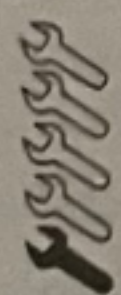
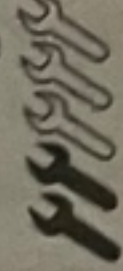
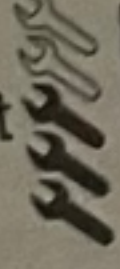




Chapter 5 Part B: Ignition system – petrol engines

Contents

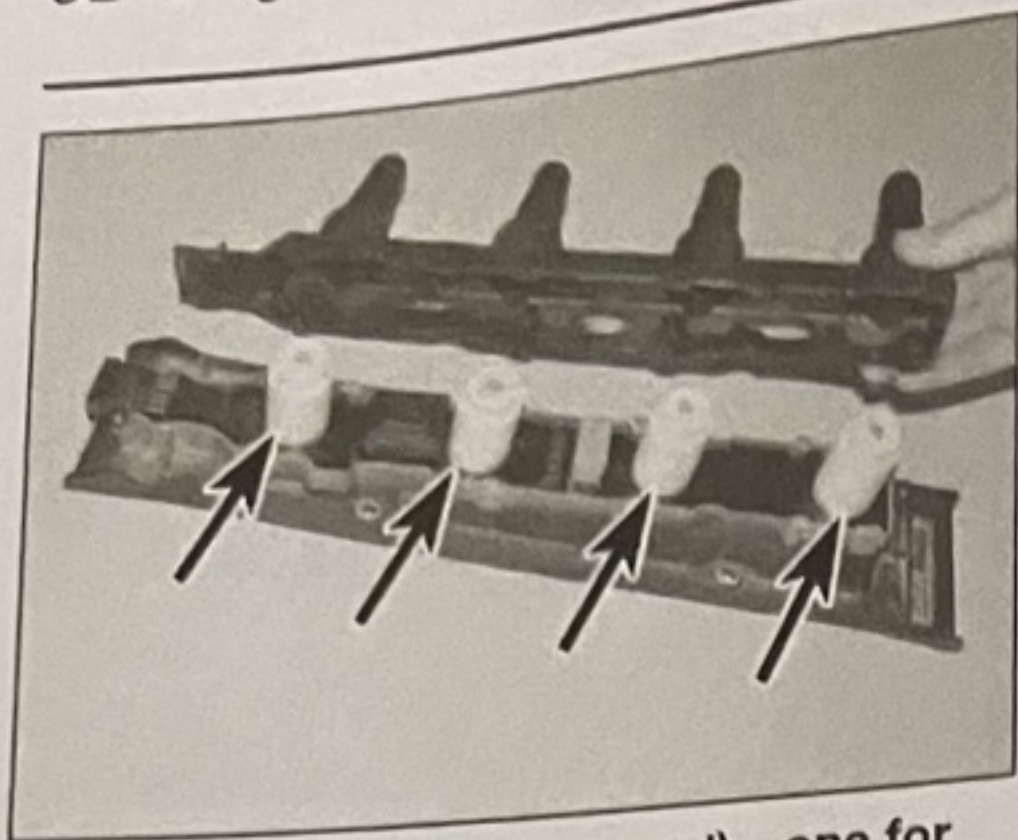
	Section number		Section number
General information	1	Ignition system – testing	2
Ignition discharge module – removal and refitting	3	Ignition timing – general information	6
Ignition HT coils – general information	4	Slotted rotor for crankshaft sensor – removal and refitting	5

