505 TURBO INJECTION

N9 TE

AUTOMOBILES PEUGEOT

direction après-vente

505

TURBO INJECTION

N9TE

TECHNICAL DESCRIPTION

AUTOMOBILES PEUGEOT

direction après-vente

CONTENTS


TURBO

INTRODUCTION

The 505 Turbo Injection, a top-of-the range saloon capable of 205km/h (127 mph), is fitted with a new engine which develops 160ch (158 BHP) DIN at 5 200 rpm.

Engine equipment is characterised by:

- supercharging by turbocharger,
- electronic fuel injection,
- electronic ignition developed to detect knocking.

Externally, the 505 Turbo Injection differs from other versions in having an air dam incorporated in the front bumper, a rear spoiler on the boot, a skirt incorporated in the rear bumper, two internally-adjustable external rear view mirrors and a rear monogram: Turbo Injection.

The headlamps are"Kangaroo H4 + H1".

Paintwork is two-tone:

- upper part: light grey or light blue,
- lower part: dark grey.

The light alloy wheels are fitted with PIRELLI P6 195x60 HR 15 tyres.

Inside, the seats are trimmed in velour (with leather as an option) and are fitted head restraints at the rear; the driver's is adjustable for height.

A speech synthesizer, fitted as standard, informs the driver of various parameters as an aid to driving.

A trip computer, fitted as standard, gives the driver full information on distance or time as well as full as fuel consumption.

A cruise control, available as an option, allows a pre-progammed speed to be maintained.

EQUIPMENT LEVEL AND OPTIONS

I - Principal items of standard equipment

- Manual 5-speed gearbox
- Final drive with limited slip differential
- Power steering
- Laminated windscreen
- Tinted glass
- "Kangaroo H4 + H1 "headlamps"
- Headlamp elevation controllable from inside the car
- Rear fog lamps
- Heated rear window
- Electrically operated front and rear windows
- Centralised door and fuel filler flap locking
- Inertia seat belts front and rear
- Head restraints front and rear
- Special front seat cushions
- Driver's seat mechanically adjustable for height
- Special steering wheel
- Speech synthesizer + 2 speakers
- Air horn
- 5 light alloy wheels
- Air dam incorporated in front bumper
- Rear spoiler in body colour
- Skirt incorporated in rear bumper
- Side rubbing strips
- Exterior paint:
  - upper part: Silver grey 1399 or Glacier blue 1477,
  - lower part: Winchester grey 1752
- Vinyl roof
- Front and rear seat trim: plain blue velour
- Velour insert in door trim panels
- Radio pre-equipment
- Trip computer
- Air conditioning (overseas territories)

II - Optional equipment

- Dark blue leather upholstery
- Cruise control
- Air conditioning (standard for overseas territories).

GENERAL DATA

Type	551 A96
Serial No. from	1 613 584

GENERAL

Fiscal rating (FRANCE)	10
Number of seats	5
Kerb weight (1) (2)	1 330 kg (2933 lb)
- distribution on front wheels	720 kg (1588 lb)
on rear wheels	610 kg (1345 lb)
Gross vehicle weight (GVW)	1 770 kg (3903 lb)
Maximum permissible load	
- on front wheels	930 kg (2051 lb)
- on rear wheels	990 kg (2183 lb)
Gross train weight (GTW)	2 870 kg (6328 lb)
Maximum trailer weight (without exceeding GTW) (3)	
- unbraked	665 kg (1466 lb)
- braked	1 300 kg (2866 lb)
Recommended nose weight	80 kg (176 lb)
Recommended maximum towing speed	80 km/h (50 mph)
Maximum starting gradient	
- fully loaded	> 30 %
- vehicle and trailer at GTW	16 %
Overall lenght	4,579 m (180.25 in)
Overall width	1,737 m (68.4 in)
Height at kerb weight (1)	1,424 m (56 in)
Height fully loaded	1,363 m (53.7 in)
Wheelbase	2,743 m (108 in)
Front track	1,492 m (58.75 in)
Rear track	1,458 m (57.4 in)
Ground clearance loaded (4)	0,109 m (4.3 in)
Lowest point loaded (4)	Front exhaust pipe

ENGINE

Type	(176B) (N9TE)
Fuel	Petrol (Super, 4 star)
Number of cylinders	4 in line
Installation	longitudinal, inclined 15° to the right
Bore x stroke	91,7 x 81,6 mm
Capacity	2 155 cm³
Compression ratio	8/1
Maximum power (5)	
- fan not running DIN	160 ch (158 BHP) at 5 200 rpm
- fan not running EEC	114 kW at 5 200 rpm
Specific power DIN	74,2 ch (73.2 BHP)/litre
EEC	52,9 kW/litre
Maximum torque (5)	
- fan not running DIN	25 m.kg (180 lbf ft) at 3 000 rpm
- fan not running EEC	254 mdaN (187 lbf ft) at 3 000 rpm
Cylinder head	aluminium alloy
Valves	rocker-operated overhead
Cylinder block	cast iron
Cylinder liners	integral in cylinder block
Pistons	aluminium alloy (3 rings)
Connecting rods	forged steel
Crankshaft	forged steel (5 bearings)
Camshaft drive	by chain with hydraulic tensioner
Camshaft	overhead
Air supply	supercharged by Garrett turbocharger
Fuel supply	Bosch L-Jetronic electronic injection
Fuel supply pump	Bosch electric
Fuel scavenge pump	submerged in fuel tank
Air cleaned	dry
Lubrication	pressure by chain-driven gear pump
Oil filter	Purflex LS 468
Engine oil capacity maximum	5 litres (8.8 pints)
minimum	4 litres (7 pints)
Cooling	by permanent Peugeot liquid in a pressurised system (0,8 bar, 11,6 lbf in²) with centrifugal pump and expansion bottle (yellow cap)
Total capacity of cooling system	9,5 litres (16.75 pints)
Radiator	copper core with plastic tank (pitch 1,5)
Thermostat	starts to open at 83°C $^{+0}_{-3}$ (181°F) $^{+0}_{-5}$
	opens fully at 96°C (200°F), stroke 7,5 mm
Temperature-controlled fan	335 mm (13 in) diameter, 6 blades, air gap: 0,25 to 0,35 mm (0,010 to 0,014 in)
hight temperature warning switch	closes at 110°C (230°F)
Fan switch	closes at 88°C (190°F), opens at 79°C (175°F)
Ignition	electronic, developed to detect knocking (ATE)
Spark plugs	BOSCH W7 DTC (gap 1 mm)

CLUTCH

Cover assembly	diaphragm
Type	Verto 235 DBR 525
Plate	dry disc with damper hub
Lining size	165 x 235 mm (6 1/2 x 9 1/4 in)
Plate thickness, compressed	7,7 mm (0,303 in)
Thrust bearing	ball bearing
Operation	hydraulic

MANUAL GEARBOX

Type	BA 10/5
Number of forward speeds	5
Input gear ratio	28 x 37
Gearbox ratios (output shaft revolutions per crankshaft revolution)	
1st	0,2893
2nd	0,4851
3rd	0,7109
4th	1,0000
5th	1,2154
Reverse	0,2863
Gearbox control	lever on floor
Speedometer drive ratio	10 x 19

(1) With oil, coolant and full fuel tank
(2) For a vehicle fitted with a sun roof, add 15 kg (33 lb) to the kerb weight (5 kg (11 lb) front, 10 kg (22 lb) rear)
(3) Values homologated in FRANCE - in other countries comply with local regulations.
(4) Vehicle at GVW.
(5) 1 ch = 735 W, 0,735 kW or 0,986 BHP — 1 m.kg = 9,81 mN, 0,981 mdaN, or 7,235 lbf ft

GENERAL DATA

FINAL DRIVE

Type	HYPOID
	PC7 with limited slip differential
Ratio	10 x 37 (0,2702 or 3,7/1)
Overall gear ratios (number of wheel revolutions to one crankshaft revolution)	
1st	0,0782
2nd	0,1311
3rd	0,1921
4th	0,2703
5th	0,3285
Reverse	0,0774
Theoretical road speeds per 1000 rpm in km/h (mph) - with 195 HR 15 tyres (rolling radius (loaded) 0,29 m (11.7 in)	
1st	8,80 (5,46)
2nd	14,75 (9,16)
3rd	21,61 (13,42)
4th	30,41 (18,88)
5th	36,95 (22,95)
Reverse	8,71 (5,41)

PROPELLER AND DRIVE SHAFTS

Propeller shaft	45 mm diameter in torque tube
Drive shafts	each with two internally-sliding tripod homokinetic joints

FRONT SUSPENSION LINKAGE

Geometry (at kerb weight)	
- toe-in	3 ± 1 mm
- camber	−1° ± 30'
- castor	3°30' ± 30'
- steering axis inclination	9°30' ± 30'

REAR SUSPENSION LINKAGE

Geometry (at kerb weight)	
- toe-in	2,65 ± 2 mm
- camber	−1° ± 30'

STEERING

Type	power-assisted rack and pinion with universally-jointed column
Linkage to wheels	levers and tie rods
Ratio	15,5 : 1
Pinion	10 teeth
Rack	34 teeth
Number of turns lock-to-lock	3
Turning circles:	
- theoretical (at tyre centre)	10,625 m (34,86 ft)
- between kerbs (at outside of tyre)	10,70 m (35,11 ft)
- between walls (overall)	11,30 m (37,08 ft)

BRAKES

Front brakes	ventilated discs
Calipers	TEVES SR 54 sliding
Disc diameter	273 mm (10 3/4 in)
Disc thickness	20 mm (0,787 in)
Pad material	Textar T 297
Effective friction area (per wheel)	92,8 cm² (14,38 in²)
Rear brakes	
Type	floating caliper; parking brake incorporated
Calipers	GIRLING M 12
Disc diameter	273 mm (10 3/4 in)
Braking surface width	45,5 mm (1,79 in)
Pad material	FERODO 2430
Effective friction area (per wheel)	54 cm² (8,37 in²)
Disc thickness	12 mm (0,472 in)
Hydraulic system	split circuit
Assistance	DBA - TEVES vacuum servo
Front-to-rear distribution	load sensitive
Master cylinder	DBA - TEVES - GIRLING tandem
Front wheel cylinder diameter	54 mm (2.126 in)
Rear wheel cylinder diameter	43 (1,693 in)
Fluid reservoir	double with low level indicator
Hand brake	cable controlled on rear wheels with automatic adjustment

SUSPENSION SPRINGS

Front	
- spring rate	66,3 mm/100 daN (86,2 lbf in)
- wheel rate	56 mm/100 daN (102 lbf/in)
- anti-roll bar diameter	27 mm (1,063 in)
Rear	
- spring rate	22,5 mm/100 daN (254 lbf/in)
- wheel rate	46 mm/100 daN (124 lbf/in)
- anti-roll bar diameter	18 mm (0,709 in)
Dampers, front and rear	Peugeot, double-acting telescopic hydraulic

WHEELS AND TYRES

Wheels	6 J 15 FHH25
Number of holes	4 x 15 mm diameter
Offset	25 mm (1 in)
Pressures	Pirelli P6195/60 HR 15 tubeless bar or kg/cm² lbf/in²
front	2 29
rear	2,1 30,5

EXHAUST SYSTEM

stainless steel

ELECTRICAL EQUIPMENT

Battery	12 V – 225 A – 45 AH
Generator	3 phase alternator with integral regulator LTS
- type	Paris-Rhône A14 N59, 1 200 W, 85 A
Starter motor	Paris-Rhône D9E 45

GENERAL DATA

CONSUMPTION AND PERFORMANCE

Fuel consumption per 100 km (mpg)	
Official figures:	
- constant 90 km/h (56 mph)	7,7 (36,7)
- constant 120 km/h (75 mph)	9,8 (28,8)
- urban cycle	12,5 (22,6)
Maximum speed	205 km/h (127 mph)
Acceleration	
- 400 m standing start	16,2s
- 1000 m standing start	29,6s
- 0 to 100 km/h (62 mph)	8,6s

LUBRICATION AND MAINTENANCE

Engine

Oil grade	SUPER SHELL 200 10W40 or SHELL KARINA or ESSO UNIFLO + 10 W 40
Capacity	5 litres (8,8 pints) (including filter)
Minimum level	4 litres (7 pints)
Oil filter	Purflex LS 468 (change every 7 500 km (5000 miles)
Drain and refill	every 7 500 km (5000 miles)
Check level	every 1 000 km (500 miles)

Manual gearbox

Oil grade	ESSO UNIFLO 10 W 40 or SHELL SUPER 200 10 W 40
Capacity	1,6 litres (2,8 pints)
Drain and refill	every 30 000 km (20 000 miles)
Check level	every 7 500 km (5 000 miles)

Final drive

Oil grade	ESSO GEAR OIL LSA 90 or SHELL GEAR GL 90
Capacity	1,55 litres (2,7 pints)
Drain and refill	every 30 000 km (20 000 miles)
Check level	every 7 500 km (5 000 miles)

Power steering pump

Oil grade	ESSO ATF DEXRON II D 21065 SHELL ATF DEXRON II D 20137
Capacity	0,65 litre (1,14 pints)
Check level	every 15 000 km (10 000 miles)

Mechanical units

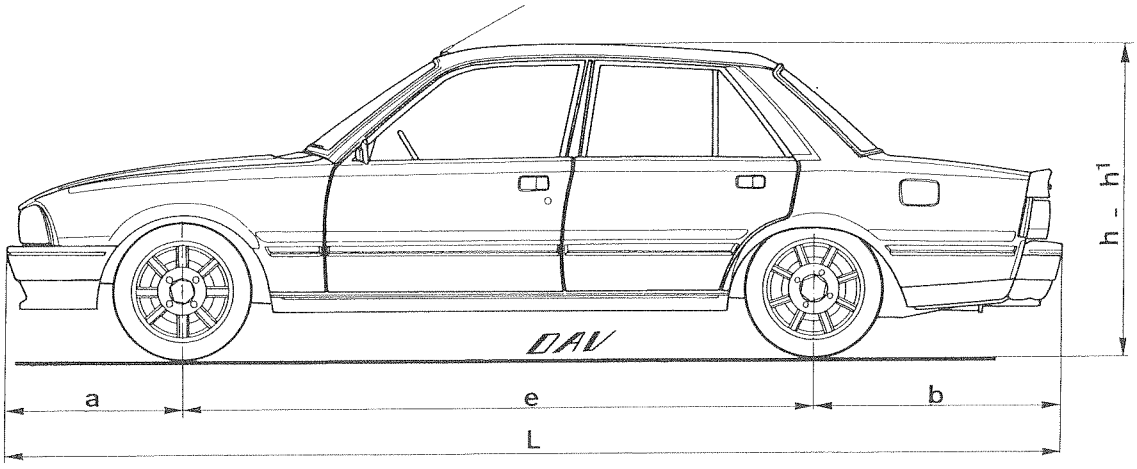
Lubrication	every 7 500 km (5 000 miles)

Fuel tank

Capacity	70 litres (15 1/2 gallons)

EXTERNAL DIMENSIONS

Reference	Description	Dimension metres	Dimension inches
L	Overall length	4,579	181
e	Wheelbase	2,743	108
a	Front overhang	0,773	30,4
b	Rear overhang	1,063	41,85
v	Front track	1,492	58,75
v1	Rear track	1,458	57,4
h	Height at kerb weight	1,424	56,06
h1	Height loaded	1,363	53,66
l	Overall width:		
	- with side rubbing strip	1,737	68,38
	- without side rubbing strip	1,726	67,95
c	Ground clearance loaded	0,109	4,29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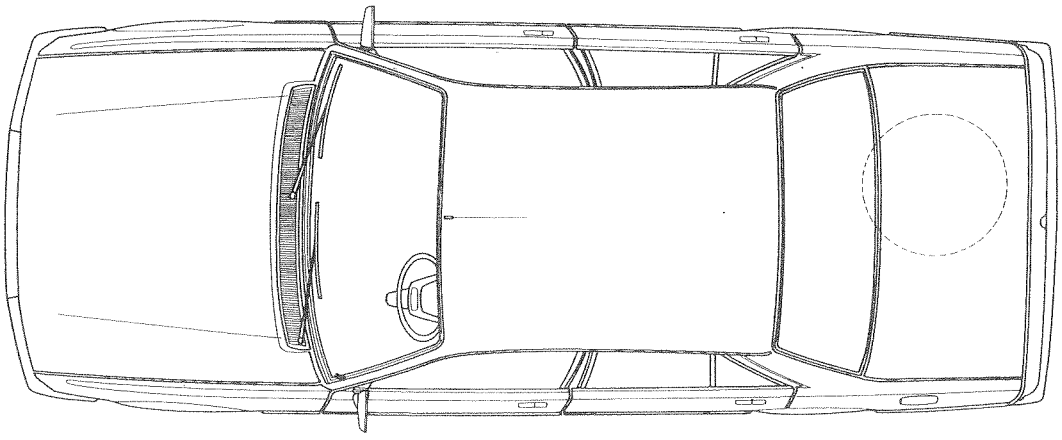

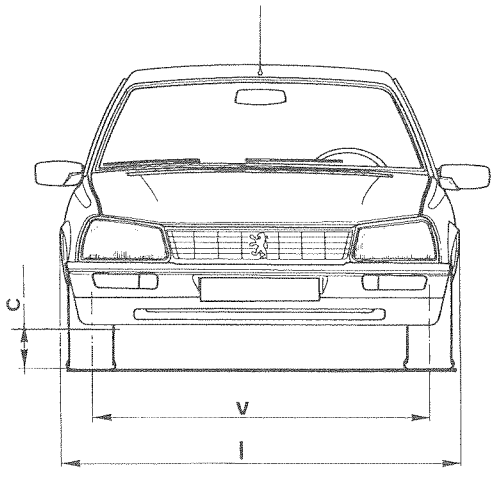
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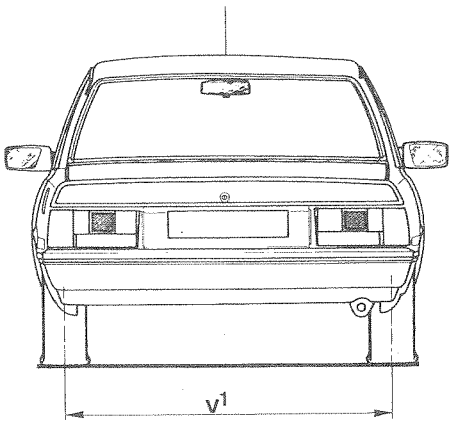
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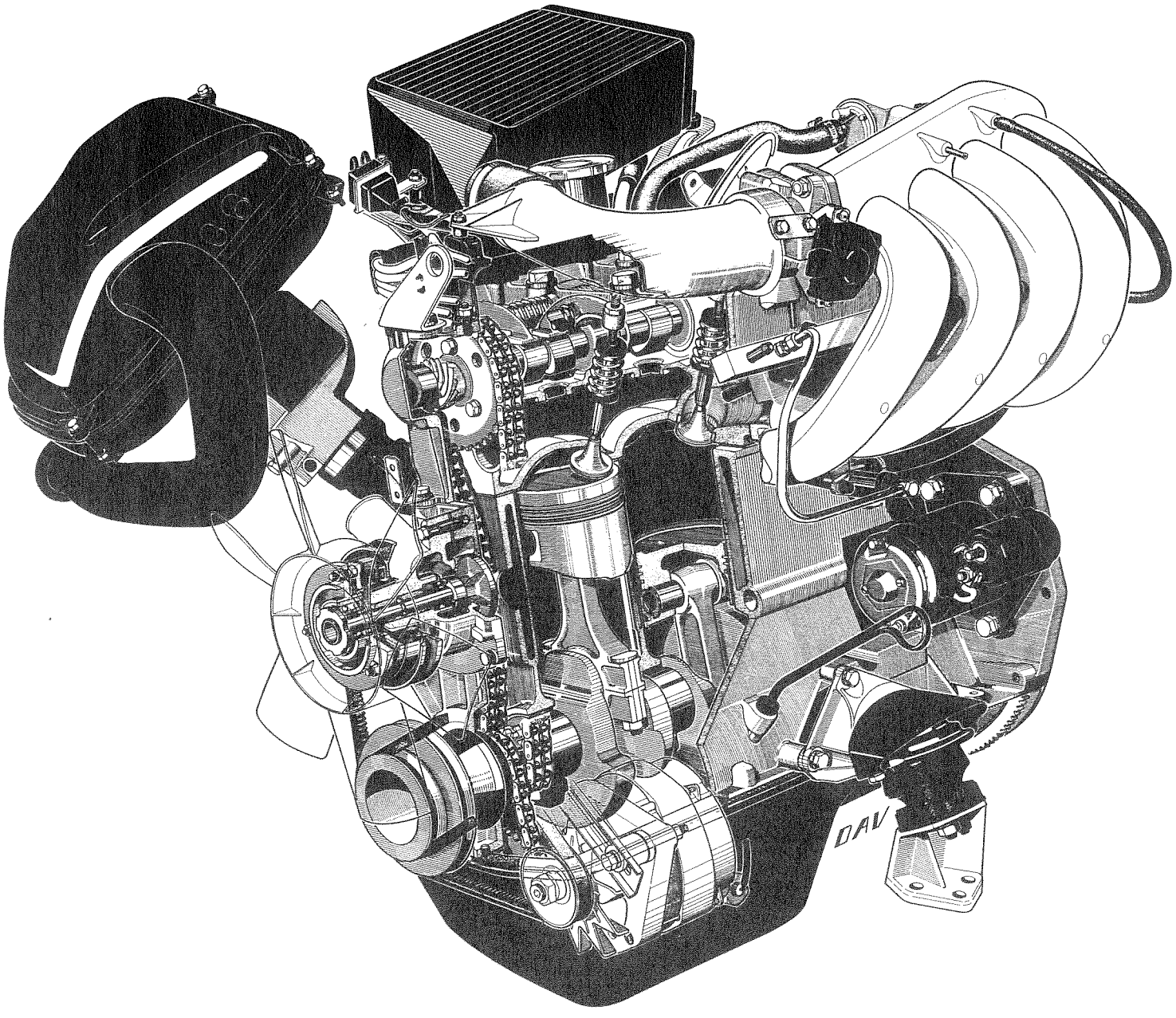
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MECHANICAL

505 TURBO INJECTION ENGINE

The 176 B (N9TE) engine of the 505 TURBO INJECTION is a four cylinder in line of 2155 cm^3.

