CITROËN
CUSTOMER SERVICES
AFTER SALES TECHNICAL DEPARTMENT

TECHNICAL BULLETIN

XM 1

CONCERNING:
ALL COUNTRIES

APPLYING TO:
ALL COUNTRIES

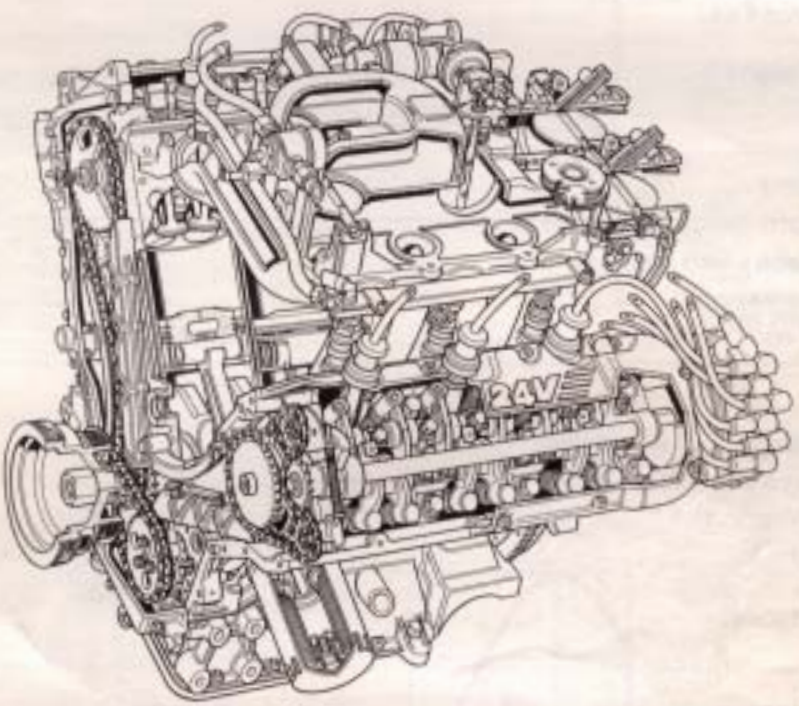
CONCERNING:
CITROEN XM
V6-24 Valve Engine
Characteristics and Checks

No. 23

30th April, 1991

THIS DOCUMENT IS TO BE FILED IN: BULLETIN BINDER No. MAN 058930

CITROËN XM V6 .24



SKZ 6-CYLINDER ENGINE

SUMMARY:

GENERAL CHARACTERISTICS

Commercial name	XM V6.24 v
Factory symbol	Y 3-A L
Guarantee type	Y 3-A L
French fiscal rating	16 CV
Number of seats	5

- **DIMENSIONS:**

Dimensions unchanged. Refer to Technical Bulletin XM ⓪ No. 1.

- **WEIGHTS:**

– Unladen weight	1465 kg
- on front axle	935 kg
- on rear axle	530 kg
– Gross vehicle weight	1920 kg
- on front axle	1095 kg
- on rear axle	835 kg
– Gross train weight	3420 kg
– Max. trailer weight (without brakes)	720 kg
– Max. trailer weight (with brakes)	1500 kg
– Max. trailer nose weight	110 kg
– Max. weight on roof rack	80 kg

- **PERFORMANCE:**

– 400 m standing start (*driver only*)	15.8 s
– 1000 m standing start (*driver only*)	28.6 s
– 0 - 62 m.p.h. (*driver only*)	8 s
– Maximum speed	146 m.p.h.

- **FUEL CONSUMPTION:**

– At 56 m.p.h.	34.4 m.p.g.
– At 75 m.p.h.	27.7 m.p.g.
– Urban	17.8 m.p.g.

- **GEARBOX:**

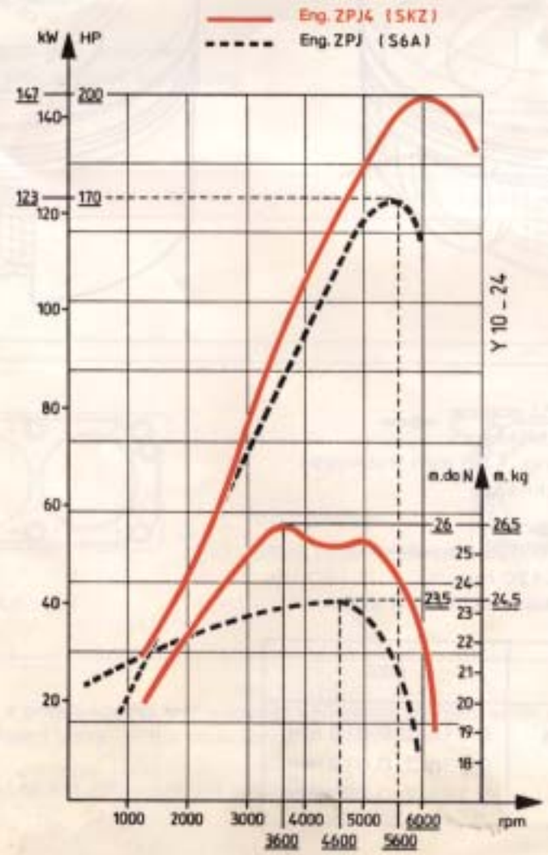
TYPE	REFERENCE	ENGINE	TYRES	LADEN ROLLING CIRCUMFERENCE
ME5 T	2 GM 02	SKZ	205/60 R15 MXV2	1.920 m

GEAR	GEARBOX RATIO	FINAL DRIVE RATIO	OVERALL RATIO	SPEED mph per 1000 rpm
1	12 x 38		0.0776	5.56
2	18 x 33		0.1341	9.59
3	28 x 35	15 x 61	0.1967	14.08
4	32 x 31		0.2538	18.16
5	43 x 33		0.3204	22.93
Rev.	13 x 41		0.0779	5.57
Speedometer drive ratio: 25 x 20				

ENGINE

I. CHARACTERISTICS

Vehicle factory symbol	Y 3-A L
Engine type	SKZ (ZPJ4)
Number of cylinders	6
Bore	93 mm
Stroke	73 mm
Cubic Capacity	2975 cc
Compression ratio	9.4 : 1
Max. power EEC	147 kW at 6000 rpm
Max. torque EEC	26 mdaN at 3600 rpm
Maximum rpm	6400
French fiscal rating	16 CV
Recommended fuel	Unleaded petrol
Octane rating	95 RON minimum



II CONSTRUCTION

- **Cylinder block:**

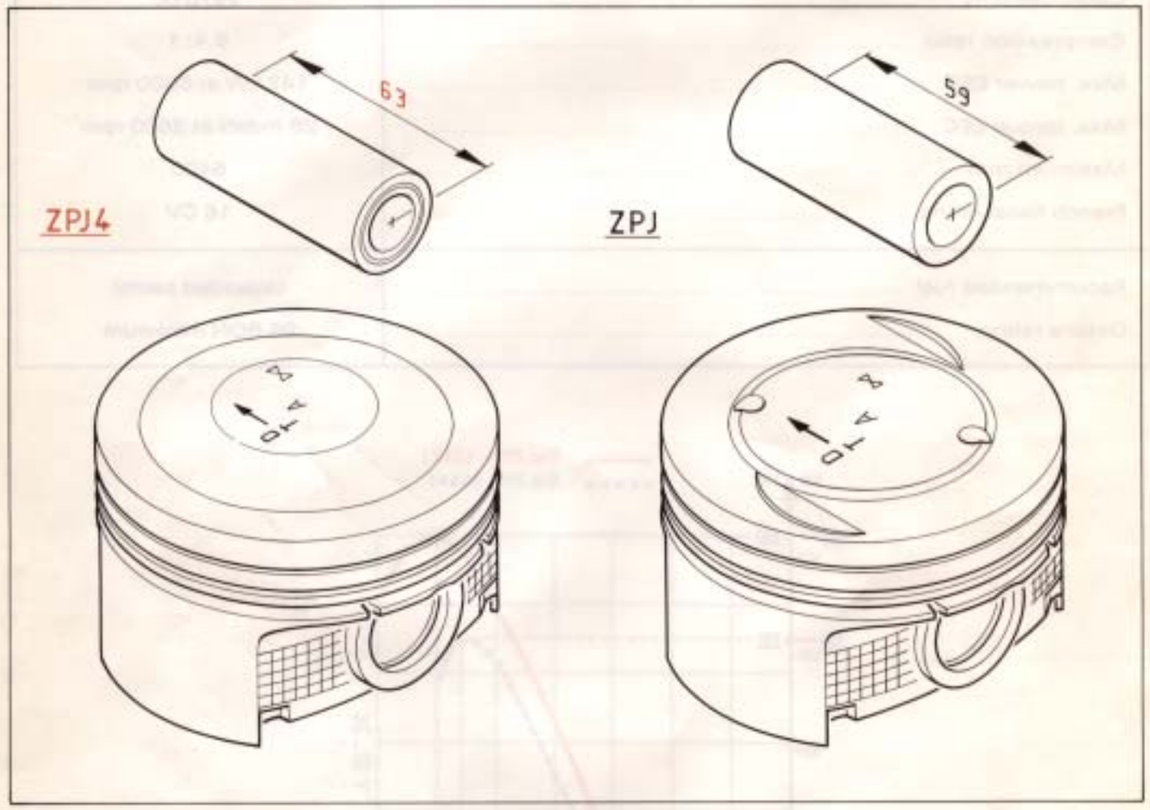
  Identical to ZPJ cylinder block.

- **Moving parts:**

  Crankshaft identical to that of ZPJ engine, end float from 0.07 - 0.27 mm.
  Bearings and seals identical to ZPJ engine.

- **Con-rods - Pistons - Rings and Barrels:**

  Con-rods and barrels identical to ZPJ engine.



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Piston rings: identical to ZPJ engine
– chromed ring, 1.75 mm thickness
– "eagle-beack" stepped ring, 1.75 mm thickness
– scraper ring, 3.5 mm thickness

Barrels: identical to ZPJ engine
Cast-iron, height 98.975 ± 0.025 mm
Stand-proud: from 0.05 - 0.120 mm
Adjustable by coated steel base seals in 3 sizes:

COLOUR	SIZE
– Yellow - orange	0.116 ± 0.018 mm
– Colourless	0.136 ± 0.018 mm
– Blue	0.166 ± 0.028 mm

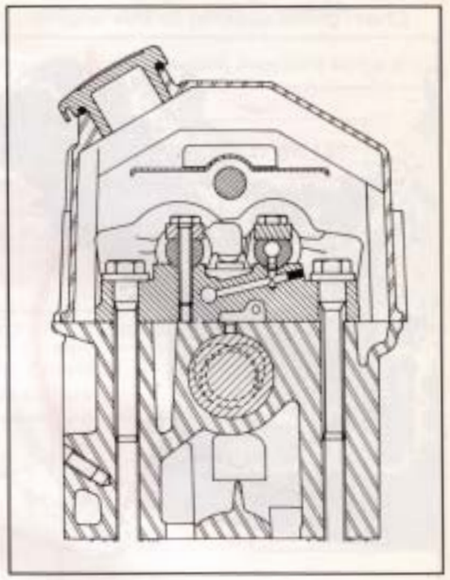
- **Cylinder heads**

In light alloy with 4 bearings.
Single chain driven overhead camshaft in each cylinder head. The chain tensioner operates hydraulically and has a mechanical rearming device. 4 valves per cylinder operated by intermediate cam followers and hydraulic tappets housed in the rockers.

A support housing carries:

- two rocker shafts:
  – one shaft for individual inlet rockers (6 rockers per cylinder head),
  – one shaft for the one-piece exhaust rockers (3 per cylinder head),
- a balance shaft identical to ZPJ engine in the front cylinder head. The operating principle of the hydraulic tappet is described in Technical Bulletin XM (1) No. 1, page 4.

ATTENTION: The centre cam followers are different:
inlet: length 41.32 mm
exhaust: length 40.12 mm



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Cylinder head tightening:

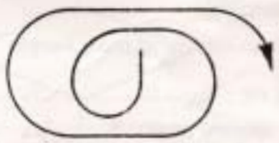
Final head tightening is carried out on assembly.

