Chapter 5 Part B: Ignition system

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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

System type:	
1.2 litre models	Bosch Motronic 1.5.5 engine management system
1.4 litre models	Bosch Mono-Motronic engine management system
1.6 litre models	Weber IAW engine management system
1.8 litre models	Hitachi engine management system
Firing order	1-3-4-2 (No 1 at timing belt end)
Ignition timing at idle	Under ECU control, constantly changing according to engine load, to maintain idle speed
Ignition coil winding resistance (at 20°C):	
Primary:	
1.2 and 1.4 litre models	0.45 to 0.55 ohms
1.6 litre models	0.55 to 0.61 ohms
1.8 litre models	0.6 ohms
Secondary:	
1.2 and 1.4 litre models	12 000 to 14 600 ohms
1.6 litre models	8645 to 9555 ohms
1.8 litre models	N/A
Crankshaft TDC sensor:	
Electrical resistance:	
1.2 litre models	9600 ohms
1.4 litre models	774 to 946 ohms
1.6 litre models	575 to 750 ohms
1.8 litre models	440 to 570 ohms
Air gap:	
1.4 litre models	0.8 to 1.5 mm
1.8 litre models	0.8 ± 0.4 mm
All other models	0.5 to 1.5 mm

Torque wrench settings

	Nm	lbf ft
Knock sensor	25	18
Spark plugs:		
All except 1.6 litre engine	25	18
1.6 litre engine	27	20

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 (refer to Chapter 4, Part A or B for information on the fuel injection side of the system).

On all models, the ignition side of the system is of the static (distributorless) type. The ECU uses its inputs from the various sensors to calculate the required ignition advance setting and coil charging time. Some of the sensors described in Parts A or B of Chapter 4 are also used to determine the appropriate ignition firing point for different operating conditions.

The basic timing information is derived from an inductive sensor, positioned above a reluctor wheel mounted on the engine crankshaft. The reluctor wheel has a number of equally-spaced teeth around it, resembling a small flywheel. As the crankshaft turns, the sensor detects the teeth passing it, and sends a pulse signal to the engine management ECU. At the crankshaft TDC position, one of the reluctor teeth is missing, and this creates a variation in the signal produced by the sensor. The ECU uses this information to determine the crankshaft position and speed of rotation, to calculate the optimum firing point for the engine.

All models have a knock sensor, which is used as a safeguard against possible engine damage from pre-ignition (detonation, or 'pinking'). The sensor is bolted to the engine block, adjacent to the top of the combustion chambers. The sensor is sensitive to a particular frequency of vibration, corresponding to that produced during pre-ignition (a condition which can occur when the wrong grade of fuel is used, or when a fuel system problem has resulted in a weak mixture, for example). When the knock sensor detects pre-ignition, it sends a signal to the ECU, which then retards the ignition timing until pre-ignition stops; the timing is then progressively advanced until pre-ignition recurs. This process is repeated many times, until the ECU determines the most efficient running condition for the engine.

In the event of a fault in the system due to loss of a signal from one of the sensors, the ECU reverts to an emergency ('limp-home') program. This will allow the car to be driven, although engine operation and performance will be limited. A warning light on the instrument panel will illuminate if the fault is likely to cause an increase in harmful exhaust emissions.

To facilitate fault diagnosis, the ignition system is provided with an on-board diagnostic facility, which can be interrogated in the same way as for other engine management system faults, as described in Chapter 4A or B.

1.2, 1.4 and 1.6 litre models

On all except 1.8 litre models, the system components consist only of a pair of twin-output ignition coils located on the left-hand side of the cylinder head, and four HT spark plug leads. Note that the ignition coils are housed in a single sealed unit. Each ignition coil supplies two cylinders (one coil supplies cylinders 1 and 4, and the other cylinders 2 and 3).

Under the control of the ECU, the ignition coils operate on the 'wasted spark' principle, ie. each coil produces an HT voltage at both outputs every time its primary coil voltage is interrupted. The result of this is that each spark plug fires twice for every cycle of the engine, once on the compression/ignition stroke and once on the exhaust stroke. The spark voltage is greatest in the cylinder which is on its compression stroke, due to the composition and high density of the air/fuel mixture. The 'wasted' spark occurs in the cylinder that is on its exhaust stroke; the composition and low density of the exhaust charge means that the spark produced is very weak and so has little effect.

1.8 litre models

On 1.8 litre models, each spark plug has its own dedicated 'plug-top' HT coil, which fits directly onto the top of the spark plug (conventional HT leads are therefore not fitted). A power module, driven by the engine management system ECU, controls the supply to the primary circuit in each one of the four coils; unlike the 'wasted spark' system, a spark is generated at each spark plug only once per engine cycle.

2 Ignition system - testing

General

1 The components of the ignition system are normally very reliable; most faults are far more likely to be due to loose or dirty connections, or to 'tracking' of HT voltage due to dirt, dampness or damaged insulation, than to the failure of any of the system's components. **Always** check all wiring thoroughly before condemning an electrical component, and work methodically to eliminate all other possibilities before deciding that a particular component is faulty.

2 The old practice of checking for a spark by holding the live end of an HT lead a short distance away from the engine is **not** recommended; not only is there a high risk of a powerful electric shock, but the ECU, HT coil, or power stage may be damaged. Similarly, **never** try to 'diagnose' misfires by pulling off one HT lead at a time.

3 The following tests should be carried out when an obvious fault such as non-starting or a clearly detectable misfire exists. Some faults, however, are more obscure and are often disguised by the fact that the ECU will adopt an emergency program ('limp-home') mode to maintain as much driveability as possible. Faults of this nature usually appear in the form of excessive fuel consumption, poor idling characteristics, lack of performance, knocking or 'pinking' noises from the engine under certain conditions, or a combination of these conditions. Where problems such as this are experienced, the best course is to refer the car to a suitably-equipped garage for diagnostic testing using dedicated test equipment.