Degrees of difficulty

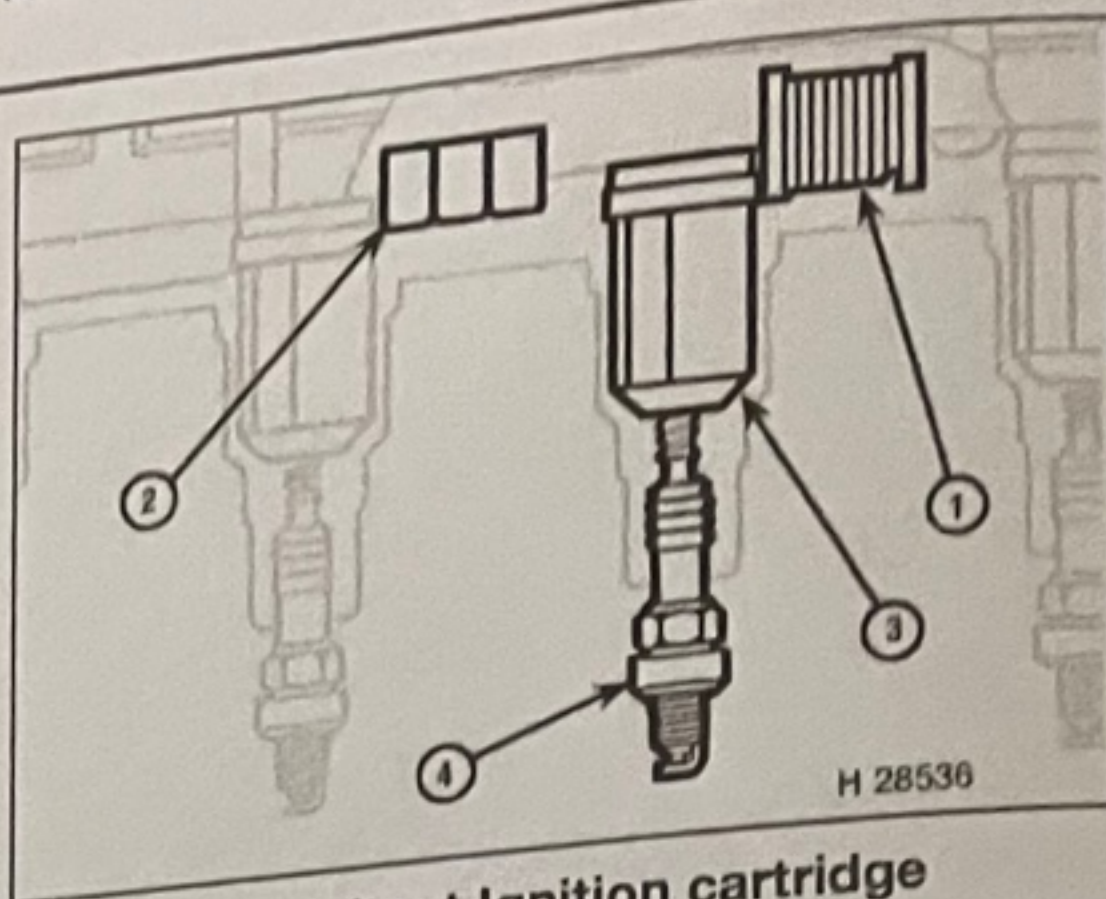
	Easy , suitable for novice with little experience		Fairly easy , suitable for beginner with some experience		Fairly difficult , suitable for competent DIY mechanic		Difficult , suitable for experienced DIY mechanic		Very difficult , suitable for expert DIY or professional
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Specifications

System type	Direct Ignition (DI) system incorporated in Trionic engine management system	
Direct Ignition (DI) system		
Ignition discharge module:		
Capacitor voltage	400 volts	
Ignition voltage (maximum)	40 000 volts	
Ignition timing	Pre-programmed in ECM	
Firing order	1-3-4-2 (No 1 cylinder at timing chain end)	
Torque wrench settings	Nm	lbf ft
Crankshaft pulley bolt	175	129
Ignition discharge module	12	9
Spark plugs	28	21