After cylinder head removal:

DO NOT RETIGHTEN AT 1ST SERVICE

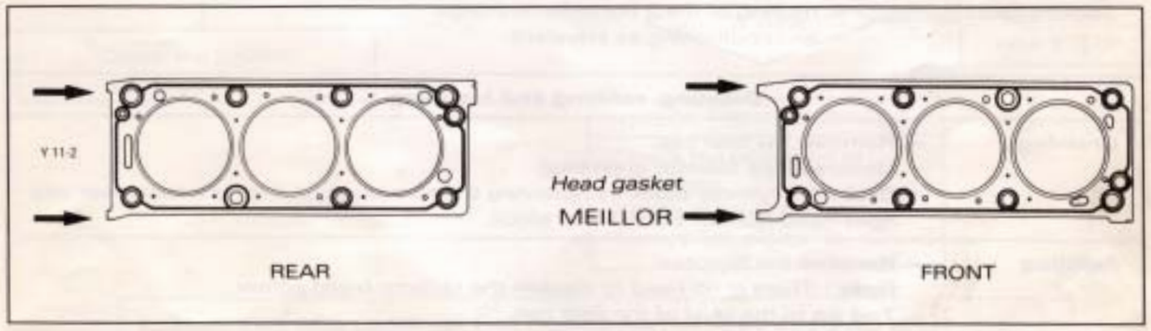
TIGHTENING OF THE HEAD BOLTS is by the angular method (bolt head faces and threads lubricated), following a conventional circular sequence as shown:

1°) Tighten each bolt to **6 mdaN** in the order shown.
2°) Slacken each bolt in turn and retighten to **4 mdaN** plus a further angular tightening of **180°.**



This tightening method is carried out with the engine cold and no subsequent tightening is required

Identification: (➡)

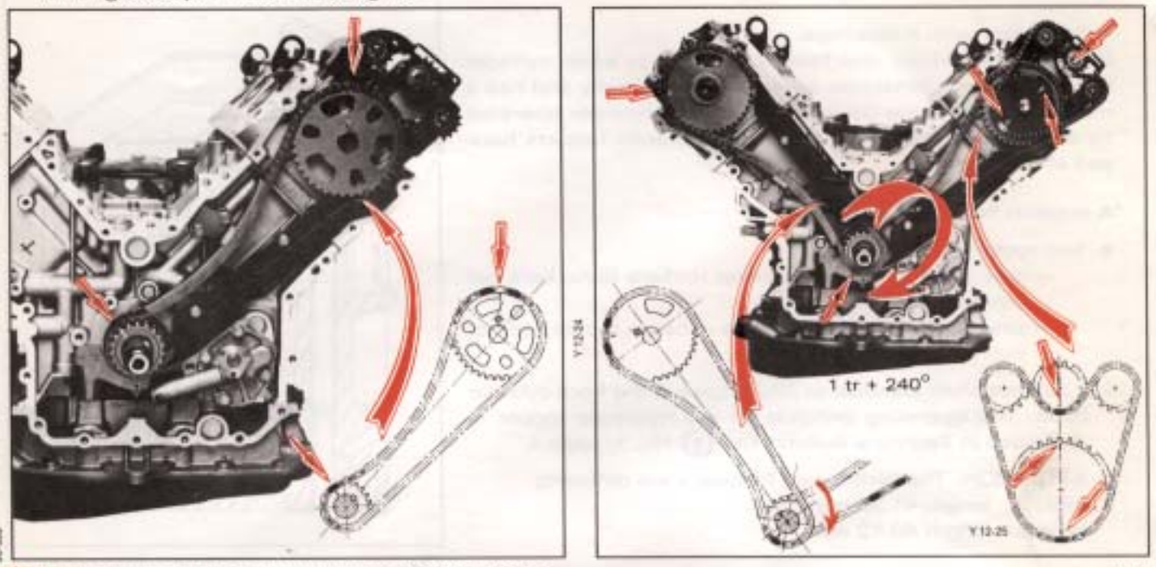


Inlet valves (Ø 37 mm) with a green spring and exhaust valves (Ø 32 mm) with a red/black spring.
Hexagonal headed cylinder head bolts, 178 mm in length.

The front and rear camshafts of the ZPJ4 engine are identical.

- **Valve timing**

Specific timing chains, 62 links *(64 links on ZPJ)*.
Chain guide specific to this engine.



Valve timing by reference marks on the chains.

- **Lubrication:**

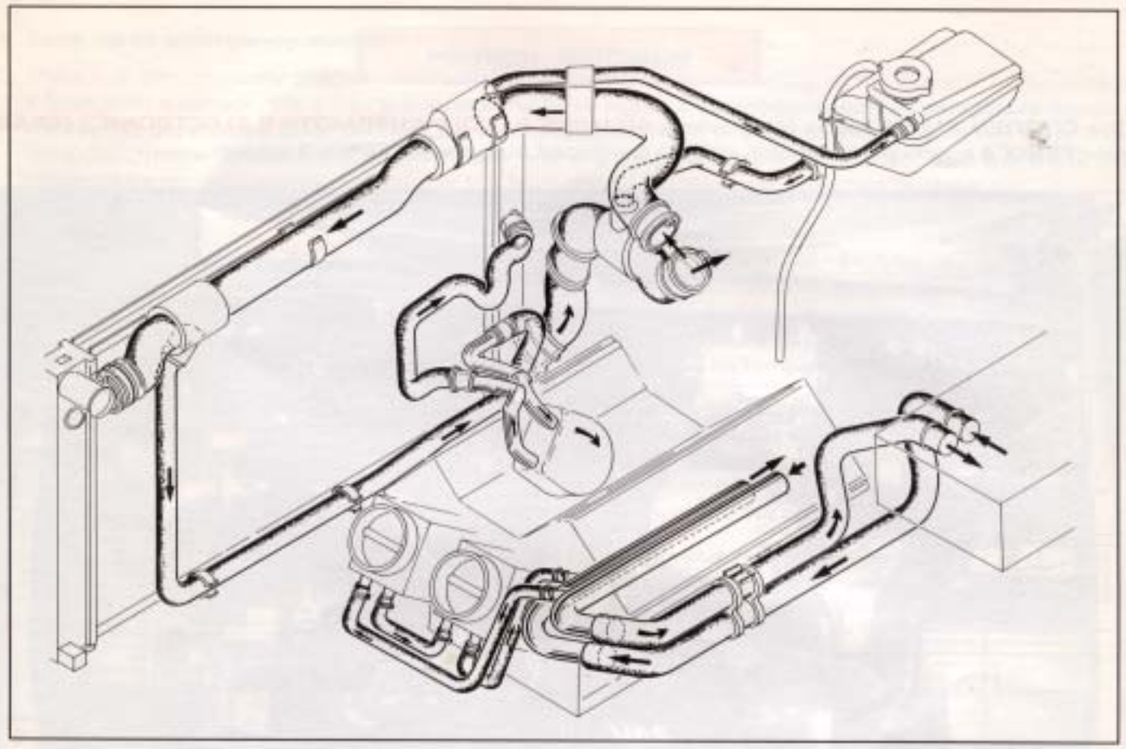
7-tooth gear type oil pump driven by chain (identical to ZPJ engine).

Capacity after draining	6.5 litres
new engine	7 litres
Difference between min. and max. levels	2 litres
Recommended oil	TOTAL QUARTZ or TOTAL GOLD
Minimum oil pressure at 80°C	5.5 bars at 5,500 rpm
Low oil pressure switch setting	0.5 bar
Oil filter reference	PURFLUX LS 520 C, replace every 12000 miles
R.P. No.	95 638 903

- **Cooling system**

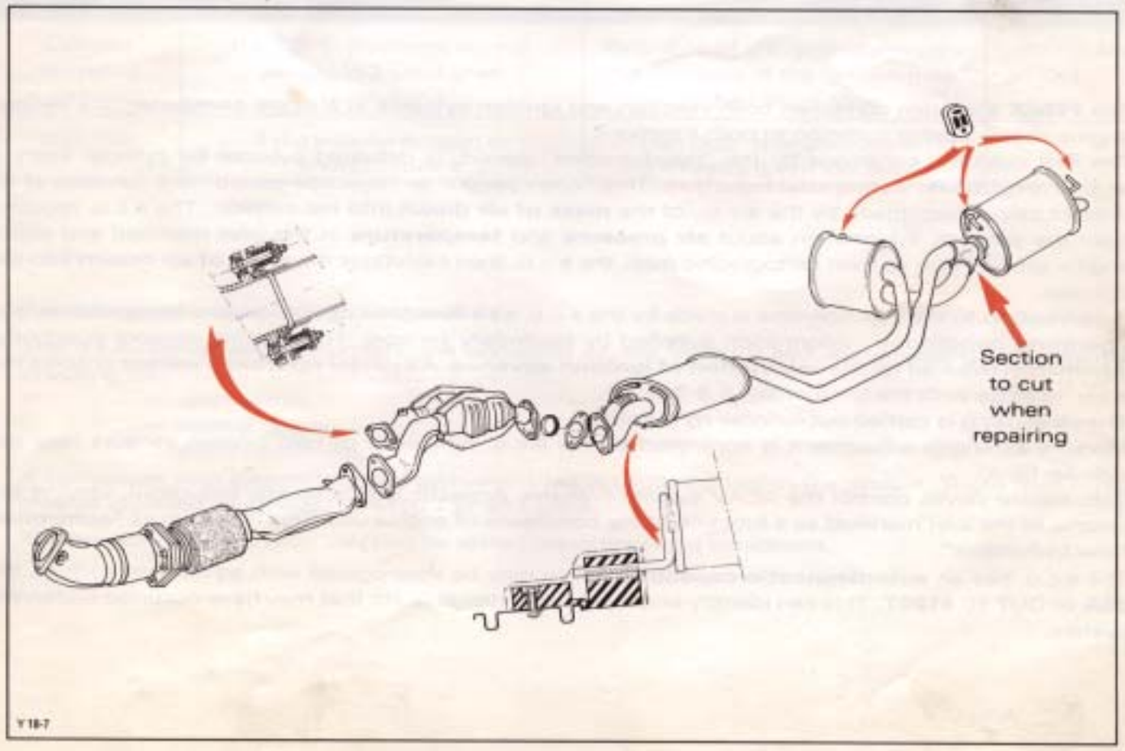
Water pump driven by "polyvee" belt.
Specific coolant circuit: – heating of the 2 butterfly housings
– air conditioning as standard.

Draining, refilling and bleeding	
Draining	: – **Remove** the filler cap. – **Unscrew** the radiator drain plug – **Drain** the cylinder block by removing the two plugs on the right-hand rear and right-hand front of the cylinder block.
Refilling	: – **Remove** the filler cap. **Note** : *There is no need to slacken the radiator bleed screw.* – **Top up** to the level of the filler cap.
Bleeding	: – **Refit** the filler cap. – **Start** the engine and run it at 1500 - 3000 rpm to assist the bleeding. – **Let** it run until the cooling fans cut-in. – **Switch off** and wait for the engine to cool. – **Top up** coolant level to the MAX. mark. – **Refit** the filler cap.



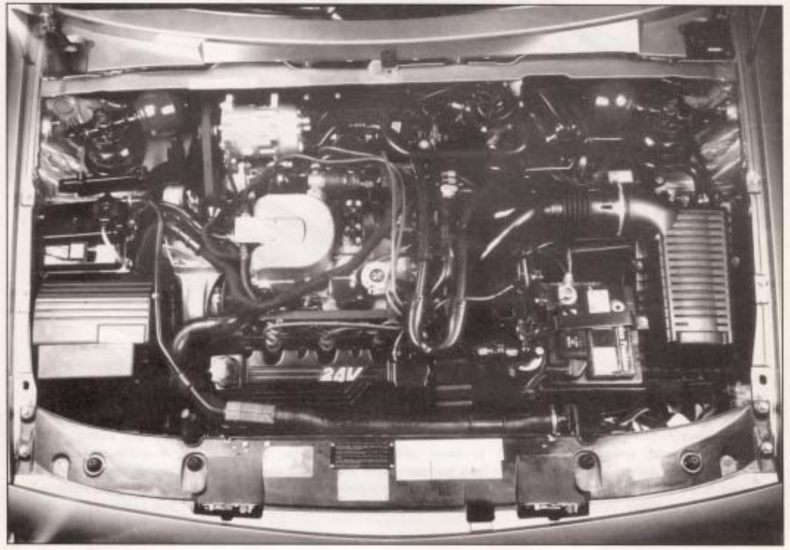
- **Exhaust**

A "6-into-1" manifold with "METEX" swivel joint for each cylinder head. As the front exhaust line is longer, a small priming catalyser, located under the engine, pre-treats the exhaust gas. This pre-treatment increases the exhaust gas temperature and the 2 main catalytic converters receive the gases from each bank at equal temperatures. Each cylinder bank gas has its own oxygen sensor and catalytic converter. A specific repair procedure allows certain components of the exhaust system to be replaced individually.