Engine will not start

Note: *Remember that a fault with the anti-theft alarm or immobiliser will give rise to apparent starting problems. Make sure that the alarm or immobiliser has been deactivated, referring to the vehicle handbook for details. If the CODE warning light on the instrument panel is flashing, this indicates that the ignition key being used has not been programmed into the immobiliser control unit - use the master key, and refer to Disconnecting the battery in the Reference section.*

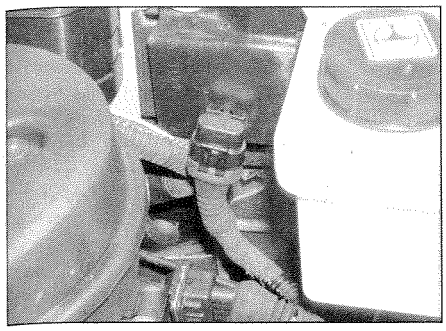
4 If the engine either will not turn over at all, or only turns very slowly, check the battery and starter motor. Connect a voltmeter across the battery terminals (meter positive probe to battery positive terminal) then note the voltage reading obtained while turning the engine over on the starter for (no more than) ten seconds. If the reading obtained is less than approximately 9.5 volts, first check the battery, starter motor and charging system as described in Part A of this Chapter.

5 If the engine turns over at normal speed but will not start, check the HT circuit.

6 Connect a timing light (following its manufacturer's instructions) and turning the engine over on the starter motor; if the light flashes, voltage is reaching the spark plugs, so these should be checked first. If the light does not flash, check the HT leads themselves (where applicable). If there is a spark, continue with the checks described in Section 3 of this Chapter.

7 If there is still no spark, check the condition of the coil(s), if possible by substitution with a known good unit, or by checking the primary and secondary resistances. If the fault persists, the problem lies elsewhere; if the fault is now cleared, a new coil is the obvious cure. However, check carefully the condition of the LT connections themselves before obtaining a new coil, to ensure that the fault is not due to dirty or poorly-fastened connectors.

8 If the coil is in good condition, the fault is probably within the power stage (built into the ECU, on all except 1.8 litre models), one of the system sensors, or related components (as applicable). In this case, a fault code should be logged in the diagnostic unit, which could



2.8 **Diagnostic connector plug location on a 1.4 litre model**

be read using a fault code reader **(see illustration)**.

9 Fault codes can only be extracted from the ECU using a dedicated fault code reader. A FIAT dealer will obviously have such a reader, but they are also available from other suppliers, including Haynes. It is unlikely to be cost-effective for the private owner to purchase a fault code reader, but a well-equipped local garage or automotive electrical specialist will have one.

Engine misfires

10 An irregular misfire is probably due to a loose connection to one of the ignition coils or system sensors.

11 With the ignition switched off, check carefully through the system, ensuring that all connections are clean and securely fastened.

12 Where applicable (not 1.8 litre models), check the condition of the spark plug HT leads. Ensure that the leads are routed and clipped so that they come into contact with fewest possible metal surfaces, as this may encourage the HT voltage to 'leak', via poor or damaged insulation. If there is any sign of damage to the insulation, renew the leads as a set.

13 Unless the HT leads are known to have been recently replaced, it is considered good practice to eliminate the HT leads from fault diagnosis in cases of misfiring, by fitting a new set as a matter of course.

14 When fitting new leads, remove one lead at a time, so that confusion over their fitted positions does not arise. If the old leads were damaged, take steps to ensure that the new leads do not become similarly damaged.

15 If the HT leads are sound, regular misfiring indicates a problem with the ignition coil(s) or spark plugs. Fit new plugs as described in Chapter 1, or test the coil(s) as described in Section 4. A dirty or faulty crankshaft sensor could also be to blame - see Section 6.

16 Any further checking of the system components should be carried out after first checking the ECU for fault codes - see paragraph 9.

3 Fault finding - general information and preliminary checks

Note: *Both the ignition and fuel systems must ideally be treated as one inter-related engine management system. Although the contents of this section are mainly concerned with the ignition side of the system, many of the components perform dual functions, and some of the following procedures of necessity relate to the fuel system.*

General information

1 The fuel and ignition systems on all engines covered by this manual incorporate an on-board diagnostic system to facilitate fault finding and system testing. Should a fault occur, the ECU stores a series of signals (or fault codes) for subsequent read-out via the diagnostic connector (see the Section on testing the fuel injection system, in Chapter 4A or 4B).

2 If driveability problems have been experienced and engine performance is suspect, the on-board diagnostic system can be used to pinpoint any problem areas, but this requires special test equipment. Once this has been done, further tests may often be necessary to determine the exact nature of the fault; ie, whether a component itself has failed, or whether it is a wiring or other inter-related problem.

3 Apart from visually checking the wiring and connections, any testing will require the use of a fault code reader at least. A FIAT dealer will obviously have such a reader, but they are also available from other suppliers, including Haynes. It is unlikely to be cost-effective for the private owner to purchase a fault code reader, but a well-equipped local garage or automotive electrical specialist will have one.

Preliminary checks

Note: *When carrying out these checks to trace a fault, remember that if the fault has appeared only a short time after any part of the vehicle has been serviced or overhauled, the first place to check is where that work was carried out, however unrelated it may appear, to ensure that no carelessly-refitted components are causing the problem.*

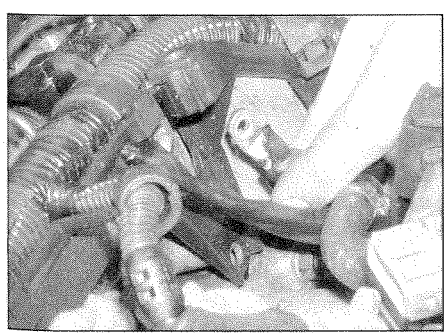
If you are tracing the cause of a 'partial' engine fault, such as lack of performance, in addition to the checks outlined below, check the compression pressures. Check also that the fuel filter and air cleaner element have been renewed at the recommended intervals. Refer to Chapter 1 and the appropriate Part of Chapter 2 for details of these procedures.