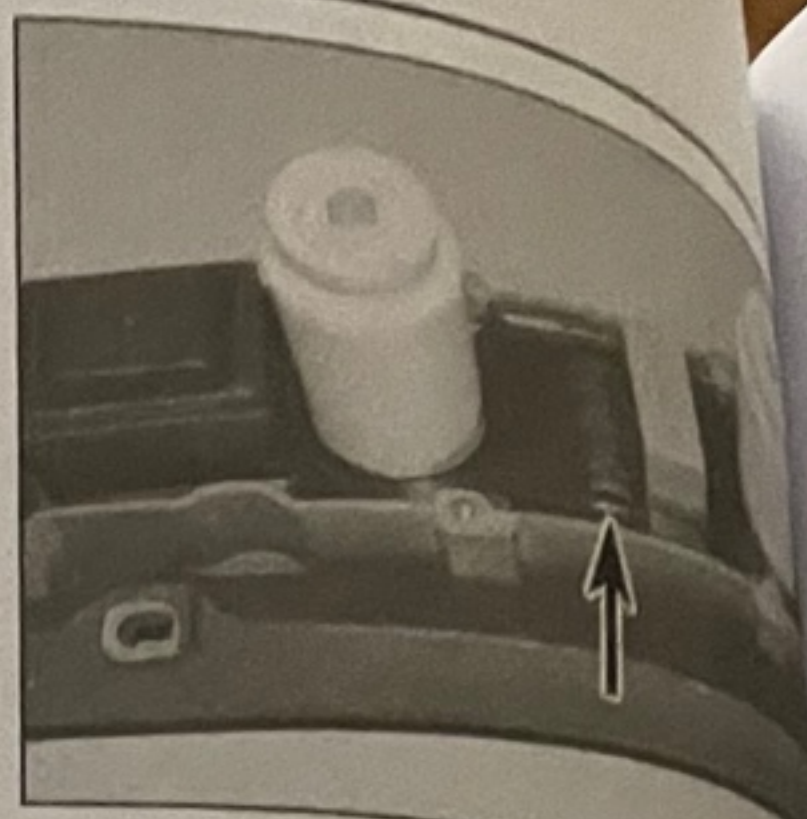


1.2 Separate coils (arrowed) – one for each cylinder



1.8a Direct Ignition cartridge

- 1 Transformer (12 volts/400 volts)
- 2 Capacitor
- 3 Ignition coil
- 4 Spark plug



1.8b Direct Ignition capacitor located in the cartridge

1 General information

1 All models have a Direct Ignition system, which is incorporated into the Saab Trionic engine management system. With this system, a single electronic control module (ECM) controls both the fuel injection and ignition functions. More information on the system components are given in Chapter 4A.

2 The Direct Ignition system uses a separate HT coil for each spark plug (see illustration). The system's electronic control module monitors the engine by means of various sensors, in order to determine the most efficient ignition timing.

3 The components of the system are a crankshaft position/speed sensor, ignition discharge module with one coil per plug, diagnostic socket, ECM, pressure sensor in the intake manifold (to determine engine load), and a solenoid valve (to regulate the turbocharger operation).

4 During starting at a crankshaft speed in excess of 150 rpm, HT sparks are triggered in the cylinder pair with the pistons at TDC. Under difficult conditions, multi-sparking occurs during this period, to aid starting. The ECM determines in which cylinder combustion is taking place by monitoring the flow of current across the spark plug electrodes, and then uses this information to determine the firing.

5 When the engine starts, the ignition timing is always set to 10° BTDC, and will remain at this setting until the engine speed exceeds



3.2 Slacken and remove the four screws (arrowed) securing the ignition cartridge

825 rpm. The ECM will regulate the ignition timing at engine speeds above 825 rpm.

6 When the ignition is switched off and the engine stops, the main relay remains operational for a further 6 seconds. During this period, the Trionic control module earths all the trigger leads 210 times a second for 5 seconds in order to burn off impurities from the spark plug electrodes.

7 Because the system does not use any HT leads, radio suppression must be incorporated in the spark plugs, so resistor-type plugs must always be used.

8 The Direct Ignition system uses the capacitive discharge method of producing an HT spark. Approximately 400 volts is stored in a capacitor (see illustrations), and at the time of ignition, this voltage is discharged through the primary circuit of the relevant coil. Approximately 40 000 volts is induced in the HT secondary coil, and this is discharged across the spark plug electrodes.

9 Should a fault occur in the system, a fault code is stored in the ECM. This code can only be accessed by a Saab dealer, using dedicated equipment.

10 Note that the starter motor must never be operated with the ignition cartridge disconnected from the spark plugs but still connected to the wiring loom. This can cause irreversible damage to the cartridge.

11 The engine management system controls engine pre-combustion via a knock sensor incorporated into the ignition system. Mounted onto the cylinder block, the sensor detects the high frequency vibrations caused when the engine starts to pre-ignite, or 'pink'. Under these conditions, the knock sensor sends an electrical signal to the ECM, which in turn retards the ignition advance setting in small steps until the 'pinking' ceases. With the Saab Trionic system, the spark plugs themselves are used as knock sensors, instead of employing a separate knock detector in the cylinder block. It achieves this by applying a small, direct current voltage across each spark plug. When two cylinders approach TDC, this voltage causes an ionisation current to flow across the terminals of the spark plug in the cylinder under combustion; a high current indicates

that knock is occurring thus indicating that a cylinder requires ignition retardation. Spark control of the fuel injection is achieved in the same manner (see Chapter 4A).