INJECTION - IGNITION

The **CITROEN XM V6 24v** is fitted with a **SIEMENS BENDIX AUTOMOTIVE ELECTRONICS (SBAE)** type **FENIX 4** injection and ignition system developed from the **V6 FENIX 3** system.



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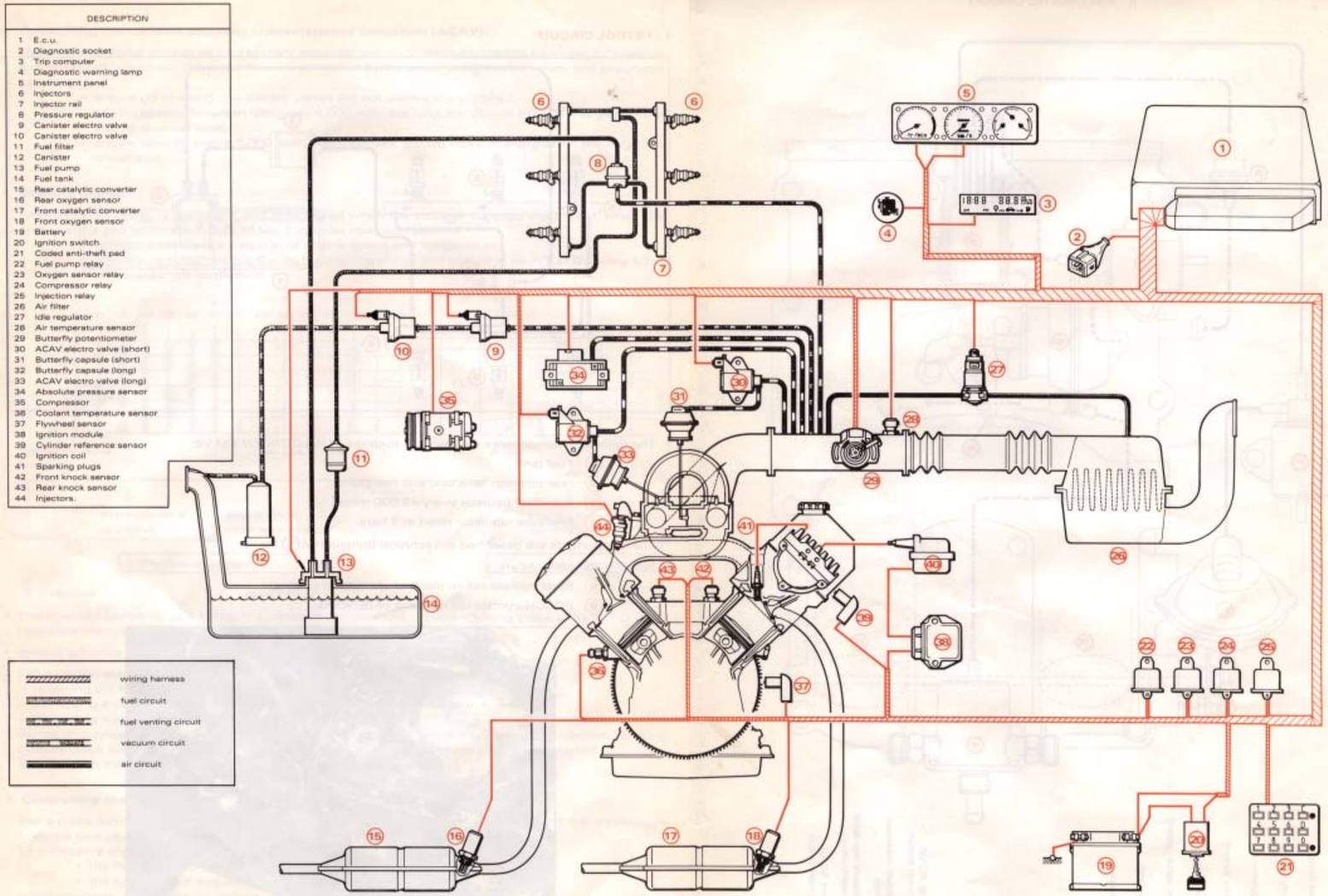
The **FENIX 4** system combines both injection and ignition systems in a single **computer**, the various engine sensors being common to both functions.
The fuel quantity, controlled by the "injector open" period, is delivered cylinder by cylinder every 2 engine revolutions: **sequential injection**. This "open period" or "injection period" is a function of an indirect calculation, made by the e.c.u., of the **mass of air** drawn into the cylinder. The e.c.u. receives from the sensors, information about **air pressure** and **temperature** in the inlet manifold and about engine speed. From its own cartographic map, the e.c.u. then calculates the **mass of air drawn** into the cylinder.
A **correction** to the injection time is made by the e.c.u. as a **function of** both engine **temperature** and **operating conditions** ; information supplied by secondary sensors. These same sensors supply the information required for the **calculation of ignition advance.** A cylinder **reference sensor** enables the e.c.u. to **align** with the firing order: **1-6-3-5-2-4.**
Knock sensing is carried out cylinder by cylinder.
Mixture strength adjustment is controlled by the e.c.u. by means of two oxygen sensors (one per cylinder bank).
Two electro valves control the ACAV system (Variable Acoustic Characteristic Induction), varying the volume of the inlet manifold as a function of the conditions of engine use. This is known as **"controlled flow induction"**.
The e.c.u. has an **autodiagnostic capability** which may be interrogated with equipment such as the **26A** or OUT 10 **4120T**. This can identify and report operational faults that may have occurred within the system.

DESCRIPTION
1 E.c.u.
2 Diagnostic socket
3 Trip computer
4 Diagnostic warning lamp
5 Instrument panel
6 Injectors
7 Injector rail
8 Pressure regulator
9 Canister electro valve
10 Canister electro valve
11 Fuel filter
12 Canister
13 Fuel pump
14 Fuel tank
15 Rear catalytic converter
16 Rear oxygen sensor
17 Front catalytic converter
18 Front oxygen sensor
19 Battery
20 Ignition switch
21 Coded anti-theft pad
22 Fuel pump relay
23 Oxygen sensor relay
24 Compressor relay
25 Injection relay
26 Air filter
27 Idle regulator
28 Air temperature sensor
29 Butterfly potentiometer
30 ACAV electro valve (short)
31 Butterfly capsule (short)
32 Butterfly capsule (long)
33 ACAV electro valve (long)
34 Absolute pressure sensor
35 Compressor
36 Coolant temperature sensor
37 Flywheel sensor
38 Ignition module
39 Cylinder reference sensor
40 Ignition coil
41 Sparking plugs
42 Front knock sensor
43 Rear knock sensor
44 Injectors.



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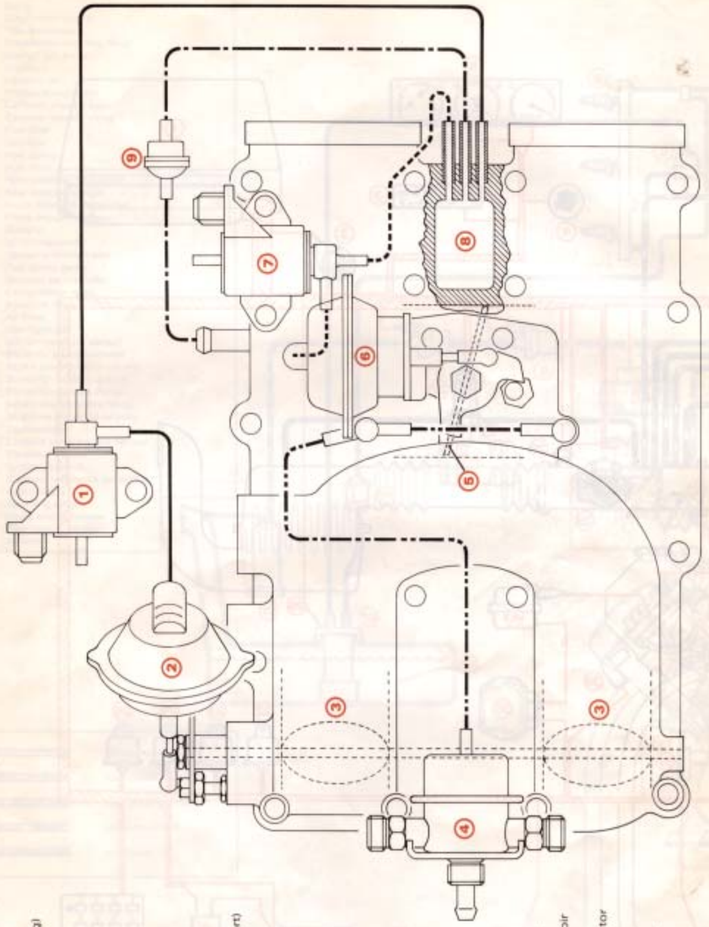
II - PNEUMATIC CIRCUIT

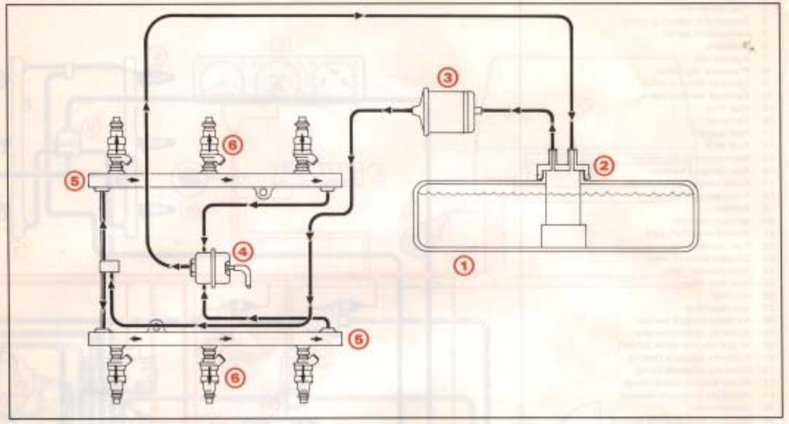


DESCRIPTION

1. ACAV electro valve (long)
2. ACAV capsule (long)
3. ACAV butterfly (long)
4. Pressure regulator
5. ACAV butterfly (short)
6. ACAV capsule (short)
7. ACAV electro valve (short)
8. Vacuum reservoir
9. Non-return valve.

Long ACAV vacuum circuit
Vacuum reservoir circuit
Pressure regulator vacuum circuit
Short ACAV vacuum circuit.

I - PETROL CIRCUIT



▶ The following components are identical to those of the CITROEN XM V6:

1. Fuel tank
2. Fuel pick-up: tank unit and fuel pump
3. Fuel filter (replace every 48,000 miles)
4. Pressure regulator rated at 3 bars.

These components are described in Technical Bulletin XM (1) No. 1.

