Identification data

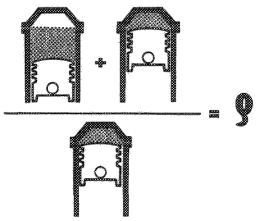
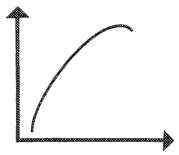
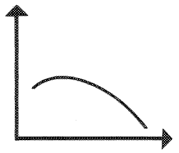
	CHASSIS	ENGINE	VERSION	VERSION	3 DOORS	5 DOORS	GEARBOX 5 speeds
1372 *turbo CF2*	ZFA 176.000	176 B6.000	176 A553H	GT	●		●
1698 *TD 60*	ZFA 176.000	176 B7.000	176 AT53A	S SX	●		●
			176 AT55A	S SX		●	●

Performance - Fuel consumption

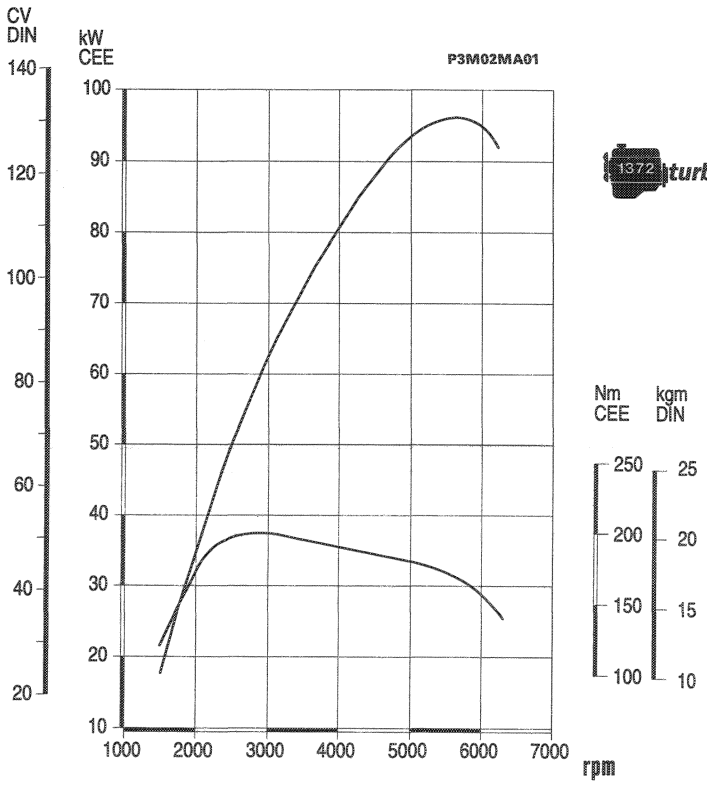
ENGINE		1372 *turbo*	1372 *turbo CF2* (*)	1698 *TD 60*
Speed km/h (average load)	1	58	53	31
	2	91	83	55
	3	134	121	84
	4	177	162	118
	5	⩾ 200	⩾ 200	155
	6	53	53	31
Fuel consumption ECE standard (litres/100 km)	Urban cycle (A)	9.7	9.4	7.3
	Constant speed 90 km/h (B)	6.1	5.7	4.6
	Constant speed 120 km/h (C)	8.3	7.8	6.7
	Mean fuel consumption (CCMC proposal) $\frac{A + B + C}{3}$	8	7.6	6.2

* *The values show changes introduced on the 1372 turbo CF2 version.*

Fuel consumption figures in the table were calculated during official tests and in accordance with official EEC procedures. Simulated urban cycle fuel consumptions were measured at a test bench whereas fuel consumption figures at constant speed of 90 and 120 km/h were measured on a dry, level road and in equivalent bench tests. These figures can provide a useful guide for comparing different vehicles. However, traffic situations, driving style, weather conditions and general vehicle state may in practice lead to fuel consumption figures different to those established by means of the above legal procedure.

CHARACTERISTICS		1372 turbo	1372 turbo CF2 (*)
	Compression ratio	7.8 + 0.1 - 0.2	9 + 0.2 - 0.1
 Maximum power	kW (EEC) (BHP) (EEC)	98 (136)	96 (130)
	rpm	5750	5600
 Maximum torque	daNm (EEC) (kgm) (EEC)	20.4 (21.2)	20 (20.4)
	rpm	3000	3000

* *The values show changes introduced on the 1372 turbo CF2 version CF2.*



1372 turbo CF2

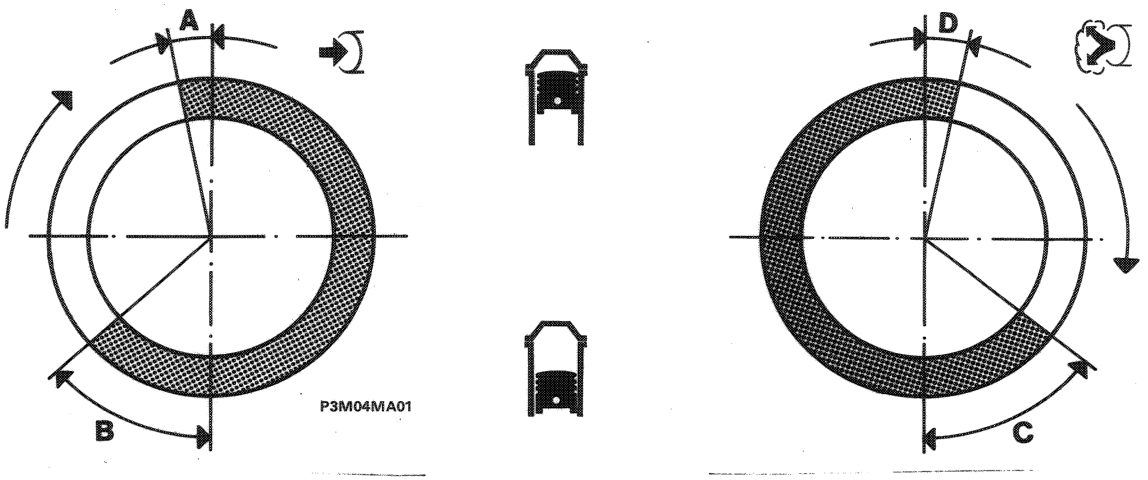
TYPICAL ENGINE CURVES MEASURED BY EEC METHOD

The power curve shown is obtained with engine overhauled and run in without fan, with exhaust silencer and air cleaner at sea level.