The basic engine, already fitted to certain vehicles in our range, has unique specification and equipment.

It is supercharged by turbocharger with an air-to-air intercooler.

Fuel supply is by electronic injection.

Ignition is electronic, developed to detect knocks.

CYLINDER HEAD

- Aluminium alloy with bispherical combustion chambers.

- Overhead camshaft operating the valves through rockers.

- Brass valve guides with oil seals.
- The exhaust valves have a cavity 60% filled with sodium. As the melting point of sodium is 98°C (208°F), it is in a liquid state when the engine is running.

- The valve head is cooled partly by the good thermal conductivity of the sodium, and more by the considerable agitation of the sodium caused by valve movement.

- CURTY head gasket with a silicone bead and stainless steel crimping.

CYLINDER BLOCK

- Cast iron with bores directly in the block.

- 5 main bearings with cast iron caps fitted with tri-metal shells (steel back, copper lead bearing, tin coating)

PISTONS - RINGS - CONNECTING RODS

- Gudgeon pins are fully floating in rod and piston.

- The aluminium pistons are fitted with 3 rings:
  - 1 domed molybdenum-coated compression ring,
  - 1 tapered oil control ring,
  - 1 scraper ring with spring expander.

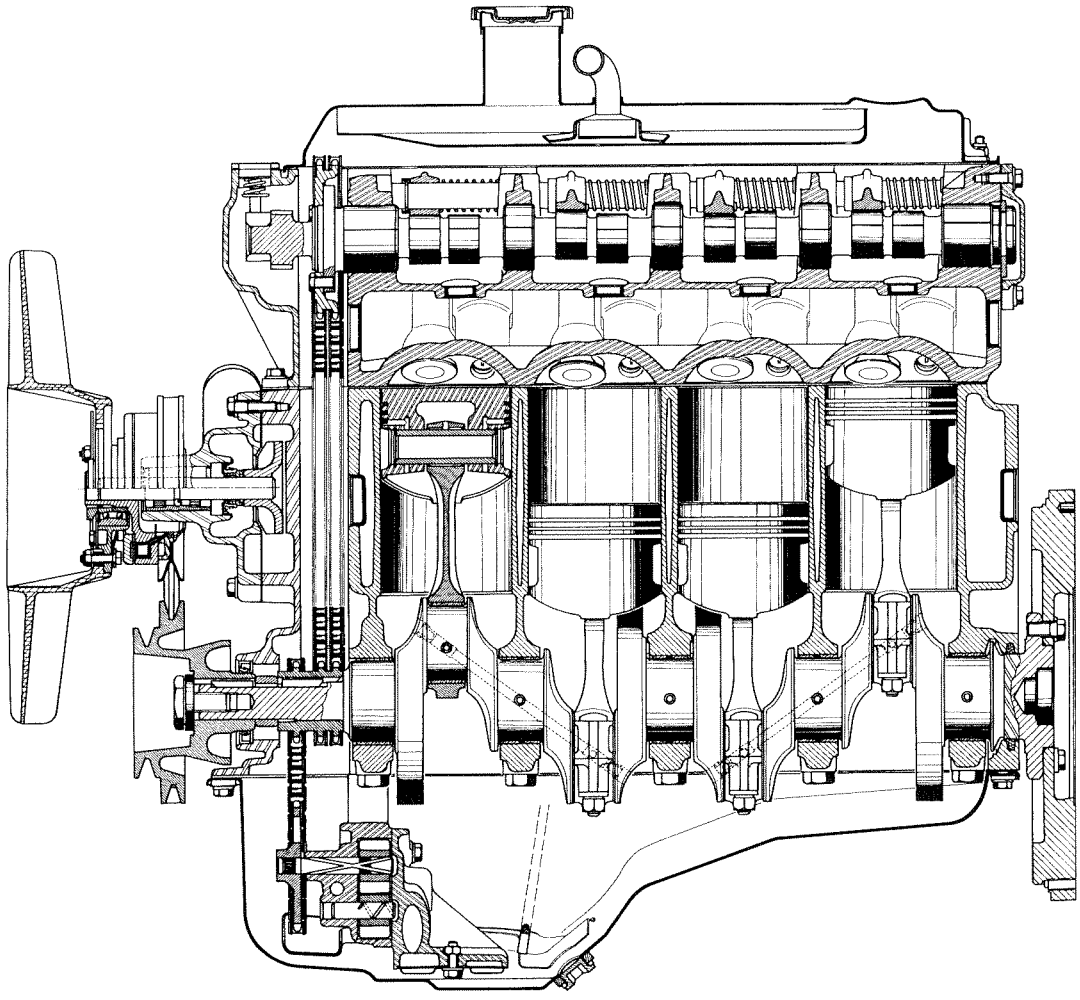
CRANKSHAFT

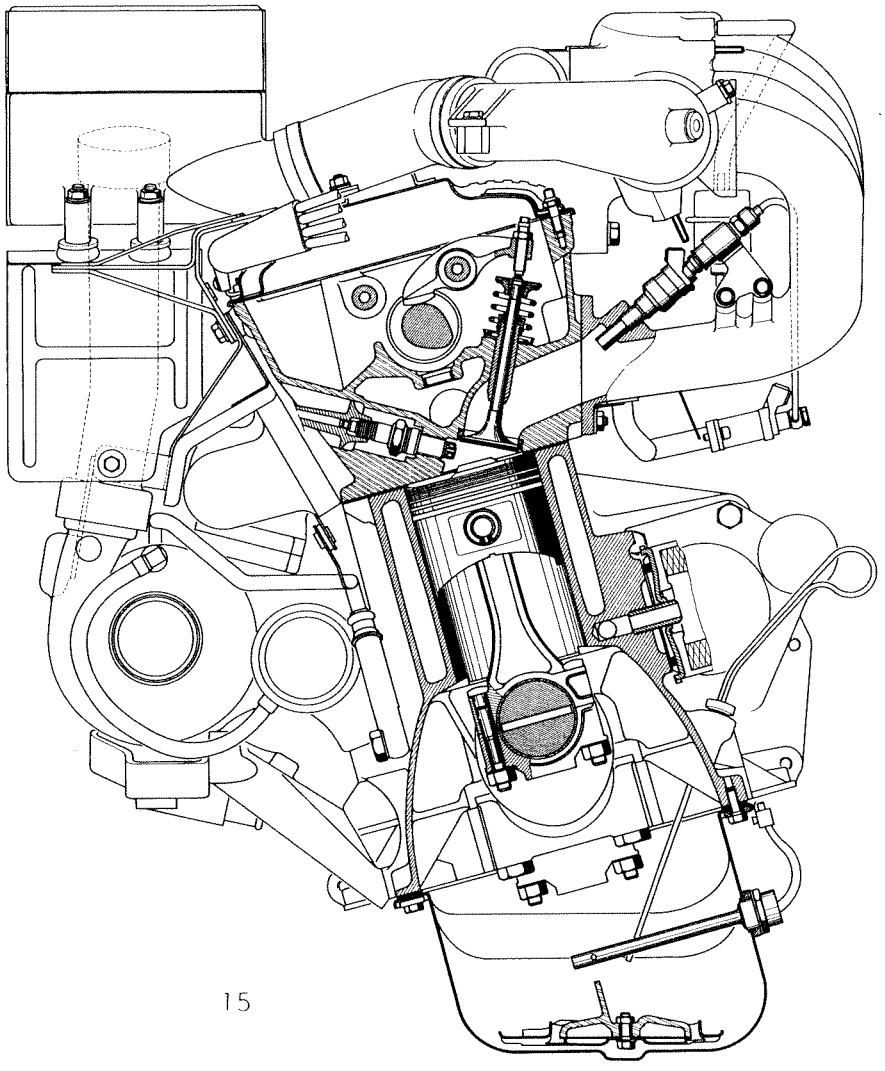
- Forged steel with 5 bearings and integral counter weights.

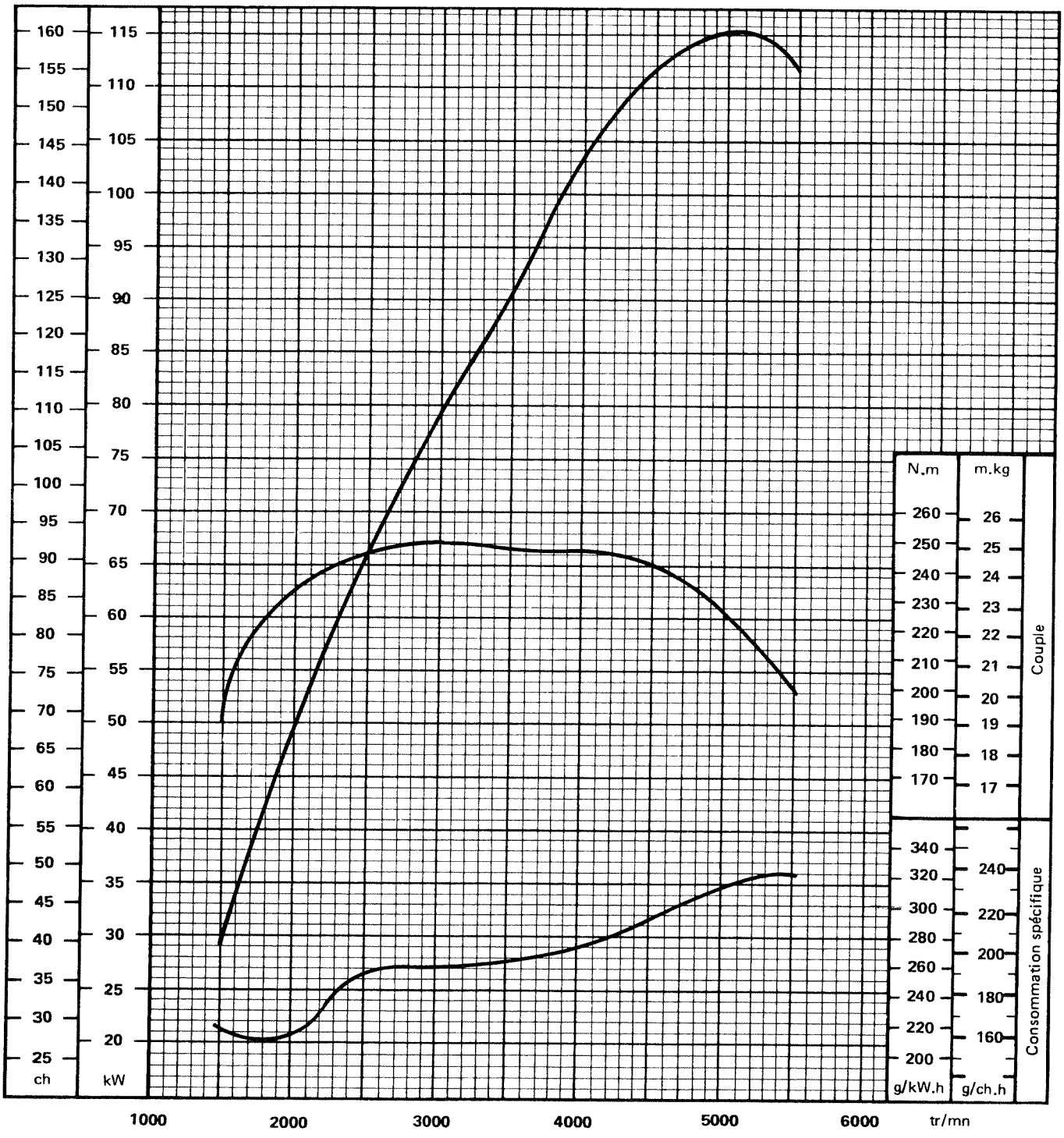
- The journals ans pins are induction hardened and Fullered.

- The forward end is sealed by a lip seal mounted in the timing cover.

- The rear end is sealed by a deflector and a pre-formed braid mounted in the block and in a false bearing cap.



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g/ch.h
Consommation spécifique

POWER, TORQUE AND CONSUMPTION CURVES

TEST BED FIGURES (Fan not running)

Engine rpm		1 500	2 000	2 500	3 000(1)	3 500	4 000	4 500	5 000	5 200(2)	5 500
Power	EEC kW	28,5	49,1	65,2	78,4	89,8	102,6	110,4	113,6	114	111,8
	DIN ch	40	69	91,5	110	126	144	155	159,5	160	157
Torque	EEC mN	195	240	250	254	252	251	247	232	219	203
	DIN m.kg	19,2	23,6	24,6	25	24,8	24,7	24,3	22,8	21,6	20
Consumption	EEC g/kW/h	219	216	258	259	267	271	297	317	324	324
	DIN g/ch/h	161	159	190	191	197	199	219	233	238	238

Note: 1ch = 0.986 bhp. 1mN = 0,738 lbf ft. 1 g/kW/h = 0.00164 lb/bhp/h

(1) Engine rpm at maximum torque

(2) Engine rpm at maximum power

ENGINE EQUIPMENT

Supercharging

Supercharging by GARRETT turbocharger has been adopted to increase torque and power without appreciably increasing the weight or bulk of the engine.

Fuel injection

Fuel supply is provided by BOSCH injection equipment (L-JETRONIC)

This is an electronically-operated intermittent injection system which accurately meters the fuel at all engine speeds.

Ignition

The N9TE engine is fitted with BOSCH electronic ignition developped to detect knocking.

This system improves power output by determining the optimum advance foe all engine speeds.

SUPERCHARGING

INTRODUCTION - PRINCIPLES

The torque and power of an engine depend mainly on the weight of mixture admitted to the cylinders per unit of time.

A compressor fitted in the induction system, by increasing the weight of air admitted in each cycle, increases the power developed without adding appreciably to the weight of the engine.

This compression causes the temperature to rise and the inlet gases to expand. For a given volume and pressure, the weight of the mixture decreases in proportion to the rise in temperature.

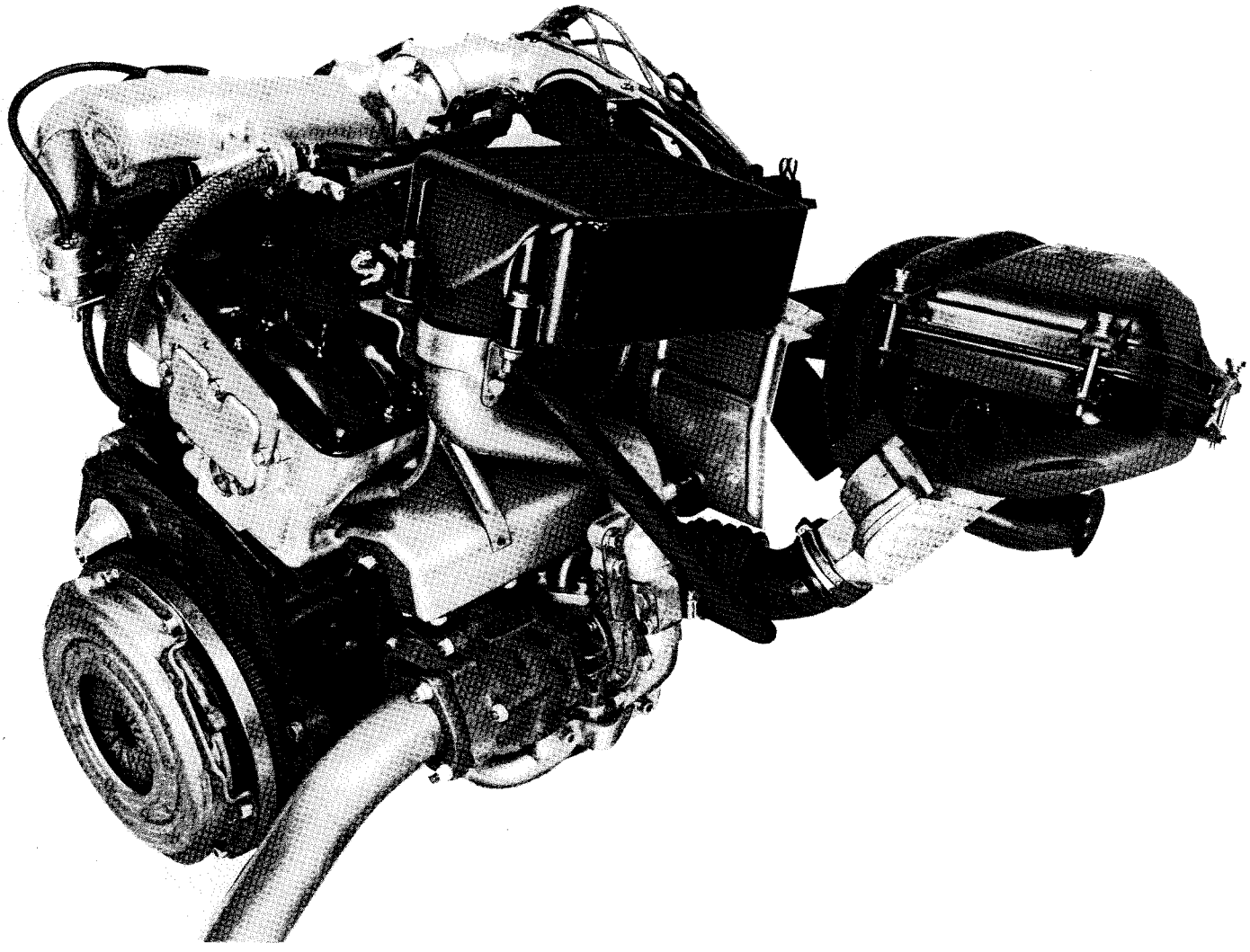
An inlet air cooler increases, for a given volume and pressure, the weight of inlet mixture.

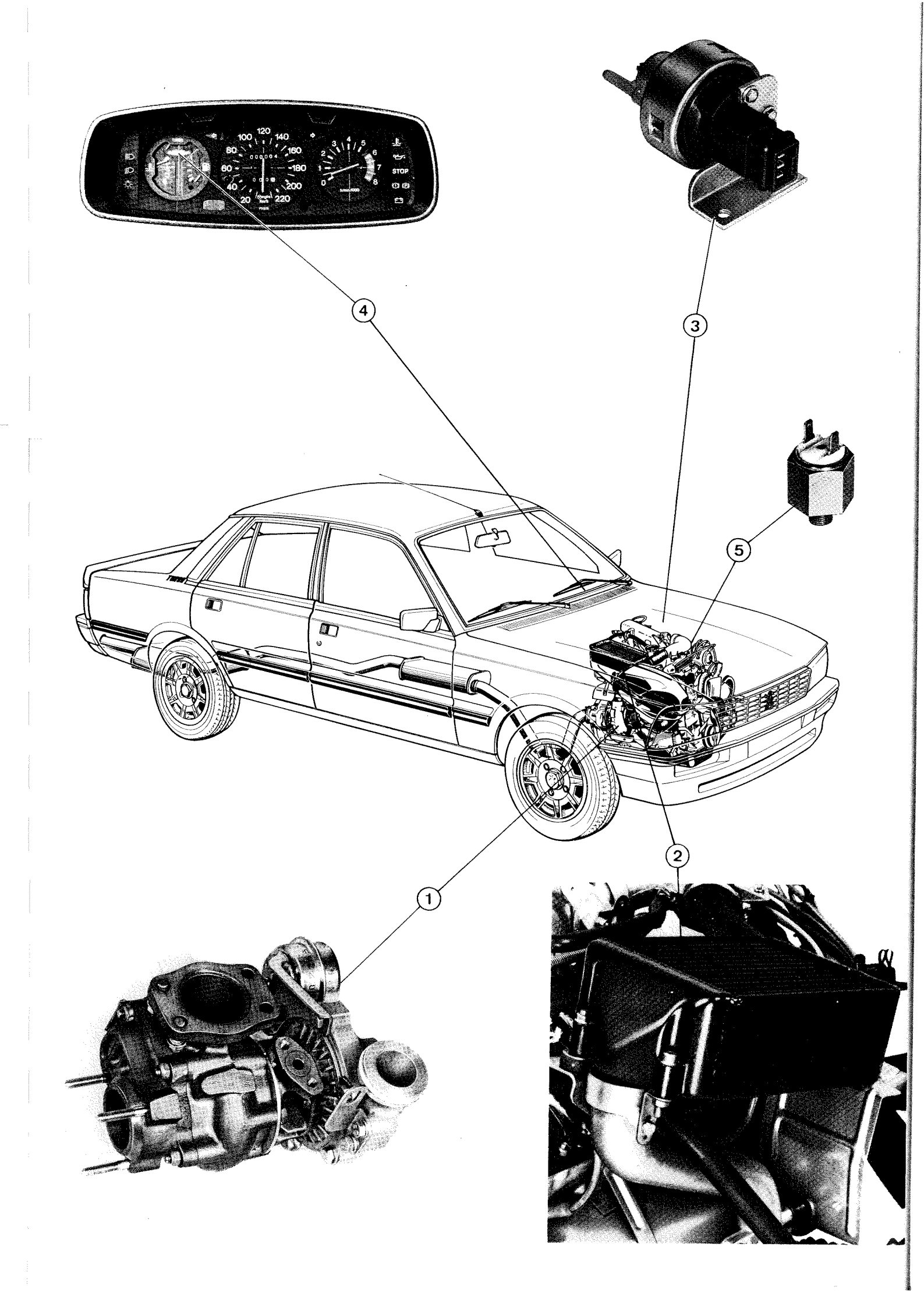
ADVANTAGES OF THE AIR-TO-AIR INTERCOOLER

- A lower inlet air temperature allows the use of a higher compression ratio without knocking.