▶ Specific components are:

5. Steel injector rail (in place of aluminium casting)
6. BOSCH injector rail (in place of BENDIX).

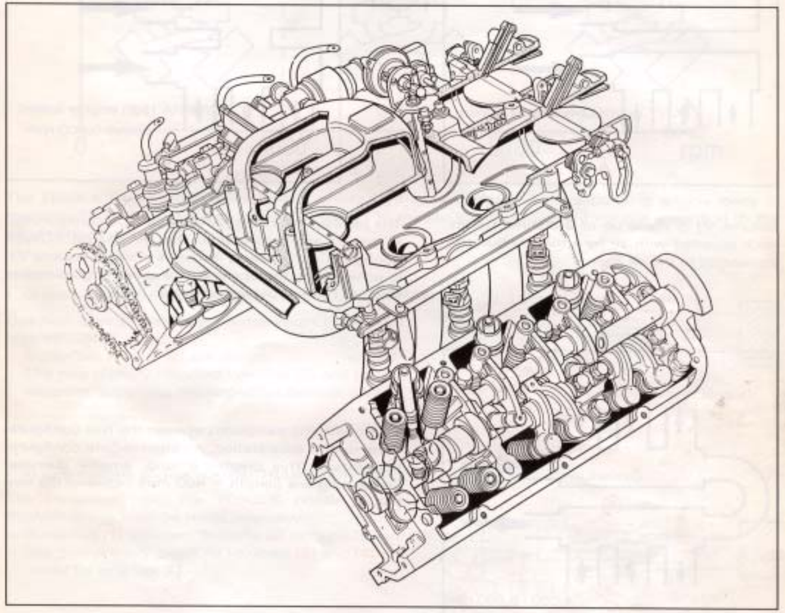
Note: As the injection is sequential, one injection of fuel every 2 engine revolutions, the injector connections are marked with the relevant cylinder number.

III - AIR CIRCUIT

Air filter identical to **CITROEN XM V6** replace every 24,000 miles.

Variable Acoustics Characteristics Induction (ACAV):

There are various ways of increasing engine performance: turbo charging, multi-valve...
The method used for the **CITROEN XM V6 24v** is by use of a multi-valve inlet and exhaust system completed by the ACAV.
The multi-valve inlet system provides good cylinder filling at high engine speeds. The problem of loss of torque at low engine speeds is corrected by induction with variable acoustic characteristics.



The ACAV uses the phenomenon of wave propagation in a given volume to optimise cylinder filling.

- *Operating principle*:

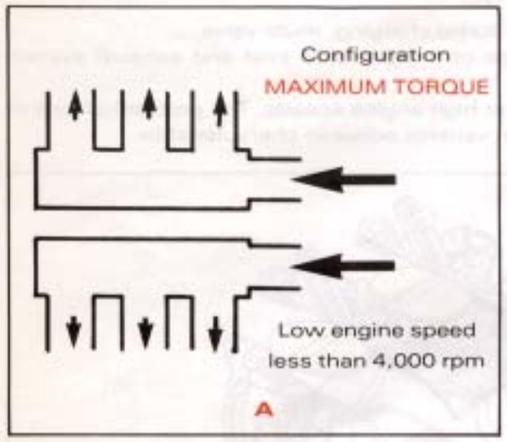
The manifold distributes the air to the cylinders and consists of 6 ducts. The injectors are mounted in these ducts and are located upstream of the inlet valves. The manifold is completed by the ACAV system.
The assembly consists of:

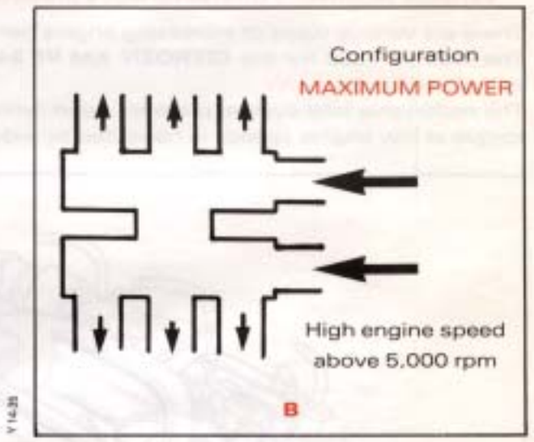
- two primary inlet air volumes,
- a link "**L**" (long) with two blanking butterflies,
- a link "**C**" (short) having one blanking butterfly,
- a vacuum reserve, the energy source for the capsules controlling the butterflies.

The two throttle butterflies, which open simultaneously, are controlled mechanically by the accelerator pedal.

The e.c.u. controls the operation of the two electro valves as a function of engine speed and throttle position, acting on information from the throttle potentiometer.

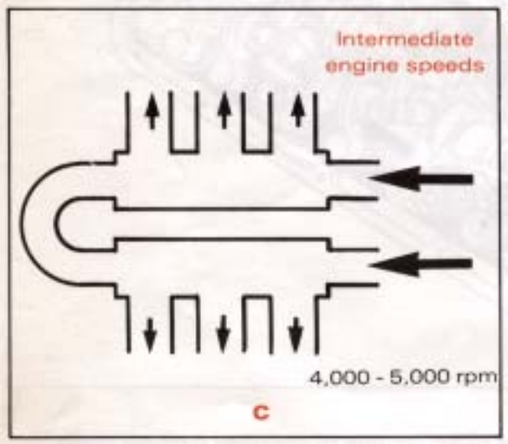
When an electro valve is supplied electrically, the vacuum reservoir is connected to the corresponding butterfly capsule which acts on the butterfly spindle.





Volume V1 is made up of 2 distinct halves, each supplied with air by a throttle butterfly connected to the air filter.

The passage from MAXIMUM TORQUE configuration (2 halves are separate) to the MAXIMUM POWER configuration (2 halves linked as a single volume V1) is achieved by the opening of a short, large diameter tract (Ø 70 mm) between the two halves.



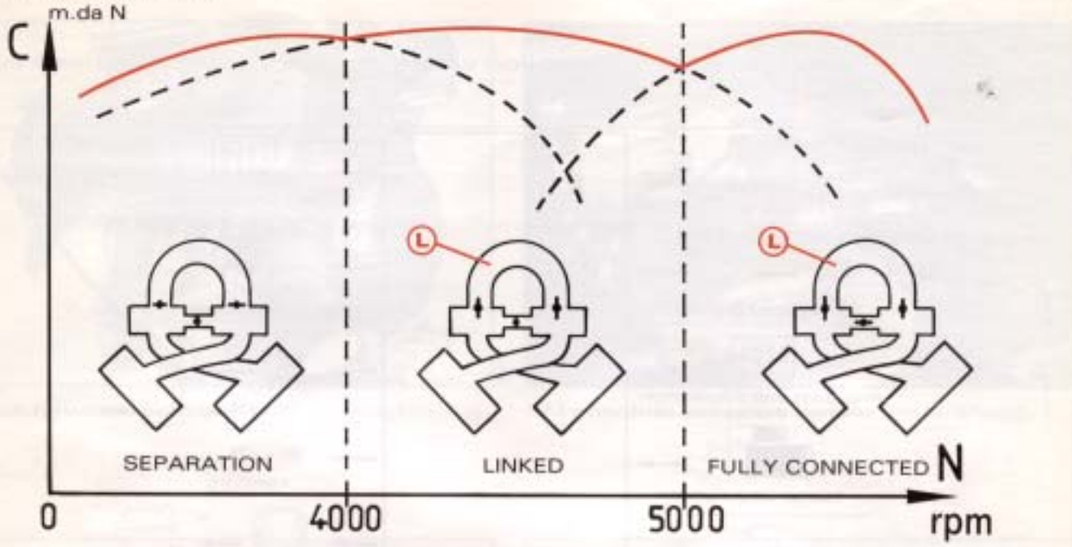
To smooth the transition between the two configurations during acceleration, an intermediate configuration exists. This creates a long, smaller diameter connecting link (length ≃ 400 mm) between the two halves.

The switching between each configuration is carried out when under **FULL LOAD**:

- below 4,000 rpm **(A)** SEPARATION as far as the air filter,
- between 4,000 rpm and 5,000 rpm **(C)** LINKED (long tract opened by two butterflies of 50 mm diameter),
- above 5,000 rpm **(B)** FULLY INTERCONNECTED (short tract opened by a butterfly of 70 mm diameter).

NOTE: if the system is without fault, the long tract will remain open at all engine speeds above 4,000 rpm even for part-load conditions. This allows the inlet pressures of the two cylinder banks to balance and provides even distribution of the air from the idling regulator (when cold or at idle).

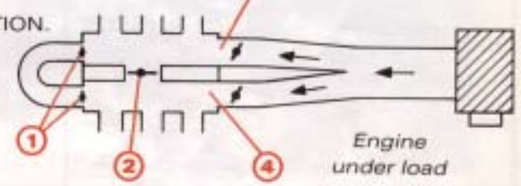
- *OPERATING STAGES:*



The FENIX 4 e.c.u. holds characteristic points of engine speed and corresponding engine loads in memory. Thus, it can control the electro valves to modify the inlet manifold volume according to the conditions of use:

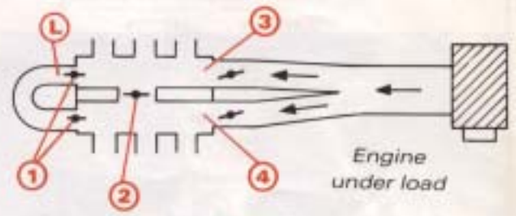
- At low engine speeds: TORQUE obtained by SEPARATION.

Gas flow speed must be at the maximum to produce high torque:
- Butterflies **(1)** and **(2)** are closed,
- The two primary manifold volumes **(3)** and **(4)** are separate, supplying the respective cylinder bank.



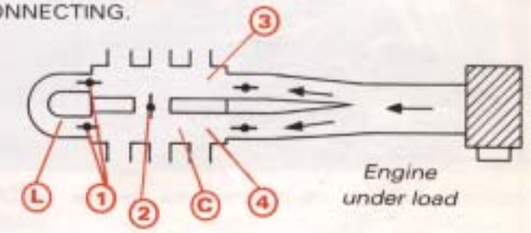
- At intermediate engine speeds: TRANSITION "Torque/Power" obtained by LINKING.

The transition from the TORQUE phase to the POWER phase must be made smoothly:
- Butterflies **(1)** are open, butterfly **(2)** remains closed.
- The two primary manifold volumes **(3)** and **(4)** are linked by long link **(L)**.



- At high engine speeds: POWER obtained by INTERCONNECTING.

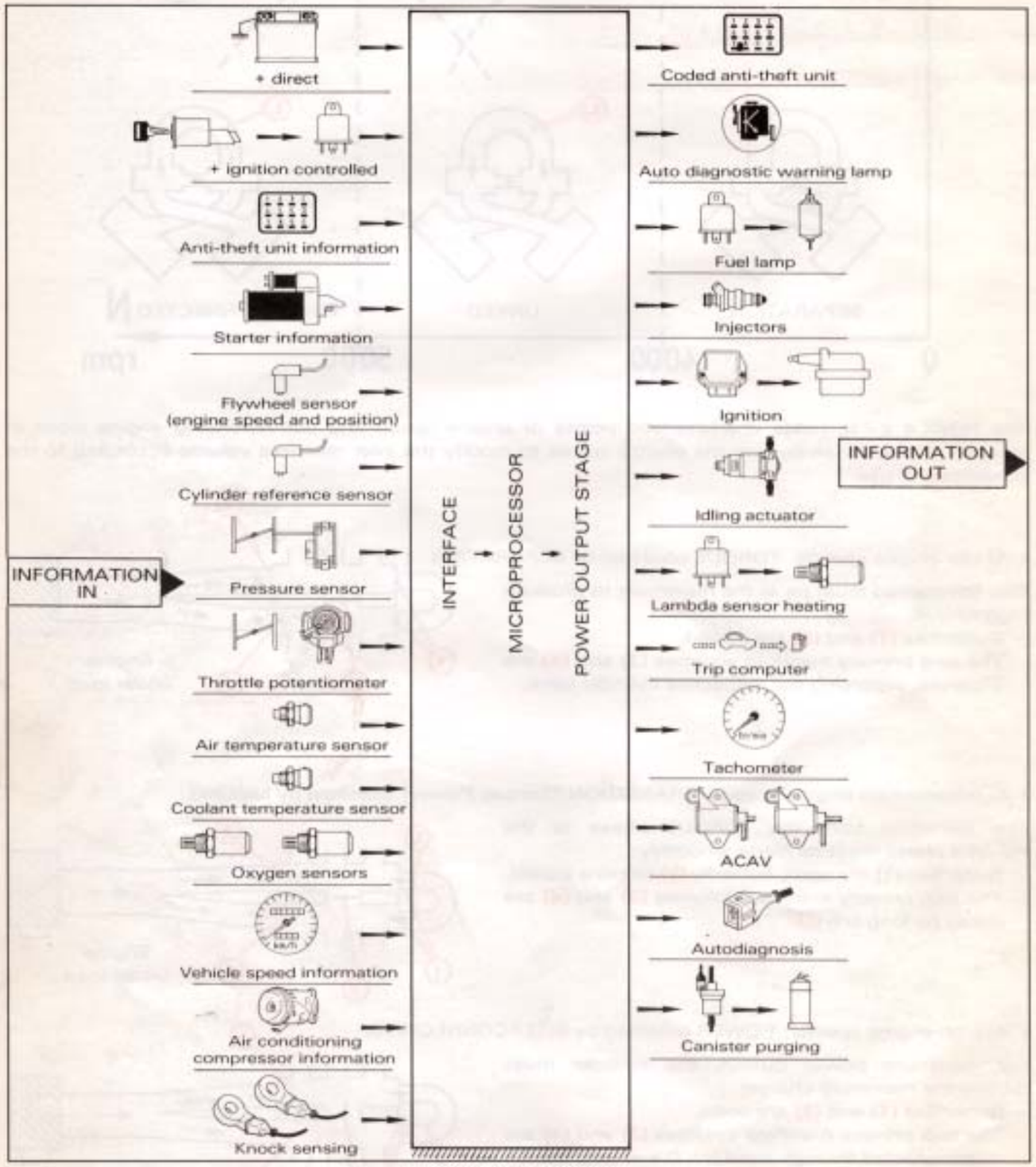
For maximum power output, the cylinder must receive the maximum charge:
- Butterflies **(1)** and **(2)** are open.
- The two primary manifold volumes **(3)** and **(4)** are interconnected through short link **C** and long link **L**.