DESCRIPTION			1372 turbo	1372 turbo CF2 (*)
			Values in mm	
Piston		X	10.5	10.5
	⌀	A	80.450-80.460	80.450-80.460
	⌀	B	-	80.460 - 80.470
	⌀	C	80.470-80.480	80.470-80.480
	⌀	E	80.490-80.500	80.490-80.500
	⌀ FIAT >		-	0.4
Volume of combustion chamber in cylinder head		cm³	36.42	33.85
Cam lift			9.564	8.8
			8.8	8.8
for timing check			0.80	0.80
			0.80	0.80
				0.35
operational clearance			0.40 ± 0.05	0.45 ± 0.05
			0.50 ± 0.05	0.45 ± 0.05

* *The values show changes introduced on the 1372 turbo CF2 version.*

TIMING DIAGRAMS



Timing angles

			1372 turbo	1372 turbo CF2 (*)
A	Inlet	start before TDC	14°	0°
B	Inlet	end after BDC	44°	43°
C	Exhaust	start before BDC	36°	40°
D	Exhaust	end after TDC	6°	3°

* *The values show changes introduced on the 1372 turbo CF2 version.*

COMPONENTS OF BOSCH MOTRONIC M2.7 INTEGRATED ELECTRONIC INJECTION SYSTEM

	1372 turbo	1372 turbo CF2 (*)
Electronic control unit	0.261.203.099	0.261.204.159
Fuel vapour control solenoid	0.280.142.150	0.280.142.301
Idle adjustment actuator	0.280.140.505	0.280.140.553
Lambda probe	0.258.003.222	0.258.003.772

SUPERCHARGING

Exhaust gas-driven turbocharger with wastegate and intercooler

Turbocharger	I.H.I. VL7	I.H.I. VL7
Maximum turbocharging pressure	1.3 bar	1.2 bar

BOSCH MOTRONIC M2.7 INTEGRATED ELECTRONIC INJECTION-IGNITION CONTROL MODULE

Make and type	Bosch 0.261.303.099	Bosch 0.261.204.159

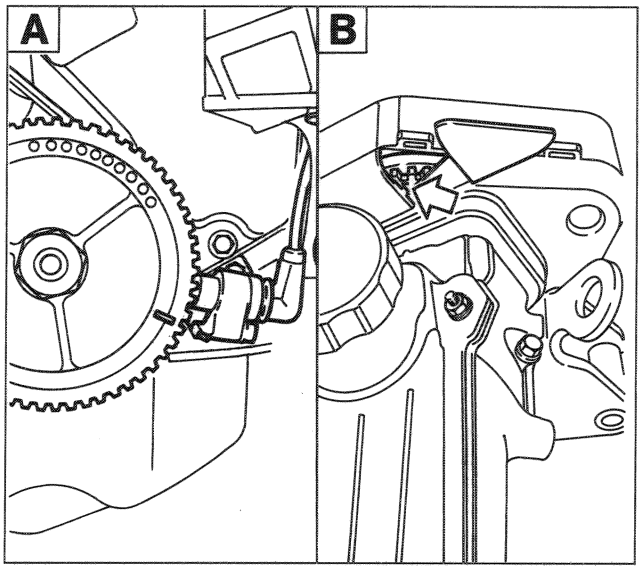
ADVANCE ON ENGINE

With engine idling	5° ± 2° (850±50RPM)	9° ± 2° (800±50RPM)

SPARK PLUGS

Make and type	Champion	RC7BYC4	RC7BYC
	Fiat/ Lancia	7GBYSR4	7GBYSR
Thread		M 14×1.25	M 14×1.25
Electrode gap	mm	0.8 - 1	0.6 - 0.8

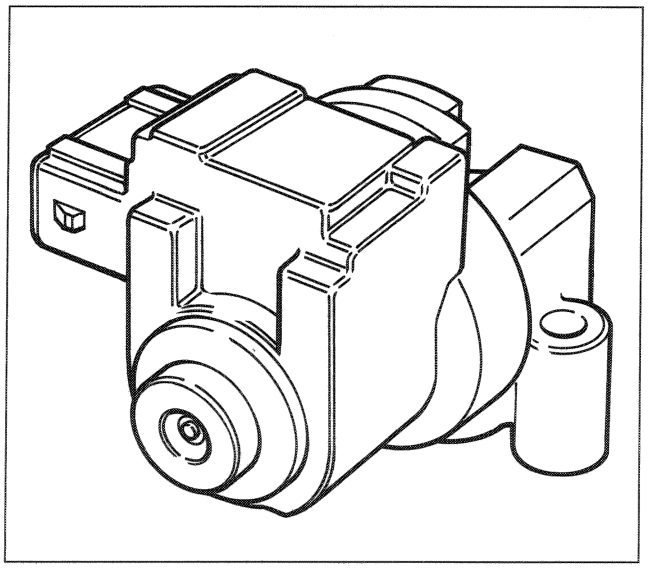
* *The values show changes introduced on the 1372 turbo CF2 version.*



P3M06MA01

ADJUSTING INJECTION TIMING SENSOR

Set injection timing sensor with piston pair 1-4 on TDC, and cylinder 4 in combustion phase.
Align TDC marks on crankshaft pulley and rpm sensor mount (Fig. A).
Check that the timing adjustment sign appears in the window on the timing belt guard cover (Fig. B). In this position cylinder (1) is in combustion phase. If not, turn crankshaft through another turn.