Remember that any fault codes which have been logged will have to be cleared from the ECU memory using a dedicated fault code reader (see paragraph 3) before you can be certain the cause of the fault has been fixed.

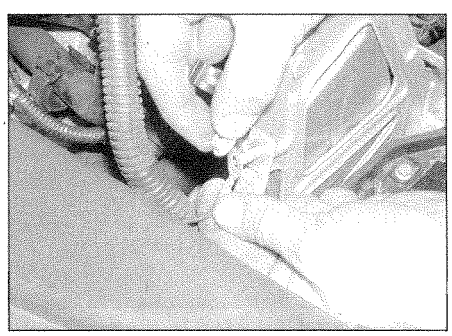
4 Open the bonnet and check the condition of the battery connections - remake the connections or renew the leads if a fault is found. Use the same techniques to ensure that all earth points in the engine compartment provide good electrical contact through clean, metal-to-metal joints, and that all are securely fastened **(see illustrations)**.

5 Next work methodically around the engine compartment, checking all visible wiring, and the connections between sections of the wiring loom. What you are looking for at this stage is wiring that is obviously damaged by chafing against sharp edges, or against moving suspension/transmission components and/or the auxiliary drivebelt, by being trapped or crushed between carelessly-refitted components, or melted by being forced into contact with hot engine castings, coolant pipes, etc. In almost all cases, damage of this sort is caused in the first instance by incorrect routing on reassembly after previous work has been carried out (see the note at the beginning of this sub-Section).

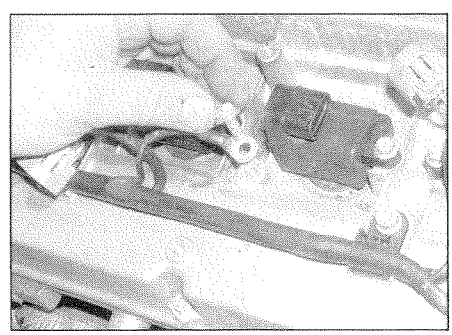
6 Obviously, wires can break or short together



3.4a **Engine earth point behind the camshaft cover - 1.4 litre model . . .**



3.4b **. . . on the ECU mounting bracket - 1.6 litre model . . .**



3.4c **. . . and between the ignition coils - 1.8 litre model**

inside the insulation so that no visible evidence betrays the fault, but this usually only occurs where the wiring loom has been incorrectly routed so that it is stretched taut or kinked sharply; either of these conditions should be obvious on even a casual inspection. If this is thought to have happened and the fault proves elusive, the suspect section of wiring should be checked very carefully during the more detailed checks which follow.

7 Depending on the extent of the problem, damaged wiring may be repaired by rejoining the break or splicing-in a new length of wire, using solder to ensure a good connection, and remaking the insulation with adhesive insulating tape or heat-shrink tubing, as desired. If the damage is extensive, given the implications for the vehicle's future reliability, the best long-term answer may well be to renew that entire section of the loom, however expensive this may appear.

8 When the actual damage has been repaired, ensure that the wiring loom is re-routed correctly, so that it is clear of other components, is not stretched or kinked, and is secured out of harm's way using the plastic clips, guides and ties provided.

9 Check all electrical connectors, ensuring that they are clean, securely fastened, and that each is locked by its plastic tabs or wire clip, as appropriate. If any connector shows external signs of corrosion (accumulations of white or green deposits, or streaks of 'rust'), or if any is thought to be dirty, it must be unplugged and cleaned using electrical contact cleaner. If the connector pins are severely corroded, the connector must be renewed; note that this may mean the renewal of that entire section of the loom.

10 If the cleaner completely removes the corrosion to leave the connector in a satisfactory condition, it would be wise to pack the connector with a suitable material which will exclude dirt and moisture, and prevent the corrosion from occurring again; a FIAT dealer may be able to recommend a suitable product.

11 All models have an inductive sensor which determines crankshaft speed and TDC position. On an older engine, it is possible that the tip of the sensor may become contaminated with oil and/or dirt, interfering with its operation and giving rise to a misfire. Similarly, if the sensor air gap is incorrect, this may result in a misfire (at best). Refer to Section 6 for sensor removal and refitting information.

12 Working methodically around the engine compartment, check carefully that all vacuum hoses and pipes are securely fastened and correctly routed, with no signs of cracks, splits or deterioration to cause air leaks, or of hoses that are trapped, kinked, or bent sharply enough to restrict air flow. Check with particular care at all connections and sharp bends, and renew any damaged or deformed lengths of hose.

13 Check the crankcase breather hoses for splits, poor connections or blockages. Details of the breather system vary according to which engine is fitted, but all models have at least one hose running from the top of the engine connected to the air inlet duct or inlet manifold **(see illustrations)**. The breather hoses run from the engine block (or from the oil filler tube) and carry oil fumes into the engine, to be burned with the fuel/air mixture. A variety of poor-running problems (especially unstable idling) can result from blocked or damaged breather hoses.

14 Working from the fuel tank, via the filter, to the fuel rail (and including the feed and return), check the fuel lines, and renew any that are found to be leaking, trapped or kinked. Check particularly the ends of the hoses - these can crack and perish sufficiently to allow leakage.

15 Check that the accelerator cable is correctly secured and adjusted, and that it is routed with as few sharp turns as possible. Renew the cable if there is any doubt about its condition, or if it appears to be stiff or jerky in operation. Refer to Chapter 4A or 4B for further information, if required.