IV - ELECTRICAL CIRCUIT

E.c.u.: SBAE FENIX 4

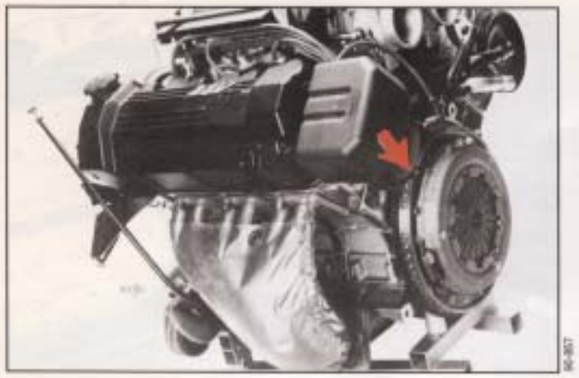
Located in the e.c.u. carrier on the right hand front wheel arch. Inputs and outputs are made through a **55-way** connector.



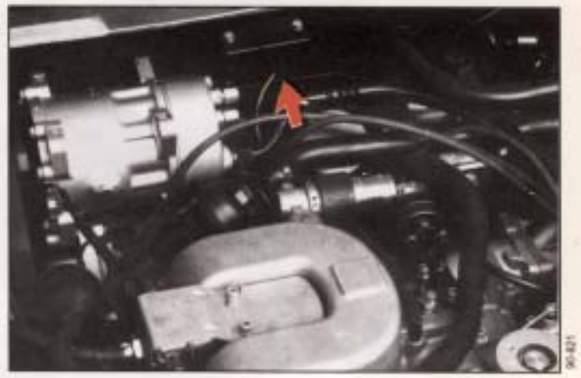
Y 14-12

The following components are specific to the CITROEN XM V6 24v:

- E.c.u.
- Oxygen sensors
- Cylinder reference sensor
- ACAV electro valves
- Injectors.

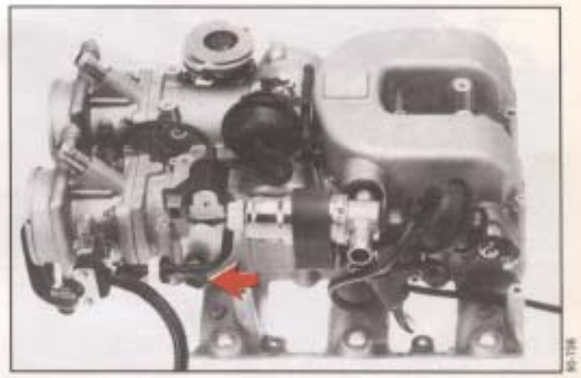


BENDIX **flywheel sensor** (in bell housing).

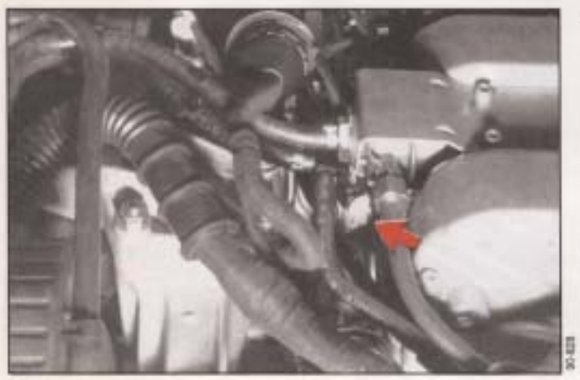


GM **absolute pressure sensor** (on bulkhead).

BENDIX **throttle potentiometer** (on rear butterfly housing).

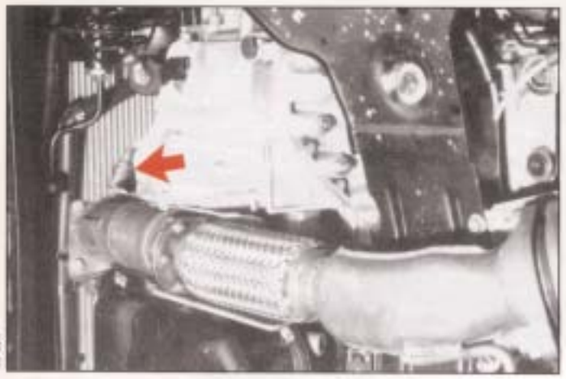


JAEGER **air temperature sensor** (grey connector) (in inlet manifold).

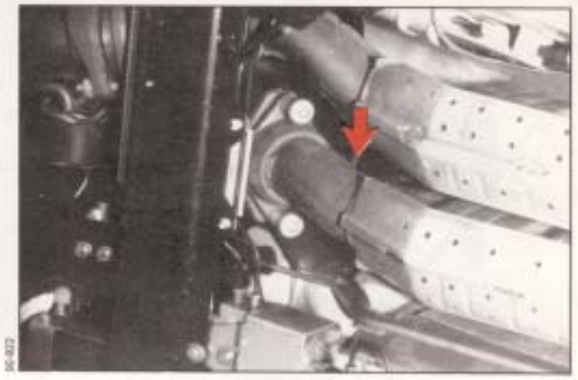


JAEGER **coolant temperature sensor** (green connector) (in coolant outlet housing).

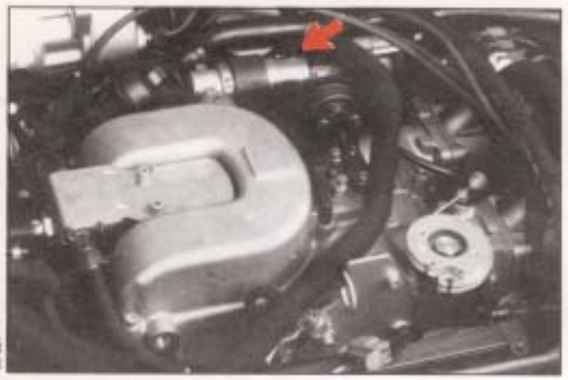
EATON **speed sensor** (driven by speedometer cable).



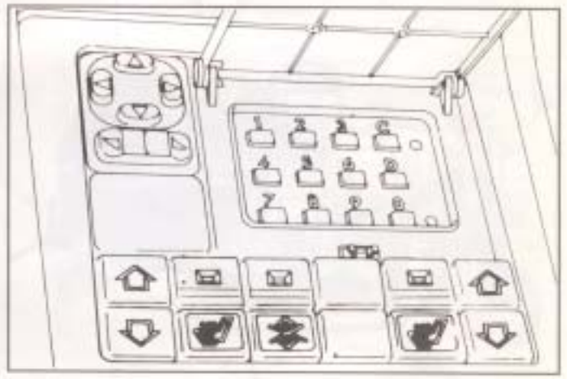
Oxygen sensor for front bank.



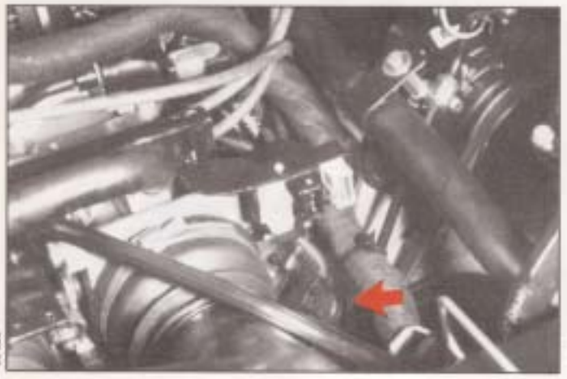
Oxygen sensor for rear bank.



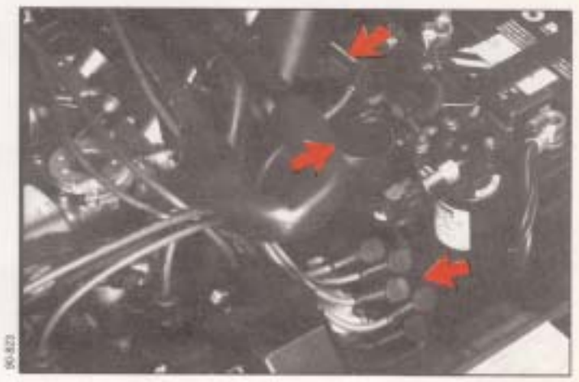
BOSCH **knock sensors**
One sensor per cylinder bank:
- green sensor - front bank
- blue sensor - rear bank.



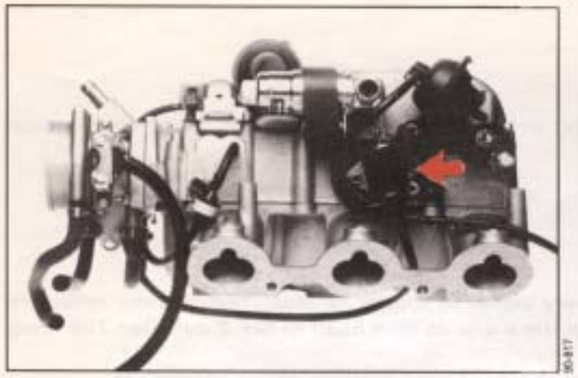
JAEGER **coded anti-theft key pad.**



Cylinder reference sensor
(on rear head opposite the cam pulley).



Ignition circuit
The ignition module sends a primary voltage to the ignition coil which is transformed into a secondary voltage. This is sent to the appropriate cylinder by means of the distributor.