- Improvement in fuel consumption in town driving (higher compression ratio) and in high speed driving (weaker mixture).

- Increase in engine power output.

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DESCRIPTION

The supercharging system comprises:

- a turbocharger **(1),**
- an air-to-air intercooler **(2),**
- a turbocharger pressure sensor **(3),**
- a turbocharger pressure gauge **(4)** on the instrument panel,
- a high pressure switch **(5).**

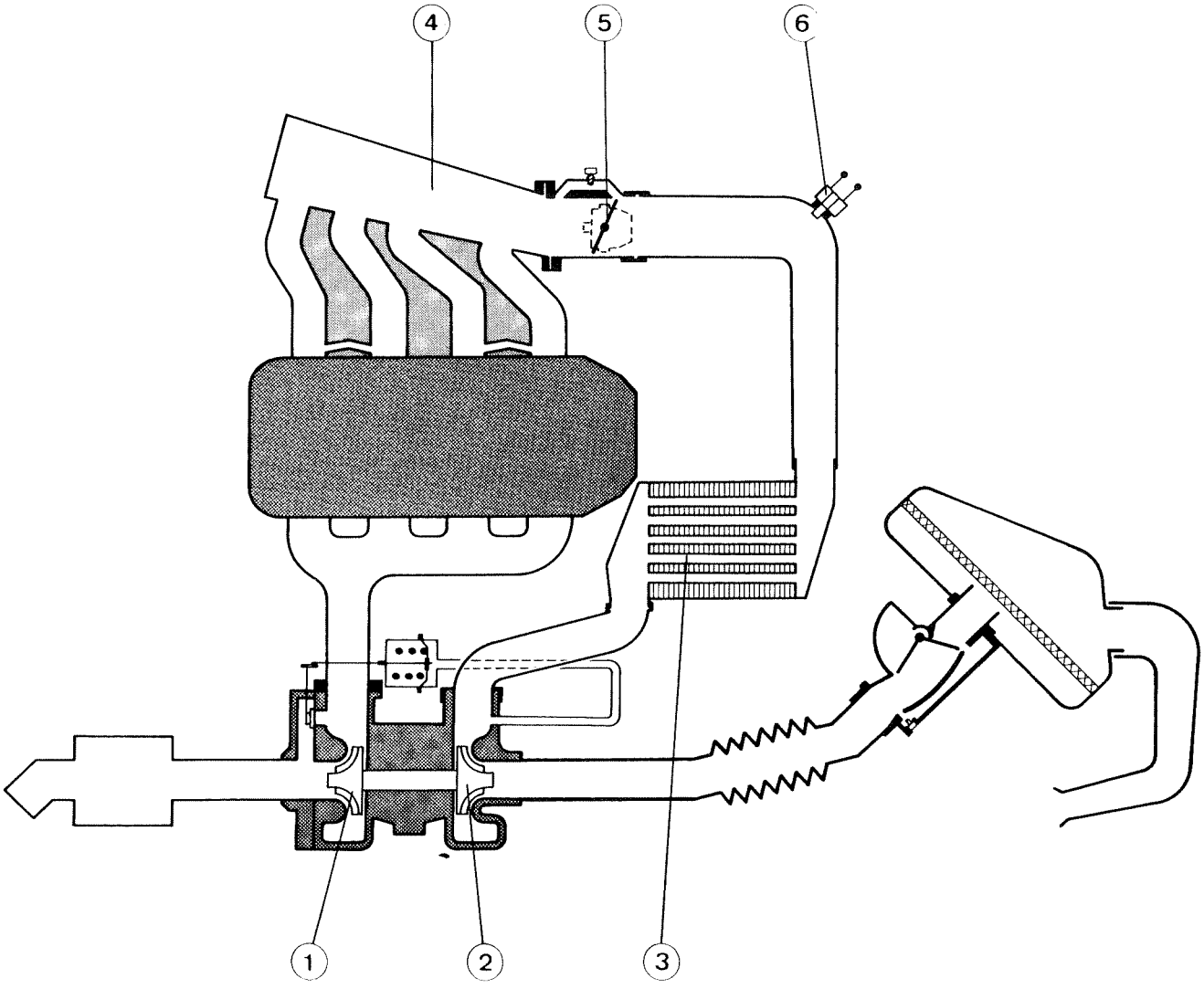
OPERATION

The turbocharger compresses the inlet gases.

The turbine **(1),** driven by the exhaust gas energy, drives the compressor wheel **(2)** which compresses the inlet air.

The inlet air, heated by this compression, passes through the air-to-air intercooler **(3),** then is distributed to the cylinders via the inlet manifold **(4)**, the volume admitted being regulated by the throttle unit **(5)**.

As a safety measure, a high pressure contact switch **(6)**, limits engine speed to 3 000 rpm cutting off injection if the turbocharger pressure exceeds 1 100 mbars (16 lbf in^2).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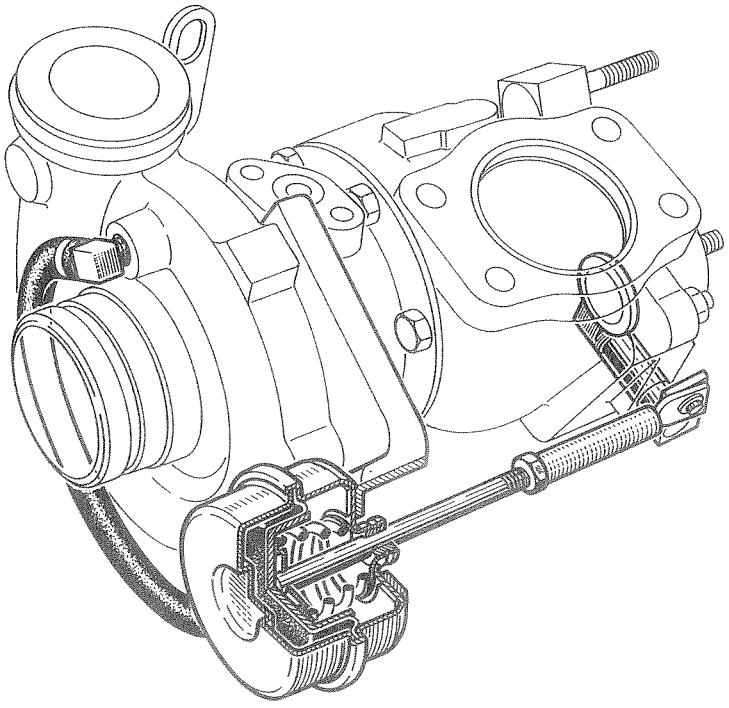

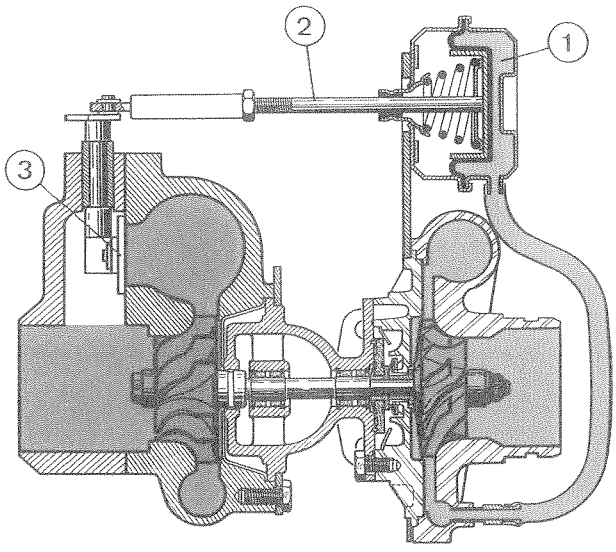
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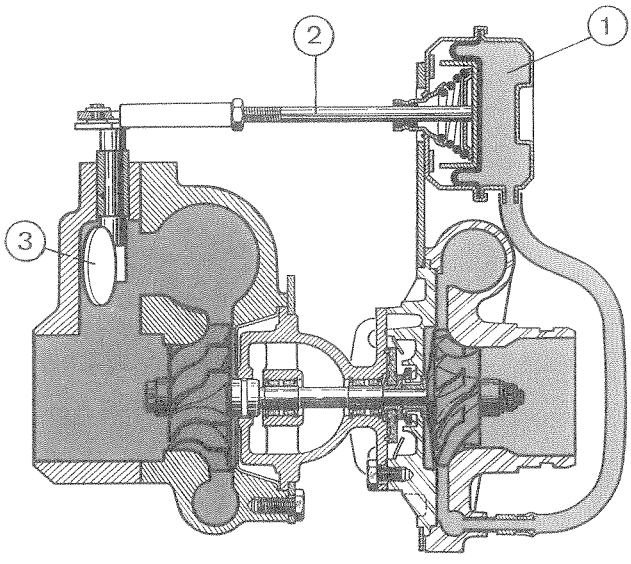
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TURBOCHARGER PRESSURE REGULATING DEVICE

Supercharging of the N9TE engine is designed to produce a high torque: 25 mKg (181 lbf ft) at 3 000 rpm.

In order to regulate the pressure between 520 mbar (7,5 lbf in^2) at maximum torque and 440 mbar (6,4 lbf in^2) at maximum power, the turbocharger is fitted with a pressure regulating device which comprises:

- a pressure-sensitive capsule **(1),**
- a connecting rod **(2),**
- a wastegate **(3).**

When the maximum air inlet presure is reached, the force on the membrane of the pressure-sensitive capsule and the connecting rod cause the wastegate to open, thus allowing the exhaust gases to by-pass the turbine to produce the correct air inlet pressure

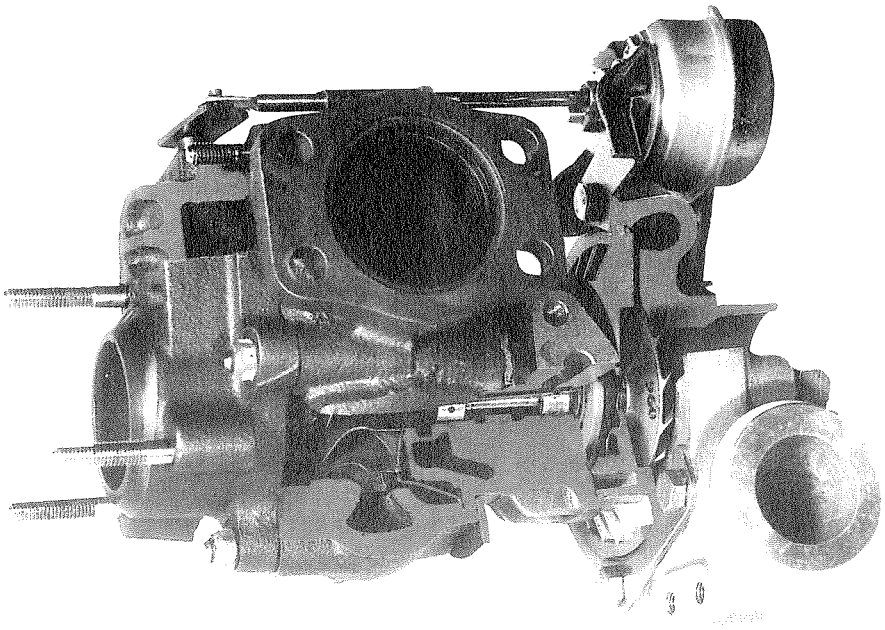
PRECAUTIONS IN USE

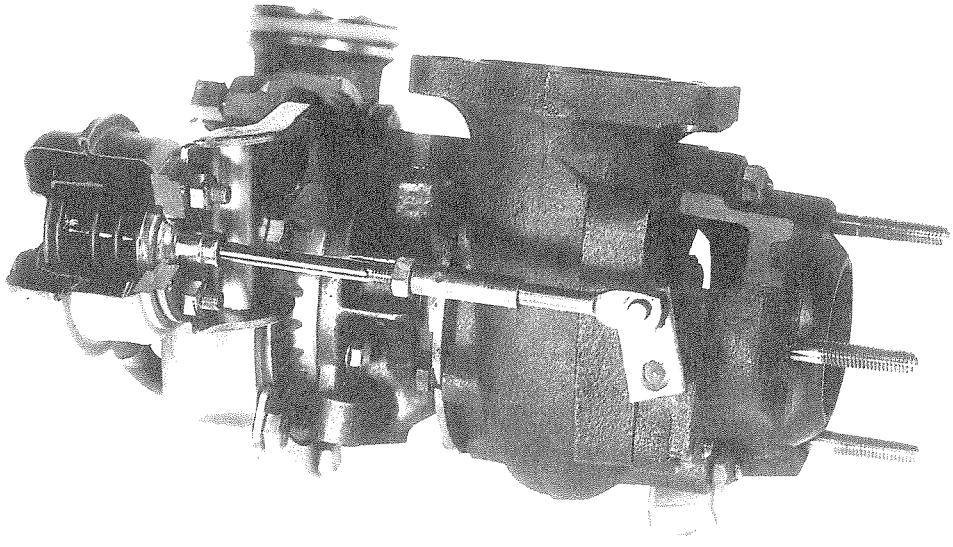
- Never start the engine without the air cleaner fitted.
- Religiously observe the oil filter change periods and the lubricant recommendations.
- Use of supercharging in a petrol engine produces severe temperature conditions in the turbocharger bearings. The driver should:
  - not rev the engine when starting or stopping it.
  - wait until the engine has reached normal running temperature before loading the engine fully.
  - allow the engine to idle for approximately 30 seconds before switching off after a long fast journey, such as on a motorway.

TECHNICAL DATA

TURBOCHARGER:

Make	:	GARRET AIRESEARCH.
Type	:	TB03.
Speed	:	120 000 rpm.
Inlet pressure	:	510 mbars ± 35 (7,39 ± 0,5 lbf in^2) at 3 000 rpm at full engine load, pressure limited by exhaust gas by-pass device. Wastegate system.
Lubrication	:	under pressure from engine system.
Turbine	:	inconel 713 C.
Turbine housing	:	nickel iron.
Compressor wheel	:	light alloy
Compressor housing	:	light alloy
Bearings	:	aluminium alloy.





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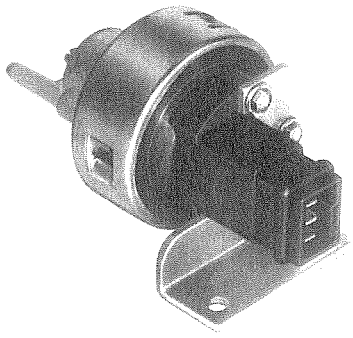

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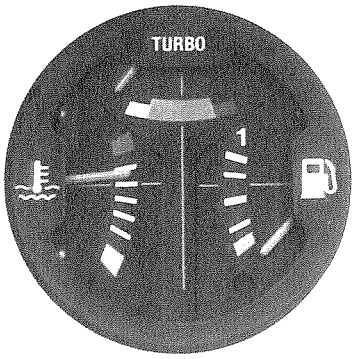

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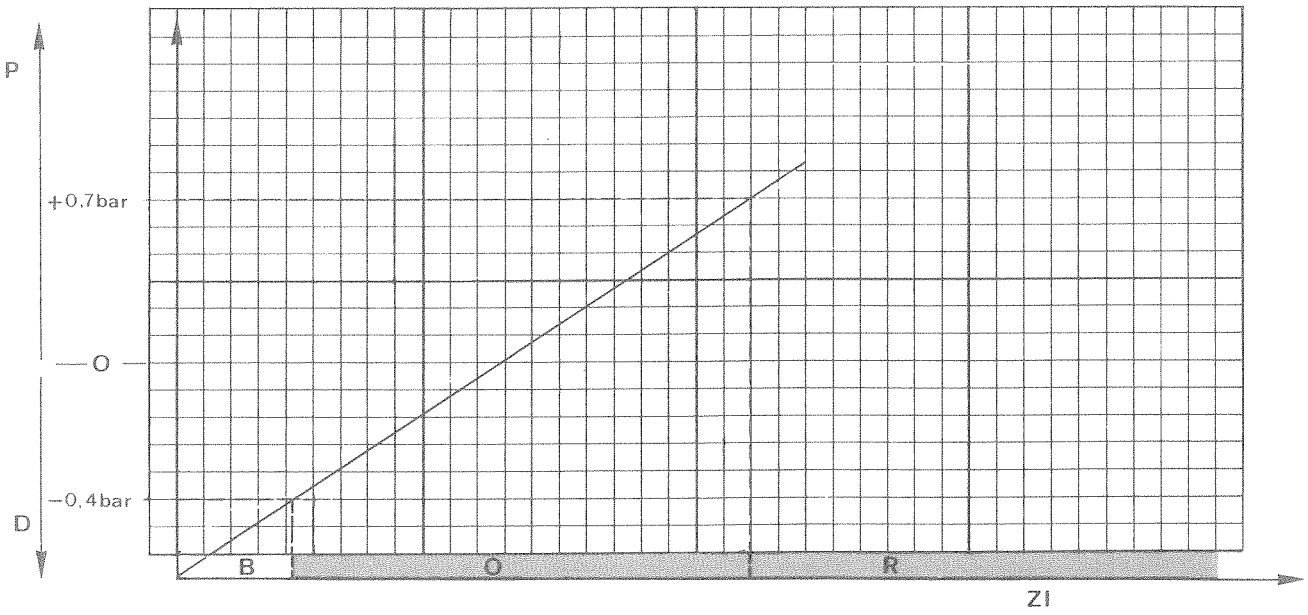

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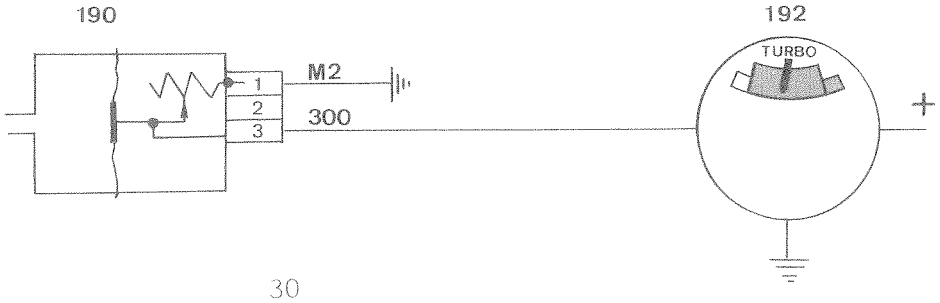

I - TURBOCHARGER PRESSURE GAUGE

IDENTIFICATION

a) Pressure sensor (fig. I)

Resistance between terminals 1 and 3:

- approximately 196 Ω at atmospheric pressure,
- approximately 64 Ω at 0,6 bar (8,7 lbf in^2) air inlet pressure.

b) Turbocharger pressure gauge (fig. II)

a) white sector,
b) orange sector (normal operation)
c) red sector.

OPÉRATION

The pressure sensor receives its information from the air delivery pipe. The membrane of the sensor controls a rheostat, the resistance of which varies in relation to the air inlet pressure; the position of the needle of the gauge on the instrument panel is related to this resistance.