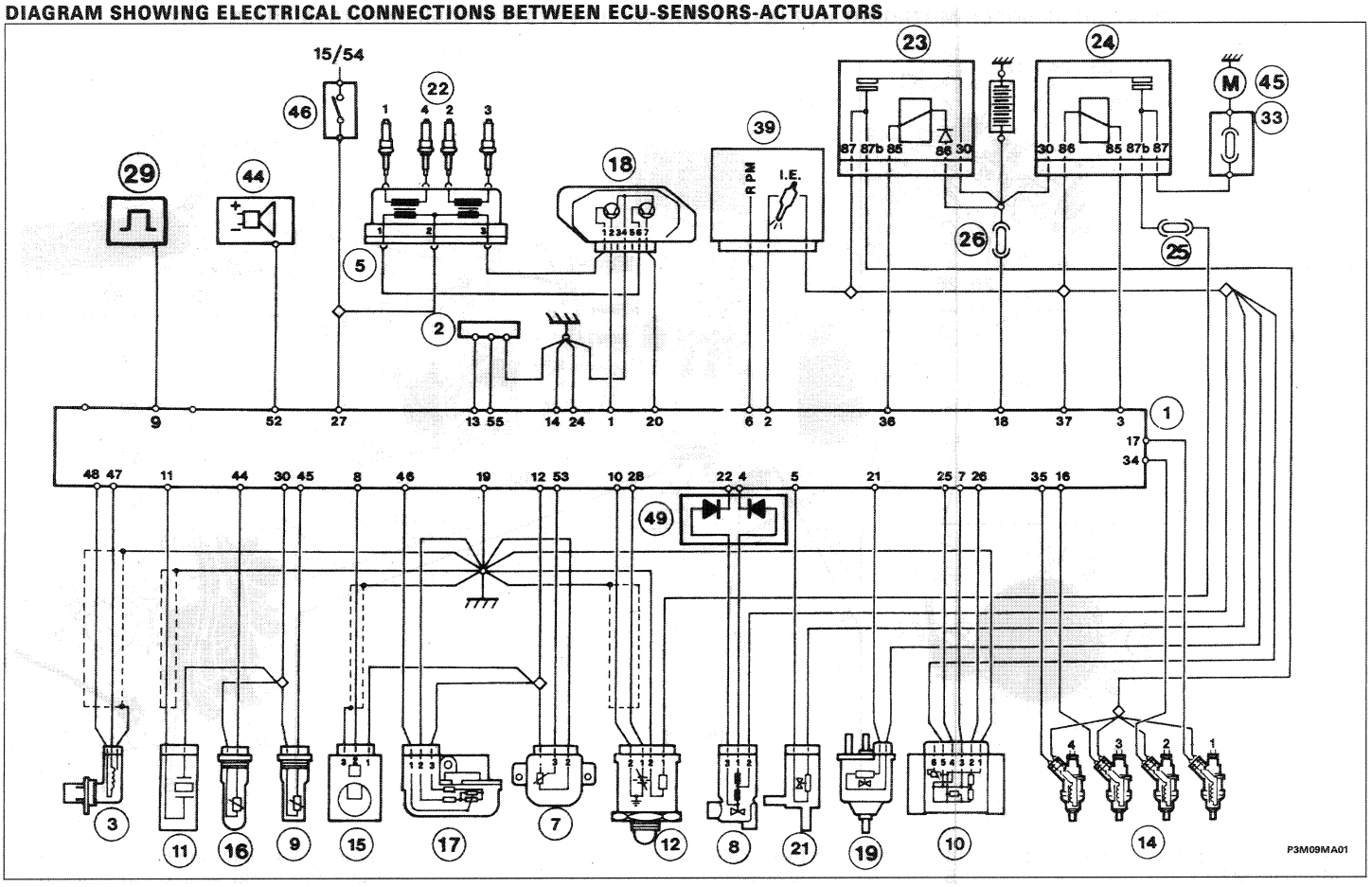


P3M06MA02

ENGINE IDLE SPEED ACTUATOR

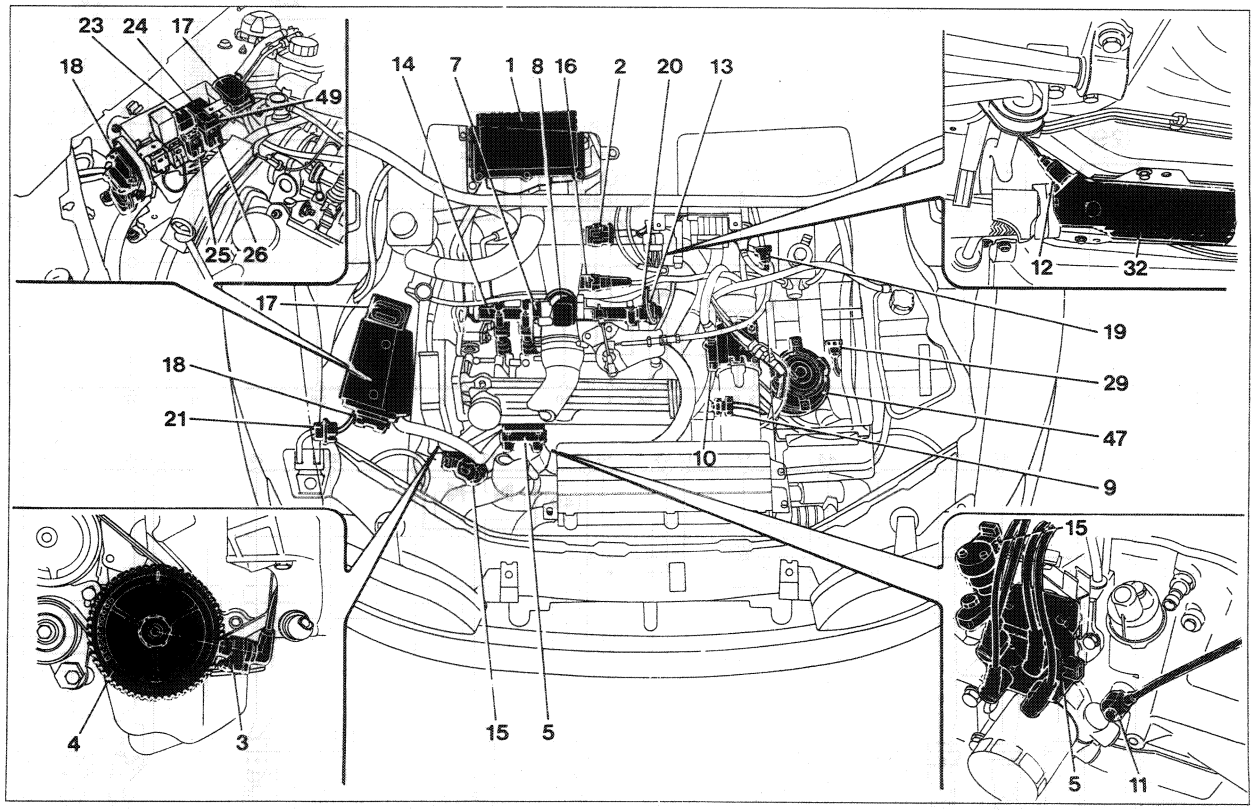
The engine idle speed actuator is fitted directly to the butterfly valve case.
It consists of an electric motor which increases or reduces the size of the supplementary air passage (which carries air in parallel to the air that leaks through the throttle when the accelerator is released) in the butterfly valve case. This devices keeps engine idle speed automatically constant at any load (supplementary appliances on or off, engine warm or cold etc.).
The passage opening brought about by distributor rotation is governed by electrical pulses processed by a special section of the injection ECU, which turns the distributor one way or another according to engine speed.

DIAGRAM SHOWING ELECTRICAL CONNECTIONS BETWEEN ECU-SENSORS-ACTUATORS



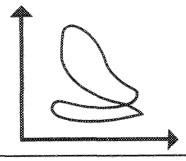
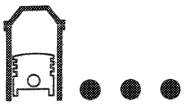
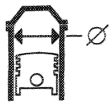
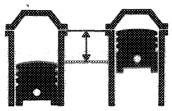
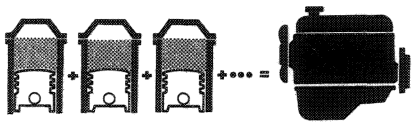
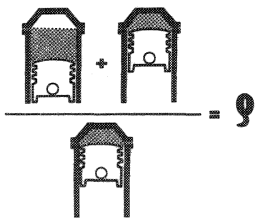
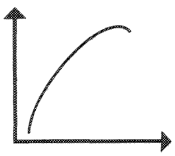
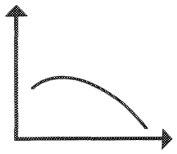
1. Electronic injection-ignition control unit, Bosch Motronic M2.7
2. Diagnostic socket for Fiat/Lancia tester
3. Rpm and TDC sensor
5. High tension coil with four outlets
7. Throttle valve position sensor
8. Engine idle speed regulation actuator
9. Coolant temperature sensor
10. Air flow meter (debimeter)
11. Knock sensor
12. Lambda probe
15. Injection timing sensor
16. Inlet air temperature sensor
17. Absolute pressure sensor (barometric sensor)
18. Ignition power module
19. Three-way turbocharging control solenoid
21. Vapour recirculation solenoid
22. Spark plugs
23. Motronic injection-ignition system relay Motronic (injector control unit, idle adjustment actuator, vapour recirculation solenoid, turbo control solenoid, air flow meter, system warning light)
24. Motronic injection-ignition system relay Motronic (electric fuel pump, lambda probe heating)
25. Lambda probe preheating circuit fuse
26. System fuse (injection-ignition)
29. Speedometer sensor on gearbox
33. Fuel pump fuse
39. Instrument panel
44. Antitheft device
45. Electric fuel pump
46. Ignition switch
49. Diodes for control unit

