential unit is conventional. Drive from the driven pulley is transmitted to the differential by an intermediate reduction gear.

14 The ECVT incorporates a warning light which illuminates when a fault occurs.

Precautions

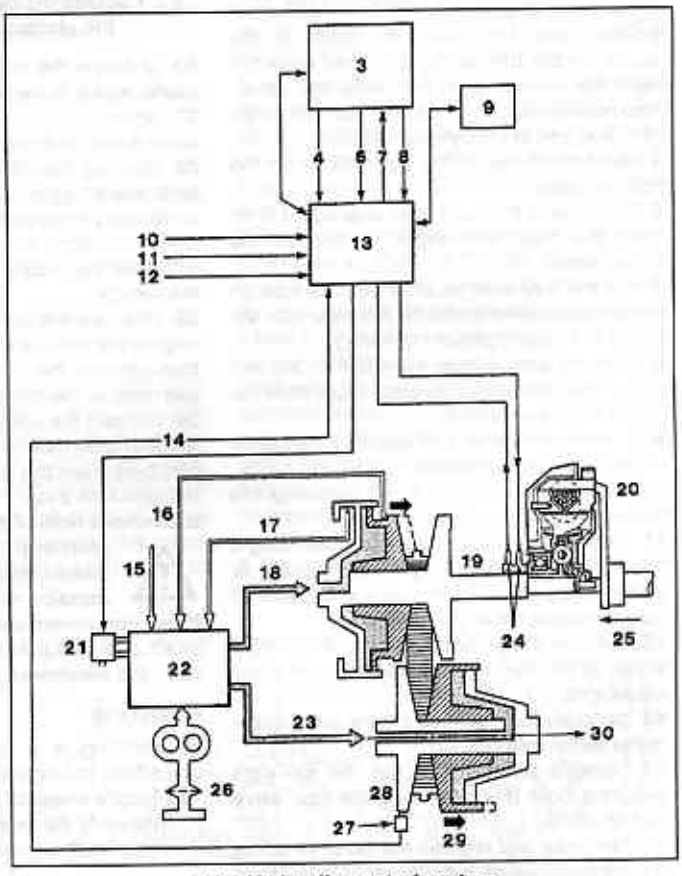
15 Observe the following precautions to avoid damage to the automatic transmission:

a) Do not attempt to start the engine by pushing or towing the car.
b) If the car has to be towed for recovery, the distance must not exceed 12 miles (20 km), and the speed must not exceed 19 mph (30 kph). If these conditions cannot be met, or if transmission damage is suspected, only tow the car with the front wheels clear of the ground.
c) Only engage P or R when the vehicle is stationary.



1.1b Electromagnetic clutch control system

1 *Coil*
2 *Signal from vehicle speed sensor*
3 *Transmission*
4 *Electromagnetic powder*
5 *Drive shaft (driven by crankshaft)*
6 *Transmission input shaft*
7 *Electromagnetic clutch housing*
8 *ECVT control unit*
9 *Accelerator pedal micro switch*
10 *Throttle valve opening position potentiometer*
11 *Multifunction switch*
12 *Ignition switch*
13 *Air conditioning signal*
14 *Engine RPM signal*
15 *Accelerator pedal*
16 *Coolant temperature signal*
17 *Injection/ignition control unit*
18 *Battery*



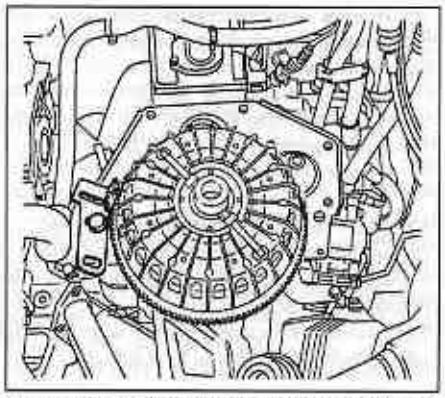
1.1c Hydraulic control system

3 *Injection/ignition control unit*
4 *Air conditioner sensor signal*
6 *Coolant temperature signal*
7 *Clutch signal*
8 *Engine RPM signal*
9 *ECVT warning light*
10 *Selector lever position*
11 *Accelerator pedal switch/throttle valve potentiometer/torque signal*
12 *Brake switch*
13 *ECVT control unit*
14 *Signal from vehicle speed sensor*
15 *Accelerator pedal position switch*
16 *Pulley ratio*
17 *Input shaft RPM*
18 *Primary oil pressure*
19 *Primary pulley*
20 *Electromagnetic clutch*
21 *Pressure regulating solenoid valve*
22 *Oil pressure control valve*
23 *Secondary oil pressure*
24 *Slip ring*
25 *Drive from engine*
26 *Oil pump*
27 *Vehicle speed sensor*
28 *Secondary pulley*
29 *Belt and pulley*
30 *Drive to driveshafts*