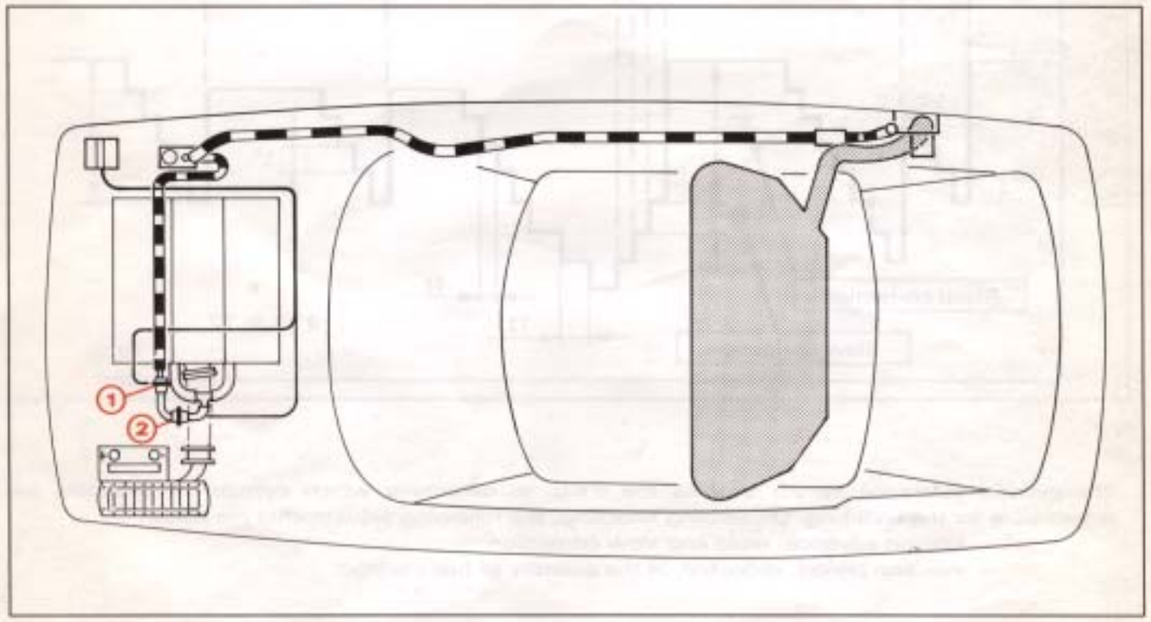


ACAV butterfly capsule **electro valves.**

ACAV butterfly **capsules.**

- **Other information** supplied by the e.c.u.:
  As on the CITROEN XM V6, the e.c.u. controls:
  - the heating of the oxygen sensors
  - the tachometer information
  - the autodiagnostic warning lamp
  - the information required by the trip computer
  - the memorising of the incidents and their codes.

- **Purging of the canister** (if fitted).



Y 17-22

To optimise engine performance and conform to emission regulations, the e.c.u. controls the purging valve of the canister **(1)**, recycling the fuel vapour from the tank. The purging is controlled as a function of engine operating conditions.
This valve is open at rest. To avoid an accumulation of fuel vapour in the inlet manifold, a second valve (closed at rest) **(2)** cuts off the canister purging circuit when the engine is not running.
ATTENTION: Make sure that the 2 valves are connected correctly.
Emission standard 15-05: 2-way white connector to 2-way black connector
(without canister) the other 2-way black connector remains unconnected.
Emission standard US 83: 3-way white connector to canister electro valve
a 2-way black connector to canister purge electro valve
the other 2-way black connector remains unconnected.

V - OPERATING PHASES

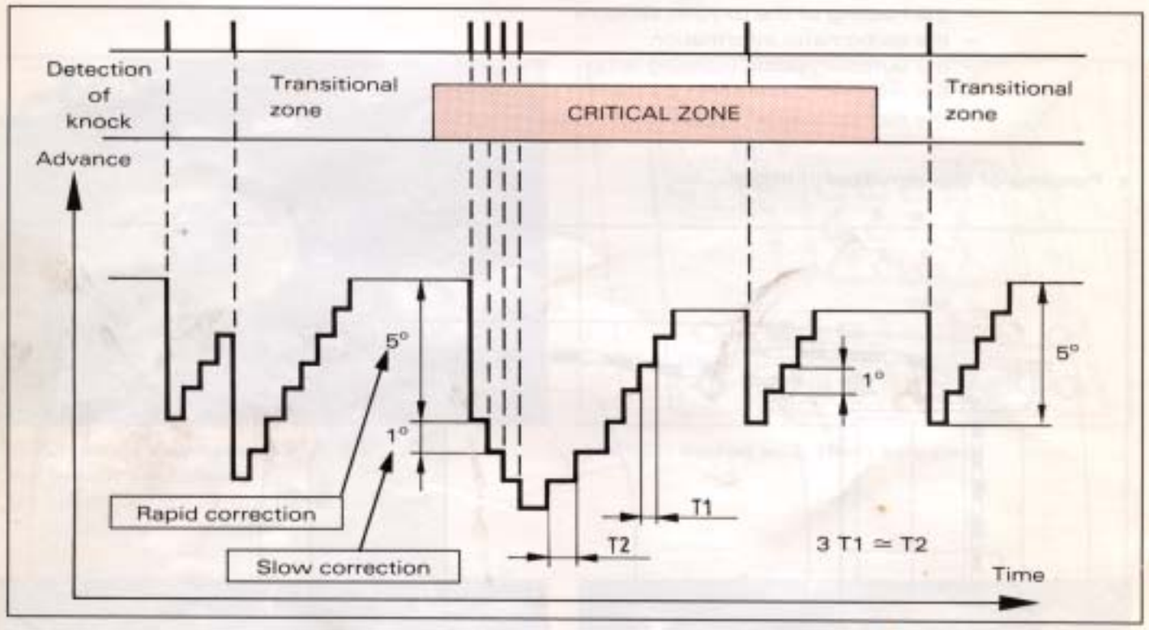
The FENIX 4 e.c.u. controls the injection and ignition system based on information from two principal sources:
- Pressure
- Engine speed.

- **Controlling the ignition**

The e.c.u. sends the ignition module the necessary signal to trigger ignition. The cylinder reference sensor, mounted opposite the cam pulley enables the e.c.u. to time itself to No. 2 cylinder. The firing order remains: 1.6.3.5.2.4.
Ignition advance is calculated as a function of engine conditions: starting, idling control etc.

- **Knock sensing**

The sensing principle is identical to that of the FENIX 3B system.



Y 21-18

The cylinder reference sensor enables the e.c.u. to determine which cylinder or cylinders are responsible for the knocking. On sensing knocking, the following adjustments are made:
- ignition advance: rapid and slow correction
- injection period: reduction of the quantity of fuel injected.

- **Injection operation**

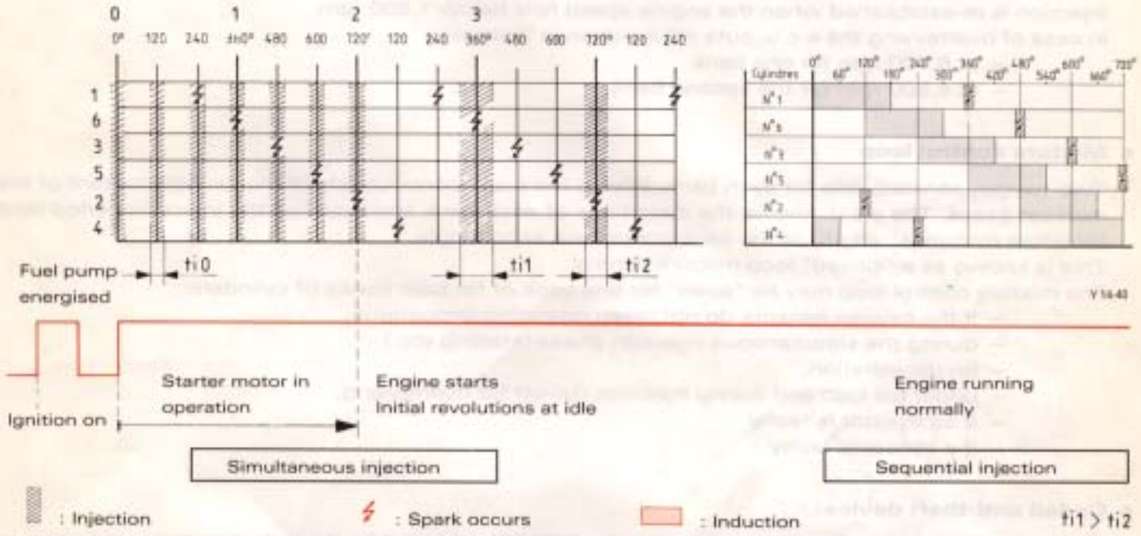
The 12 volt electro magnetic BOSCH injectors are controlled by the e.c.u. They are electrically supplied in six stages ie one stage per injector.
The injection mode is as follows:
- during starting phase: simultaneous injection every 1/3rd of a crankshaft revolution
- exiting starting phase: simultaneous injection every crankshaft revolution
- passing to sequential injection when the engine speed is above 300 rpm and the cylinder reference signal has been detected several times.

- **Controlling the variable acoustic characteristics induction (ACAV):**

The ACAV systems consist of two primary volumes whose characteristics can be varied by opening and closing of butterflies. The butterflies are controlled by the e.c.u. using electro valves and pneumatic capsules:
- engine off or idling, the electro valves are not electrically supplied,
- engine speeds between idling and 4,000 rpm, the long link electro valve is energised if the engine is under load,
- engine speeds above 5,000 rpm, the short link electro valve is energised if the engine is under load.

- **Starting phase:**

Entry into this phase is automatic and is triggered when the e.c.u. is supplied electrically, when the engine stalls and when the **T.D.C.** of No. 2 cylinder has been sensed.
- Ignition advance is a function of engine speed and temperature.
- Injection is simultaneous during the starting phase and occurs at each **T.D.C.** (every 1/3rd of a crankshaft revolution).



- The injection period ti0 is a function of coolant temperature, injection taking place at each T.D.C. (3 injections per revolution).
- Ignition advance is corrected as a function of engine temperature.

Exit from the starting phase can be triggered by:
- releasing the key from the starter postion,
- exceeding a certain engine speed, determined by engine temperature,
- exceeding a pre-determined length of time.

During this phase, the idling actuator valve is wide open. When the engine fires, injection remains simultaneous for a minimum of 2 engine revolutions to confirm that the engine has started.
The injection then becomes sequential.

- **Controlling the idling speed:**

The e.c.u. controls the idling once a pre-determined engine speed is reached and if the information from the throttle potentiometer corresponds to the closed throttle position.
To maintain a stable idling, the e.c.u. varies:
- the flow of air across the idling actuator valve.
- the fuel injected sequentially by each injector.

Idling regularity is achieved by instant changes to the ignition advance.
The e.c.u. uses information about engine temperature and load to determine the idling speed.

- **Full engine load and transitional phases:**

The e.c.u. controls the injection time and the ignition advance according to the driver's requirements, based on information of inlet manifold pressure and position or variation of the throttle potentiometer.
The e.c.u. can modify: the injection time (mixture strength)
and the ignition advance (retard)
to avoid jerking or hesitation.

- **Injection cut-off**

The coded anti-theft key pad sends a multiplex message to the e.c.u. which must be recognized before injection can take place and therefore engine starting.
In order to conform to emission standards, injection is cut during deceleration if the following conditions occur simultaneously:
- coolant temperature above a pre-determined value
- engine speed above a threshold value
- closed throttle position information.

Injection is re-established when the engine speed falls below 1,500 rpm.
In case of overrevving the e.c.u. cuts off injection in 2 stages:
- at 6,400 rpm for one bank
- at 6,500 rpm for the second bank.

- **Mixture control loop**

Two oxygen sensors, one for each bank, inform the e.c.u. continuously of the oxygen content of the exhaust gases. The e.c.u. knows the conditions of each bank and modifies the injection period (and therefore mixture strength) of the bank concerned, accordingly.
This is known as a "closed" loop mixture control.
The mixture control loop may be "open" for one bank or for both banks of cylinders:
- if the oxygen sensors do not reach operating temperatue,
- during the simultaneous injection phase (starting etc.),
- on deceleration,
- under full load and during injection cut-off for overrevving,
- if an injector is faulty,
- if a sensor is faulty.

- **Coded anti-theft device:**

The anti-theft device is fitted as standard to the CITROEN XM V6 24v, it sends a multiplex message to the e.c.u. which it must recognize before authorising injection to take place.

- **E.c.u. self-correction**

The e.c.u. can adapt itself to the engine it controls:
- the sealing of the engine during its life,
- different fuel qualities,
- condition of the injection components,
- production tolerance differences in engine.

It optimises the basic mixture settings to compensate for any variations.
The adjustments made by the self-correction function are reset after each interruption in the e.c.u. electrical suply:
- battery disconnected
- e.c.u. disconnected.