16 Remove the air cleaner cover as described in Chapter 1, and check that the air filter is not clogged or soaked. A clogged air filter will obstruct the inlet air flow, causing a noticeable effect on engine performance. Renew the filter if necessary; refer to the relevant Sections of Chapter 1 for further information, if required.

17 Start the engine and allow it to idle.

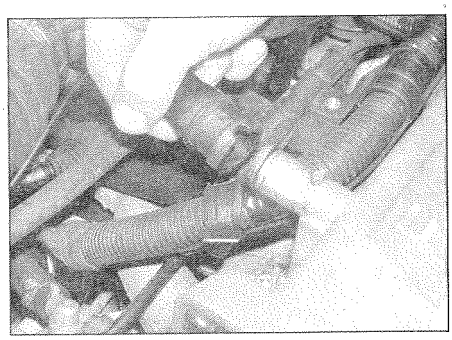
Caution: Working in the engine compartment while the engine is running requires great care if the risk of personal injury is to be avoided; among the dangers are burns from contact with hot components, or contact with moving components such as the radiator cooling fan or the auxiliary drivebelt. Refer to Safety first! at the front of this manual before starting, and ensure that your hands, and any long hair or loose clothing, are kept well clear of hot or moving components at all times.

18 Working from the air inlet, via the air cleaner assembly and the airflow sensor (or air mass meter) to the throttle housing and inlet manifold (and including the various vacuum hoses and pipes connected to these), check for air leaks. Usually, these will be revealed by sucking or hissing noises, but minor leaks may be traced by spraying a solution of soapy water on to the suspect joint; if a leak exists, it will be shown by the change in engine note and the accompanying air bubbles (or sucking-in of the liquid, depending on the pressure difference at that point). If a leak is found at any point, tighten the fastening clamp and/or renew the faulty components, as applicable.

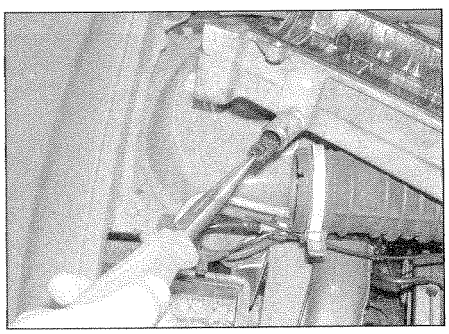
19 Similarly, work from the cylinder head, via the manifold to the tailpipe, to check that the exhaust system is free from leaks. The simplest way of doing this, if the vehicle can be raised and supported safely and with complete security while the check is made, is to temporarily block the tailpipe while listening for the sound of escaping exhaust gases; any leak should be evident. If a leak is found at any point, tighten the fastening clamp bolts and/or nuts, renew the gasket, and/or renew the faulty section of the system, as necessary, to seal the leak.

20 It is possible to make a further check of the electrical connections by wiggling each electrical connector of the system in turn as the engine is idling; a faulty connector will be immediately evident from the engine's response as contact is broken and remade. A faulty connector should be renewed to ensure that the future reliability of the system; note that this may mean the renewal of that entire section of the loom.

21 If the preliminary checks have failed to reveal the fault, the car must be taken to a FIAT dealer or suitably-equipped garage for diagnostic testing using electronic test equipment.



3.13a Disconnecting a breather hose from the camshaft cover - 1.4 litre model



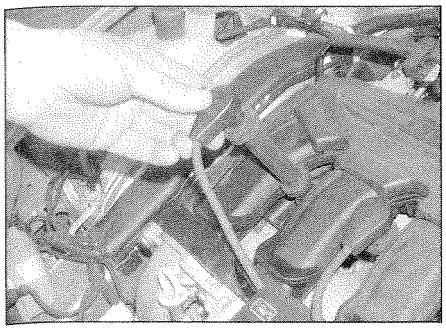
3.13b On 1.4 litre models, the breather hose stub contains a filter which can be removed for cleaning

4 Ignition HT coil(s) - removal, testing and refitting

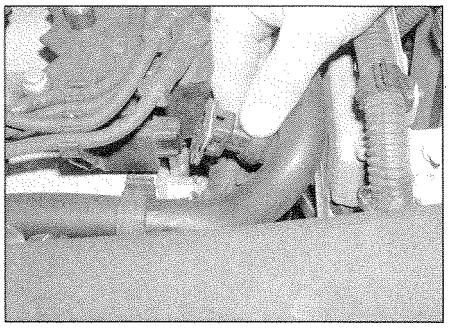
1.2, 1.4 and 1.6 litre models

Removal

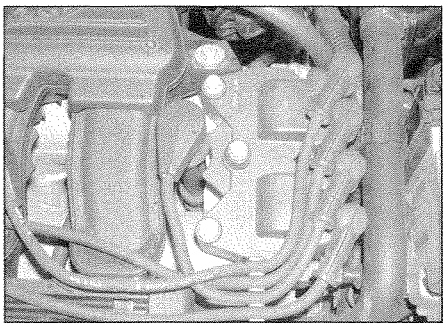
1 On 1.2 and 1.4 litre models, remove the three bolts securing the engine top cover, and lift away the cover for access to the spark plug HT leads.



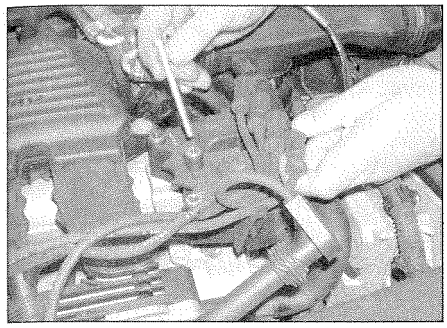
4.4 Pull the HT leads off the spark plugs



4.5 Disconnect the LT wiring plug from the ignition coil



4.6a On 1.6 litre models, the coil is secured by three bolts



4.6b Removing the ignition coil

2 Before removing the ignition coil unit, attach labels to the spark plug HT leads to indicate which plug they serve. Number the leads 1 to 4, starting from the timing belt end of the engine.