2 Automatic transmission - removal and refitting

Removal

1 Select a solid, level surface to park the vehicle upon. Give yourself enough space to move around it easily. Apply the handbrake then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*). Remove both front wheels.
2 Remove the battery and mounting tray as described in Chapter 5A.
3 Remove the air cleaner and air inlet duct as described in Chapter 4A.
4 Disconnect the kickdown cable at the sector on the throttle housing and detach it from the mounting on the camshaft cover. Also release the cable from the support on the left-hand end of the cylinder head.
5 Disconnect the wiring connectors on the transmission.
6 Disconnect the fluid inlet and outlet lines from the heat exchanger on top of the transmission.
7 Pull the fluid level dipstick from its tube on the front of the transmission and tape over the top of the tube to prevent dirt entry.
8 Unscrew and remove the retaining pin and disconnect the speed selector cable from the top of the transmission.
9 Unscrew the upper bolt securing the starter motor to the transmission.
10 Unscrew the upper bolts securing the transmission to the engine.
11 Support the weight of the engine using a hoist attached to the engine lifting eyes, or alternatively use a trolley jack and block of wood beneath the engine.
12 Remove the screws and remove the front wheel arch liner from under the left-hand wheel arch.
13 Unscrew the nut securing the earth cable to the transmission.
14 Using a punch drive out the roll pins securing both driveshafts to the final drive output shafts.
15 Unscrew and remove the bolts securing the left-hand swivel hub assembly to the front suspension strut, then separate the components and support the swivel hub on an axle stand.
16 Move the swivel hub assembly outwards and slide the inner end of the driveshaft from the splines on the transmission output shaft. Support the shaft away from the transmission to prevent damage to the gaiters.
17 Unscrew the Lambda/oxygen sensor from the exhaust downpipe and position it in a safe place to prevent damage.
18 Unscrew the nuts securing the downpipe to the exhaust manifold, then lower it and support on an axle stand. Recover the gasket.
19 Unscrew the knurled nut and disconnect the speedometer cable from the top of the final drive housing.



3.2 Locking the flywheel when removing the electromagnetic clutch

20 Unscrew the remaining bolt securing the starter motor to the transmission
21 Unbolt and remove the lower flywheel cover from the transmission.
22 Working beneath the vehicle, unscrew the bolts securing the rear engine mounting to the underbody then unscrew the bolts securing the mounting to the transmission and withdraw the mounting assembly from under the vehicle.
23 Unscrew the bolts securing the left-hand engine/transmission mounting to the body then unscrew the bolts from the transmission and remove the mounting.
24 Support the weight of the transmission on a trolley jack then unscrew the remaining nut and bolt from the bellhousing and pull the transmission away from the engine. Lower it and remove from under the vehicle.

Warning: Support the transmission to ensure that it remains steady on the jack head. Keep the transmission level until the input shaft and pump shaft are fully withdrawn from the electromagnetic clutch housing.

Refitting

25 Refitting is a reversal of the removal procedure, but note the following points.
a) Apply a smear of high-melting-point grease to the splines of the transmission input shaft and oil pump driveshaft.
b) Tighten all nuts and bolts to the specified torque, where given.
c) Renew both driveshaft roll pins.

3 Electro-magnetic clutch - removal, inspection and refitting

Removal

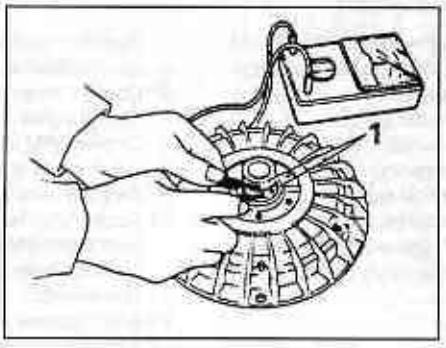
1 Remove the transmission as described in Section 2.
2 Turn the flywheel so that two of the four mounting bolts are accessible. Hold the flywheel stationary then unscrew the two bolts. To hold the flywheel, insert a wide bladed screwdriver in the ring gear teeth or alternatively use a piece of angle iron against one of the retaining bolts temporarily inserted in the cylinder block **(see illustration)**.
3 Turn the crankshaft half a turn and unscrew the remaining bolts, then withdraw the electromagnetic clutch.

Inspection

4 Turn the driven element by means of the slip rings, and check that the bearing is not noisy or rough.
5 Inspect the slip rings for burning or other damage. Clean them if necessary using fuel and a clean rag.
6 Check the resistance of the clutch windings, using an ohmmeter connected across the slip rings **(see illustration)**. The resistance at 20°C should be 2 to 4 ohms.
7 Check the insulation of the windings, using an ohmmeter connected between either slip ring and the body of the clutch **(see illustration)**. Resistance should be infinity.
8 If the clutch fails any of the foregoing checks, renew it. Apart from the brush gear, individual spares are not available.

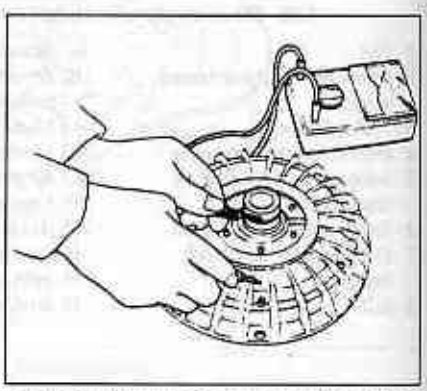
Refitting

9 Refitting is a reversal of removal but tighten all bolts to the specified torque.



3.6 Checking the resistance of the clutch windings

1 Slip rings



3.7 Checking the insulation of the clutch windings

4 Electro-magnetic clutch brushes - removal, inspection and refitting

Removal

1 Remove the battery and battery tray as described in Chapter 5A.
2 Disconnect the wiring connector for the brushes. The brush holder is located near the dipstick tube.
3 Unscrew the mounting screws and withdraw the brush holder from the transmission **(see illustration)**.

Inspection

4 Inspect the brushes. If they are worn down to the limit lines, or if they do not move smoothly in their holders, renew the brush carrier assembly **(see illustration)**. **Note:** *Be careful not to damage the brush supply leads when checking the brushes for free movement.* It is not possible to renew the brushes separately.