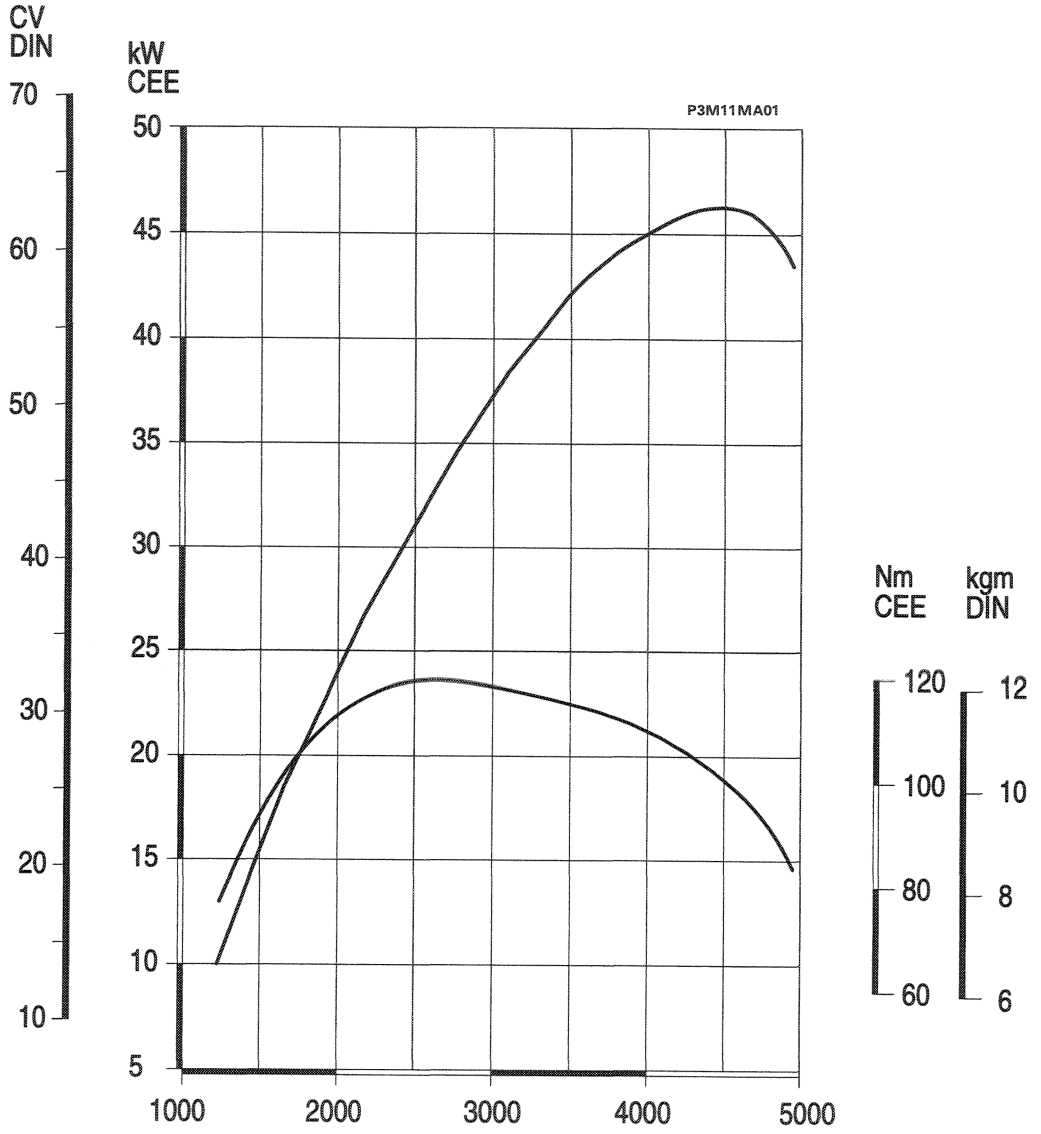
LOCATION OF BOSCH MOTRONIC M2.7 INJECTION-IGNITION SYSTEM COMPONENTS IN ENGINE BAY



1. Electronic injection-ignition control unit, Bosch Motronic M2.7
2. Diagnostic socket for Fiat/Lancia tester
3. Rpm and TDC sensor
4. Engine pulley ring gear (phonic wheel)
5. High tension coil with four outlets
7. Throttle valve position sensor
8. Engine idle speed regulation actuator
9. Coolant temperature sensor
10. Air flow meter (debimeter)
11. Detonation sensor
12. Lambda probe
14. Injectors and fuel manifold
15. Injection timing sensor
16. Inlet air temperature sensor
17. Absolute pressure sensor (barometric sensor)
18. Ignition power module
19. Three-way turbocharging control solenoid
21. Fuel vapour recirculation solenoid
22. Spark plugs
23. Motronic injection-ignition system relay (injector control unit, idle adjustment actuator, vapour recirculation solenoid, turbo control solenoid, air flow meter, system warning light)
24. Motronic injection-ignition system relay (electric fuel pump, lambda probe heating)
25. Lambda probe preheating circuit fuse
26. System fuse (injection-ignition)
29. Speedometer sensor on gearbox
31. System warning light
32. Catalytic converter
44. Antitheft device
45. Electric fuel pump
46. Ignition switch
47. Injector cooling fan
48. Air conditioner compressor
49. Diodes for control unit

CHARACTERISTICS

			1698 TD 60
	Cycle		DIESEL, 4 STROKE
	Timing gear		single overhead cam
	Engine balancing		–
	Fuel system type		Indirect mechanical injection
	Number of cylinders		4
	Cylinder liner (bore)	mm	82.6
	Stroke	mm	79.2
	Capacity	cm^3	1698
	Compression ratio		20.3
	Maximum power	kW (EEC) (BHP) (DIN)	46 (62)
		rpm	4500
	Maximum torque	daNm (EEC) (kgm) (DIN)	11.8 (12)
		rpm	2500



Engine typical curves

The power curve shown is obtained with the engine serviced and run in (50 hours of operation), without fan, with exhaust silencer and air cleaner, at sea level.

FUEL SYSTEM

	1698 TD 60
Firing order	1 - 3 - 4 - 2
Rotary type injection pump	BOSCH VE R 691
Injector	BOSCH 0.432.217.195
Nozzle holder type	BOSCH KCA 30 S 41
Nozzle type	BOSCH DN 12 SD 290
Injector setting pressure	150 - 158 bar
Injection pump operation: with piston of cylinder no. 1 at TDC (compression)	piston stroke = 0.94 ± 0.05 mm
Engine idle speed	880 - 920 rpm
Maximum free running engine speed	5200 - 5300 rpm

COMPONENTS OF EXHAUST EMISSION CONTROL DEVICE

Exhaust gas emission control unit	M. Marelli MCR 111.01
Modulator solenoid	Borg-Warner
Rpm sensor	M. Marelli SEN 8I
Coolant temperature sensor	Weber WTS-05/01
Injection pump with Bosch potentiometric engine load sensor	VER 691
Exhaust gas recirculation E.G.R. valve	Mitsubishi

00.10

DATA FOR CHECKING BOSCH INJECTION PUMP TYPE VE R 691

GENERAL TEST CONDITIONS

- Test oil: ISO 4113
- Temperature of test oil: 45° ± 1°C (reflux outlet ●)
- Pump entry pressure: 0.35 bar
- Rotation: clockwise

SPECIFIC TEST CONDITIONS

- Bosch injectors 1.688.901.022
- Injectors: Bosch 1.688.901.922 (DNO SD 1510) set at 130 - 133 bar
- Piping: 2x6x450 mm.