3 As an added precaution, check to see whether there are any cylinder numbers marked next to the HT lead terminals on the coil assembly itself - if not, make your own marks, to correspond with the HT lead numbering.

4 Disconnect the HT leads from the spark plugs, and unclip the leads from their locations on the top of the engine **(see illustration)**. Place the leads to one side.

5 Disconnect the LT wiring plug from the ignition coil assembly **(see illustration)**.

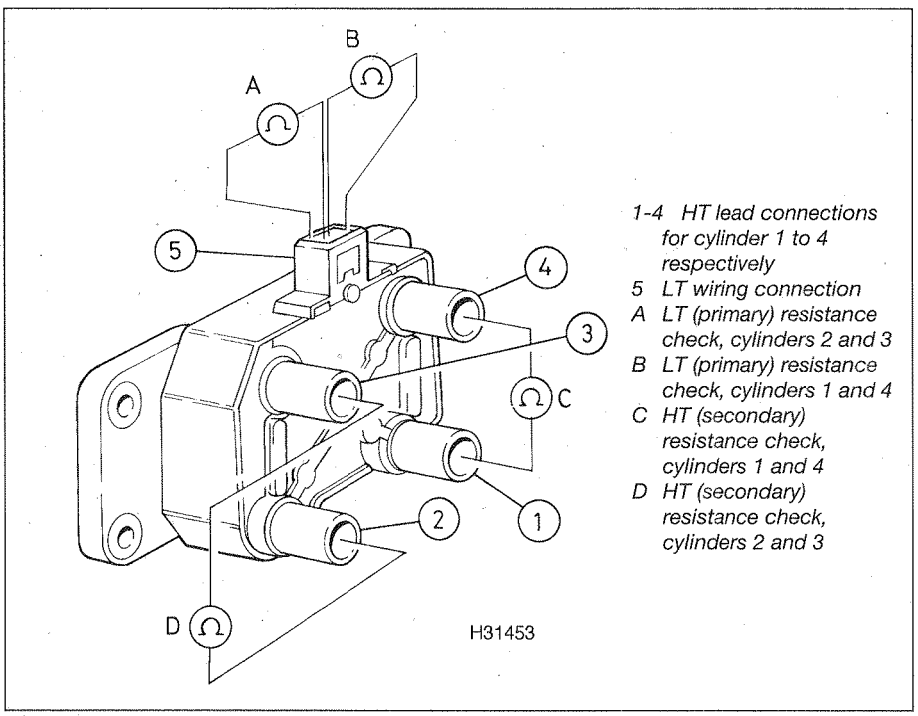
6 The ignition coil assembly is secured by four bolts from the side on 1.2 and 1.4 litre models, and by three bolts from the top on 1.6 litre models. Remove the bolts, and recover the washers **(see illustrations)**.

7 Lift the ignition coil assembly away from the engine, complete with HT leads. Recover the support plate fitted to 1.4 litre models.

Testing

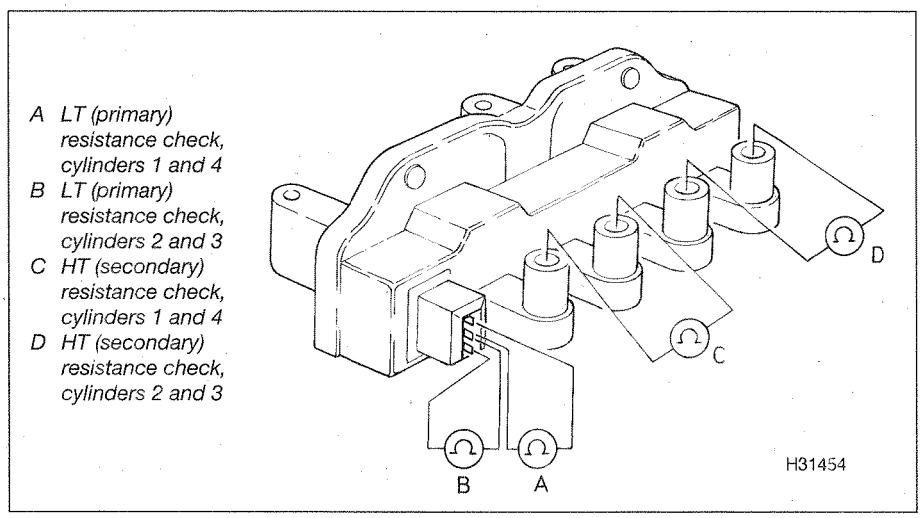
8 The only testing which can be carried out without special test equipment is to measure the coil primary and secondary resistance values.

9 The primary resistances are checked on the pins for the LT wiring plug. Connect an ohmmeter between the centre (+) pin of the three, and each of the outer pins in turn **(see illustrations)**. Both tests should give virtually



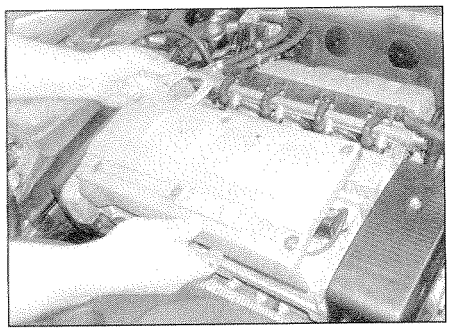
1-4 HT lead connections for cylinder 1 to 4 respectively
5 LT wiring connection
A LT (primary) resistance check, cylinders 2 and 3
B LT (primary) resistance check, cylinders 1 and 4
C HT (secondary) resistance check, cylinders 1 and 4
D HT (secondary) resistance check, cylinders 2 and 3