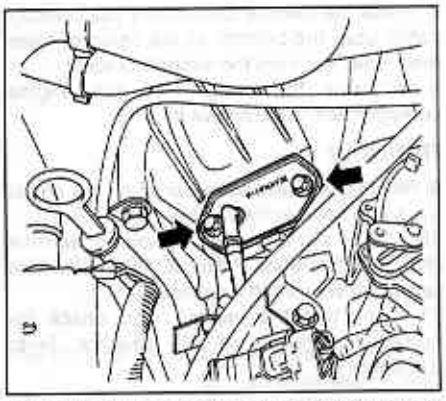
Refitting

5 Refitting is a reversal of removal.

5 Electronic control unit - removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).



4.3 Brush holder mounting screws on top of the transmission

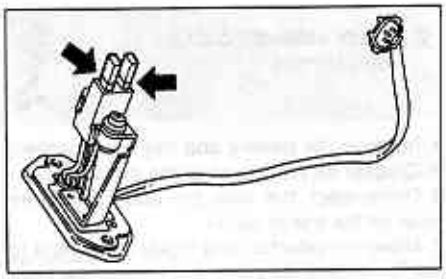
2 Unscrew the mounting screws and remove the centre console.
3 Unscrew the mounting bracket screws, lower the control unit then disconnect the two wiring connectors **(see illustration)**. Withdraw the unit from inside the vehicle.

Refitting

4 Refitting is a reversal of removal.

6 Kickdown cable - removal and refitting

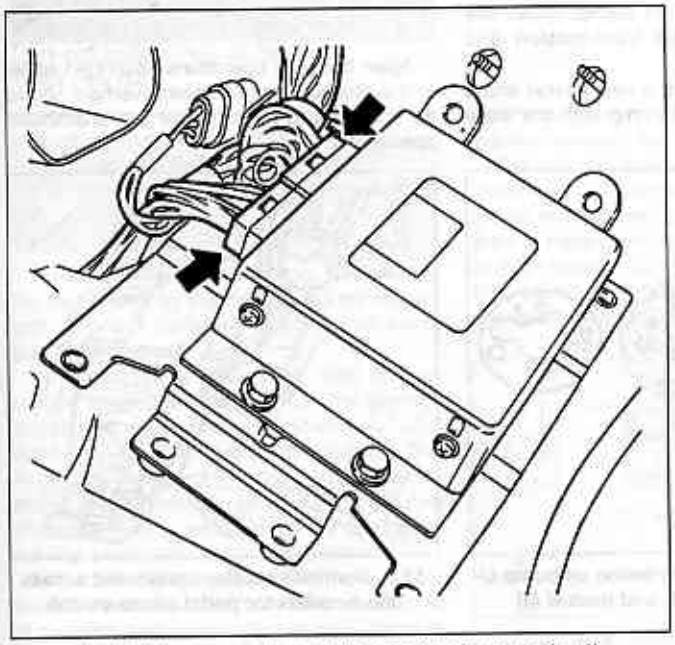
This operation involves the removal of the hydraulic control unit from inside the transmission. It should therefore be left to a Fiat dealer or other specialist.



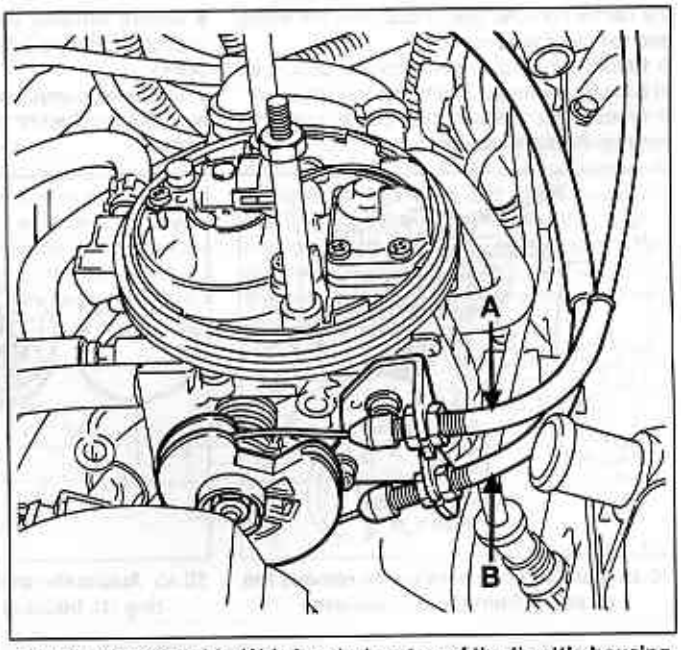
4.4 Wear limit lines on the brushes

7 Kickdown cable - adjustment

1 Remove the air cleaner and air inlet duct assembly as described in Chapter 4A. The throttle cable is located on top of the throttle housing sector and the kickdown cable is located on the bottom of the sector **(see illustration)**.
2 Turn the throttle housing sector fully clockwise so that the throttle is wide open, then position the kickdown outer cable so that its inner cable is slightly tensioned. Make the adjustment at the two adjustment nuts on the support bracket.
3 Check and if necessary adjust the accelerator cable as described in Chapter 4A.
4 Fully depress the accelerator pedal then check that there is approximately 0.5 to 1.0 mm free travel available on the kickdown cable. If necessary re-adjust the kickdown cable until it is set correctly.
5 Road test the vehicle and check for correct operation.



5.3 Wiring connectors on the electronic control unit



7.1 The throttle cable (A) is located on top of the throttle housing sector and the kickdown cable (B) on the bottom

8 Gear selector cable - adjustment

1 Remove the battery and tray as described in Chapter 5A for access to the transmission.
2 Disconnect the selector cable from the lever on the transmission.
3 Move the selector lever inside the vehicle to the N (Neutral) position, then move the lever on the transmission to its central (Neutral) position. Locate the cable end over the lever. If the cable end fitting does not line up exactly with the hole in the lever, loosen the adjustment nut and reposition the end fitting.
4 With the adjustment correct reconnect the cable to the lever, then move the selector lever to the P (Park) position. Check that the lever on the transmission has also moved to the P position.
5 Refit the battery and tray as described in Chapter 5A.
6 Road test the vehicle, and check for correct operation in all selector lever positions.