Turbocharger pressure gauge curve (fig. III)

P : Supercharge pressure
O : Atmospheric pressure
D : Depression

ZI : gauge sectors

B - White
O - Orange
R - Red

Wiring diagram (fig. IV)

190 : Pressure sensor
192 : Turbocharger pressure gauge

SUPERCHARGE CONTROL DEVICES

II - HIGH-PRESSURE CONTACT SWITCH

IDENTIFICATION (fig. I)

OPERATION

The pressure switch located in the neck of the air intake pipe signals the injection electronic control unit when the turbocharger pressure reaches 1100 mbar $\pm$ 50 (16 $\pm$ 0,7 lbf in^2); the control unit cuts the injection if the engine speed is higher than 3 000 rpm (safety feature).

Electrical connections (fig. II)

181 : Injection electronic control box.

191 : High-pressure contact switch.

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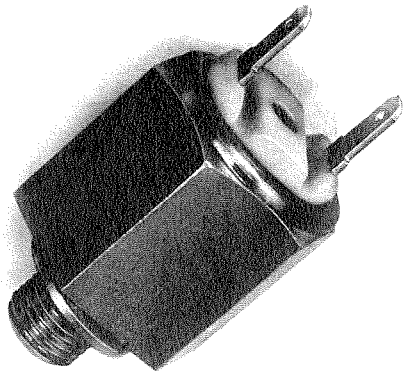

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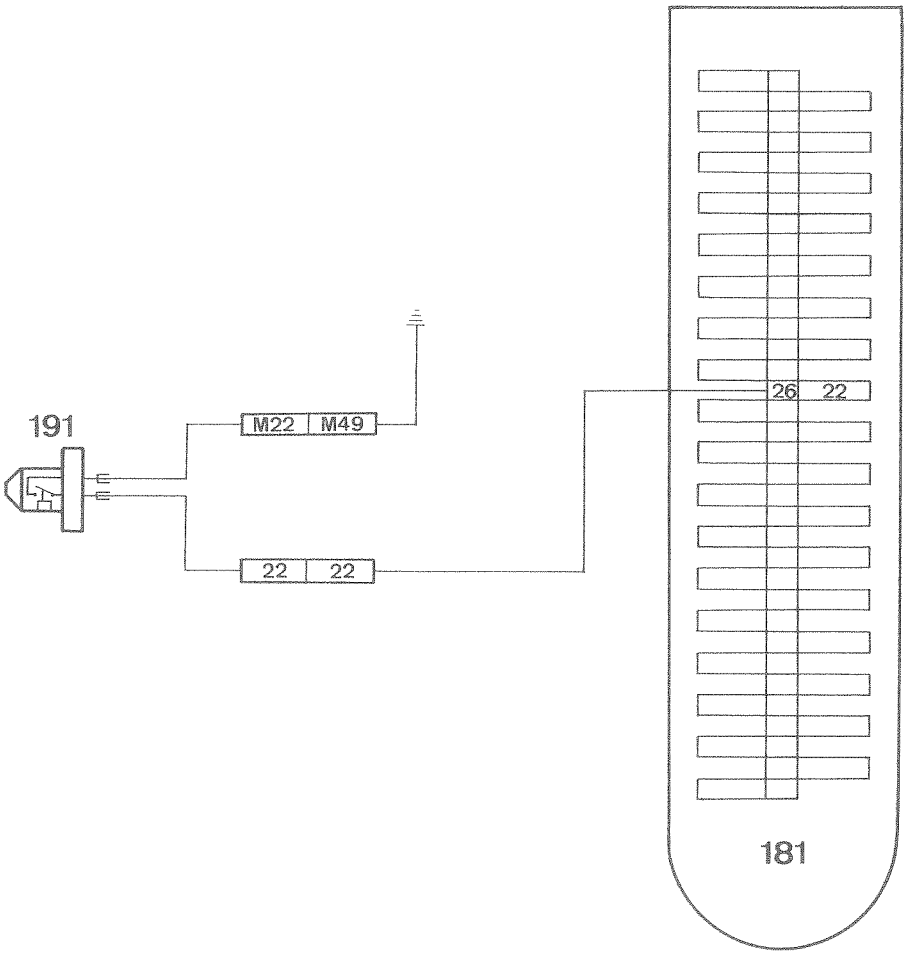


ELECTRONIC INJECTION

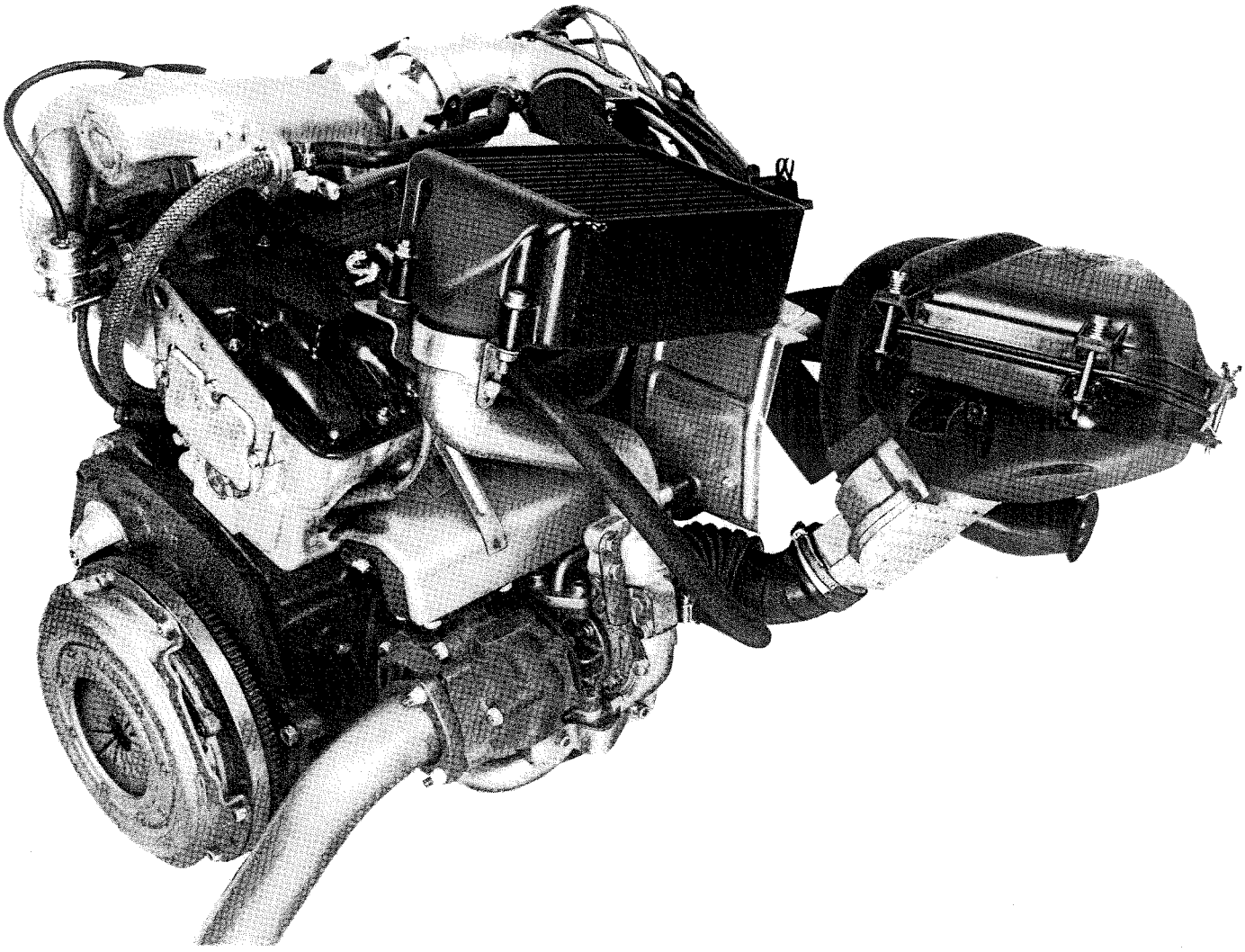
INTRODUCTION

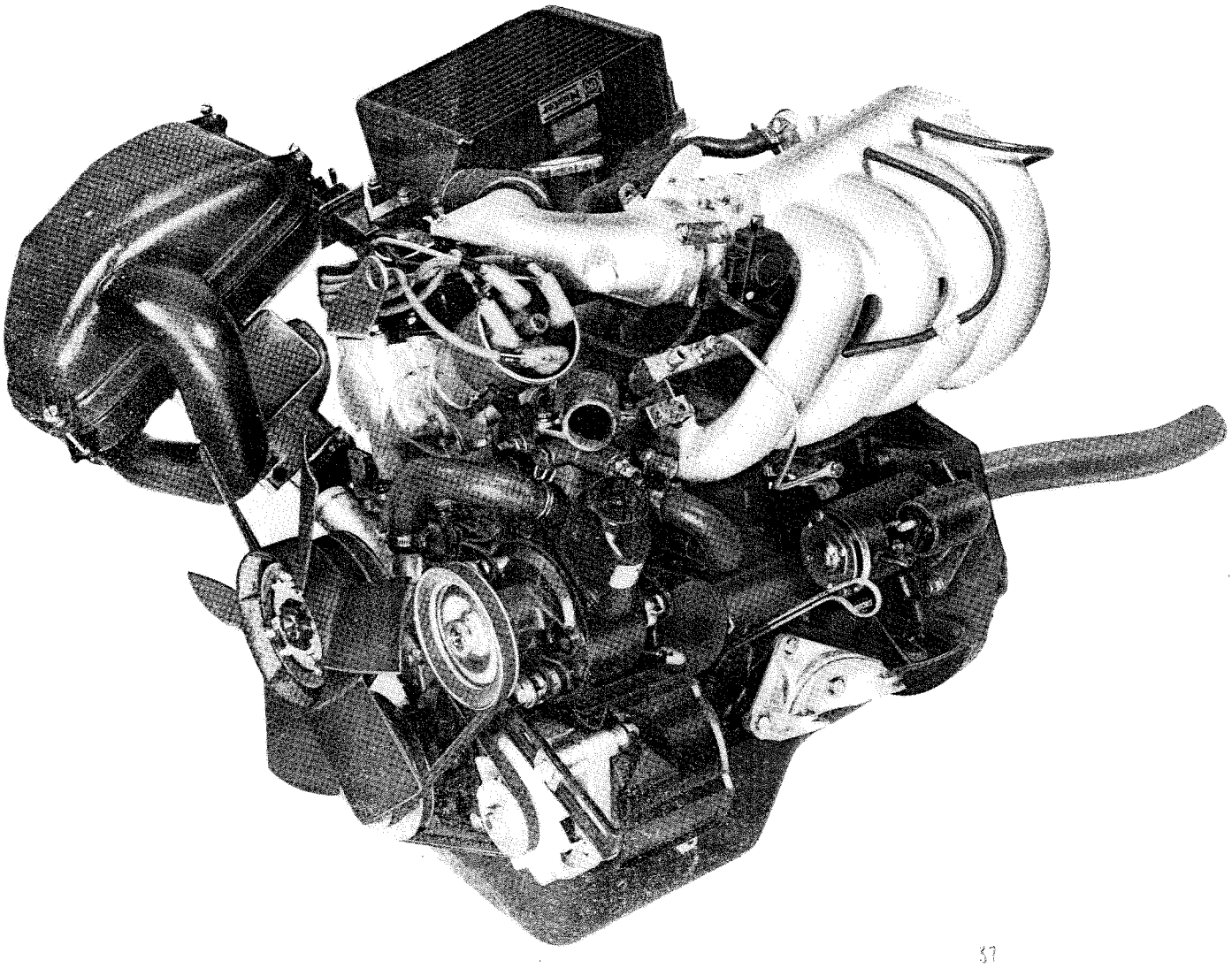
The L-JETRONIC fuel injection system adapts the fuel supply precisely to the needs of the engine at all speeds.

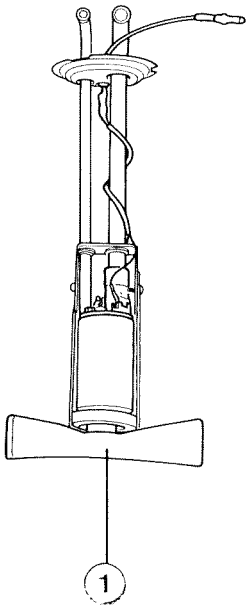
This intermittent injection system, operating at low pressure, is primarily controlled by the volume of air drawn in by the engine.

The operating conditions of the engine are detected by various sensors, which, by means of electrical signals, transmit the information to an electronic injection control unit. This determines the fuel requirement of the engine and controls the injectors.

The main contribution of this device is reduction of the concentration of noxious gases in the exhaust.



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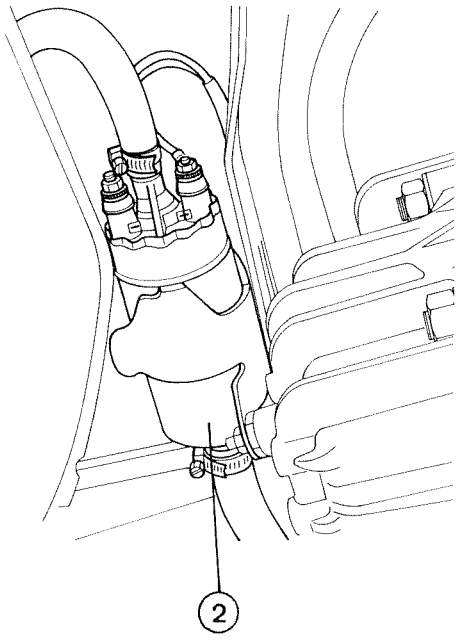
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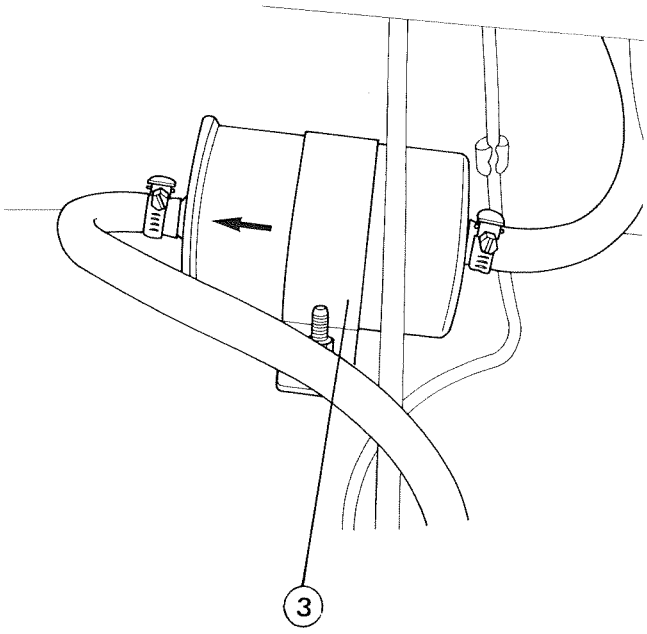
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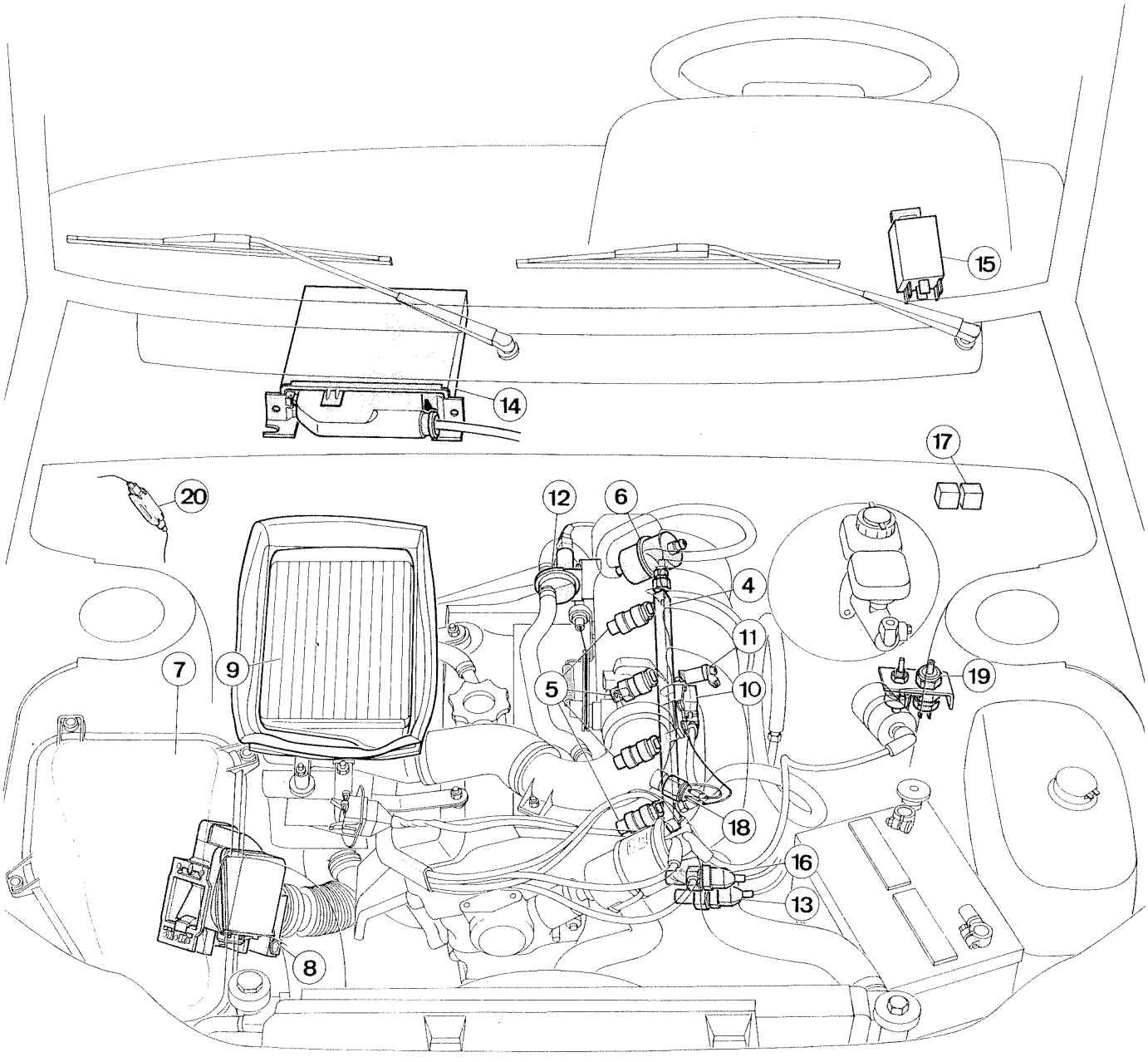
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INSTALLATION

FUEL SUPPLY SYSTEM

1 - Scavenge pump in the tank

2 - Fuel supply pump

3 - Fuel filter

} under the car

4 - Distribution pipe to injectors

5 - Injectors

6 - Fuel pressure regulator

AIR SUPPLY SYSTEM

7 - Air cleaner

8 - Air flow sensor

9 - Air-to-air intercooler

10 - Throttle switch unit

COLD START SYSTEM

11 - Cold start injector

12 - Supplementary air device

13 - Thermal time switch

ELECTRICAL SYSTEM

14 - Electronic injection control unit

15 - Tachymetric relay

} inside the car

16 - Engine temperature sender

17 - Injection relay

18 - High-pressure contact switch

19 - Full load enrichment pressure switch

20 - 10 000 Ω resistor

OPERATING PRINCIPLES

Fuel drawn from the tank by a scavenge pump and a supply pump is permanently supplied under pressure to the injectors.