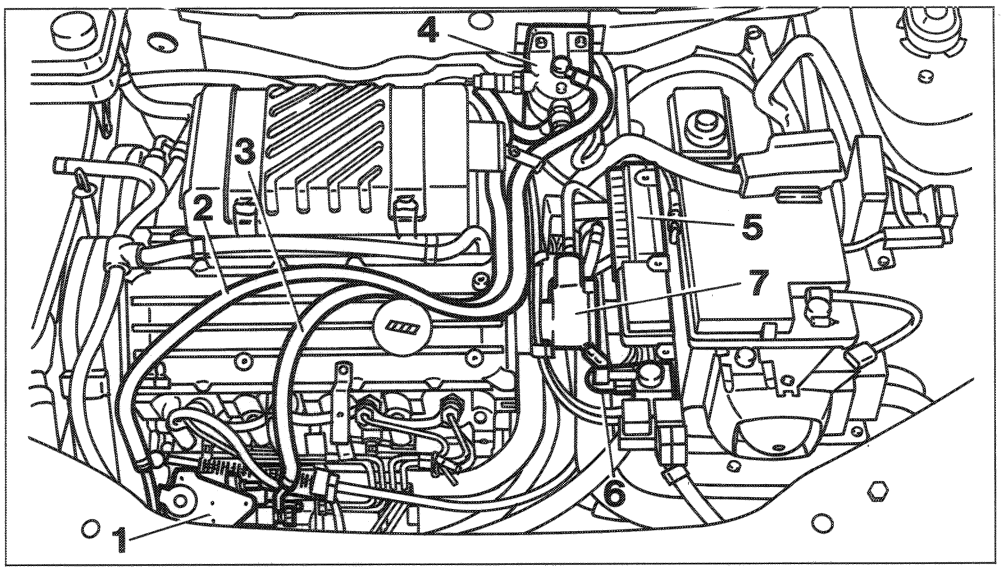
Type of control	Regulator lever position	Rotating speed rpm	Advance check mm	Transfer pressure bar	Output per element mm³/cycle	Max. dev. between strokes mm³/cycle	Turbo pressure bar
Advance	Max	900	0.7-1.7	3.9-4.5	–	–	1
	Max	1500	4.5-5.5	5.2-8.8	–	–	1
	Max	2000	7.9-8.9	7.2-8	–	–	1
Output	Max	700	–	–	32-36	–	0
	Max	1500	–	–	32.5-36.5	⩽3	1
	Max	2200	–	–	36-40	–	1
	Max	2400	–	–	27-33	–	1
	Max	2700	–	–	4.5-12.5	–	1
	Max	2950	–	–	⩽3	–	1
Starting (enrichment)	Max	100	–	–	35-59	–	0
End of enrich-ment	Max	300	–	–	37-57	–	0
	Max	500	–	–	17-37	–	0
Reflux output (●)	Max	750	–	–	15-30 l/h	–	1
	Max	2300	–	–	20-50 l/h	–	1
Min	Min	450	–	–	9-15	⩽3	0
Residual output	Min	400	–	–	20-26	–	0
	Min	550	–	–	⩽3	–	0
Arrest (●●)	Max	450	–	–	⩽3	–	0

cont. ☞

Type of control	Regulator lever position	Rotation speed rpm	Advance check mm	Transfer pressure bar	Output per element mm^3/cycle	Max dev. between strokes mm^3/cycle	Turbo pressure bar
Automatic- coldadvance (KSB) (■)	Max	450	1.3-2.3	–	–	–	0
Setting 3rd arrest (▲)	Partial	1000	–	–	9.5 ± 2	–	0

Fixed installation advance = 1° ± 1°
Electric arrest: minimum operating voltage 8 V. Operating voltage 11 - 13 V
Maximum free running engine speed: 5250 ± 50 rpm.
Engine idle speed: 880-920 rpm.
(●) Fuel return from pump to tank.
(●●) Carry out with electric arrest de-activated
(■) Remove KSB thermostatic bulb and fit tool
(▲) Supply the potentiometer at a voltage of 3.70 Vdc; interpose a 12 mm shim between the accelerator lever and the 3rd arrest screw. Check that potentiometer output voltage is 1.00±0.1 Vcc and adjust the screw if necessary.

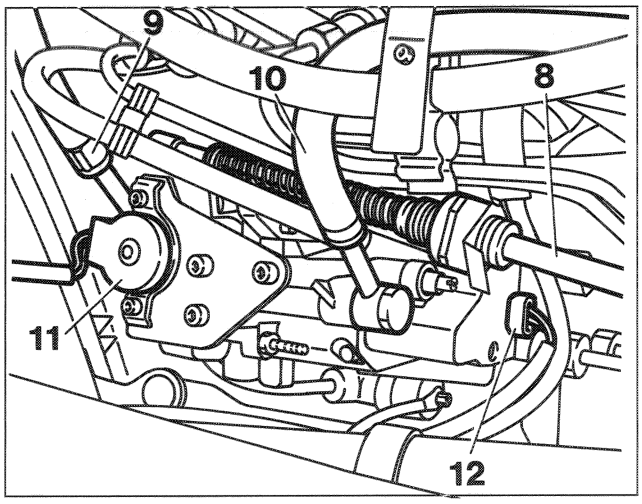
For the advance check, ensure that the KSB device thermostatic bulb is supplied with 12V for at least 2 minutes before the test.



P3M14MA01

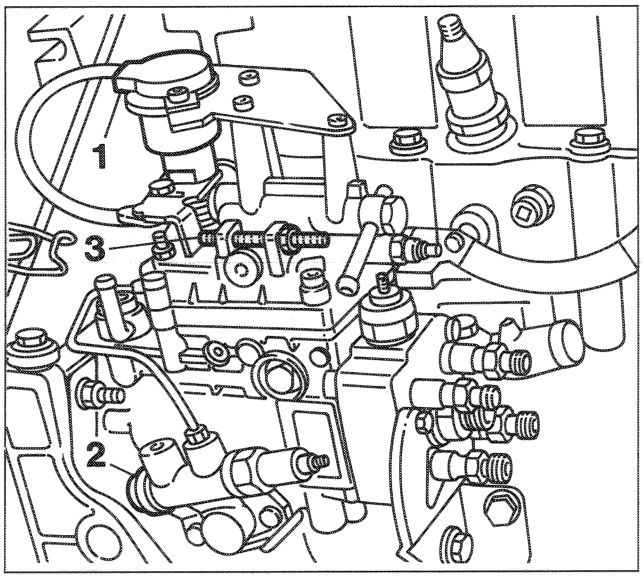
LOCATION OF MAIN FUEL SYSTEM COMPONENTS IN THE ENGINE BAY