9 Gear selector cable - removal and refitting

Removal

1 Using an Allen key, unscrew the screw and remove the selector lever knob from the lever.
2 Remove the oddment tray and the ashtray.
3 Remove the screws and withdraw the centre console and selector mechanism cover.
4 Unscrew the mounting screws, slightly lift the centre console, then disconnect the wiring and remove the console.
5 Remove the battery and tray as described in Chapter 5A for access to the transmission.
6 Disconnect the selector cable from the lever on the transmission.
7 Inside the vehicle disconnect the selector cable from the bottom of the selector lever then remove it from the support bracket.
8 Withdraw the cable into the engine compartment, and remove it.

Refitting

9 Refitting is a reversal of removal, but adjust the cable as described in Section 8.
10 Check that it is only possible to start the engine in positions P and N. Reposition the selector lever switch if necessary.
11 Road test the vehicle, and check for correct operation in all selector lever positions.

10 Transmission oil pump - removal and refitting

Removal

1 Apply the handbrake, then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*). Remove the left-hand wheel.
2 Unscrew the screws and remove the wheel arch liner.
3 Working through the left-hand wheel arch, remove the three bolts which secure the oil pump.
4 Attach a slide hammer to the oil pump, using the two tapped holes provided. Withdraw the pump using the slide hammer. Be prepared for some oil spillage. Recover the gasket and O-ring **(see illustrations)**.
5 If the pump is defective, it must be renewed; no spares are available.

Refitting

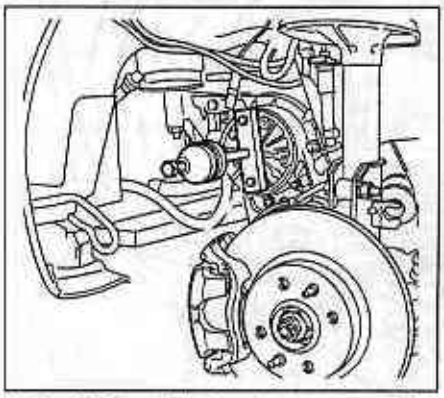
6 Before refitting the oil pump, clean the mating surfaces of the transmission and pump.
7 Fit the oil pump, using a new gasket and a new O-ring. Secure the pump with the three bolts.
8 Refit the wheel arch liner, then refit the wheel and lower the vehicle to the ground.
9 Check the transmission fluid level as described earlier in this Section, and top-up if necessary.

11 Accelerator pedal micro-switch(es) - checking and adjustment

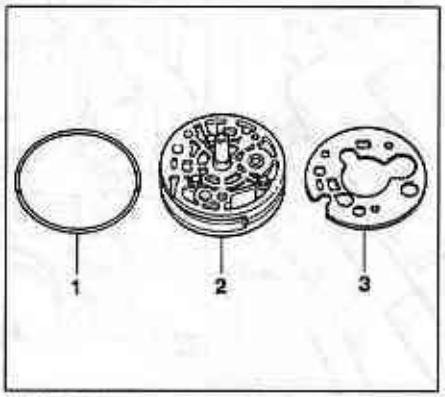
1 Correct adjustment of the micro-switch which senses the accelerator pedal position is essential for correct operation of the clutch. A quick check can be made by listening for the switch clicking as the accelerator is depressed. For an accurate check, proceed as follows.
2 Disconnect the microswitch wiring connector inside the vehicle. Connect a continuity tester across the terminals of the switch, located at the top of the pedal box **(see illustration)**.
3 Remove the air cleaner and air ducting as described in Chapter 4A.
4 With the accelerator pedal released, the switch must be closed (zero resistance). Slowly depress the pedal, and check that the switch opens when the throttle valve on the throttle housing is 30° open. This will occur when the pedal has travelled between 3 and 7 mm. Adjust the switch position if necessary.
5 If the switch is permanently open or permanently closed, and adjustment makes no difference, renew it.
6 Remake the original wiring connections on completion.

12 Automatic transmission - overhaul

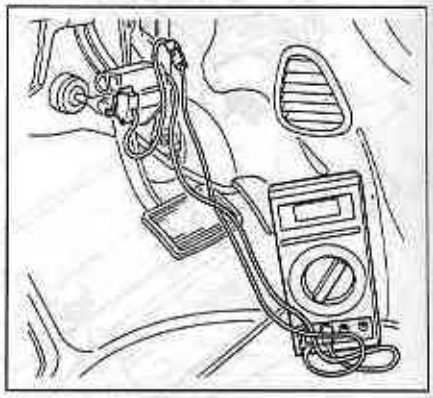
Apart from the operations described earlier in this Section, transmission overhaul should be entrusted to a Fiat dealer or transmission specialist.



10.4a Using a slide hammer to remove the oil pump from the transmission



10.4b Automatic transmission oil pump O-ring (1), housing (2) and gasket (3)



11.2 Continuity tester connected across the accelerator pedal micro-switch

Chapter 8
Driveshafts

Contents

Driveshaft gaiter check ..... See Chapter 1A or 1B
Driveshaft overhaul and rubber gaiter renewal 3
Driveshafts - removal and refitting 2
General information 1
Intermediate driveshaft - removal and refitting 4

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Specifications

General

Type	Unequal-length, solid steel shafts, splined to inner and outer constant velocity joints. Intermediate shaft with support bearing on turbo diesel models with equal length driveshafts.