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. Refer to the precautions in Chapter 5A, Section 1, before starting work. Always switch off the ignition before disconnecting or connecting a component, and when using a multimeter to check resistances.

1 If a fault appears in the engine management system, first check that all wiring is secure and in good condition. If necessary, individual components of the Direct Ignition system may be removed for visual investigation as described later in this Chapter. The coils are best checked by substituting a suspect one with a known good coil, and checking if the misfire is cured.

2 Due to the location of the spark plug beneath the ignition discharge module, it is not possible to easily check the HT circuit for faults. Further testing should be carried out by a Saab dealer, who will have equipment to access fault codes stored in the system ECM.

3 Ignition discharge module – removal and refitting

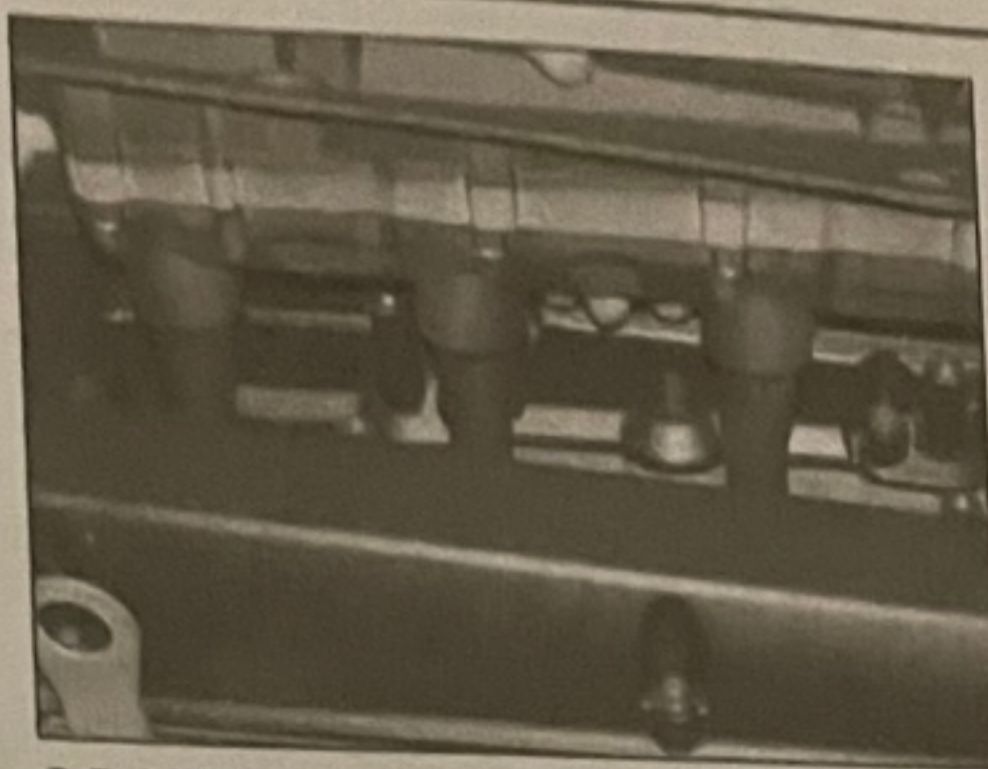
Removal

1 Open the bonnet, unclip the cover from the top of the battery and disconnect the battery negative lead.