4.9a Ignition coil testing details - 1.2 and 1.4 litre models

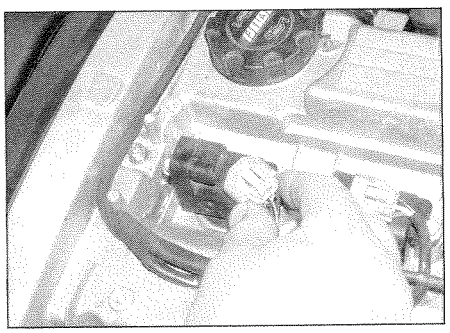


A LT (primary) resistance check, cylinders 1 and 4
B LT (primary) resistance check, cylinders 2 and 3
C HT (secondary) resistance check, cylinders 1 and 4
D HT (secondary) resistance check, cylinders 2 and 3

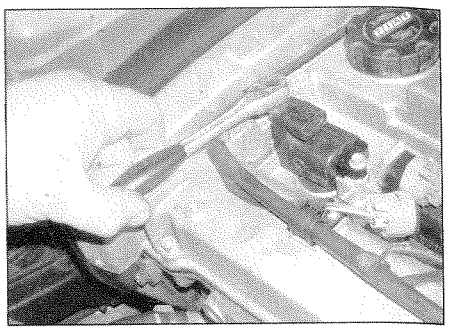
4.9b Ignition coil testing details - 1.6 litre models



4.14 Removing the engine top cover



4.15 Disconnect the coil wiring plug



4.17 Unscrew the coil retaining bolts

identical readings - compare with the specified value.

10 To check the secondary resistances, the HT leads must be disconnected from the coil HT terminals. Ensure that the cylinder number markings are visible, so that the leads can be correctly refitted.

11 Check the secondary resistance between the HT terminals for cylinders 1 and 4, then between those for cylinders 2 and 3. Again, both tests should give near-identical readings.

12 If the test results are not as expected, bear in mind that a fault is normally only indicated by a zero or infinity reading. Do not condemn the coil without consulting a FIAT dealer or automotive electrician first.

Refitting

13 Refitting is a reversal of removal, making sure that the LT and HT wiring is correctly and securely reconnected.

1.8 litre models

Removal

14 Unscrew the oil filler cap, and remove the two bolts concealed underneath. Remove the six main cover bolts, and lift off the engine top cover, for access to the ignition coil assemblies **(see illustration)**.

15 Disconnect the wiring plugs from the ignition coil which fits over each spark plug **(see illustration)**.

16 If all four coils are to be removed, mark the coil assemblies for position, noting that No 1 coil is nearest the timing belt end of the engine.

17 Unscrew the two bolts securing the coil to the cylinder head **(see illustration)**.

18 Carefully pull the coil and plug connector upwards off the plug, and withdraw it from the cylinder head recess **(see illustration)**.

Testing

19 The primary resistances are checked on the pins for the LT wiring plug. Connect an ohmmeter between the two outer pins - compare the result with the specified value.

20 If the test results are not as expected, bear in mind that a fault is normally only indicated by a zero or infinity reading. Do not condemn the coil without consulting a FIAT dealer or automotive electrician first.

21 At the time of writing, details for checking the coil secondary resistance were not available - seek the advice of a FIAT dealer.

Refitting

22 Refitting is a reversal of removal, making sure that the coils are refitted to the correct spark plugs, and that the wiring plug is securely reconnected.

5 Ignition timing - checking and adjustment

Note 1: *No ignition timing specifications are available from FIAT, so the results will be of academic interest only.*

Note 2: *Checking the timing on 1.8 litre models may not be possible with a conventional stroboscopic timing light, as there are no HT leads.*

1 When the engine is running, the ignition timing is constantly being monitored and adjusted by the engine management system. When the engine is idling, small changes are made to the ignition timing, to help maintain a constant idle speed.

2 Although it is possible to observe the base ignition timing using a standard timing light, it is not possible to adjust it. The reading obtained will only be approximate, due to the constantly changing ignition timing.

3 On most models, timing marks are provided on the flywheel, accessed after removing a rubber bung from the transmission bellhousing **(see illustration)**. However, it is generally not possible to view the marks without significant further dismantling - the marks are only intended for setting up the camshaft timing, and are not ideal for this check. On the 1.6 litre engine, for example, the thermostat housing and battery tray must be removed for proper access to the flywheel marks.

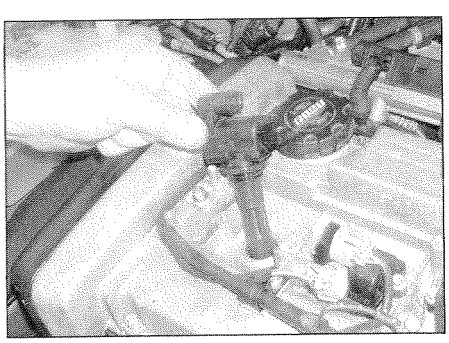
4 For those wishing to observe the ignition timing, a stroboscopic timing light will be required. The light will need to be the type which incorporates a variable delay, so that the advance angle can be determined from a single TDC marking on the flywheel. It is recommended that the timing mark is highlighted as follows.

5 Remove the rubber bung from the top of the transmission casing, then turn the engine slowly (using a spanner on the crankshaft pulley bolt) 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. If marks are not present, set the engine to TDC as described in the relevant Part of Chapter 2, and make your own TDC markings on the flywheel and transmission casing.