Lubrication

Lubricant type	Flat specification grease, supplied with gaiter repair kit

Torque wrench settings

	Nm	lbf ft
Driveshaft nut*		
All models except turbo diesel (M22 plain)	240	177
Turbo diesel (M24 with staking and captive washer)	280	207
Roadwheel bolts	85	63
Suspension strut-to-hub carrier bolts	70	52
Track-rod balljoint-to-hub carrier	40	30

**Use a new nut.*

1 General information

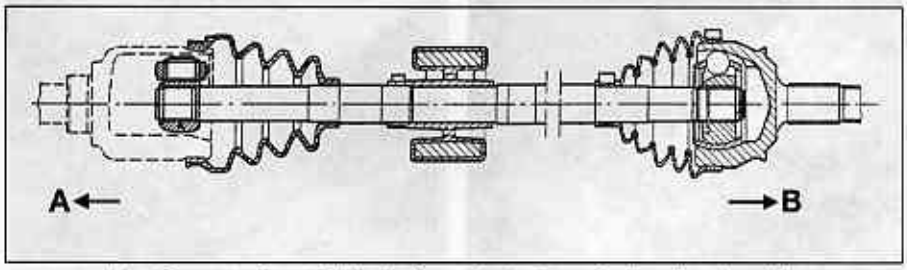
Power is transmitted from the differential to the roadwheels by the driveshafts, via inboard and outboard constant velocity (CV) joints **(see illustrations)**.

An intermediate drive shaft, with its own support bearing is fitted between the gearbox output and right-hand drive shafts on turbo diesel models **(see illustration overleaf)**. This layout has the effect of equalising driveshaft angles at all suspension positions and reduces driveshaft flexing, which improves directional stability, particularly under acceleration.

The outer Rzeppa type CV joints allow smooth transmission of drive to the wheels at all steering and suspension angles. Drive is transmitted by means of a number of radially static steel balls that run in grooves between the two halves of the joint.

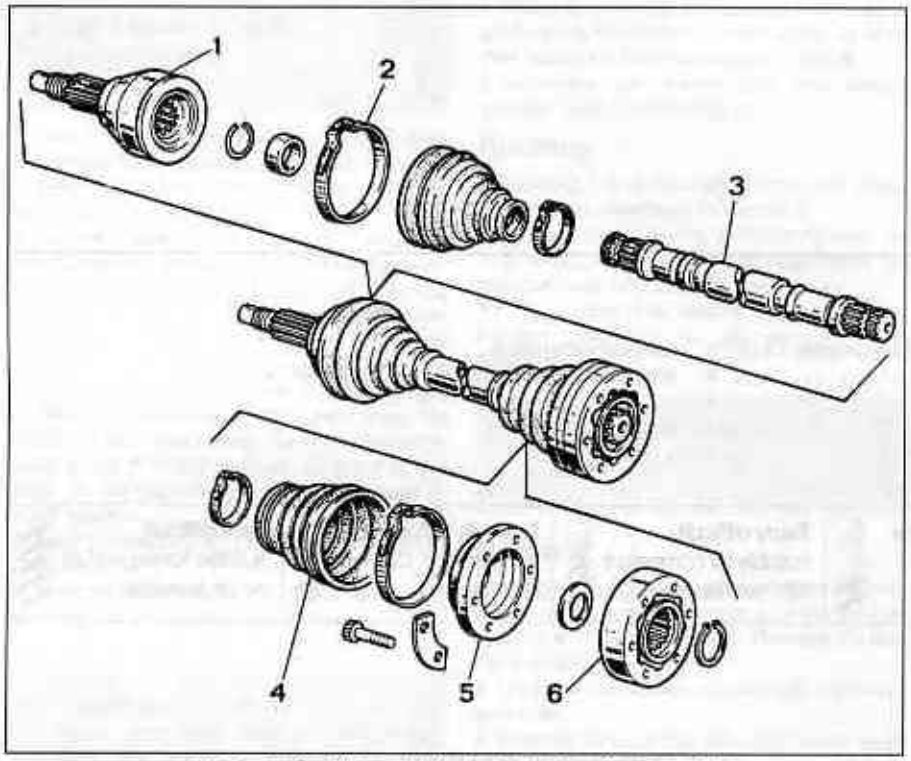
The type of inboard CV joint fitted is model dependant. Those fitted to all except the turbo diesel models are of the plunge-cup type; drive is transmitted across the joint by means of three rollers, mounted on the driveshaft in a tripod arrangement, that are radially static but are free to slide in the grooved plunge cup.

The inboard CV joints fitted to turbo diesel models are of the Rzeppa type, similar to those at the outboard end of the driveshaft. On the right-hand driveshaft, the joint is bolted directly to the end of the intermediate driveshaft flange. On the left-hand driveshaft, the joint is bolted to the transmission output shaft flange.



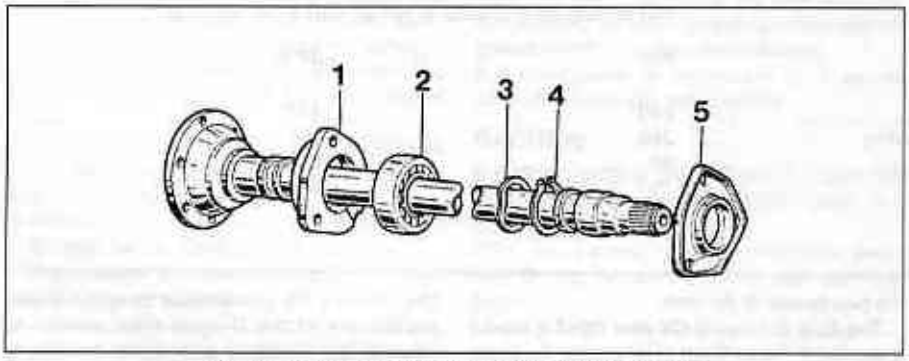
1.1a Cross section of driveshaft - petrol and non-turbo diesel models