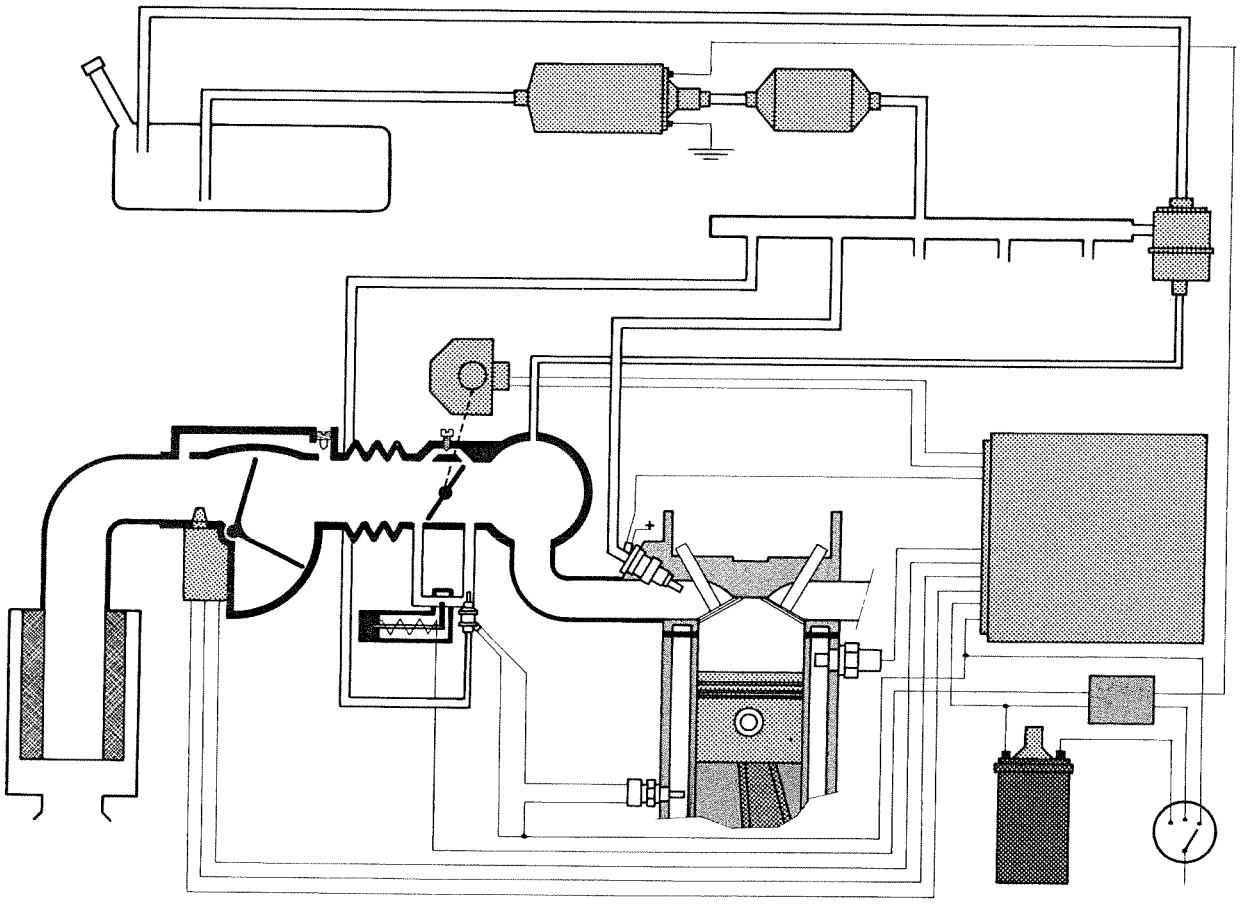
A fuel pressure regulator maintains a constant fuel pressure at the injectors.

To determine the mixture requirement of the engine, the electronic injection control unit analyses the information supplied by the sensors in relation to:

- the inlet air temperature,
- the volume of air drawn in,
- the engine temperature,
- the throttle position,
- engine speed,
- the starting phase.

The electronic control unit interprets this information and transmits electrical impulses to the injectors. The injectors, operated by electromagnets, operate simultaneously and atomise the fuel up-stream of the inlet valve.

The four injectors are supplied by the same distribution pipe. To ensure good fuel distribution, there are two injections to each revolution of the camshaft. Half the fuel metered for a complete engine cycle is atomised at each injection.



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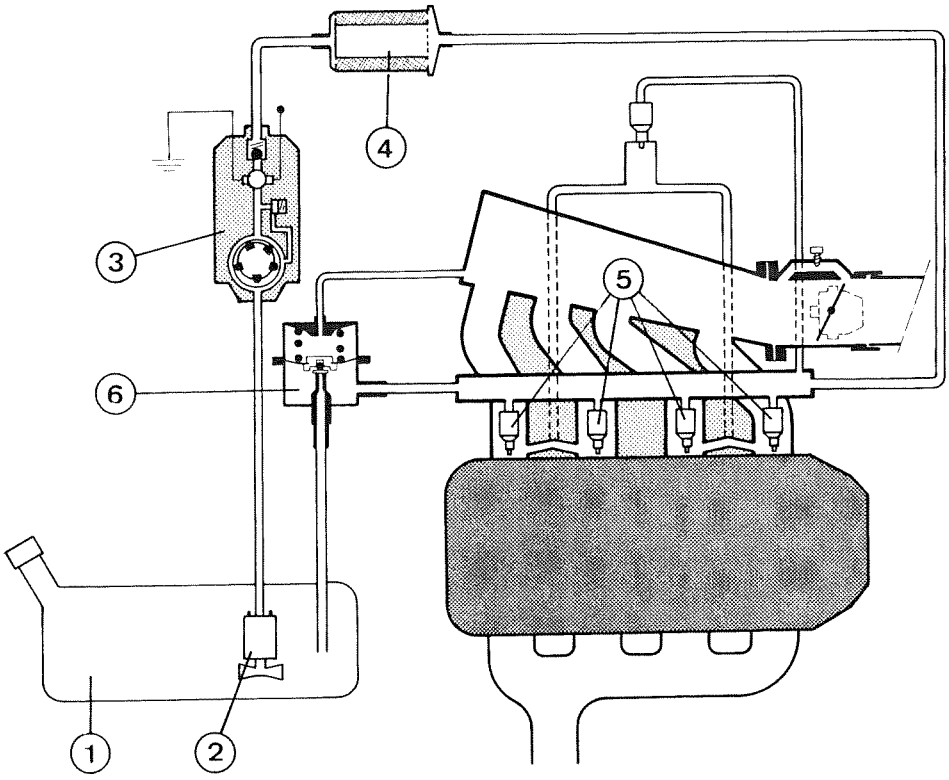

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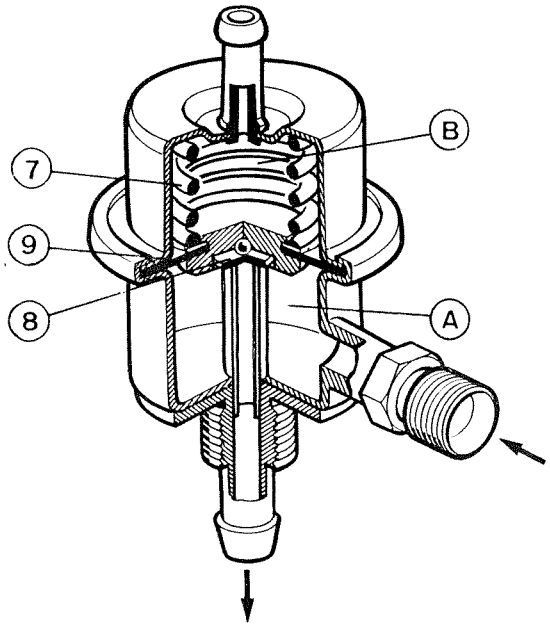

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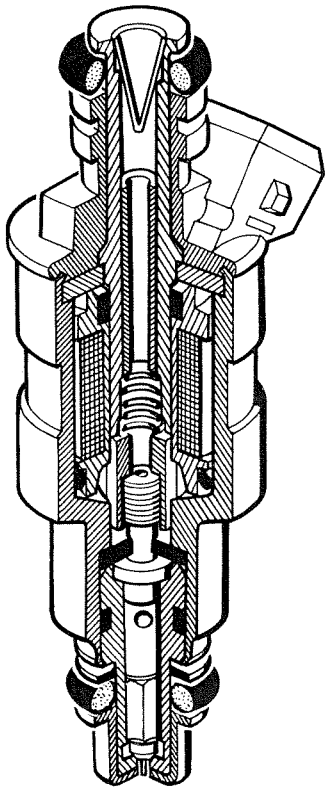

– **Fuel system (fig. I)**

Fuel drawn from the tank **(1)** by the scavenge pump **(2)** is supplied under pressure by the supply pump **(3)** to the distribution pipe for the injectors **(5)** through a filter **(4)**. The system is maintained under pressure by the pressure regulator.

– **Pressure regulator (fig. II)**

This maintains a constant pressure difference between the fuel supply system and the inlet manifold to ensure a constant flow of fuel for a given inlet pressure.

The membrane **(9)** is held in balance between two forces:

- At **(A),** the fuel pressure in the system.
- At **(B),** the action of the spring **(7)** and the pressure (or depression) in the inlet manifold. The valve **(8)** returns fuel to the tank to keep the membrane in balance.

– **Injectors (fig. III)**

- Electro-magnetically controlled.
- Connected in parallel, they inject simultaneously in 2 injections the quantity of fuel metered for 1 engine cycle, that is, one injection to each crankshaft revolution.

– Air system (fig I)

Air is drawn through a cleaner **(1)** and from the air flow sensor **(2)** by the turbocharger **(3).** After being cooled by passing through the air-to-air intercooler **(4),** the air is supplied to the engine past a throttle **(5)** which regulates the volume.

– Air flow sensor (fig. II)

Consists of a sensor plate **(6)** which moves in relation to the volume of air taken by the engine. A compensating plate **(7),** integral with the sensor plate, moves in a damping chamber **(8).**

The air flow sensor provides 2 types of information to the electronic injection control unit:

- The volume of air drawn in by the engine, by means of a resistance unit **(9)** connected to the sensor plate.
- The inlet air temperature, by means of a sensor **(10).**

– Idle mixture:

A by-pass **(11)** passes some air not measured by the sensor plate.

A screw **(12)** varies this volume of air, thus varying the mixture.

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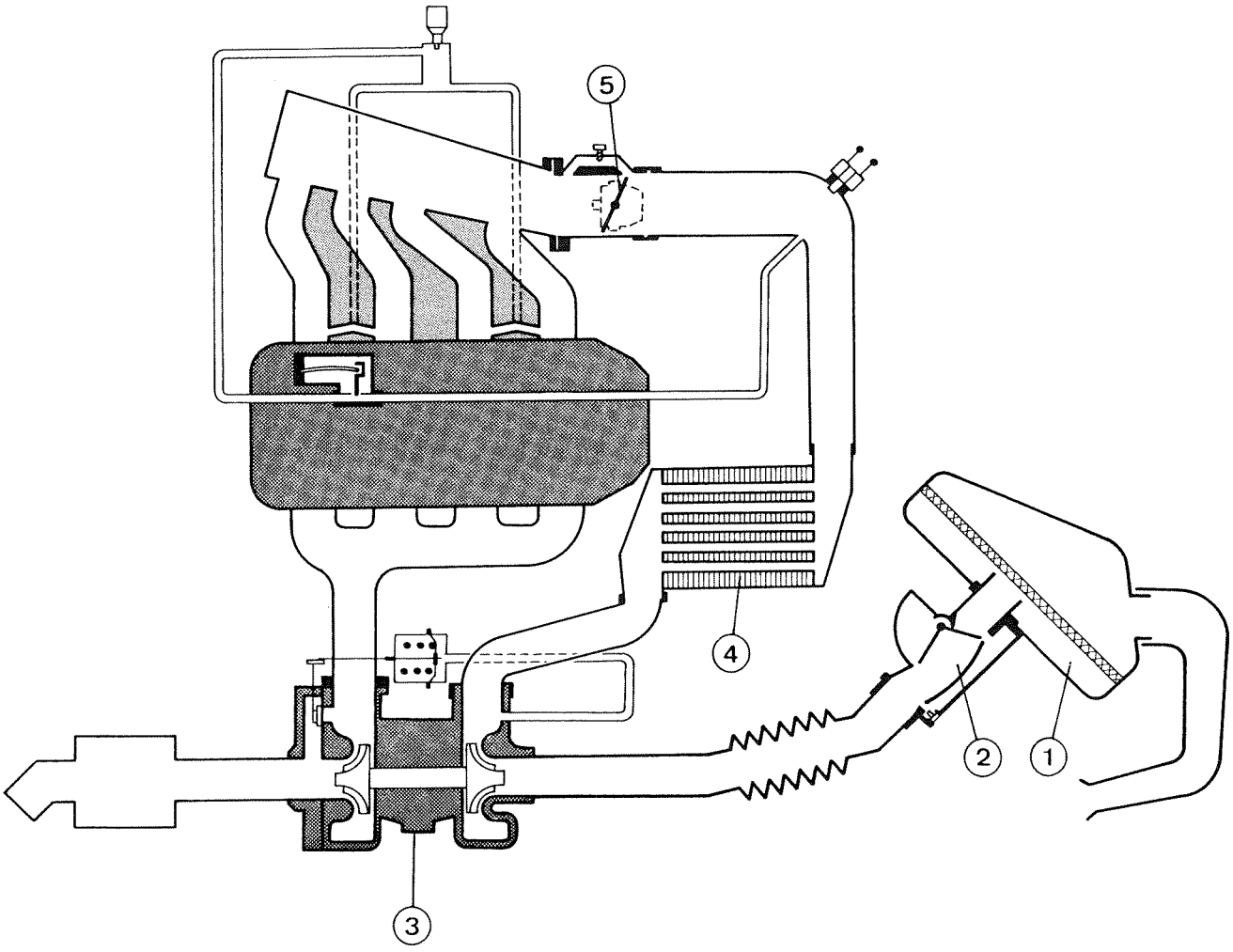

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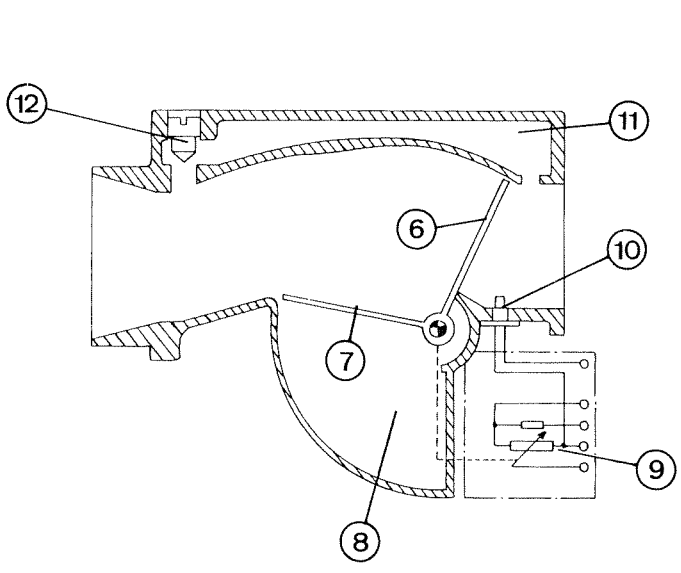

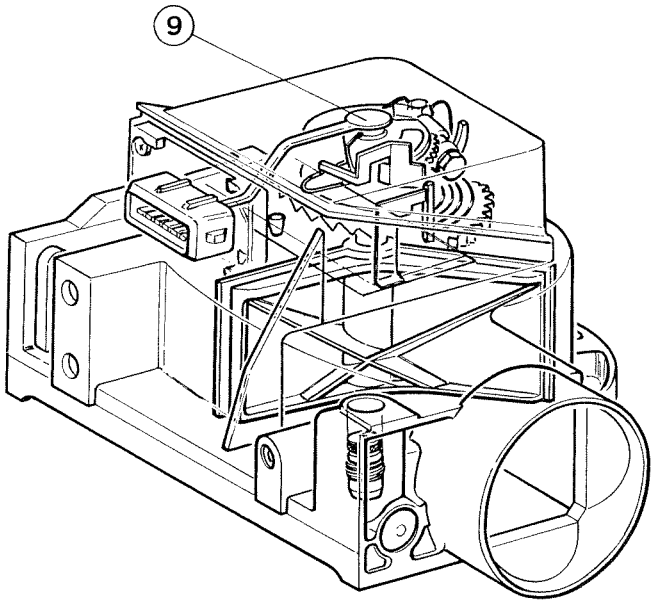

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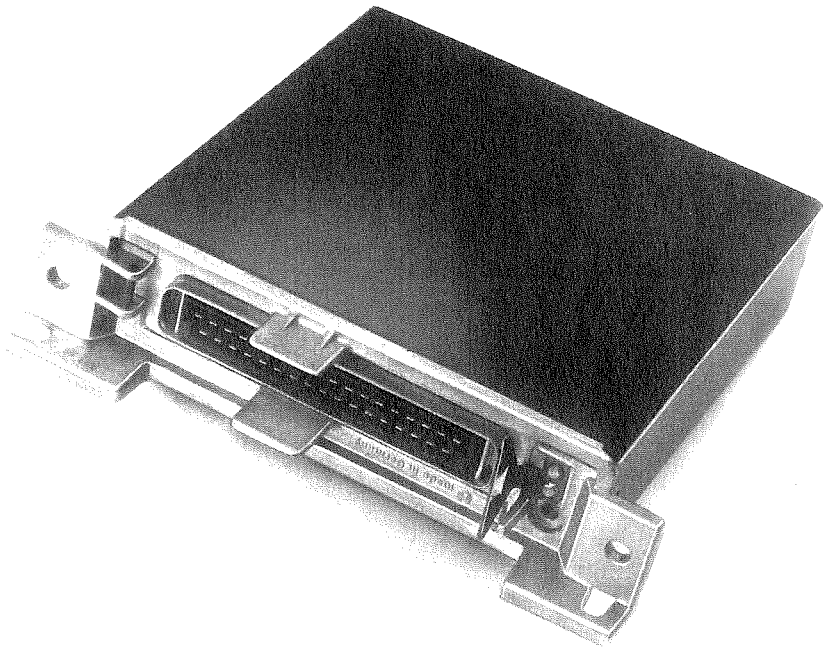

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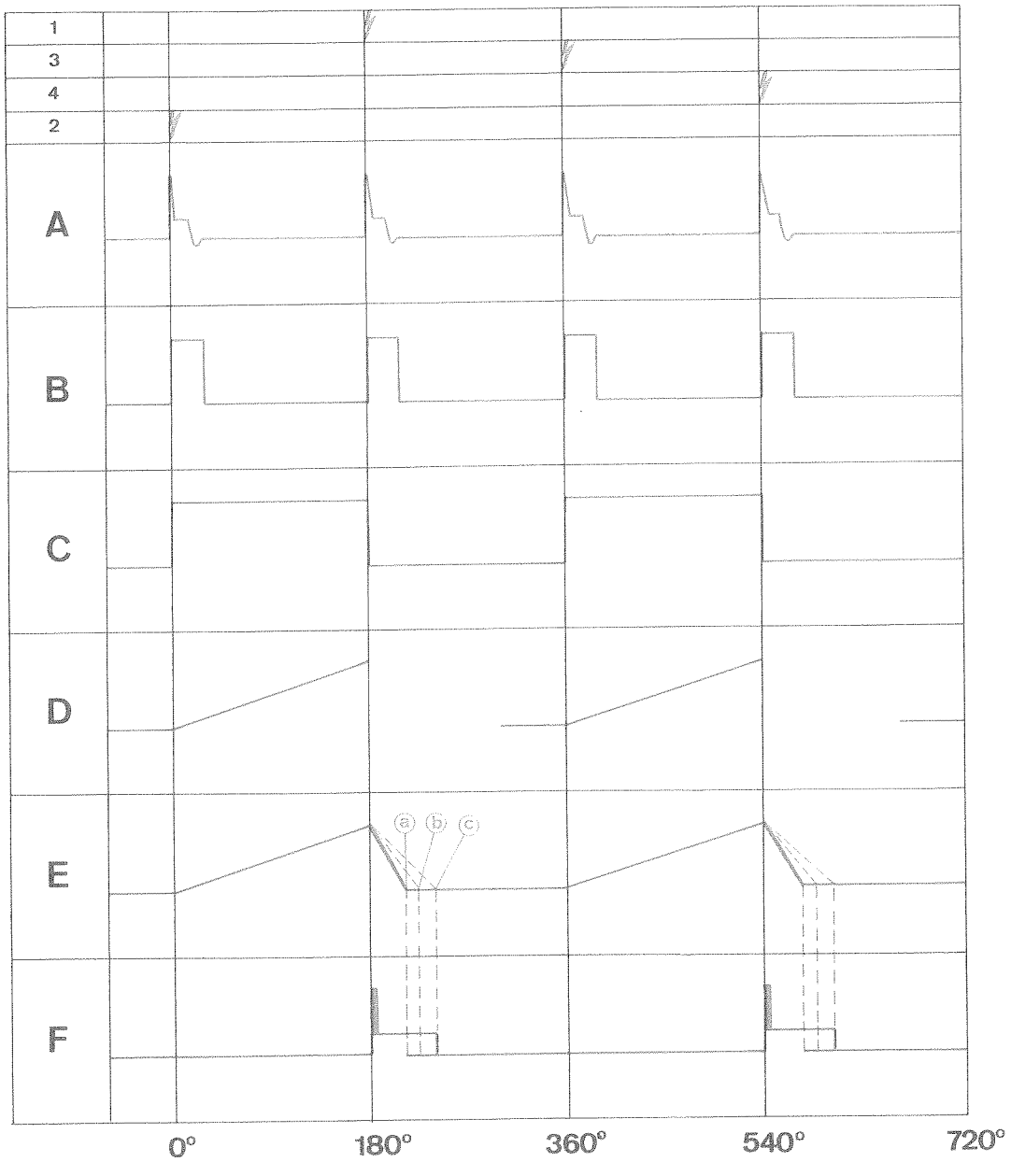

ELECTRONIC CONTROL UNIT (fig. I)

ELECTRONIC CONTROL UNIT (fig. I)

It receives information from various sensors; from these parameters it determines the period of injection. It controls the injectors by electrical impulses.

PRINCIPLE OF OPERATION AND IMPULSE DIAGRAM FOR THE L. JETRONIC (fig. II).

A - Injection impulses are controlled by ignition firing.

B - The ignition impulses are converted to square wave form in a rectifying circuit.