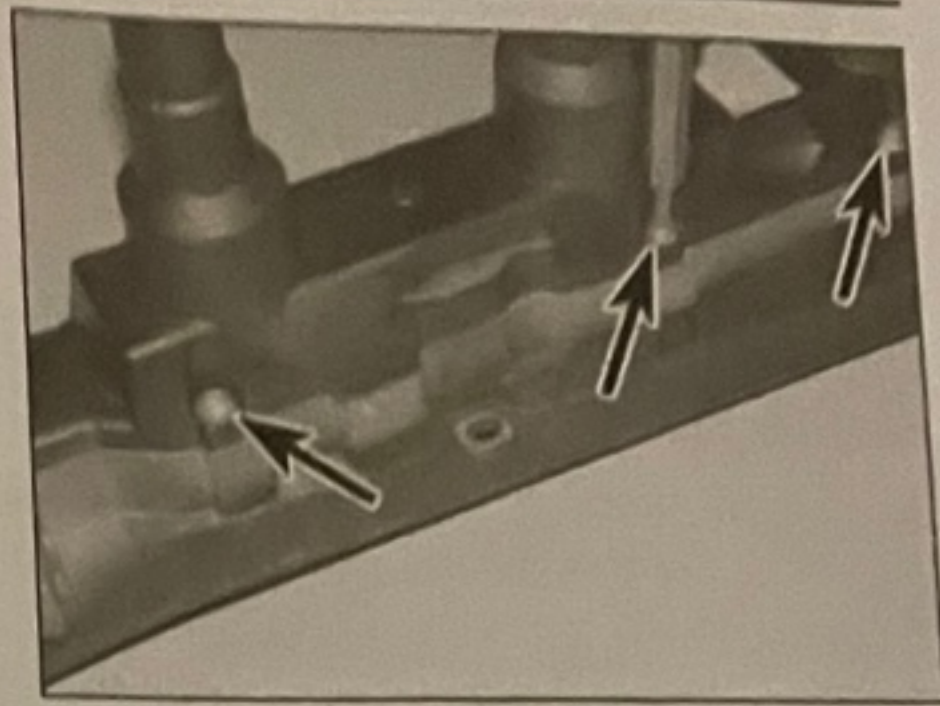
2 Unscrew the four screws securing the ignition cartridge to the top of the cylinder head (see illustration).



3.3 Release the retaining clip (arrowed) and disconnect the wiring connector



3.5 Lift the cartridge straight up to release it from the spark plugs



3.6a Unscrew the screws (three shown) . . .

3 Disconnect the wiring plug, located on the left-hand end of the ignition discharge module (see illustration).

4 Where applicable, disconnect any wiring support clips or earth lead.

5 Lift the ignition cartridge, at the same time releasing it from the tops of the spark plugs (see illustration).

Warning: When the ignition discharge module is removed, it must be kept in the upright position. If the ignition discharge module has been turned upside down for a length of time, leave it in the fitted position for a couple of hours before starting.

6 If necessary, the shroud may be removed from the bottom of the cartridge, by inverting it and removing the retaining screws. Separate the black (lower) shroud from the cartridge (see illustrations).