A Transmission side *B Roadwheel side*



1.1b Exploded view of driveshaft - turbo diesel models

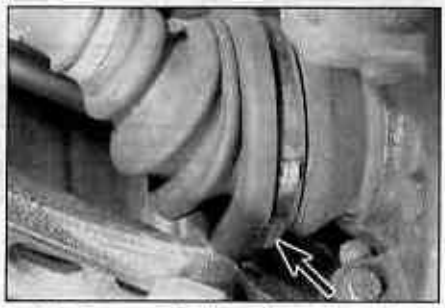
1 Outboard CV joint
2 Gaiter clip
3 Driveshaft
4 Gaiter
5 Flange
6 Inboard CV joint



1.2 Intermediate driveshaft - turbo diesel models

1 Bearing flange
2 Bearing
3 Washer
4 Circlip
5 Retaining plate

2.5 Extracting the driveshaft from the hub carrier



2.7 Remove the driveshaft gaiter clip (arrowed) from the CV joint at the transmission

The joints are protected by rubber gaiters and are packed with grease, to provide permanent lubrication. If wear is detected in the joint, it can be detached from the driveshaft and renewed. Normally, the CV joints do not require additional lubrication, unless they have been overhauled or the rubber gaiters have been damaged, allowing the grease to become contaminated. Refer to Chapter 1A or 1B for guidance in checking the condition of the driveshaft gaiters.

Both driveshafts are splined at their outer ends, to accept the wheel hubs, and are threaded so that the hubs can be fastened to the driveshafts by means of a large, staked nut.

2 Driveshafts - removal and refitting

Note: *A balljoint separator tool will be required for this operation. A new driveshaft nut and track-rod end nut should be used on refitting. In addition, new lower arm balljoint nuts should be used.*

Removal

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*). Remove the appropriate roadwheel(s).

2 The front hub must be held stationary in order to loosen the driveshaft nut. Ideally, the hub should be held by a suitable tool bolted into place using two of the roadwheel nuts. Alternatively, have an assistant firmly apply the brake pedal to prevent the hub from rotating. Using a socket and extension bar, slacken and remove the driveshaft nut. Recover the washer (where fitted).

Warning: The nut is extremely tight. Discard the nut - a new one must be used on refitting.

3 Remove the locking clip and extract the brake caliper hydraulic hose (and where applicable, the brake pad wear indicator cable) from the bracket on the base of the suspension strut.

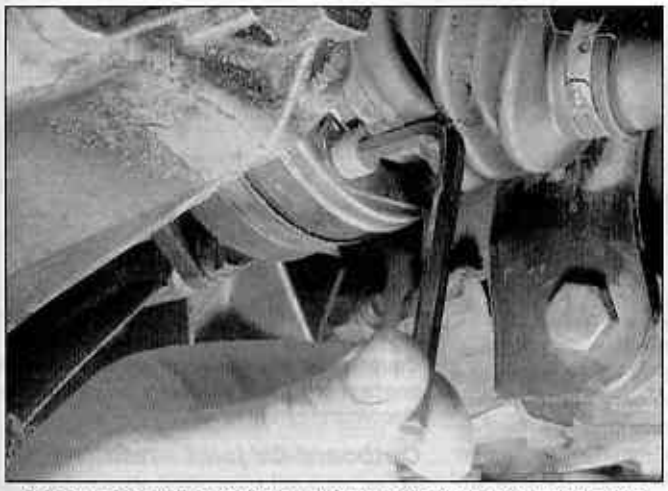
4 With reference to Chapter 10, Section 3, unbolt the base of the suspension strut from the top of the hub carrier.

5 Temporarily refit the driveshaft nut to the end of the driveshaft, to prevent damage to the driveshaft threads, then using a soft-faced mallet, carefully tap the driveshaft from the hub carrier **(see illustration)**. If the shaft is a tight fit, a suitable hub puller can be used to force the end of the shaft from the hub. Support the end of the driveshaft - do not allow the end of the driveshaft to hang down as this will strain the joint components and gaiters.

6 Proceed as follows, according to which driveshaft is to be removed.

All models except turbo diesels

7 Remove the driveshaft gaiter clip from the CV joint at the transmission **(see illustration)**.



2.9 On turbo diesel models, unscrew the driveshaft Allen bolts (right-hand driveshaft shown)

2.13 Fitting a new driveshaft nut

then pull the driveshaft away from the plunge cup. Position a container underneath the joint to catch any grease that may escape (driveshaft grease becomes liquid with use).

8 Remove the driveshaft from under the vehicle. Cover the open plunge cup on the vehicle to prevent the ingress of dirt; use a plastic bag secured with elastic bands.

Turbo diesel models

9 Unscrew the six Allen bolts securing the inboard end of the driveshaft to the intermediate shaft flange (right hand driveshaft) or gearbox output shaft flange (left hand driveshaft flange) **(see illustration)**. Recover the reinforcement plates (where fitted).

10 Remove the driveshaft from under the vehicle. Cover the exposed flange at the gearbox/intermediate shaft, to prevent the ingress of dirt; use a plastic bag secured with elastic bands.

11 Loosely refit one of the strut lower mounting bolts, to support the hub carrier whilst the driveshaft is out of the vehicle.

Refitting

12 After removing the temporarily-fitted bolt from the strut mounting, pivot the hub carrier away from the vehicle and push the splined end of the driveshaft into the hub.

13 Fit a new driveshaft nut, but do not fully tighten it at this point **(see illustration)**.

14 Support the driveshaft with one hand and push the hub carrier back towards the vehicle.

All models except turbo diesels

15 Re-engage the tripod at the inboard end of the driveshaft with the plunge cup at the gearbox. Slide the gaiter into position over the joint and briefly lift the lip of the gaiter to expel any air trapped inside. Ensure that the gaiter is seated squarely over the universal joint, then fit a new clip around the centre of the joint to secure it in place.