C - To produce one injection per engine revolution, the signal frequency is divided by two.

D - The signal produced charges a capacitor.

E - The start of injection is controlled by the capacitor discharging.

The injection period is governed by:

- information from the air flow sensor **(a),**
- various correcting factors: full load **(b),** engine temperature **(c),** etc.

F - The injectors are controlled by earthing their coils. The current is regulated by the electronic control unit.

Cold enrichment

During the starting and warming up phase of the engine, 2 correction factors are applied to the fuel metering:

— **Fig. I** - By the cold start injector **(2)** supplied from the starter motor + through a thermal time switch **(1).**

— **Fig. II** - By the engine temperature sensor which indicates to the electronic control unit the need for mixture enrichment, descreasing as the engine warms up.

A supplementary air device **(fig. III)** supplies an additional volume of mixture to the engine to maintain a sufficiently high engine speed when it is cold.

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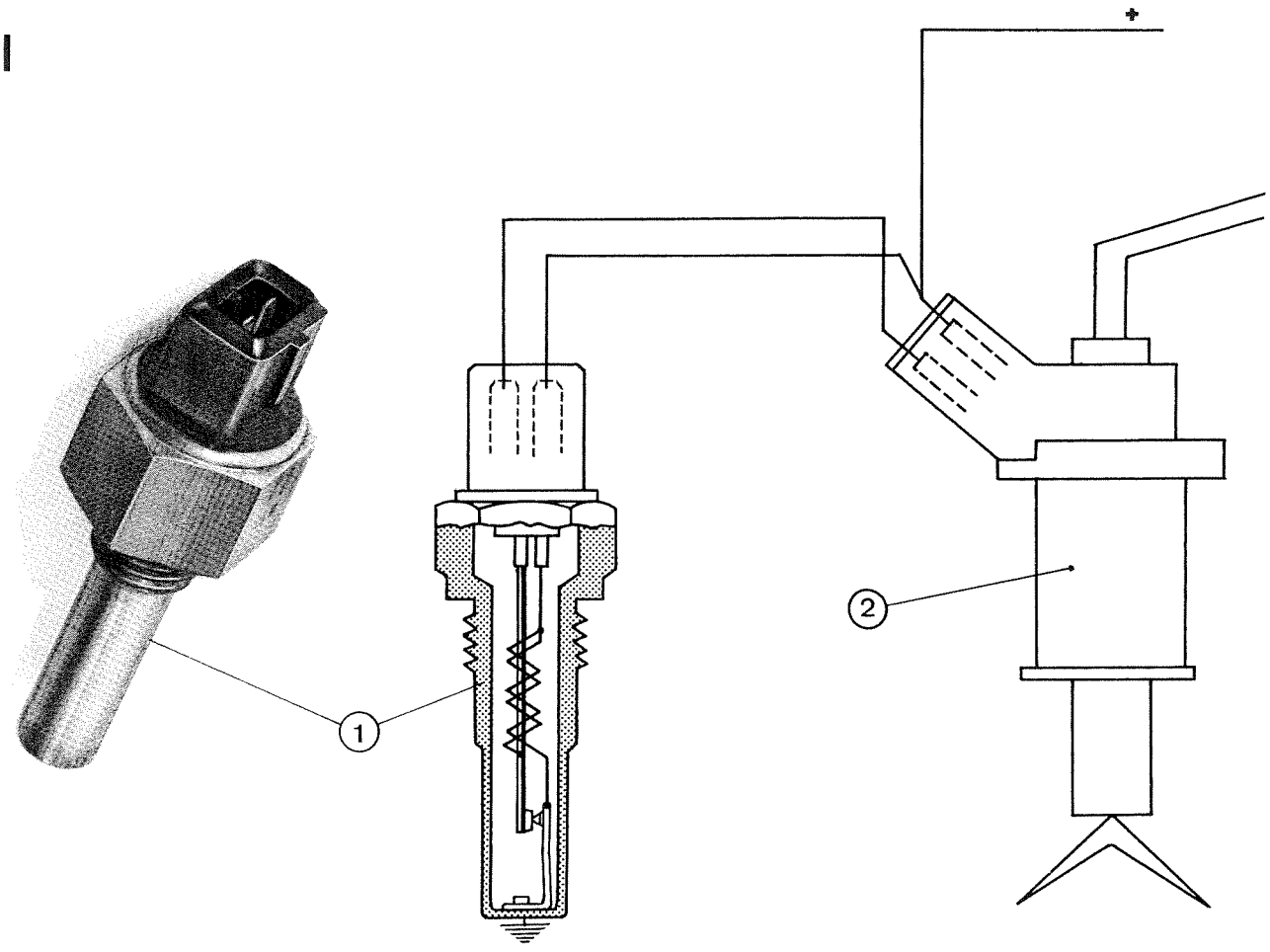

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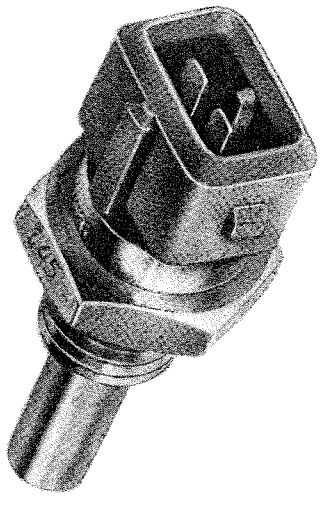

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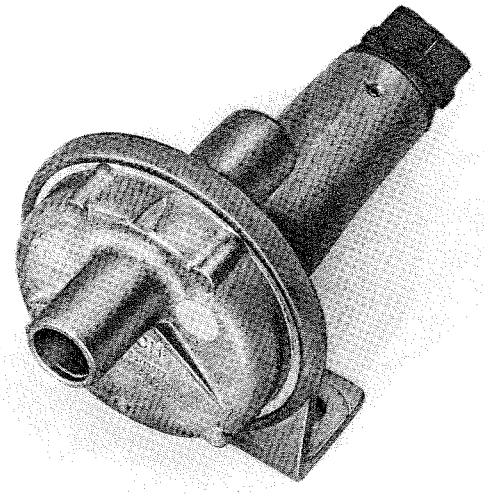

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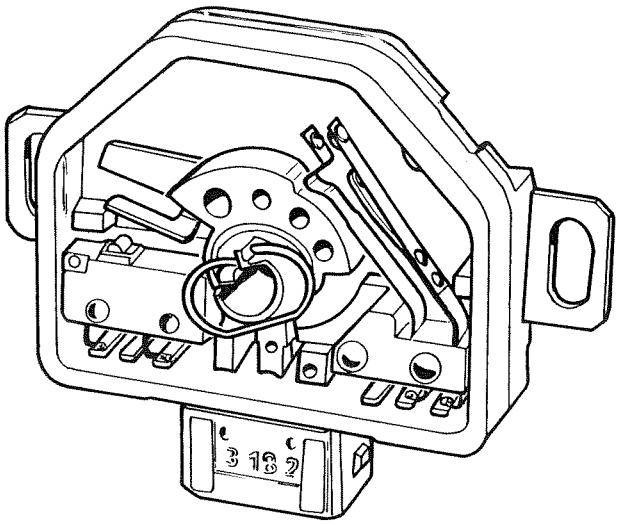

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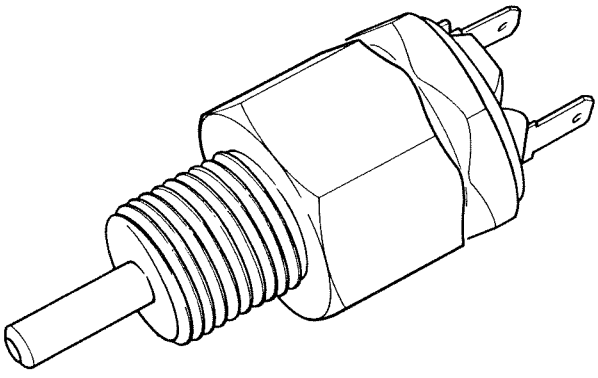

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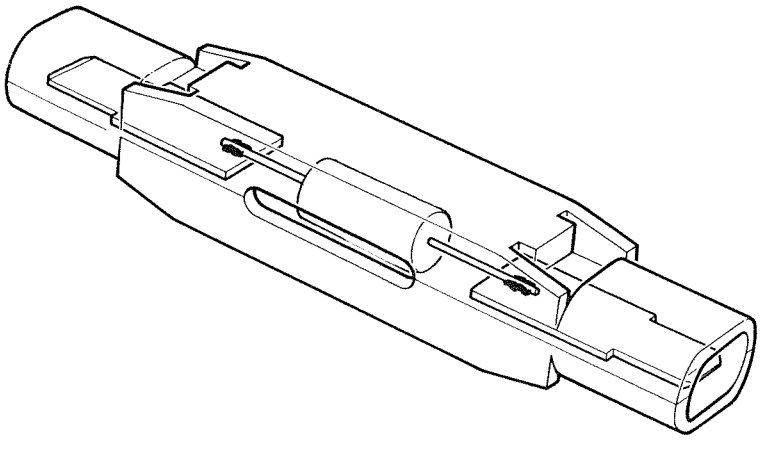


Full load enrichment:

The full load enrichment function is controlled by 2 factors:

– The throttle position: a switch **(fig. I)** in the throttle unit provides information on the position on the accelerator.

– The inlet pressure: a pressure switch **(fig. II)** connected to the inlet manifold gives information on the actual engine load.

A 10 000 Ω resistor **(fig. III)** in series in the full load circuit limits the extent of enrichment.

I - MAXIMUM SPEED LIMITATION

The L-JETRONIC electronic control unit fitted to the 505 has a speed limiting function. At 6 000 rpm, injection is cut off automatically.

II - SPEED LIMITATION IF SUPERCHARGE PRESSURE IS TOO HIGH

If the turbocharger supercharge pressure exceeds 1 100 mbars ± 50 (16 ± 0,7 lbf in^2), a pressure switch in the inlet manifold informs the electronic control unit, which limits the speed to 3 000 rpm by cutting off the injection.

TECHNICAL DATA

Scavenge pump

Make	JAEGER
Reference	32 176 301
Output at 0,7 bar (10 lbf in^2)	110 litres/hour (24,2 gal/hour)

Fuel supply pump

Make	BOSCH
Reference	0 580 464 023
Output at 3 bars (43,5 lbf in^2)	130 litres/hour (28,6 gal/hour)

Fuel filter

Make	BOSCH
Reference	0 450 905 095
Filter area	3 000 cm^2 (465 in^2)
Filtration threshold	8 µ
Change period	90 000 km

Fuel pressure regulator

Make	BOSCH
Reference	0 280 160 216
Nominal pressure at flow of 40 litres (8,8 gal)/hour	2,5 bars (36,25 lbf in^2)

Injector

Make	BOSCH
Reference	0 280 150 200
Nominal voltage	operates only with the calculator

Cold start injector

Make	BOSCH
Reference	0 280 170 402
Nominal power	37 W
Delivery at 4,5 bars (65,25 lbf in^2)	115 cm^3/min (7 in^3 min)
Angle of spray	approximately 45°

Supplementary air device

Make	BOSH
Reference	0 280 140 110
Nominal resistance at 20°C (68° F)	49Ω
Average operating time at 20°C	3 min. 40 sec.
Nominal air supply at 20°C	10 m³/h (353 ft³/h

Air flow sensor

Make	BOSCH
Reference	0 280 202 044

Throttle switch unit

Make	BOSCH
Reference	0 280 120 305

Temperature sensor

Make	BOSCH
Reference	0 280 130 026
Nominal resistance at 20°C (68°F)	2,5 kΩ

Thermal time switch

Make	BOSCH
Reference	0 280 130 214
Nominal power	40 W
Operating time at 20°C at 10 V	8 sec.

Electronic control unit

Make	BOSCH
Reference	0 280 000 219

Tachymetric relay

Make	BOSCH
Reference	0 280 230 006

Full load pressure switch

Make	TORRIX
Pressure to close contacts	100 ± 20 mbars (1,45 ± 0,3 lbf in²)

Full load enrichment limiting resistor 10 000 Ω

ELECTRONIC IGNITION WITH KNOCK DETECTOR

INTRODUCTION

The particular operating conditions of a supercharged engine, with its high compression pressures and temperature, as well as the need to obtain the optimum power output, demand that the ignition system perfectly matches all the engine's needs.

Electronic ignition, developed to detect knocking, gives both high engine output and optimum reliability.

Advantages:

Optimum ignition advance up to the point of knocking: maximum power and reliability.

Advance adapted to engine load: improvement of light load and low speed performance.

INSTALLATION

1 - Hall effect distributor

2 - Electronic advance unit

3 - Pressure switch (advance curve selection)

4 - Knock detection unit

5 - Knock sensor

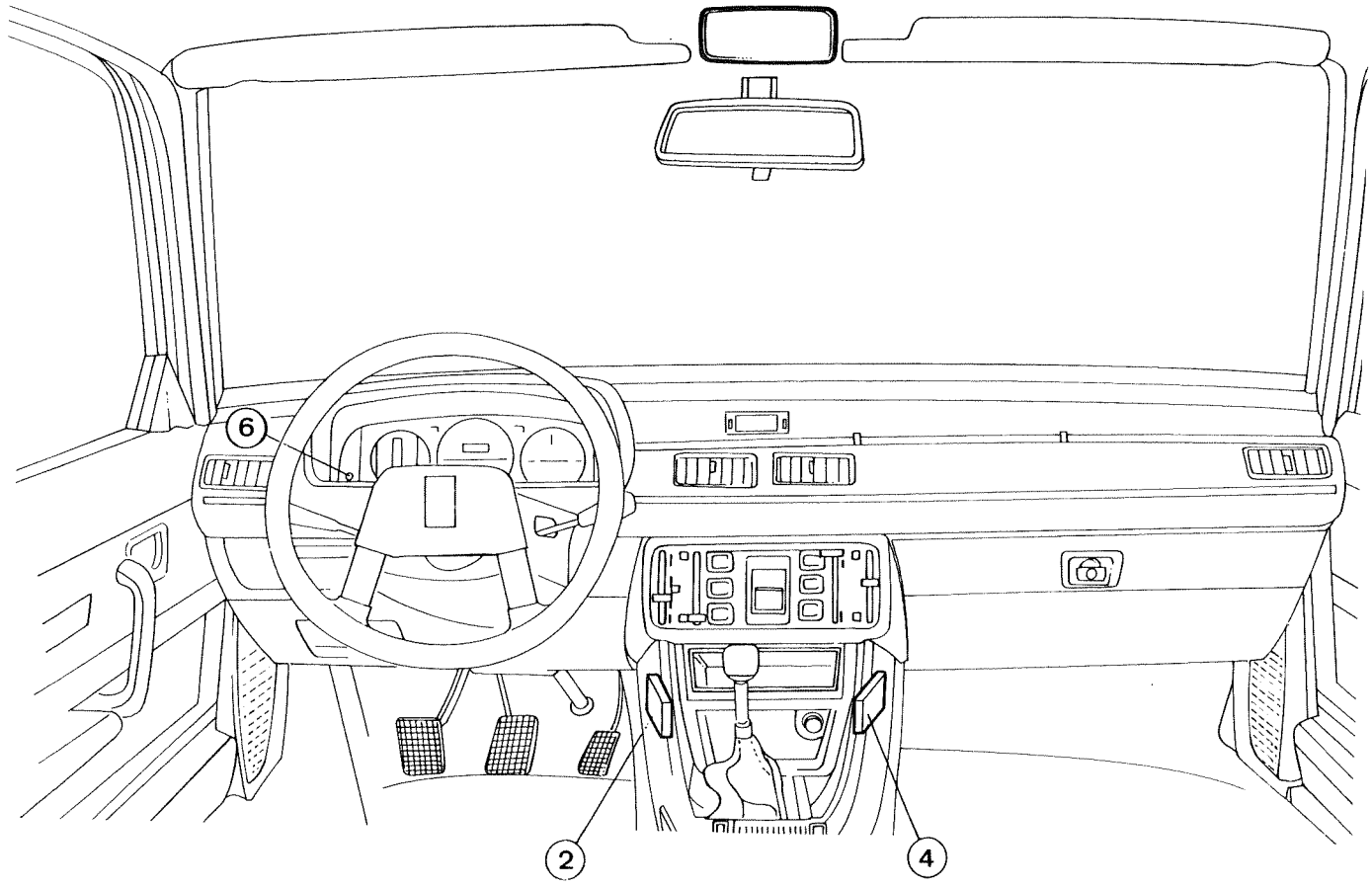
6 - Knock warning lamp

7 - Amplifier module

8 - Ignition coil

9 - Spark plugs

10 - Ignition relay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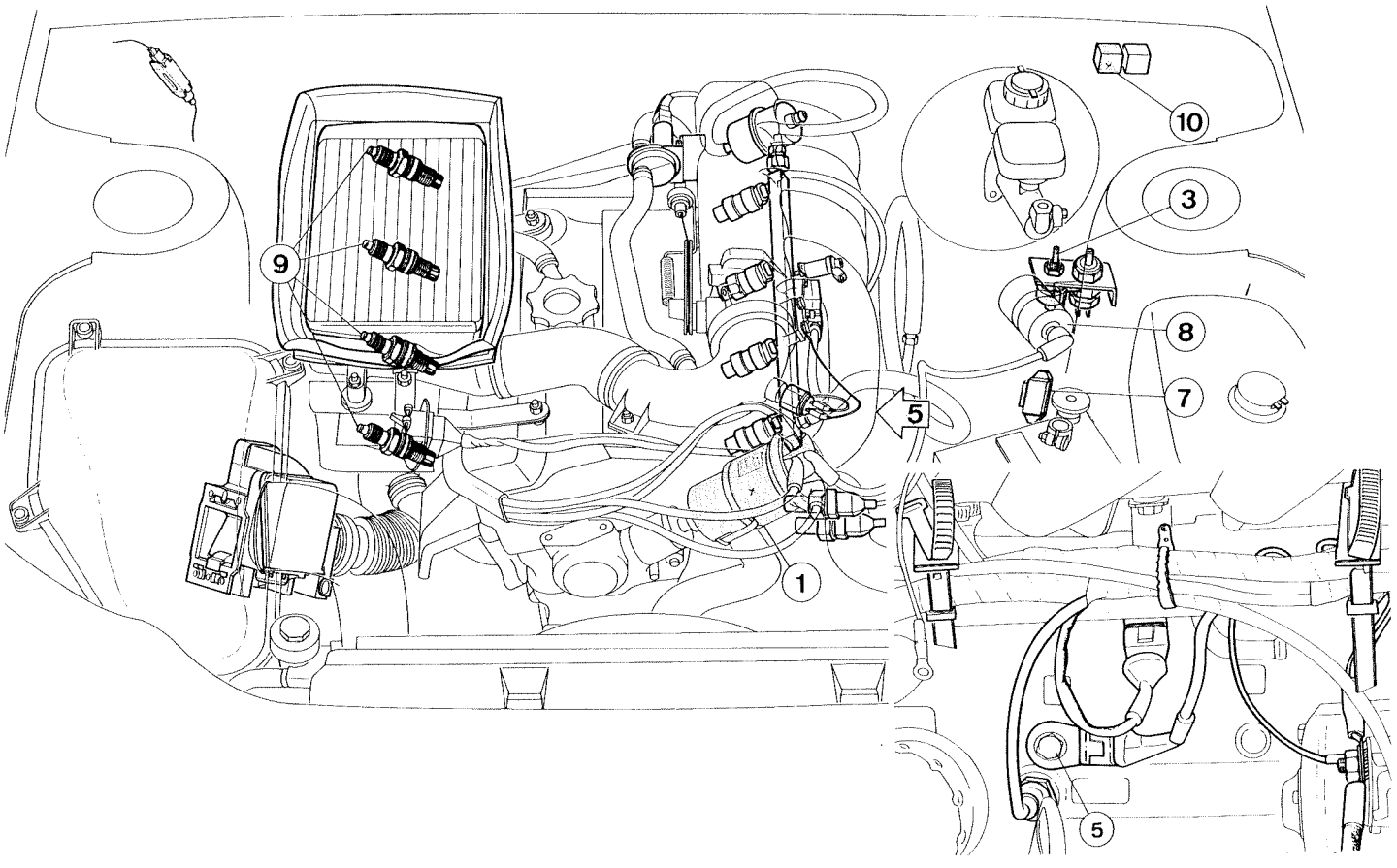
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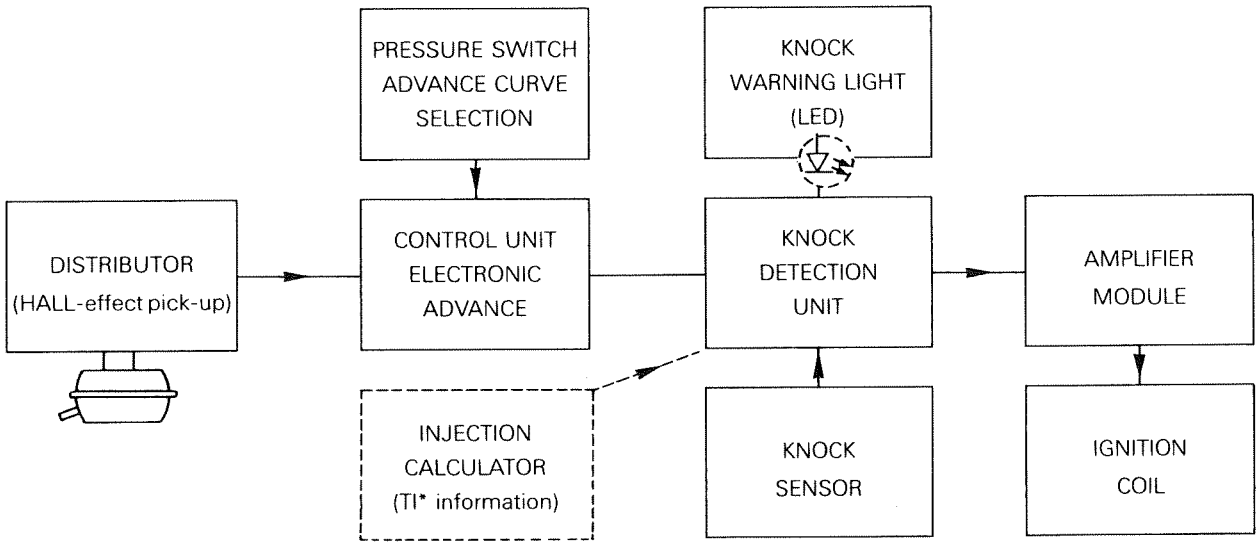
Ignition system block diagram



*** TI injection period**

Principle of operation

Ignition firing is produced by the HALL effect pick-up located in the distributor. The electronic advance unit determines ignition advance in relation to engine speed and load.