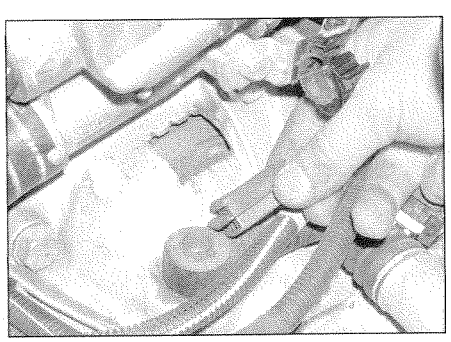
6 Start the engine and run it to normal operating temperature, then stop it.

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

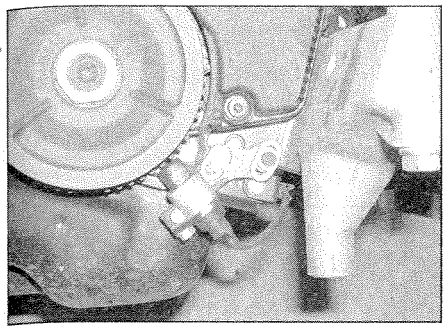
8 Start the engine, allow it to idle, and point the timing light at the transmission housing



4.18 Pull the coil upwards off its spark plug



5.3 Remove the rubber bung for access to the flywheel timing marks



6.1 Crankshaft sensor on 1.6 litre model (1.2 litre similar)

aperture/crankshaft pulley. Adjust the timing light firing point using the variable delay function, until the TDC marks are aligned with each other, and read off the corresponding ignition advance figure.

9 No ignition timing figures are available from FIAT. If there are symptoms which suggest the ignition timing is incorrect, it may be that the engine management system has detected a fault, and entered its emergency running mode. When this happens, the timing is usually set to a fixed value, which may not be ideal for all conditions. In this case, take the car for testing using special diagnostic equipment.

10 After making the check stop the engine, disconnect the timing light, and refit the rubber bung to the top of the transmission casing, and the wheel arch liner and roadwheel, if removed.

6 Ignition system sensors - removal and refitting

Note: *Certain other engine management system sensors are used in calculating the optimum ignition setting, but the two listed here have the most direct influence on the ignition system, and so appear in this Chapter, rather than in Chapter 4A or 4B.*

Crankshaft TDC/engine RPM sensor

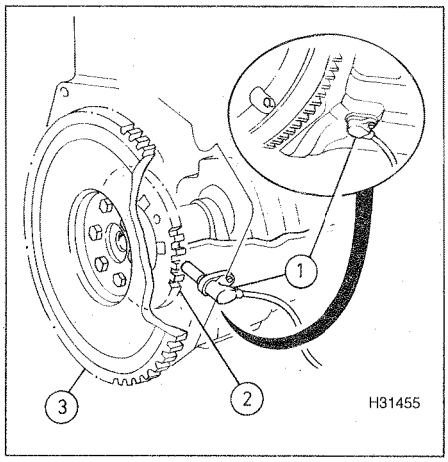
1 On 1.2 and 1.6 litre models, the sensor is located at the right-hand end of the engine, mounted on a bracket, adjacent to the crankshaft pulley **(see illustration)**.

2 On 1.4 and 1.8 litre models, the sensor is mounted at the flywheel end of the engine, to the rear **(see illustration)**. Access to the sensor may be found easier from below, in which case, jack up the front of the car and support on axle stands (see *Jacking and vehicle support*).

Removal

3 Ensure that the ignition is switched off, then trace the wiring from the sensor back to the connector and unplug it from the main harness.

4 Unscrew the securing bolt and remove the sensor from the engine **(see illustration)**. On 1.4 and 1.8 litre models, recover any shims fitted between the sensor and the engine.



6.2 Crankshaft sensor on 1.4 litre model (1.8 litre similar)

1 Sensor 2 Pickup wheel 3 Flywheel

5 On 1.6 litre models, note that the sensor bracket must not be removed, otherwise the sensor setting will be lost. One of the bolts securing the sensor bracket is of shear-head type, to discourage removal. A special FIAT tool is required to reset the sensor position, if the bracket is disturbed.

Refitting

6 Refitting is a reversal of removal, noting the following points:

a) The sensor must be clean - any oil or dirt on the sensor tip may interfere with the sensor's operation.

b) Ensure that the sensor mounting bolt is securely tightened, and the sensor wiring is correctly routed and securely reconnected.

c) Check the sensor air gap as described below.

Air gap checking

1.2 and 1.6 litre models

7 On 1.2 and 1.6 litre models, using a feeler gauge, check the air gap between the end of the sensor and the tips of the teeth on the reluctor wheel, mounted behind the crankshaft pulley **(see illustration)**.

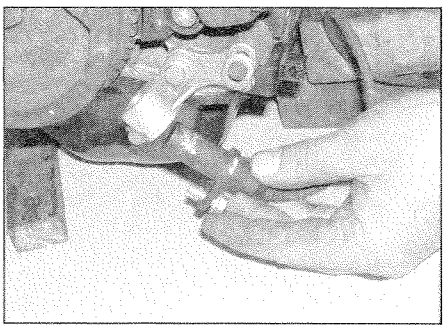
8 If the gap is not within the tolerance given in the Specifications, this can only mean that the sensor mounting bracket has been disturbed, or that the sensor is damaged.

9 If the mounting bracket has been moved, FIAT special tools will be required to accurately re-position it.

10 If the engine runs satisfactorily, it is not wise to move the bracket to correct a small discrepancy in the air gap.

1.4 and 1.8 litre models

11 Checking the air gap on these models is less easy, as there is no access to the sensor tip and reluctor teeth once the sensor has been fitted.



6.4 Removing the crankshaft sensor - 1.6 litre model

12 One way to check the air gap is to remove the flywheel, as described in the relevant Part of Chapter 2. This should provide sufficient access to check the air gap using a feeler blade, as for 1.2 and 1.6 litre models.