NOTE *The air intake sleeve has been removed for greater clarity.*



P3M14MA02

1. Injection pump
2. Fuel delivery pump
3. Fuel return line
4. Fuel filter
5. EGR control unit
6. EGR valve
7. Vacuum pump
8. Accelerator cable
9. Fuel inlet fitting
10. Fuel outlet fitting
11. EGR control potentiometer
12. Coded antitheft device control connector



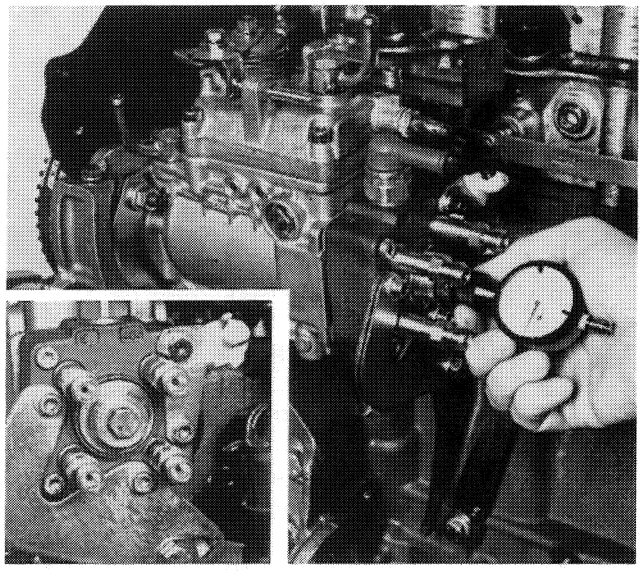
P3M14MA03

INJECTION PUMP

Manufacturer: BOSCH
Type : VE R 691

1. EGR control potentiometer
2. KSB device
3. Idle speed adjustment screw

The rotary injection pump is located on the front end of the engine and turned by the toothed timing belt.
Compared to the previous version, the pump lacks an LDA device to adjust fuel flow to turbo boost pressure.
This version is equipped with a fast idle device TLA, which automatically adjusts both idle speed when the engine is cold and KSB device speed.
The pump is also equipped with a coded antitheft device, which acts on the engine arrest solenoid to enable opening only once the integral microprocessor has successfully recognised a signal from the ignition.



P3M15MA01

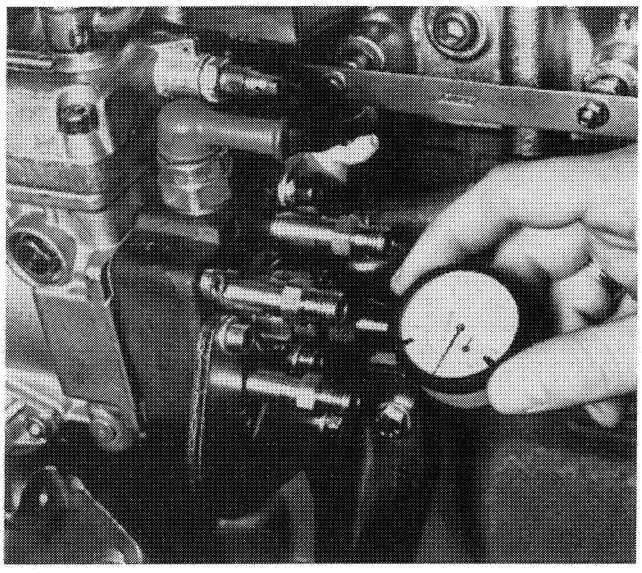
P3M15MA02

CHECKING IGNITION ADVANCE

Disconnect the fuel delivery lines leading from the injection pump to the injectors.

Install fitting 1865090000 with dial gauge to the injection pump.

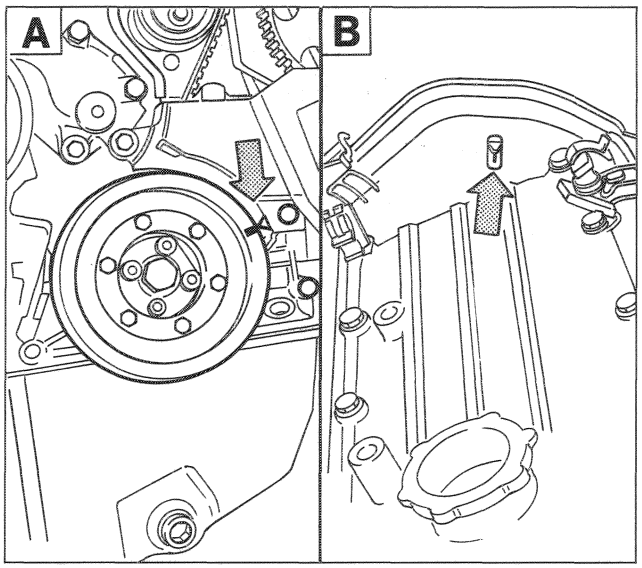
Remove the cap covering the lock ring (arrowed) and tighten tool 1865090000 together with dial gauge, into the threaded seat. Place the probe in contact with the distributor piston crown.



P3M15MA03

Zeroing the dial gauge

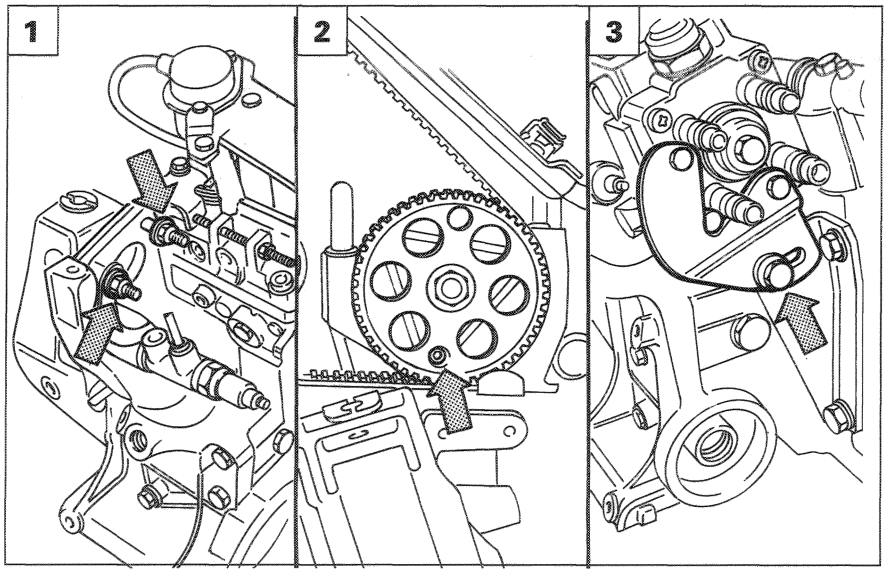
Turn the engine against its direction of rotation until the gauge shows that the pump distributor piston is set to B.D.C.
Now set the gauge to zero.