Information provided by the electronic advance control unit is transmitted to the knock detection unit, which reduces the advance by a designed number of degrees if the sensor indicates knocking.

The knock detection unit does not apply any correction if the engine torque is below 10 mdaN (74 lbf ft). This torque reading is determined from the "Injection period" output from the L. JETRONIC calculator.

In the amplifier module, the signals from the knock detector unit control the final transistor which makes and breaks the coil primary circuit.

THE DISTRIBUTION

I - HALL-EFFECT PICK-UP

1) The HALL effect principle

The principle lies in the property of the material of the detector plate **(2b),** located in the pick-up unit **(2) :**

— **Fig. I :** A current passes across the plate between points A and B. In the absence of a magnetic field, no voltage appears between points E and F, perpendicular to A and B.

— **Fig. II :** When a S.N. magnetic field is applied perpendicular to the plate, a very weak HALL voltage (0.001 volt) appears between points E and F.

2) Description

Fig. III

The distributor firing system is composed of:

— **a fixed magnet (1)** in a horse shoe shape, located opposite a pick-up unit **(2),**

— **a pick-up unit (2)** in a plastic housing whose main components are:

- a magnetic housing **(2a)** in copper,
- the HALL detector plate **(2b),**
- an integrated circuit **(2c)** to amplify the signal,
- a connecting plate **(2d)** for the 3 terminal harness,
- a metal plate **(2f)** to conduct the magnetic flux.

— **a vaned rotor (3)** driven by the distributor shaft, which has 4 vanes **(3a),** one for each cylinder and 4 windows **(3b)** cut away sections.

The vanes of the rotor **(3)** alternate in the air gap with the cut away sections.

Fig. IV : When a vane enters the air gap, the magnet's field is diverted from the HALL plate:
— the HALL voltage is cancelled,
— the integrated circuit releases a 5 volts 5 mA signal from the electronic advance unit,
- during the period when the vane is passing through the air gap current flows into the ignition coil.

Fig. V : When a vane leaves the air gap, the magnet's field passes through the HALL plate:
— the HALL voltage appears,
— the signal to the integrated circuit is blocked,
— the amplifier module transistor cuts the primary circuit ⟶ a spark is created at the spark plug.

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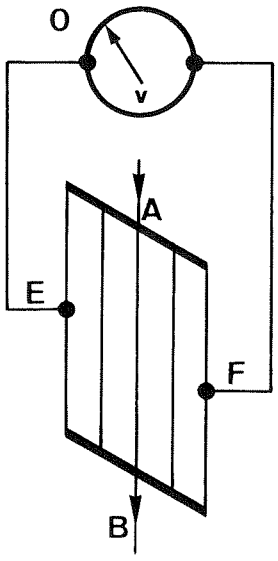

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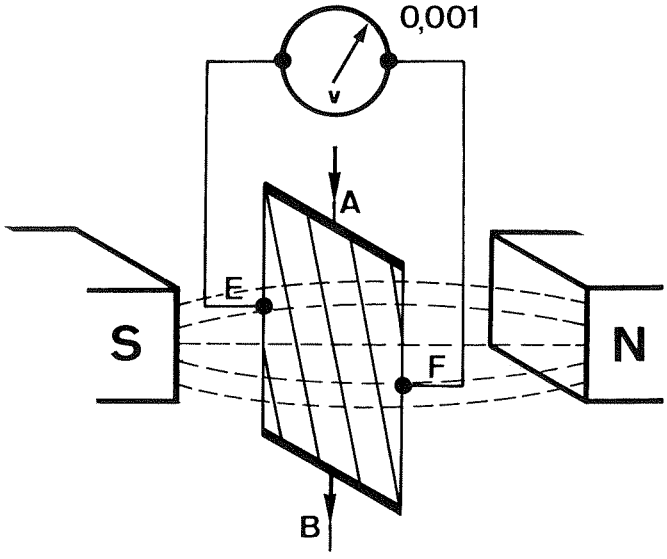

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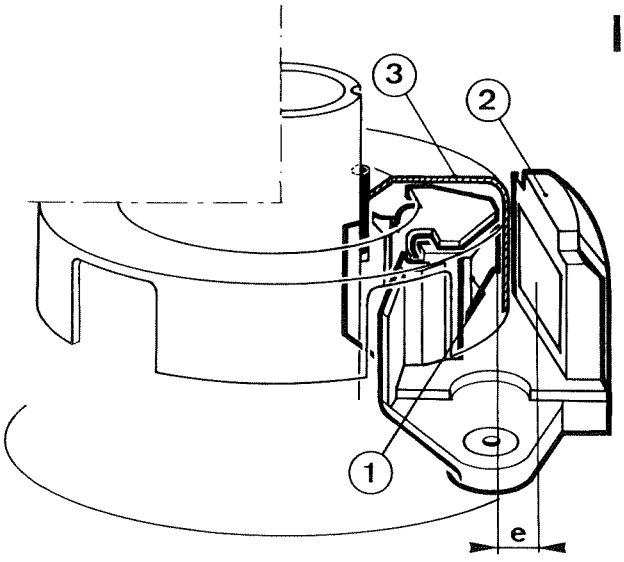

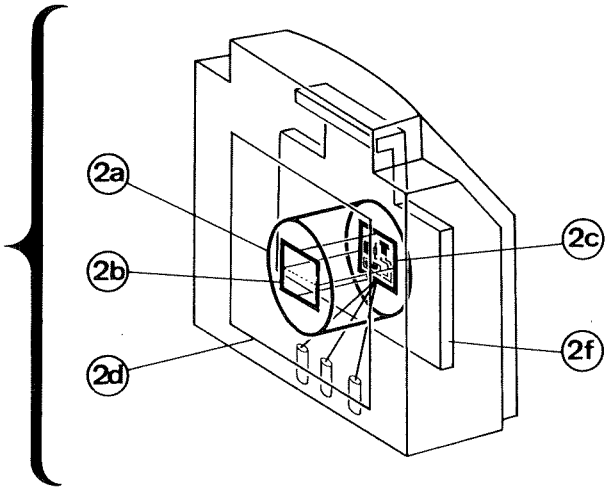

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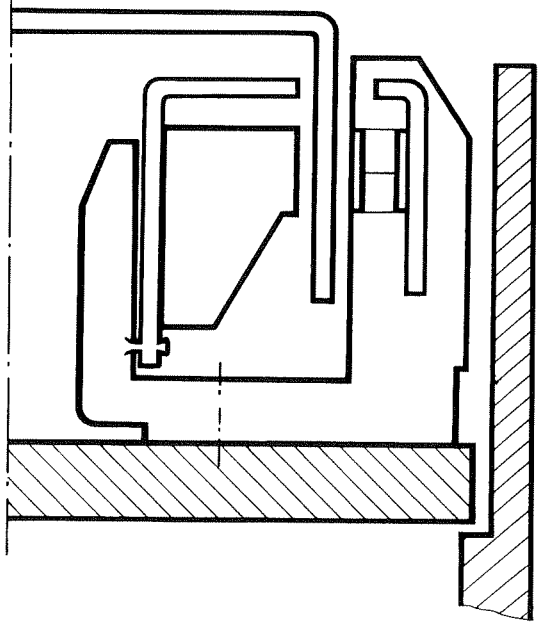

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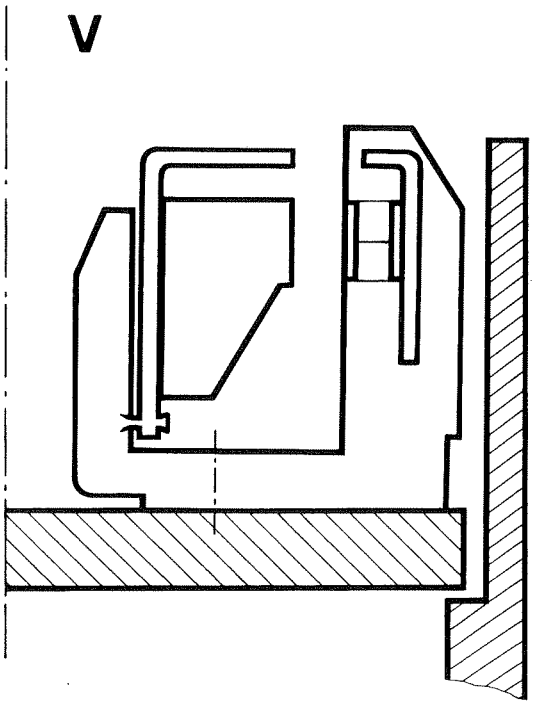

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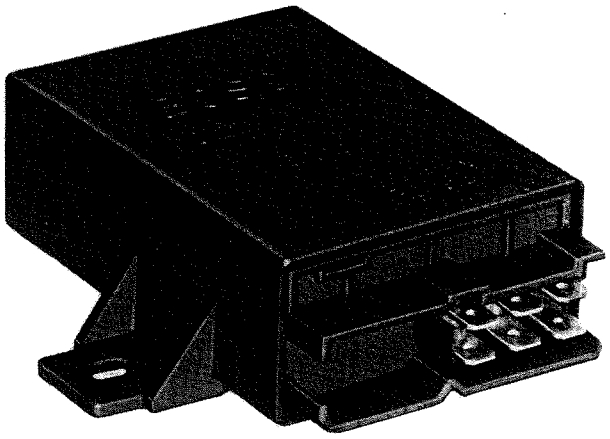

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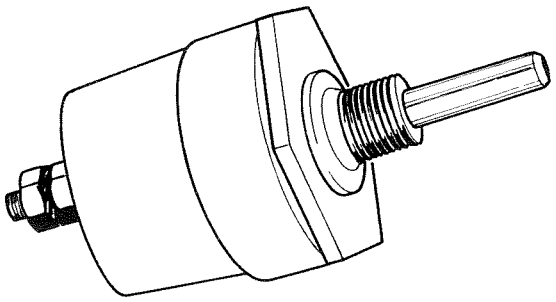

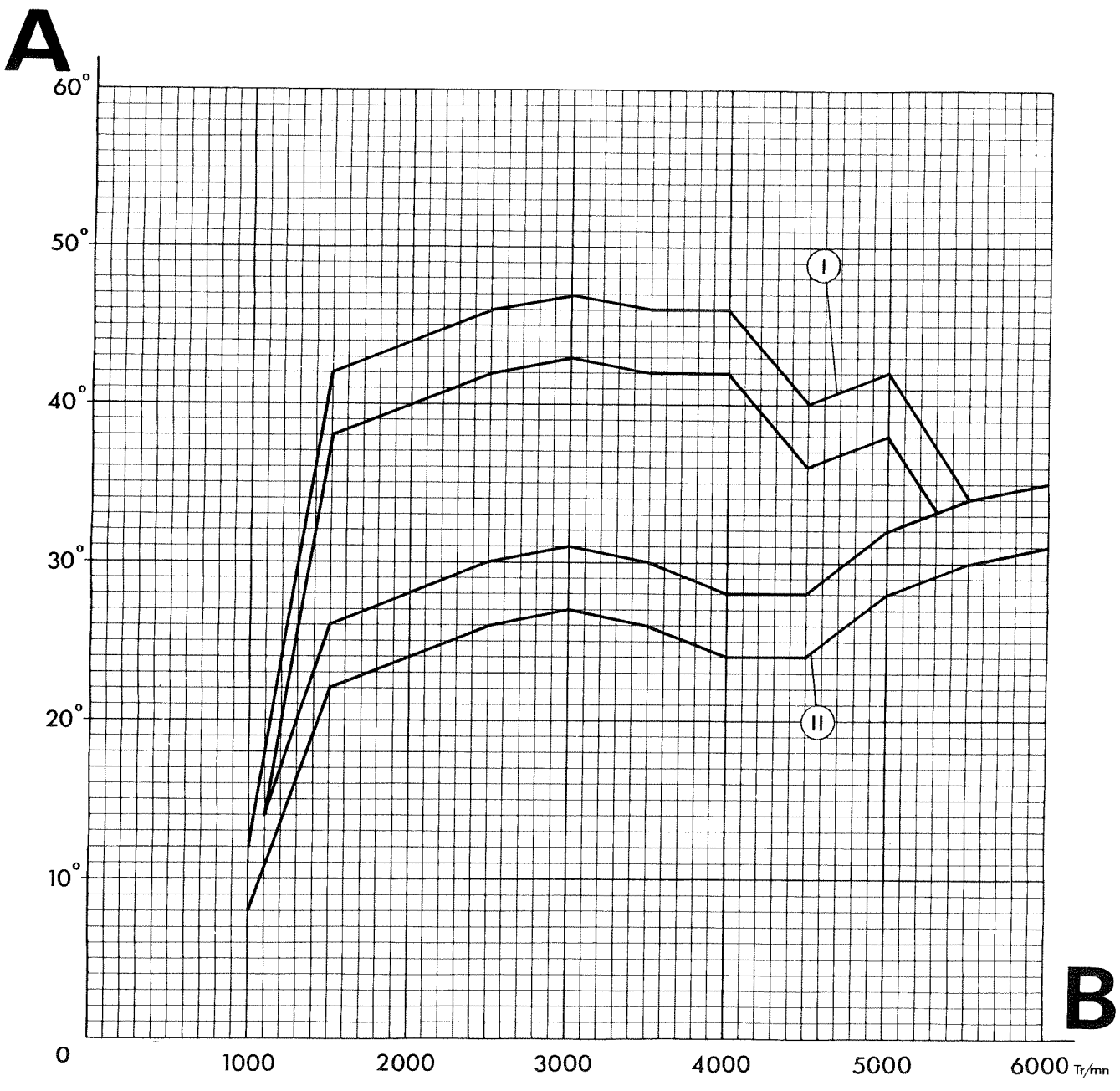

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ELECTRONIC ADVANCE UNIT

This unit **(fig. I)** holds in its memory an ignition advance curve C169E which has 2 advance maps, one of which is selected in relation to the supercharge pressure.

The selection of the appropriate advance map is made by a pressure switch **(fig. II)** connected to the inlet manifold.

The upper curve **(I)** corresponds to a supercharge pressure below 100 mbars (1 1/2 lbf in^2) (engine on light load).

The lower curve **(II)** corresponds to a supercharge pressure above 100 mbars (engine on medium or full load).

KNOCK DETECTION UNIT

Identification

Fig. I

Make : BOSCH
Type : 0 261 201 002

Operation

This unit reduces the advance when the sensor indicates knocking.

Analysis and correction is performed cylinder by cylinder, that is to say that only the advance of the cylinder in which knocking has been detected is reduced.

Correction is carried out in steps of 3 ° up to a maximum of 8° if the knocking persists. When knocking ceases, the advance returns progressively to its initial value in steps of 1°.

Calculation of advance correction **fig. II :**

A : nominal ignition advance
T : time
C : appearance of knocking

– If knocking appears ⟶ ignition retarded in steps of 3°- (maximum 8°).
– If knocking ceases ⟶ return to initial value in 1° steps.

The duration of the steps **(t)** of retarding or returning to initial advance correspond to:
– 59 firing strokes at engine speeds below 3 500 rpm,
– 177 firing strokes at engine speeds above 3 500 rpm.

A warning lamp on the instrument panel (a red LED) allows the operation of unit to be checked.

– stopped with ignition on:

– the lamp glows ⟶ normal operation.

driving:

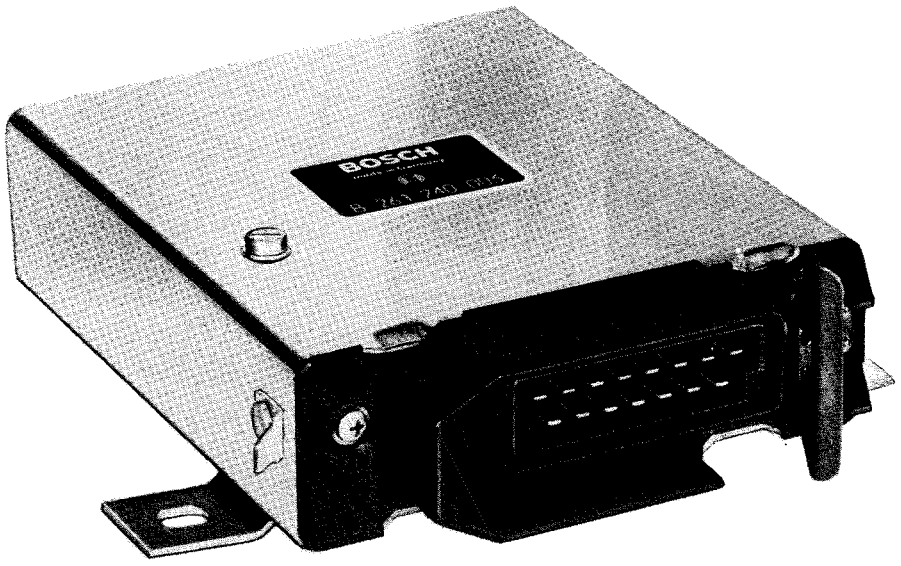
a) the lamp is extinguished ⟶ normal operation.
Note: there may be some false flasches.

b) the lamp flasches continuously above 3 000 rpm ⟶ abnormal operation.

Possible causes:

– incorrect grade of fuel,
– wrong ignition timing,
– excessive supercharge pressure,
– fault in the knock detection unit (bad connection - sensor or unit faulty).