7 The HT springs may be removed from the shroud by careful use of a screwdriver (see illustration).

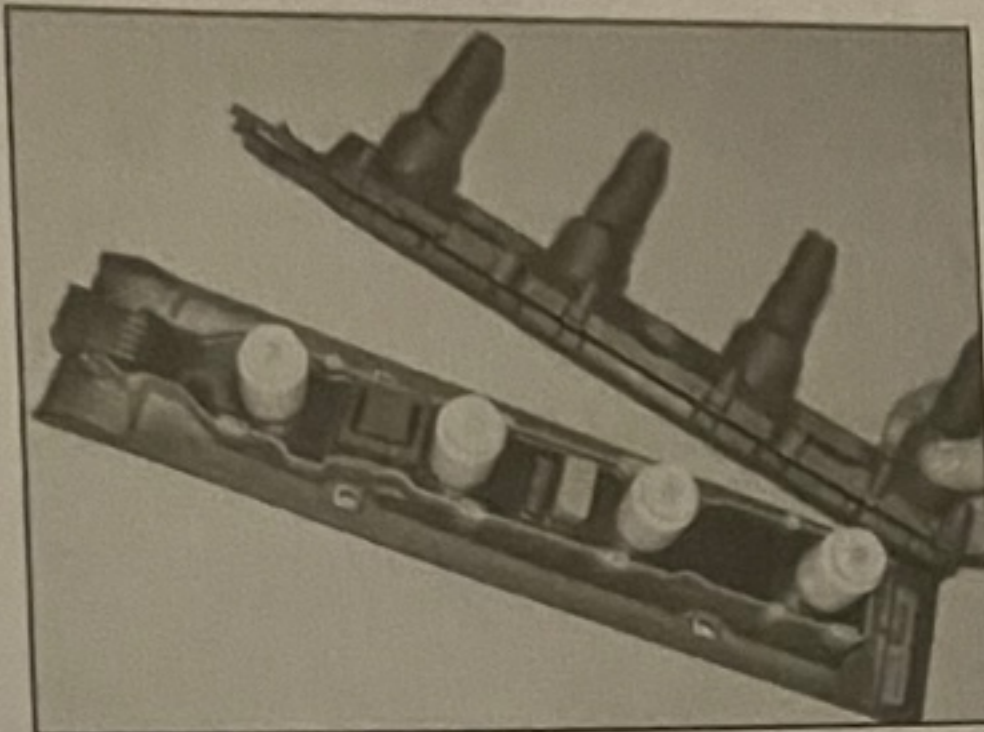
Refitting

8 Refitting is a reversal of removal, but tighten the retaining screws to the specified torque.

4 Ignition HT coils – general information

The four ignition coils are an integral part of the ignition discharge module upper assembly and can only be purchased from Saab as a complete unit.

If required, the ignition discharge module



3.6b . . . and separate the black lower shroud from the cartridge

can be removed from the vehicle as described in Section 3, then taken to your local Saab dealer or motor vehicle electrical specialist where they can check the ignition module.

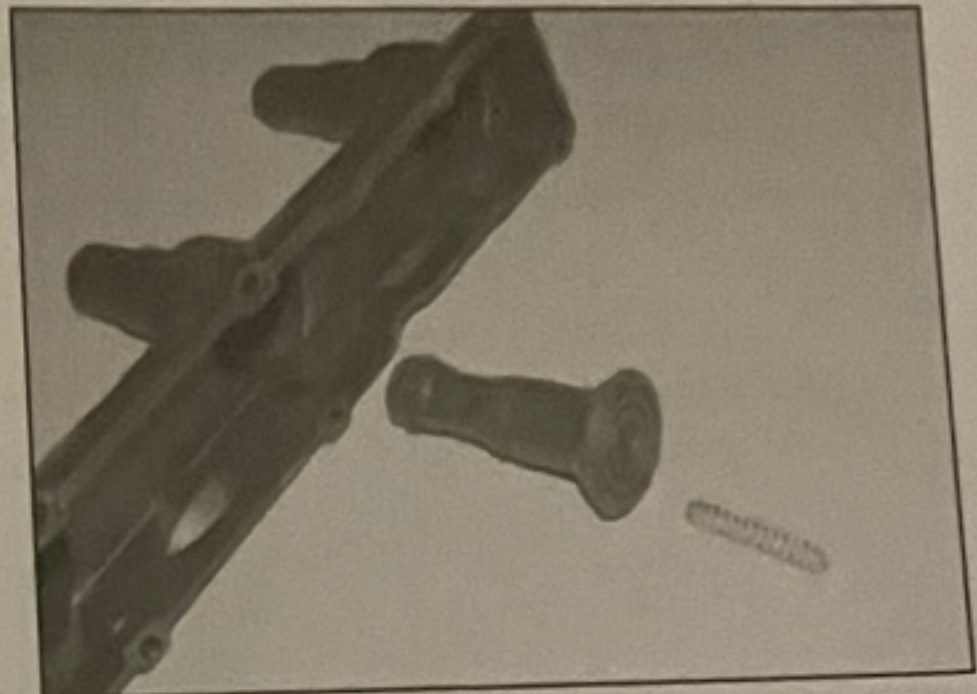
Warning: When the ignition discharge module is removed, it must be kept in the upright position. If the ignition discharge module has been turned upside down for a length of time, leave it in the fitted position for a couple of hours before starting.

5 Slotted rotor for crankshaft sensor – removal and refitting

Removal

1 The slotted rotor is located on the flywheel/driveplate end of the crankshaft. Remove the crankshaft as described in Chapter 2C.

2 Using a Torx key, unscrew the four screws



3.7 Rubber sleeve and spring from inside lower shroud

securing the slotted rotor to the crankshaft, and then remove the rotor over the end of the crankshaft.

Refitting

3 Refitting is a reversal of removal. Note that the rotor can only be fitted in one position, since the bolt holes are unequally-spaced.

6 Ignition timing – general information

The ignition timing is pre-programmed into the system ECM, and cannot be adjusted or even checked with any accuracy. If the timing is thought to be incorrect, the car should be taken to a Saab dealer who will have the necessary equipment to extract any fault codes stored in the ECM. For further information see Chapter 4A.