P3M16MA01

Checking pump advance

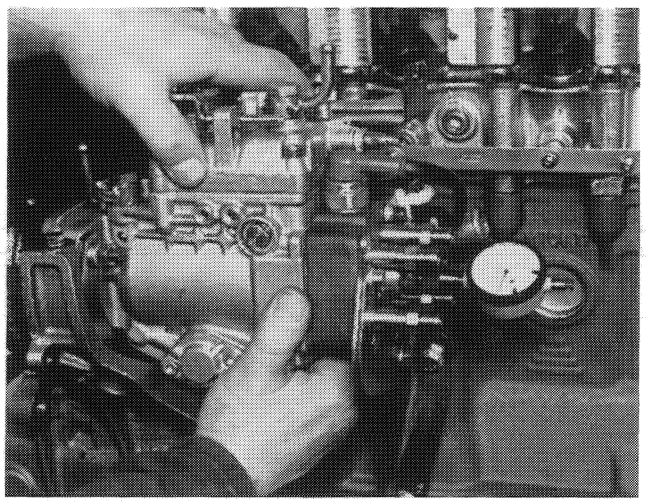
Turn the crankshaft in its direction of rotation until piston no. 1 is set to T.D.C. To do this, check the reference marks on the crankshaft pulley (A) and the camshaft pulley (B).
In this situation, the pump distributor piston should have moved through a travel of **0.94 ± 0.05 mm**.



P3M16MA02

Adjusting pump advance

If the value is not as specified, proceed as follows:
- loosen both pump retaining bolts from the pump mount side (1);
- loosen the third pump retaining bolt from the timing side (2);
- loosen the bolt retaining the pump to the rear mount (3);



P3M16MA03

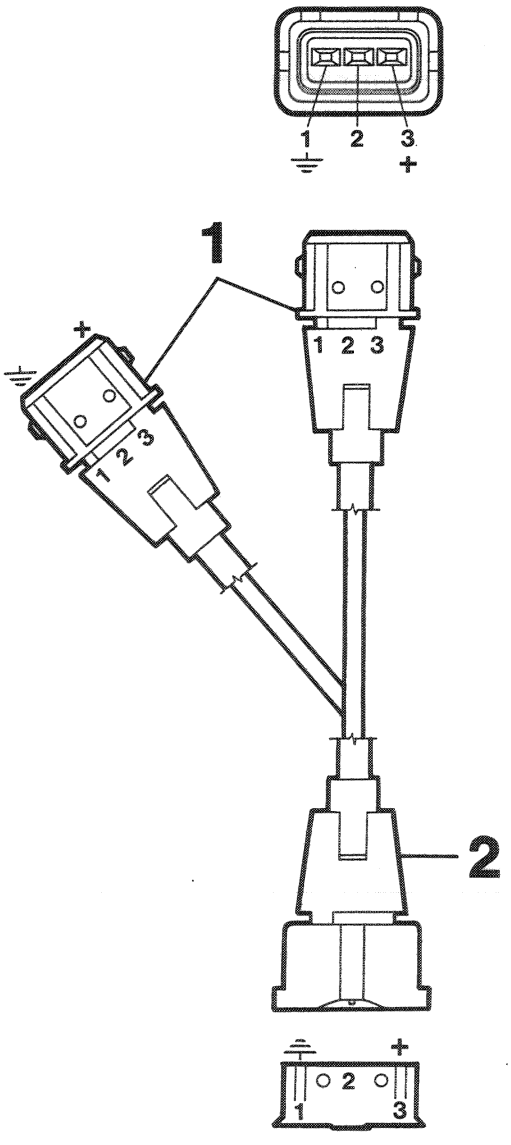
- Now turn the pump case in its slot until the dial guage shows the required reading. Then tighten the bolts retaining the pump to the mount and the rear bracket.

E.G.R. EMISSION CONTROL SYSTEM FAULT DIAGNOSIS AND CHECKS.

Full electronic testing of the EGR device can be carried out using a Fiat/Lancia Tester fitted with memory module M11-B and adaptor ADT 101A. If a tester is not available, a digital voltmeter and dial gauge can be used to check and adjust the potentiometer responsible for modulating the E.C.U. input signal for E.G.R. control. The procedure is given below.

Foreword

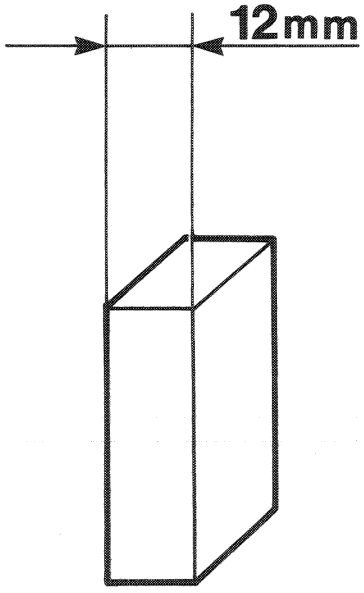
The following operations should be carried out on the car after constructing a braid (if one is not already available) to fit between the ECU-potentiometer connection lead to measure parallel voltage at the potentiometer terminals, and a feeler gauge to measure the 12 mm gap to be interposed between the tab on the speed adjustment lever and the arrest screw (see details overleaf).
Construction specifications for the two parts are given below.



P3M17MA01

Connection braid

1. Bosch minitimer connector
   N° 1254487003
   Cap N° 1280703022
   Contacts N° 1280703022
2. Bosch minitimer connector
   N° 1284485112
   Cap N° 1280703022
   Contacts N° 1/23341/44

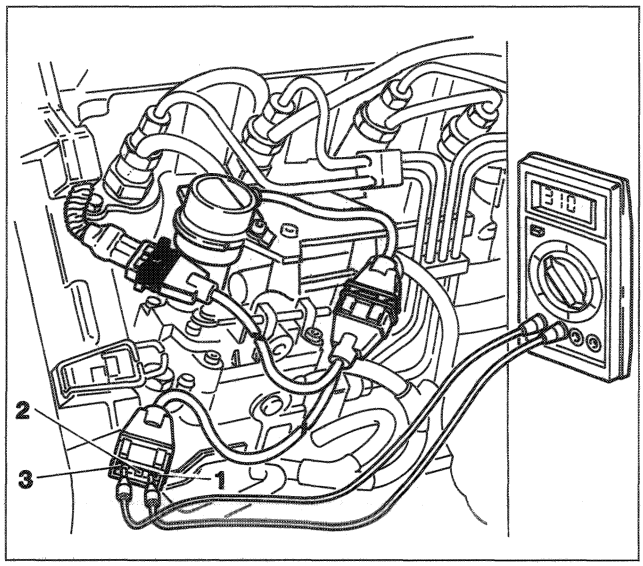


P3M17MA02

Feeler gauge

Checking and adjusting potentiometer position on injection pump

The following operations should be carried out on the car, after checking that idle speed is correct (900 ± 20 rpm). Also check that battery voltage is about 12.50 V (with the engine off).