I



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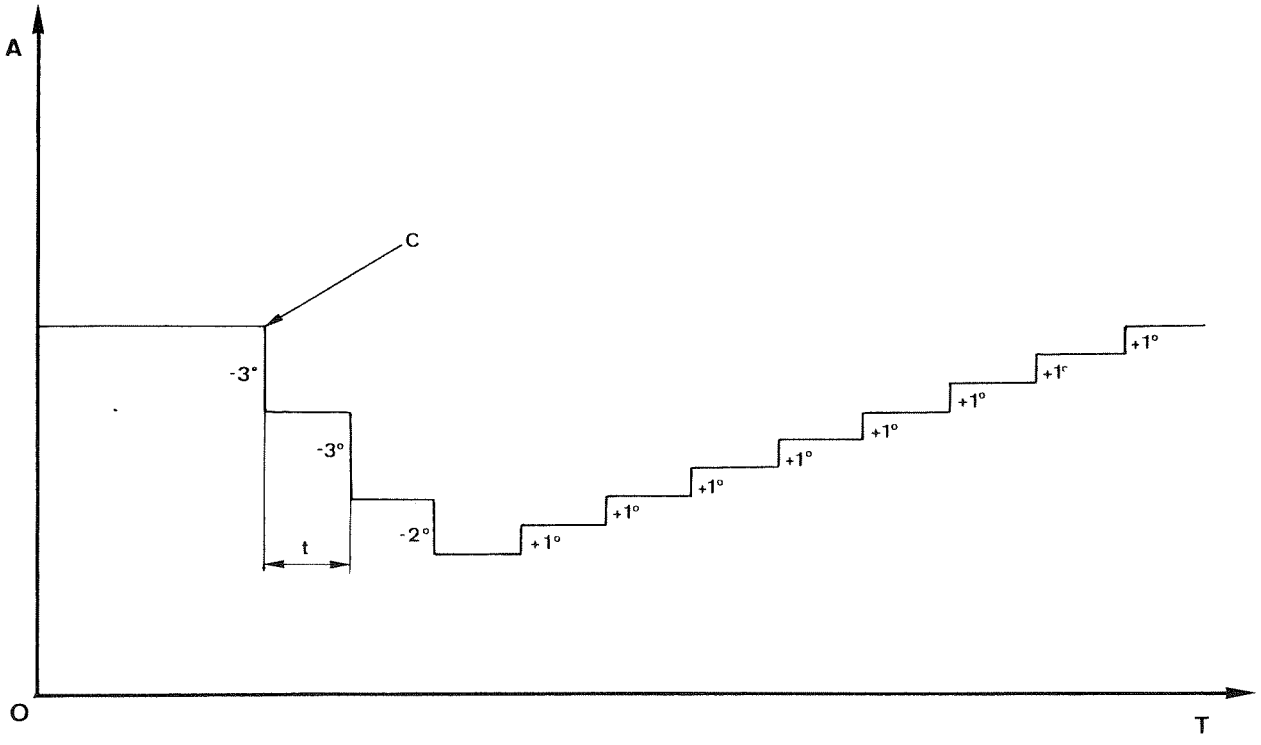

I

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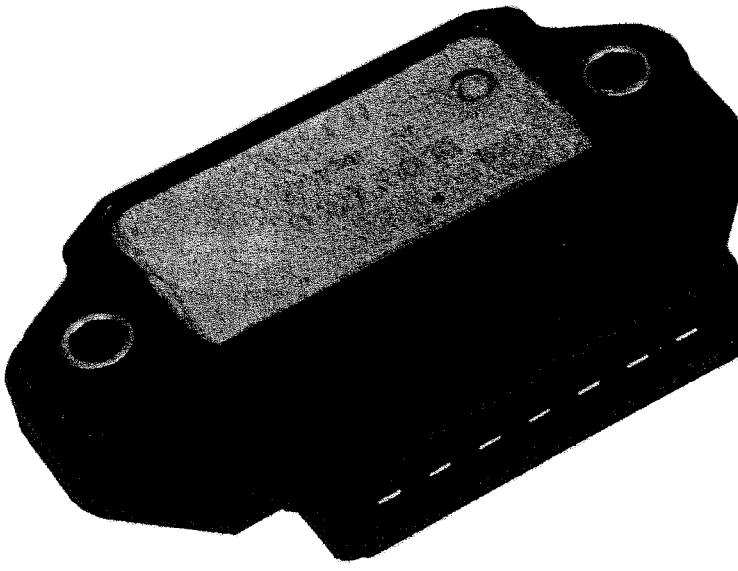
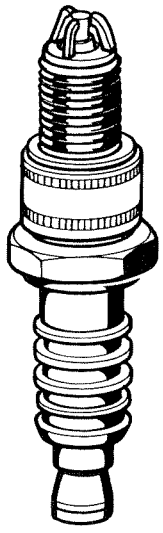


III


BOSCH
Zündspule für Transistor-Zündanlage
TCI-ignition coil
Bobine pour allumage transistorisé

IV



KNOCK SENSOR (fig. I)

Connected to the knock detection unit, it informs the unit if knocking occurs.

Detection frequency is that of audible knocking - 6 300 Hertz.

AMPLIFIER MODULE (fig. II)

Mounted on an aluminium plate to keep it cool, this module transforms and amplifies the signals from the knock detection unit.

IGNITION COIL (fig. III)

SPARK PLUGS (fig. IV)

Specific, with 3 earth electrodes.

Distributor (HALL effect pick-up)	
Make	BOSCH
Type	TSZ EV1
Timing	44° at 4 000 rpm
Advance selection pressure switch	
Make	Jaeger
Contact opening pressure	100 ± 20 mbars (1,45 ± 0,3 lbf in^2)
Electronic advance unit	
Type	0 227 921 012
Advance curve	C 169 E
Knock detection	
Unit type	0 261 201 002
Sensor type	0 201 231 001
Amplifier module	
Type	0 227 100 111
Ignition coil	
Type	0 221 122 317
Primary resistance	0,85 Ω
Secondary resistance	6 000 Ω
Plugs	
Make	BOSCH
Type	W7 DTC
Electrode gap	1 mm
Plug leads	
Make	ELECTRIFIL
Type	BOUGICORD 403 E
Resistance	5 600 Ω/m

THE SPEECH SYNTHESIZER

The speed synthesizer is intended to alert the driver, by means of audible messages, either of anomalies occuring on the vehicle or of driving problems.

These messages, delivered by either a female or a male voice according to the type of message, are preceded by a sound signal.

Three levels of message are transmitted:

- urgent messages, demanding an immediate stop,
- warning messages of low levels or of wear, requiring the affected system to be checked and/or corrected.
- messages to aid the driver.

The urgent messages and the warnings of low levels or wear complement the illumination of the instrument panel lamps.

To improve audibility, the messages are delivered at three sound levels, according to engine speed:

- first level : engine speed below 2 000 rpm,
- second level : engine speed between 2 000 and 4 000 rpm,
- third level : engine speed above 4 000 rpm.

Description:

The speech synthesizer consists of.

— a synthesizer unit **(1),** located under the facia.

This delivers the following messages in 3 languages:

A - French for FRENCH OVERSEAS TERRITORIES, BELGIUM, HOLLAND
B - German for GERMANY, AUSTRIA
C - English for DENMARK, NORWAY, FINLAND

Urgent messages (delivered twice in the event of a fault) :

I - together with coolant temperature warning lamp: "STOP! COOLANT TEMPERATURE IS NOT NORMAL" **(M)**

II - together with oil pressure warning lamp: "STOP ! OIL PRESSURE IS NOT NORMAL" **(M)**

III - together with coolant level switch: "STOP ! COOLANT LEVEL IS LOW" **(M)**

Warning messages

IV - together with oil level warning lamp: "ATTENTION ! OIL LEVEL IS LOW" **(M)**

V - together with low charge warning lamp: "ATTENTION ! BATTERY CHARGE IS NOT NORMAL" **(M)**

VI - together with brake fluid warning lamp: "ATTENTION ! BRAKE FLUID IS LOW" **(M)**

VII - together with brake pad warning lamp: "ATTENTION ! BRAKE PADS ARE WORN" **(M).**

Messages to aid the driver

a) On switching on ignition:

VIII - together with low fuel warning lamp: "ATTENTION ! FUEL LEVEL IS LOW" **(F)**

b) with engine running:

IX - together with brake warning lamp: "RELEASE THE PARKING BRAKE" **(F)**

X - "ATTENTION" ! A DOOR IS OPEN" (any door) **(F)**

XI - "PLEASE ! FASTEN YOUR SEAT BELT" (driver's seat belt only) **(F)**

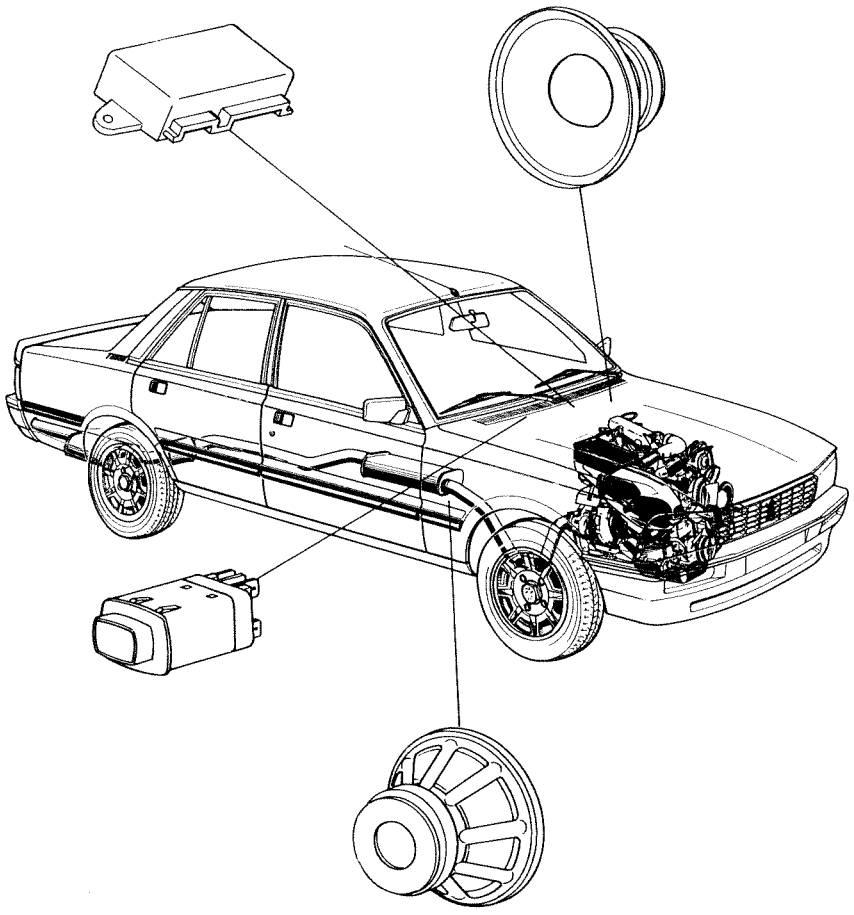
— **two loudspeakers (2)** located in the scuttle kick panels.

— **a TEST button (3)** located on the fascia console, permitting:

— **when stopped** (ignition on, engine not running): the reproduction of all the messages in sequence (without the sound signal).

(M) Male voice

(F) Female voice



	A	B	C
I	STOP! TEMPERATURE D'EAU ANORMALE	STOP! ÜBERHÖHTE WASSERTEMPERATUR	STOP! WATER TEMPERATURE IS NOT NORMAL
II	STOP! PRESSION D'HUILE ANORMALE	STOP! BITTE ÖLDRUCK PRUFEN	STOP! OIL PRESSURE IS NOT NORMAL
III	STOP! NIVEAU D'EAU INSUFFISANT	STOP! BITTE KÜHLWASSER-STAND PRÜFEN	STOP! WATER LEVEL IS LOW
IV	ATTENTION! NIVEAU D'HUILE INSUFFISANT	ACHTUNG! BITTE ÖL NACHFÜLLEN	ATTENTION! OIL LEVEL IS LOW
V	ATTENTION! CHARGE DE BATTERIE ANORMALE	ACHTUNG! BITTE BATTERIE AUFLADEN	ATTENTION! BATTERY CHARGE IS NOT NORMAL
VI	ATTENTION! NIVEAU DE LIQUIDE DE FREINS INSUFFISANT	ACHTUNG! BITTE BREMS-FLÜSSIGKEIT NACHFÜLLEN	ATTENTION! BREAK FLUID IS LOW
VII	ATTENTION! PLAQUETTES DE FREINS USEES	ACHTUNG! BITTE BREMS-BELÄGE ERNEUERN	ATTENTION! BREAK PADS ARE WORN
VIII	ATTENTION! NIVEAU DE CARBURANT INSUFFISANT	ACHTUNG! BITTE TANKEN	ATTENTION! GAS LEVEL IS LOW
IX	DEVERROUILLEZ LE FREIN DE PARKING	BITTE! HANDBREMSE LÖSEN	RELEASE THE PARKING BREAK
X	ATTENTION! PORTE NON FERMEE	ACHTUNG! TÜRE NICHT GESCHLOSSEN	ATTENTION! A DOOR IS OPEN
XI	VEUILLEZ ATTACHER VOTRE CEINTURE	BITTE! SICHERHEITSGURTE ANLEGEN	PLEASE! FASTEN YOUR SEAT BELT

– **When driving:** confirmation of the fault on repeating the message.

– **various sensors:**

- **engine speed sensor:** information is taken from the tachymetric relay (the same as a tachometer).

This information makes it possible:

1) not to transmit audible messages when the ignition is on, but the engine is stopped (for example: oil-coolant etc).

2) to modulate the sound level according to engine speed.

- **fuel level sensor**
- **coolant temperature sensor**
- **brake system sensor**
- **battery charge sensor**
- **oil pressure sensor**
- **door closing sensor**

} Information is taken in parallel from the different circuits

– **driver's seat belt sensor-** a switch is fitted to the buckle of the driver's seat belt.

When the seat belt is un-buckled, the switch is earthed and thus sends a signal to the synthesizer unit.

NOTE: ***Signals are sent to the synthesizer unit when individual sensors are earthed.***

OPERATION

The synthesizer unit has its own amplifier. It is connected to 2 loudspeakers to transmit the messages.

When the car is fitted with a radio, it is connected to the speakers through the synthesizer unit:

- if vehicle operation is normal and there are no messages, the radio signal passes through the synthesizer unit without modification.
- If there is a message to be transmitted, the speaker cables are cut and replaced by a 100 Ω equivalent resistance; the message is passed to the speakers by the synthesizer amplifier.

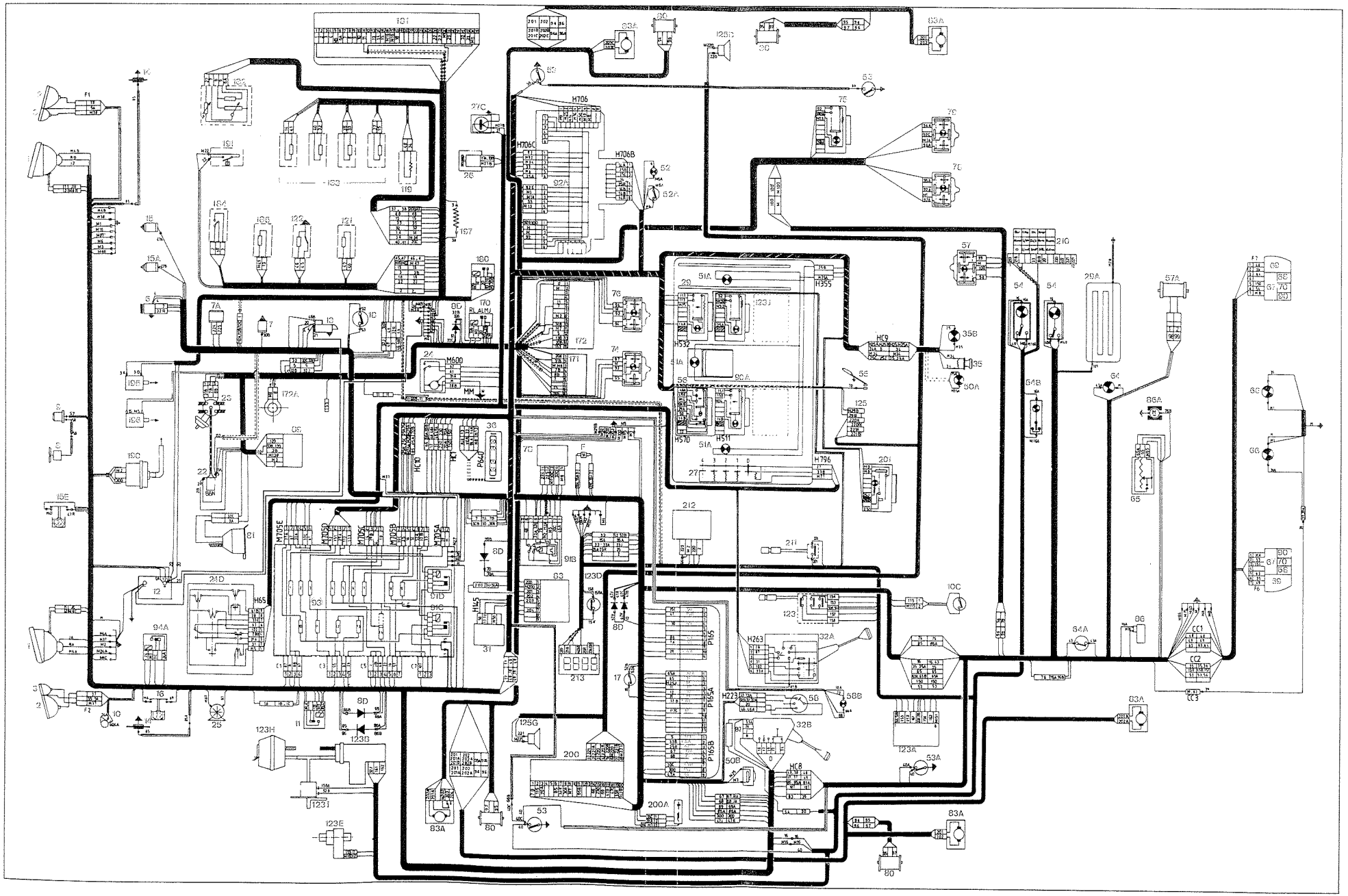
Each word of a message is broken down to a series of its elements, each representing a sound frequency.

All this information is held in an integrated circuit memory.

The latter, connected to a microprocessor, receives information from the sensors throughout the car: oil pressure, coolant temperature, etc.

On receiving a signal from one of the sensors, the microprocessor instructs the memory to assemble the frequencies which make up the words of the message to be tranmitted.

The messages thus made up synthesize human speech, a method which differs from the monochord language produced by computers or traditional recordings on magnetic disc or tape.



KEY TO GENERAL WIRING DIAGRAM

1 - Headlamp
2 - Front direction indicator
3 - Sidelamp
6 - Alternator
7 - Oil pressure switch
7A - Oil level sensor
7B Control unit, oil level
8 - Engine cooling fan
8D - Diodes
9 - Thermal switch, cooling fan
10 - Horns
10C - Switch, seat belt warning
11 - Relay, headlamps
12 - Battery
13 - Starter motor
14 - Brake pads
15 - Pick-up, temperature gauge
15A - Temperature thermal switch
15B - Warning light, coolant temperature
15E - Switch, coolant level
16 - Brake fluid reservoir
17 - Switch, stop lamps
18 - Switch, reverse lamps
22 - Ignition coil
23 - Distributor
24 - Windscreen wiper
24D - Windscreen wiper unit
25 - Pump, windscreen wash
26 - Heater fan
27 - Heater rheostat
27C - Heater control module
29 - Switch, heated rear window
29A - Heated rear window
31 - Direction indicator flasher unit
32A - Switch, windscreen wash/wipe
32B - Switch, lighting, indicators and horns
35 - Cigar lighter, front
35B - Illumination, front cigar lighter
36 - Clock
37 - Warning light, direction indicators
38 - Fuel gauge
38A - Warning light, low fuel
39 - Warning light, main beams
39A - Warning light, dipped beams
41 - Tachometer
42 - Warning light, sidelamps
43 - Warning light, brake system
44 - Gauge, coolant temperature
45 - Warning light, low oil pressure
45B - Warning light, low oil level
49 - Warning light, low charge
50 - Illumination, instrument panel
50B - Rheostat, instrument panel illumination
51A - Illumination, console
52 - Illumination, glove box
52A - Switch, glove box lamp
53 - Switch, front door
53A - Switch, rear door
54 - Interior lamp
54B - Map reading lamp
55 - Switch, hand brake
56 - Switch, hazard warning
57 - Switch, sun roof
57A - Motor, sun roof
58 - Ignition/starter switch, steering lock
58B - Illumination, ignition switch
64 - Illumination, luggage compartment
64A - Switch, luggage compartment lamp
65 - Fuel gauge tank unit
66 - Illumination, number plate
67 - Reverse lamps
68 - Stop lamps
69 - Direction indicators, rear
70 - Tail lamps
74 - Switch, front, electric window, front LH
75 - Over-ride switch, rear electric windows
76 - Switch, front electric window, front RH
78 - Switch, rear, electric window, rear LH
79 - Switch, rear, electric window, rear RH
80 - Motor, electric window
81 - Diagnostic socket
83 - Control unit, central locking
83A - Motor, central locking
86 - Pump, fuel supply
86A - Pump, fuel scavenge
89 - Electronic case or amplifier module
90 - Fog lamps, rear
90A Switch, rear fog lamps
91B - Tachymetric relay
91C - Accessories relay
91D - Relay, heated rear window
92A - Connector board
93 - Fuse board
94A - Relay, horns
119 - Supplementary air device
121 - Cold start injector
122 - Thermal time switch
123 - Switch, cruise control
123A - Control unit, cruise control
123B - Servo, cruise control
123D - Switch, cruise control disengagement
123E - Sensor, cruise control
123H - Pneumatic cylinder
123I - Safety solenoid
123J - Master switch, cruise control
125 - Radio connector
125G - Radio speaker, front LH
125D - Radio speaker, front RH
170 - Realy, ignition
171 - Advance calculator
172 - Knock detector unit
172A - Knock sensor
173 - Warning light, LED, knock detector
180 - Relay, injection
181 - Injection calculator
182 - Air flow sensor
183 - Injectors
184 - Throttle switch unit
185 - Sensor, engine temperature
190 - Sensor, inlet pressure
191 - High presure switch, turbocharger
192 - Pressure gauge, turbocharger
195 - Full load pressure switch, 100 mbar
196 - Pressure switch, advance map selection
197 - Full load resistance
200 - Speech synthesizer
200A - Filter
201 - Test button, speech synthesizer
210 - Trip computer
211 - Control, sequential display
212 - Sensor, fuel flow
213 - Display
+ aa - Accessory supply
+ ac - Supply from ignition switch
M - Earth
+ P - Supply from battery +