- **Back-up or emergency mode:**

The e.c.u. continuously checks the credibility of the various parameters of the system. In the case of a fault with a sensor, the e.c.u. will ignore the false signal and replace it with an acceptable figure. If the fault is considered to be serious, the autodiagnostic lamp in the instrument panel will light. If the fault disappears (intermittent problem) the warning lamp will be extinguished, and the e.c.u. will return to its normal operation, however the fault code will have been recorded by the e.c.u.

CIRCUIT MALFUNCTION	VALUES MEASURED	BACK-UP VALUES ASSUMED	WARNING LAMP CONDITION
Air temperature	If the temperature measured is below – 40° C or above 120° C	Air temperature = Coolant temperature if it is below 20° C otherwise air temperature = 20° C.	OFF
Coolant temperature	If the temperature measured is below – 40° C or above 120° C	Coolant temperature = Air temperature when starting. Then progressively temperature = 90° C or temperature = 90° C if the fault occurs when the engine is running.	ON
Butterfly position	Values outside tolerances	Fixed value but no recognition of "pedal released" and "pedal fully depressed" positions.	OFF
Absolute pressure sensor	– If the manifold pressure is below 180 mbar, ignition on but engine not running. – If the pressure is not below recorded threshold when the engine is idling.	Value calculated in relation to throttle butterfly position. "Open loop" mixture control.	ON
Strategy for mixture regulation	Values measures are outside memorised tolerances	"Open loop" mixture control.	ON
Knock sensing	Comparaison of the signals from the 2 sensors.	Retarding of the ignition advance on all points of the ignition map in the critical zone.	OFF
Cylinder reference sensor	If 6 T.D.C. positions are not sensed in 2 crankshaft revolutions	Retarding of the ignition advance on all points of the ignition map in the critical zone.	ON
Injectors	If the injector is open or short circuited.	"Open loop" mixture control on the relevant cylinder bank.	ON

- **Autodiagnosis - Actuating components**

The e.c.u. continuously monitors the condition of the sensors and the actuating components, checking for:
- open circuit
- normal operation
- short circuit.

It memorises both intermittent and permanent faults occurring within the system. These fault codes may be retrieved using 4097 T, 4120 T or 26A units.

The actuating components can also be tested using the same equipment.

VI - DIAGNOSIS

FAULT FINDING PROCEDURE

The e.c.u. can memorise both intermittent and permanent faults. These faults may be retrieved in the form of codes by using the **4097T**, **4120T** or **26A** units.

BEWARE: Loss of the 12 volt supply to the e.c.u., for whatever reason, will erase any fault codes recorded, will reset the adjustments made by the self-correction function and will cause the coded anti-theft device to lock.

With this warning in mind, it is **ESSENTIAL** that the test sequence below is followed:

- Deactivate the anti-theft unit by selecting the neutral mode (code 0000).
- Carry out the preliminary checks.
- Read the fault codes and road test the vehicle to confirm fault where possible.
- Connect the electrical test unit OUT 30 **4109T**.
- Locate the fault.
- Repair the fault.
- Erase the memory of the e.c.u.

LIST OF CODES SPECIFIC TO THE FENIX 4 E.C.U. (fault codes and activation codes)

	DESCRIPTION	CODE
	Start of test	12
	End of test	11
FAULT CODES	Air temperature	13
	Coolant temperature	14
	Petrol pump relay	15
	Butterfly potentiometer	21
	Idling control valve	22
	Idling adjustment stop	23
	Long ACAV electro valve	25
	Short ACAV electro valve	26
	Speed sensor	27
	Mixture control front bank	31
	Mixture control rear bank	32
	Inlet manifold pressure sensor	33
	Canister purge electro valve*	34
	Lambda probe heating control	36
	Flywheel sensor	41
	Anti-knock function	43
	Front knock sensor	44

	DESCRIPTION	CODE
FAULT CODES	Front oxygen sensor	51
	Mixture adjustment front bank	52
	Battery voltage	53
	E.C.U.	54
	Anti-theft key pad	56
	Rear knock sensor	62
	Rear oxygen sensor	63
	Mixture adjustment rear bank	64
	Cylinder reference sensor	65
	No. 1 injector control	71
	No. 2 injector control	72
	No. 3 injector control	73
	no. 4 injector control	74
	No. 5 injector control	75
	No. 6 injector control	76
OPERATIONAL CODES	Fuel pump relay	91
	Injectors	92
	Idling control valve	93
	Canister purge valve*	94
	Long ACAV electro valve	96
	Short ACAV electro valve	97

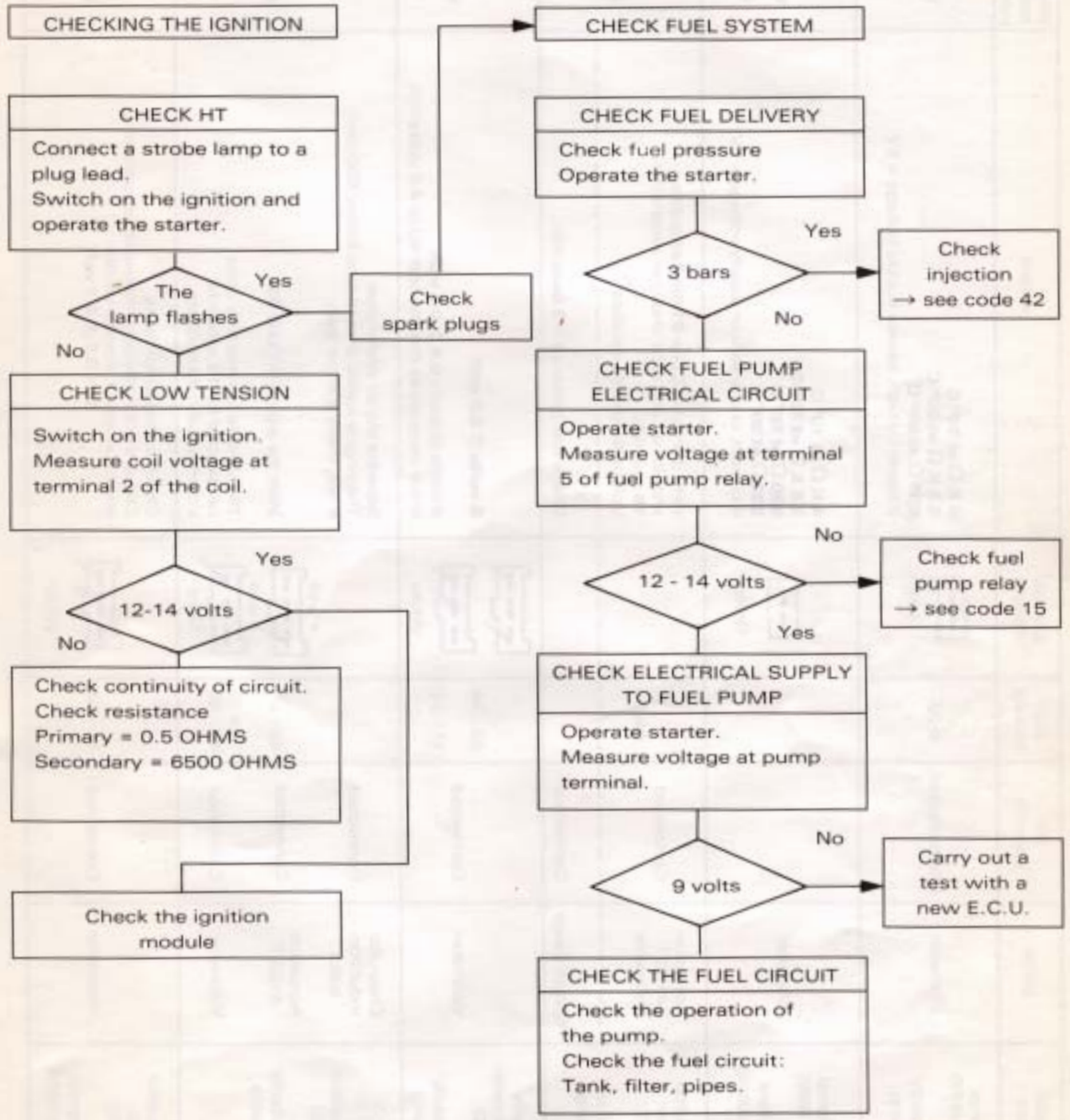
* it fitted (depending on emission standard)

Before carrying out any work on the vehicle, the following points must be checked:

1 The system earth points for:
- fuel pump, E.C.U., and battery.

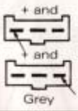
2 Check the connections of the various system components:
- pressure sensor, flywheel sensor, injectors and e.c.u.

ONLY THE GREEN LAMP OF THE CODED ANTI-THEFT KEY PAD SHOULD BE LIT

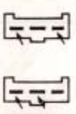
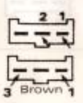


THE RED LAMP OF THE CODES ANTI-THEFT KEY PAD IS LIT

- The use of the anti-theft key pad is described in Technical Bulletin XM (1) No. 1, pages 21 and 22.
- If the injection e.c.u. is locked (red and green lamps lit simultaneously) wait one minute (ignition on) before entering the correct code.
- If the red warning lamp remains lit, check the continuity of the installation.

FAULT CODE	COMPONENT LOCATION	CHECKS	ECU CONNECTOR	410B T TERMINALS	CONPONENT TERMINALS	READINGS	EMERGENCY FUNCTION & WARNING LAMP	SERIOUS OR MINORS	INDUCED CODES
13	Air temp sensor (907) *on butterfly housing*	Ohmeter	Disconnected	9-34	 Grey	**4 K Ω at 10° C** **2.5 K Ω at 20° C** **680 Ω at 55° C** If correct, check sensor supply voltage = 5V	Yes	m	
14	Water temp sensor (909) *on coolant outlet housing*	Ohmeter			 Green	**4 K Ω at 10° C** **2.5 K Ω at 20° C** **680 Ω at 55° C** **230 Ω at 90° C** If correct, check sensor supply voltage = 5V	Yes	**S**	31
15	Fuel pump relay (807) *on e.c.u. housing*	Actuation 4120 T Voltmeter Pressure Gauge	Connected Connected	54-8		With the aid of Code **91** the fuel pump should run and stop once per second for **15** seconds. Voltmeter should oscillate Check fuel pressure = **3 bars** min.	No	m	42
21	Butterfly potentiometer (770) *on butterfly housing*	Voltmeter	Connected	33 - 34 11 - 34	 White	**5 volts ± 0.5 volt** throttle closed - **0.5 ± 0.1 volt** linear increase as throttle opened to **4.5 volts** min	Yes	**S**	31
22	Idle regulator (432) *on butterfly housing*	Check for induction leaks Actuation 4120 T Voltmeter	Connected Connected Connected	48 - 45 or 48 - 46	 + and + and Grey	Squeeze the air intake pipe: The engine speed should drop below 500 rpm. If not, there is an air leak. *With the aid of* → Code **93** The valve is opened fully once per second for **15** seconds. Voltmeter should oscillate.	No	m	31
23	Idle regulator stop (770) *on butterfly potentiometer*	Voltmeter	Connected	11 - 34	 White	Check for induction leaks. Check the throttle potentiometer adjustment - engine stopped, throttle closed: **U = 0.5 ± 0.1 volt**	No	m	31