Turbo diesel models

16 Align the inboard end of the driveshaft joint with the intermediate shaft flange. Refit the six driveshaft bolts and tighten them securely.

All models

17 Refit the suspension strut-to-hub carrier bolts and tighten them to the correct torque - refer to Chapter 10 for details.

18 Refit the brake caliper hydraulic hose (and where applicable, the brake pad wear indicator cable) to the bracket on the base of the suspension strut.

19 Refit the roadwheel and bolts.

20 Lower the vehicle to the ground and tighten the driveshaft nut to the specified torque. Stake the rim of the nut into the machined recess in the end of the driveshaft, using a hammer and punch **(see illustrations)**.

21 Tighten the wheel bolts to the specified torque and refit the wheel trim/centre cap.

3 Driveshaft overhaul and rubber gaiter renewal

1 Remove the driveshaft from the vehicle as described in Section 2.

2 Unfasten the remainder of the rubber gaiter securing clips. Slide the gaiters towards the centre of the shaft, away from the joints. Wipe off the majority of the old grease with a rag.

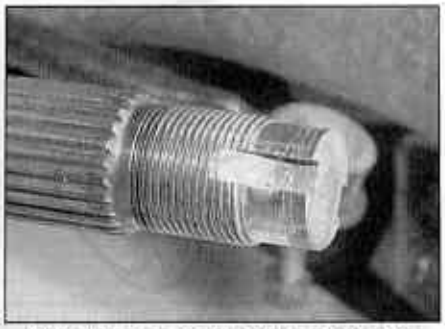
Outboard CV joint - removal

All models except turbo diesels

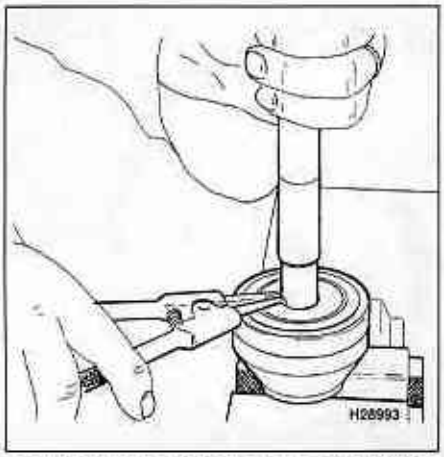
3 Mark the relationship between the joint and the driveshaft using a scriber or a dab of paint. Using pair of circlip pliers, expand the circlip that holds the driveshaft in place and withdraw the shaft from the CV joint. Note that the circlip is captive in the joint, and need not be removed, unless it appears damaged or worn **(see illustration overleaf)**.

2.20a Tighten the driveshaft nut to the specified torque (roadwheel removed for clarity)

2.20b Stake the rim of the nut into the recess in the driveshaft



2.20c Recess machined into end of the driveshaft



3.3 Using pair of circlip pliers, expand the circlip that holds the driveshaft in place

Turbo diesel models

4 Mark the relationship between the joint and the driveshaft using a scriber or a dab of paint. Attach a slide hammer to the driveshaft nut thread.

5 Draw the joint off the driveshaft using the slide hammer. Use just enough effort to overcome the tension of the internal circlip.

Inboard CV joint removal

All models except turbo diesels

6 At the inboard end of the driveshaft, use a hammer and centre punch to mark the relationship between the shaft and joint. Remove the circlip with a pair of circlip pliers, then using a three-legged puller if required, draw the tripod joint off the end of the driveshaft. Ensure that the legs of the puller bear upon the cast centre section of the joint, not the roller bearings **(see illustration)**.

Turbo diesel models

7 At the inboard end of the driveshaft, use a hammer and centre punch to mark the relationship between the shaft and joint. Remove the circlip with a pair of circlip pliers, then carefully slide the CV joint from the end of the shaft. Take great care to prevent the cage and ball bearings from falling out - secure the joint components together with wire or a nylon cable-tie.

8 Remove the washer then slide the flange from the end of the shaft.

Inspection

9 Slide both rubber gaiters off the driveshaft and discard them; it is recommended that new ones are fitted on reassembly as a matter of course. Recover the flexible washers (where fitted), making a note of their fitted positions, to aid correct refitting later.

10 Thoroughly clean the driveshaft splines, and CV joint components with paraffin or a suitable solvent, taking care not to destroy any alignment marks made during removal.

11 Examine the CV joint components for wear and damage; in particular, check the balls and corresponding grooves for pitting and corrosion. If evidence of wear is visible, then the joint must be renewed. Note that if the outboard CV joint is to be renewed on turbo diesel models, it must be matched to the driveshaft using the colour-coded paint markings.

12 Where applicable, examine the tripod joint components for wear. Check that the three rollers are free to rotate without resistance and are not worn, damaged or corroded. The rollers are supported by arrays of needle bearings; wear or damage will show up as play in the rollers and/or roughness in rotation. If wear is discovered, the tripod joint must be renewed.

13 Fit a new rubber gaiter (and where applicable, flexible washer) to the inboard end of the driveshaft and secure it in place on the shaft with a clip **(see illustration)**.

Inboard CV joint - refitting

All models except turbo diesels

14 Using the alignment marks made during removal, fit the tripod joint onto the splines of the driveshaft. Tap it into position using a soft faced mallet. To ensure that the tripod joint rollers and driveshaft splines are not damaged, use a socket with an internal diameter slightly larger than that of the driveshaft as a drift. Refit the circlip.

15 Slide the gaiter over the tripod joint and pack the gaiter with grease from the service kit.

Caution: Do not allow grease to come into contact with vehicles paintwork, as discolouring may result.

Turbo diesel models

16 Slide the flange and washer onto the end of the shaft, then fit the joint into position on the driveshaft splines, using the alignment marks made during removal. Fit the circlip.