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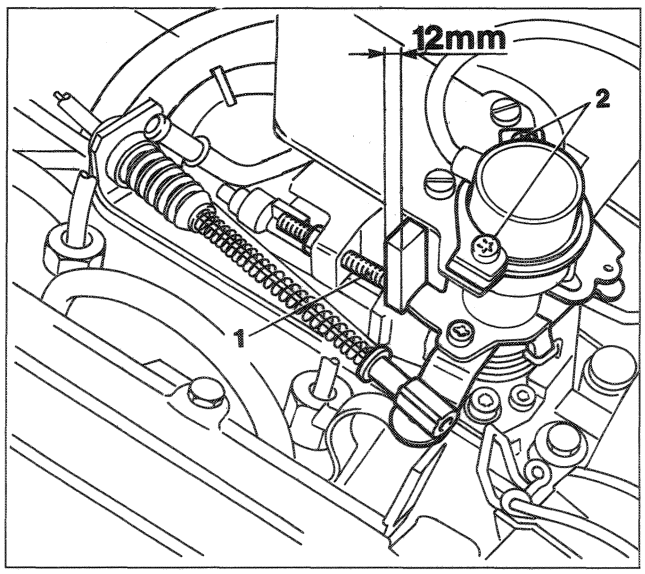


P3M18MA02

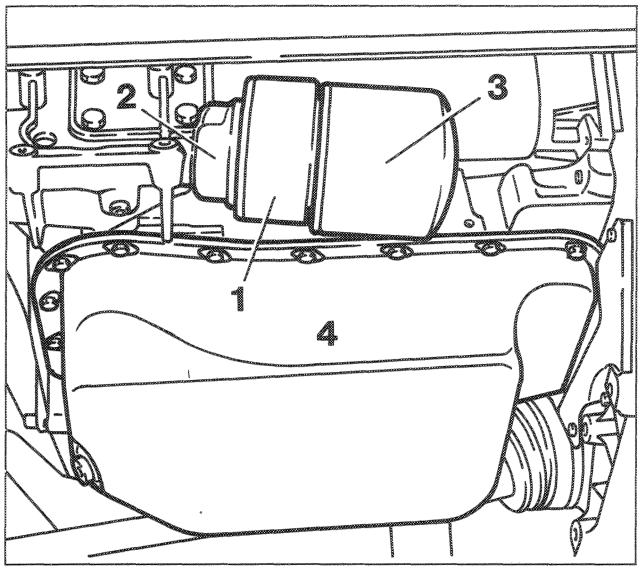
1. Fit braid for recording parallel voltage between the connectors of the lead connecting the ECU to the potentiometer.
2. Activate the control unit by turning on the panel. Then use a digital voltmeter (with centesimal gauge) to measure supply voltage by connecting to the + of terminal 3 and the - (earth) of terminal 1. Reading should be 3.70 ± 0.2 V.

If reading is not as specified, check for any false contacts, wiring breaks and short-circuits and eliminate.
Replace the ECU if the voltage is still incorrect.

3. Interpose a 12 mm feeler gauge between the tab on the speed adjustment lever and the arrest screw (1).
   Then measure the modulated output voltage from the potentiometer by connecting the voltmeter to the + of terminal 2 and the - (earth) of terminal 1. The reading should be 1.00 ± 0.1 V.

Adjust potentiomer position if the voltage reading is not as specified:
- loosen both screws (2) retaining the potentiometer to the bracket;
- turn potentiometer through an angle in one direction or another until the correct output voltage reading is obtained (1.00 ± 0.1 V);
- tighten both potentiometer retaining bolts.
- after tightening, recheck the modulated potentiometer output voltage.

- After checking/positioning the potentiometer, remove the 12 mm feeler gauge and leave the speed adjustment lever to move into contact with the idle speed arrest screw.
  Under these conditions, check that modulated potentiometer output voltage is 0.2 ± 0.1 V.
- If the test result is positive, carry out a further check by turning the speed adjustment lever slowly from MINIMUM to MAXIMUM and checking that the output voltage reading on the voltmeter ranges from 0.2 ± 0.1 V (MIN position) to 2.90 ± 0.2 V (MAX position).



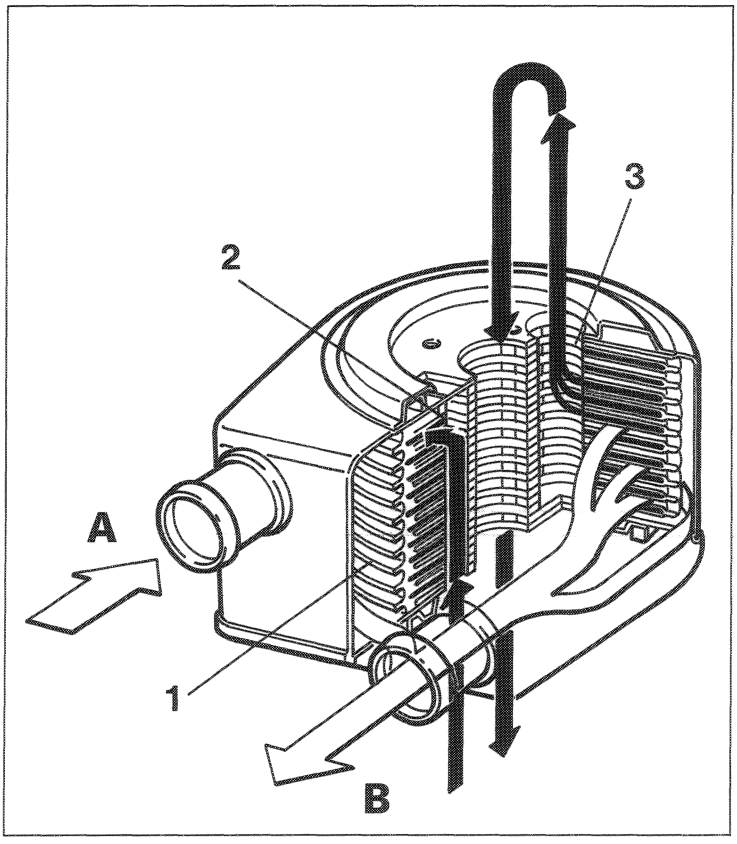
P3M19MA01

OIL-COOLANT HEAT EXCHANGER

Non air conditioned versions are equipped with an oil-coolant heat exchanger instead of the previous oil radiator.

1. Heat exchanger
2. Oil filter mounting plate
3. Oil filter
4. Oil sump

The MODINE heat exchanger reduces engine lubricating oil temperature by transferring some of the heat carried by the oil to the engine coolant.
Warm oil from the engine enters the heat exchanger and flows in parallel through interconnected plates before emerging from the heat exchanger to flow through the filter.
After filtering, the oil returns to the engine through a fitting in the centre of the heat exchanger. Coolant enters the cooling jacket, flows around the oil filled plates to extract the heat and returns to the engine cooling system.
Under extreme operating conditions, such as cold starts, excessive oil flows and pressure drops, a pressure limiting valve (1) located in the heat exchanger allows the oil to flow around the cooling plates in order to continue supplying engine oil without a break.



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1. Stainless steel cooling plates with built-in oil ports
2. Oil radiator inlet control valve; receives warm oil from engine and distributes it to cooling plates
3. Oil radiator outlet control valve; receives cooled oil from cooling plates and directs it to filter

A. Coolant intake
B. Coolant outlet

Coolant circuit

Lubricating oil circuit