LOGICAL FAULT DIAGNOSIS TABLES

FAULT CODE	COMPONENT LOCATION	CHECK	ECU CONNECTOR	410BT TERMINALS	COMPONENT READINGS TERMINALS	FUNCTION ?	EMERGENCY OR WARNING LAMP	SERIOUS MINOR	INDUCED CODES
25	ACAV (**440**) electro-valve long circuit	Actuation 4120 T Voltmeter	Connected	48-55		*With the aid of* Code **96** the electrovalve is operated once during **15** seconds When supplied V = 12 volts			
26	ACAV (**439**) electro-valve short circuit	Actuation 4120 T Voltmeter	Connected	48-52		*With the aid of* Code **97** the electrovalve is operated once during **15** seconds When supplied V = 12 volts			
27	Vehicle speed sensor (**154**) *on bulkhead*	Road test vehicle Voltmeter Ohmeter	Connected Connected Connected	22-14 –	 White on interface 9N3 & 9N9	Ensure correct operation of average speed function on trip computer **R = 300 Ω** approx. Vehicle moving, approx. **1.5 V**	No	m	23
31	Auto adjustment of mixture. Front bank *on front Lambda sensor*	Voltmeter	Connected engine running	23-14	 Red	– Checking the function of the ECU: allow 2 minutes for pre-heating of sensor Read voltage at terminals 23 & 14: 0 → 1V → 0 → 1V – Read voltage at red connector if **0.8 V** fixed – Check HT leads and sealing of exhaust upstream of sensor	No	m	51-52
32	Auto adjustment of mixture. Rear bank *on rear lambda sensor*	Voltmeter	Connected engine running	4-14	 Red	– As for 31 above except: Read voltage at terminals 4 & 14: 0 → 1V → 0 → 1V	No	m	51-52
33	Absolute pressure sensor (**903**) *on bulkhead*	Voltmeter	Connected	30-34 32-34	 Green	**V = 5 volts** Using vacuum pump, vary the pressure: 400 Pa → **2.5 V** 600 Pa → **1.25 V**	Yes	**S**	
34	Canister electrovalve (**430**) if fitted *on battery tray*	Actuation 4120 T Voltmeter	Connected	48-40	 Black	*With the aid of* Code **94** the valve is operated twice per second for **15** seconds. Voltmeter will oscillate.	No	m	
36	Lambda sensor heating (**900**) *on e.c.u. housing*	Voltmeter	Connected	53-39	 Yellow	– From cold, at terms 13 + 1: **V ≃ 1 volt** – On brown connector, V ≃ approx. **12 volts** The feed is triggered by relay **818**. – See sensor checking Code **31**.	No	**S**	
41	Flywheel sensor (**152**) *under the hydraulic pump*	Ohmeter	Disconnected	16-35 16-14	 2 1 3 Brown 1	– **330** ≃ approx. Gap not adjustable: **0.5 to 1.5 mm** Run out **0.4 mm** max – Isolated from earth	No	m	

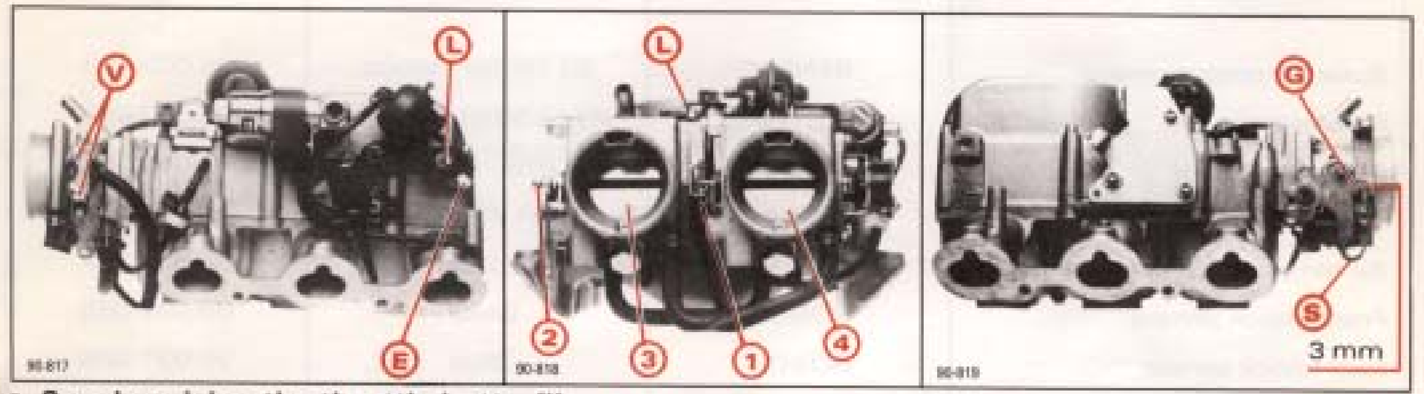
43	Anti knock adjustment					– Check quality of fuel – Check mechanical condition of engine – See Codes **44** and **62**	Yes	s	44-62
44	Knock sensor (front) **(150)** green *on front cylinder head*			15-36 15-14	2 1 3 Green 4	– Check the sensor connector – Check connections and continuity between green connector and ECU – Check insulation from earth – Tighten to 2 ± 0.5 mdaN	Yes	s	43
51	Lambda sensor **(999)** *on catalytic converter*	Volmeter	Connected	23-39	Red	See relative tests for Codes 31 and 36	No	s	52
52	Regulation of richness from front Lambda sensor	Voltmeter	Connected engine running	23-39	Red	– Check fuel quality – Verify integrity of inlet and exhaust tracts – Check fuel pressure – See relative tests for Code 31	No	s	51
53	Supply voltage to sensors	Voltmeter	Connected	9 27 } 34 30 33	Battery	**10 to 15.5 volts** Code corresponds to supply voltage to: air, water, butterfly, potentiometer, pressure sensor, anti-theft keyboard: **5 volts** Check charging circuit	No	m	21 56
54	ECU **(144)**					ECU out of service	No	s	
56	Coded anti-theft keyboard **(176)** *in console*		Connected			The ECU has not got a fault but the injection function is locked: red light is on. Tap in the code, red light goes out, green light comes on. If this incident persists, disconnect battery for one minute before entering confidential code	Yes	m	
62	Knock sensor (Rear) **(151)** blue *on rear cylinder head*			17-15 17-14	2 1 3 Blue 1	See relative tests for Code **44** (Reminder blue plug)	Yes	s	43
63	Lambda sensor (Rear) **(900)** *on cat. converter*	Voltmeter	Connected engine running	4-39	Yellow	See relative tests for Codes **31** and **36**	No	s	64
64	Regulation of richness from rear Lambda sensor **(900)**	Voltmeter Ohmeter	Connected engine running	4-39	Red	See relative tests for Codes **52** and **36**	No	s	63
65	Cyl No. 2 reference sensor **(160)**	Voltmeter Ohmeter	Connected engine running	31-12 31-39	2 1 3 Black 1	– At idle **V = 3 volts** – air gap = **1 mm** ± **0.5** – Resistance = **R** ≃ **400** Ω – Isolated from earth			
71 72 73 74 75 76	Injectors: → no. 1 → no. 2 → no. 3 → no. 4 → no. 5 → no. 6	Actuation 4120 T Ohmeter	Disconnected	43 20 42 44 } 39 38 21	Black	– With the aid of Code **92** – Disconnect fuel pump – Create successive impulses at each injector → operation audible – Injector resistance **16** Ω	No if short circuit	s	

FENIX 4 ADJUSTMENTS

Idling: not adjustable

– The idling speed is determined by the e.c.u. with the aid of an idling electro valve.
Idling speed: ≃ 750 rpm

DO NOT ALTER THE BUTTERFLY STOP SCREW SETTINGS



- **Synchronising the throttle butterflies:**

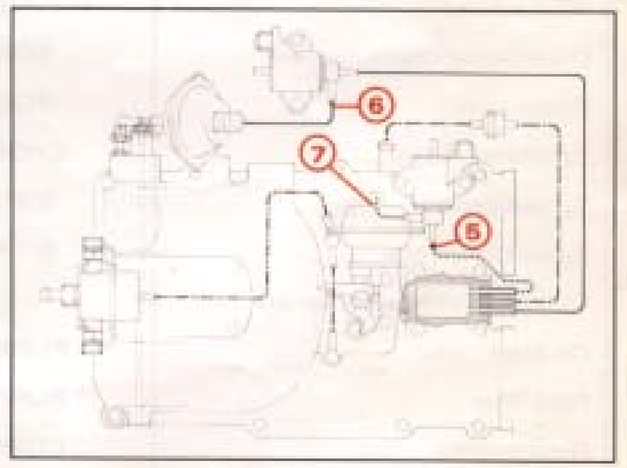
  Remove the siamese ducting between the butterfly housing and the air filter housing.
  Slacken screw **(1)** and operate throttle lever **(2)** to open the butterfly **(3)**.
  Tighten screw **(1)** until butterflies **(3)** and **(4)** are opened simultaneously. From this position, tighten screw **(1)** by one further turn.

- **Adjustment of the throttle quadrant roller:**

  In the "closed throttle" position, roller **G** should turn freely but with no clearance for a movement of **3 mm** of the quadrant **(S)** measured with a rod.

- **Adjusting the ACAV butterflies:** *In principle, there is no need to adjust the eccentrics E ; the procedure described is for information only.*
  Disconnect the two sections comprising the ACAV after removing the fixings.
  Use an elastic band to hold lever **L** in the butterfly closed position; operate the lever two or three times.
  Slacken the locknut and adjust the eccentric to obtain clearance **J** between the butterfly and the wall of the ACAV.
  Long circuit butterflies **J** = 2.6 mm approx.
  Short circuit butterfly **J** = 0.1 mm.
  Retighten the lock nut and reassemble as necessary.

- **Checking the depression:**
  – Vacuum reservoir at **(5)** between **400** and **800 mbar**, engine off, the depression should not leak rapidly.
  – Road tests in **3rd gear**:
  • below **4,000 rpm** at **(6)** : → no load, **d = 0**
  → full load, **d>650 mbar.**
  • above **5,000 rpm** at **(7)**:
  → no load, **d = 0.**
  → full load, **d>650 mbar.**



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- **Adjusting the butterfly potentiometer:**

Using the screws **V**:
▶ throttle closed: read 0.5 ± 0.1 volt at terminals 11 and 34 of the e.c.u.
▶ throttle fully open: read 4.5 volts at these terminals.

- **Anti-pollution and ignition:** not adjustable.

- Sparking plugs **EYQUEM RFC 58 LS 3:** Flat seat plugs with sealing washer.
  Electrode gap: **1** ± 0.1 mm
  Tightening torque: **1.5 mdaN.**

REPLACEMENT PARTS

DESCRIPTION	MANUFACTURE	REFERENCE OR MARKING	RP NUMBER
E.C.U.	BENDIX	5 101 880 101	96 039 263
Butterfly potentiometer	BENDIX	33 19380 - White	96 033 193
Flywheel sensor	ELECTRIFIL	C144 3030 - Brown	96 037 097
Pressure sensor	G.M.	876 - Green	96 052 503
Coolant temperature sensor	JAEGER	33 634 401 - Green	95 640 493
Air temperature sensor	JAEGER	33 707 201 - Grey	95 640 497
Front knock sensor	BOSCH	Green	96 037 065
Rear knock sensor	BOSCH	Blue	96 037 068
Idling control valve	BOSCH	Grey	74 01 317 957
Injecteur	BOSCH		96 050 712
ACAV electro valve	EATON		96 039 283
ACAV capsule	HELLA		96 093 751
Fuel pump	BOSCH	EKP 10	95 653 038
Tank unit	JAEGER		95 653 039
Coolant temperature interface	BITRON	SCT 100	95 658 682
Anti-theft key pad	JAEGER		96 003 421
Air filter element			94 01 444 108
Fuel pressure regulator	BOSCH	0 280 160 232	74 01 271 132
Coil	BOSCH	0 221 122 411	96 048 064
Ignition module	BOSCH	0 227 100 124	96 048 070
HT Distributor	BOSCH	0 237 500 030	96 045 524
HT lead set	BOUGICORD		96 061 817
Distributor cap	BOSCH		96 054 877
Rotor arm	BOSCH		77 00 267 693
Sparking plugs	EYQUEM	RFC 58 LS 3	96 073 353
Speed sensor	EATON	White	96 008 161
Speed interface	BITRON	IND. VE	96 008 165
Cylinder reference sensor			96 067 317
Oil filter	PURFLUX	LS 520 C	95 638 903
Fuel filter	PURFLUX	EP 90C	91 535 807
New engine	CITROËN		97 90 021 700
Clutch friction disc	VALEO	235 F32 BX 202	96 074 350
Clutch pressure plate	VALEO	235 CP 6050	96 088 393
Clutch release bearing	VALEO		96 092 637
Gearbox	CITROEN	ME5T	95 649 233