17 Pack the gaiter with grease from the service kit, then slide the gaiter over the joint. Briefly lift the lip of the gaiter to expel all the air from the joint, then secure the gaiter over the joint with a new clip.

Caution: Do not allow grease to come into contact with the vehicle's paintwork, as discolouring may result.

Outboard CV joint - refitting

18 Fit a new rubber gaiter to the outboard end of the driveshaft and secure it place with a clip.

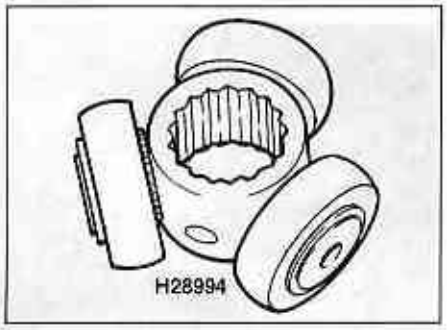
19 Pack the CV joint with grease from the service kit, pushing it into the ball grooves and expelling any air that may be trapped underneath.

20 Lubricate the splines of the drive shaft with a smear of grease, then whilst splaying the circlip open with a pair of circlip pliers, insert the driveshaft into CV joint, observing the alignment marks made during removal.

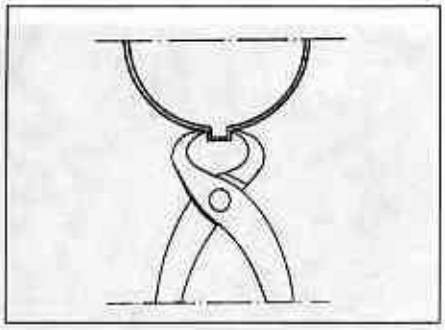
Note: *On turbo diesel models, the circlip snaps into the CV joint groove as the driveshaft is inserted - no circlip pliers are required.* Ensure that the circlip snaps securely into place; pull on the shaft to check that it is held firmly in position.

21 Pack additional grease into the joint to displace any air pockets, then slide the rubber gaiter over the joint. Briefly lift the lip of the gaiter to expel all the air from the joint, then secure it in place with a clip.

22 Refit the driveshaft (see Section 2).



3.6 Draw the tripod joint off the end of the driveshaft



3.13 Fit a new rubber gaiter to the inboard end of the driveshaft and secure it in place with a clip

4 Intermediate driveshaft - removal and refitting

Note 1: *This procedure applies only to turbo diesel engined models.*

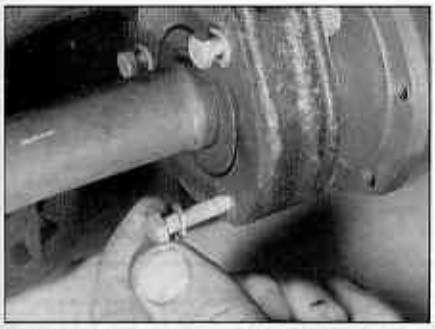
Note 2: *The intermediate shaft and bearing are not available as separate spares and can only be renewed as a complete assembly.*

Removal

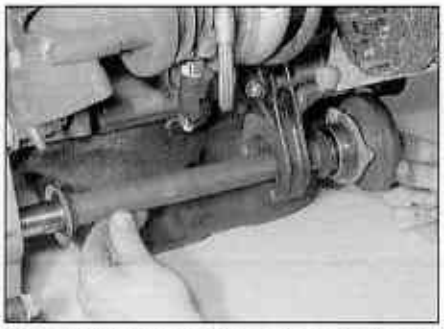
1 Firmly apply the handbrake, then jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*). Remove the appropriate roadwheel(s).

2 Unbolt the inboard end of the right-hand driveshaft from the intermediate shaft flange, as described in Section 2. Suspend the disconnected end of the driveshaft from a convenient point on the subframe, using wire or a cable-tie, to avoid straining the joint and gaiter.

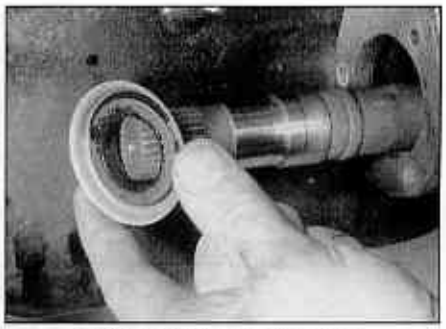
3 Drain the oil from the transmission, with reference to Chapter 1B.



4.4 Unbolt the intermediate shaft from the support bracket



4.5a Withdraw the intermediate shaft from the transmission



4.5b Recover the dust seal

4 Unbolt the intermediate shaft from the support bracket **(see illustration)**.

5 Attach a slide hammer to the intermediate shaft flange and draw the splined end of the shaft out of the transmission. Take care to avoid damaging the oil seal. Recover the dust seal **(see illustrations)**.

Refitting

6 Before installing the driveshaft, examine the oil seal in the transmission for signs of damage or deterioration and, if necessary, renew it (it is advisable to renew the seal as a matter of course).

7 Thoroughly clean the intermediate shaft splines and the aperture in the transmission. Fit a new dust seal to the shaft, then apply a thin film of grease to the oil seal lips, and to the intermediate shaft splines and shoulders.

8 Push the shaft squarely into the transmission, taking care to avoid damaging the oil seal.

9 Line up the intermediate shaft bearing with the support bracket, then insert the bolts and tighten them securely.

10 Refit the right-hand driveshaft as described in Section 2, then refit the roadwheel and lower the vehicle to the ground. Tighten the roadwheel bolts to the specified torque.

11 On completion refill the transmission with the specified quantity and grade of oil, as described in Chapter 1B.