13 The only way to avoid removing the flywheel for this check would be to use an accurate depth gauge inserted through the sensor hole, to measure the depth to the reluctor wheel teeth from the outer surface of the engine. By then measuring the fitted depth of the sensor itself (allowing for any shims used), the air gap could be established.

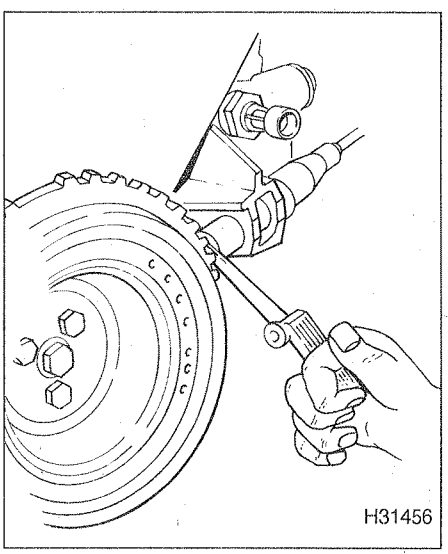
14 As mentioned in paragraph 10, air gap measurement is only essential if the engine is not running well, and fault diagnosis is being carried out.

15 If the air gap proves to be incorrect, it would be possible to alter it using suitable shims below the sensor. Refer to a FIAT dealer for advice.

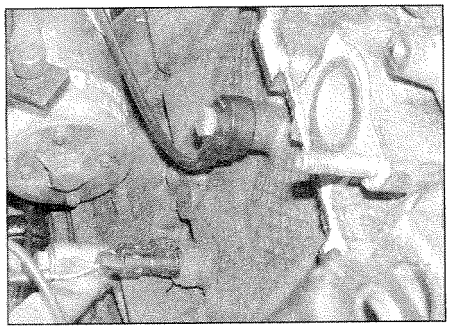
Knock sensor

Removal

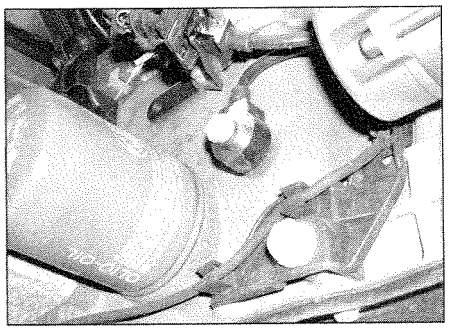
16 On all models except the 1.6 litre, the knock sensor is fitted on the rear of the engine, between Nos 2 and 3 cylinders; access is poor from above, but better from



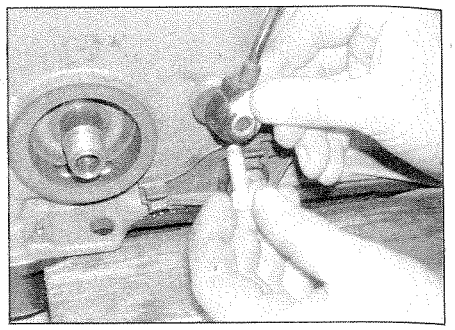
6.7 Checking the sensor air gap on a 1.2 litre model



6.16a Knock sensor on a 1.4 litre model - seen with inlet manifold removed



6.16b Knock sensor on a 1.6 litre model



6.18 Removing the knock sensor

below - jack up the front of the car if necessary, and support it on axle stands (see *Jacking and vehicle support*). On 1.6 litre models, the knock sensor is on the front of the engine, next to the oil filter **(see illustrations)**.

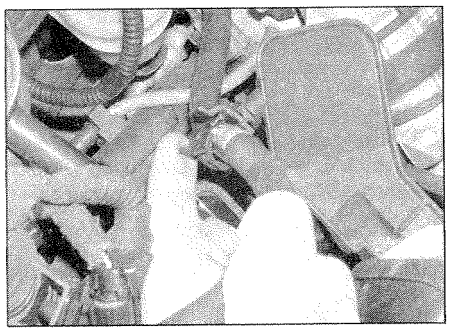
17 Trace the wiring for the knock sensor back from its location on the engine, and disconnect its wiring connector. Where applicable, release the wiring connector from its mounting bracket.

18 Unscrew the bolt securing the sensor to the engine, and remove the sensor from the engine compartment **(see illustration)**.

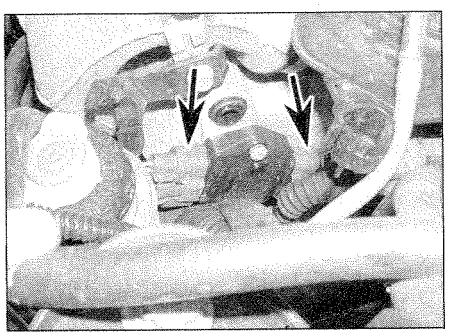
Refitting

19 Ensure that the sensor and its location on the engine are clean, then refit the securing bolt and tighten to the specified torque. The bolt must be tightened correctly for the sensor to function.

20 Refit the sensor wiring to the mounting bracket (where applicable) and reconnect it.



7.3 Unclip the expansion tank hose



7.4 Ignition power module wiring plugs (arrowed)

7 Ignition power module (1.8 litre models) - removal and refitting

Removal

1 The ignition power module is fitted to the right-hand end of the inlet manifold (right as seen from the driver's seat).

2 Ensure that the ignition is switched off (take out the key).

3 Release the clip securing the expansion tank hose to the right-hand end of the inlet manifold, and move the hose out of the way **(see illustration)**.

4 Noting their respective positions, disconnect the wiring plugs at either end of the module **(see illustration)**.

5 Unscrew the two socket-head screws securing the module, and remove the module from the engine.

Refitting

5 Refitting is a reversal of removal, ensuring that the wiring connections are correctly and securely remade.