

Formula RENAULT SPORT 1995 Workshop Manual

ENGINE

4-cylinder

Type

F3R FRS

Eric

English Translation

January 1995

"The procedures laid down by the manufacturer, in this manual, were arrived at taking into account the technical specification in force at the time the manual was prepared.

They are liable to be changed whenever the manufacturer makes changes in the construction of the components and accessories of the models in his range."

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IMPORTANT

All parts supplied in the Formula Renault 1995 Kit must be used, with the exception of nuts, bolts, washers and jubilee clips which may be replaced with parts of identical dimensions and construction.

This does not apply to:

- connecting rod bolts
- cylinder head bolts
- crankshaft bearing cap bolts
- flywheel bolts
- timing belt tensioner and idler bolts
- wheel bolts.

All of the above listed parts must be those that are supplied in the kit.

All cars must have the technical configuration as described in their homologation certificates as issued to each constructor.

ENGINE

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H

DESCRIPTION

ENGINE Specifications

IMPORTANT:

All values marked with an asterisk must be complied with.
Any other values contained in this manual are purely recommended values.

PARTICULARS OF THE F3R FR engine

- Compression ratio: 10.5 to 1
- Class A engine block
- Injectors: increased output
injector loom
- Special FR camshaft
- Pistons: different compression ratio
- Inlet and Exhaust manifolds
- Dry sump

GENERAL ADVICE

We recommend:

- the purchase of a compression tester,
- a running-in of the engine (maximum distance),
- the checking of the compression when the running-in is complete;
 - with the engine at operating temperature,
 - with the plugs removed,
 - with the throttle wide open,
 - with the battery fully charged.
- the checking of the compressions of all 4 cylinders before and after each event **IN THE SAME CONDITIONS.**

- NOT TO REMOVE THE ENGINE UNLESS THE COMPRESSION VALUES SHOW A SIGNIFICANT FALL.

ENGINE Specifications

ENGINE OIL LEVEL AND CAPACITY

- Pour 5 litres of 10W50 grade engine oil into oil tank.

PRIME LUBRICATION SYSTEM

- Disconnect HT lead
- Turn engine over on starter motor to fill lubrication system
- Connect HT lead
- Run engine for several minutes
- Stop engine

Check oil level in tank

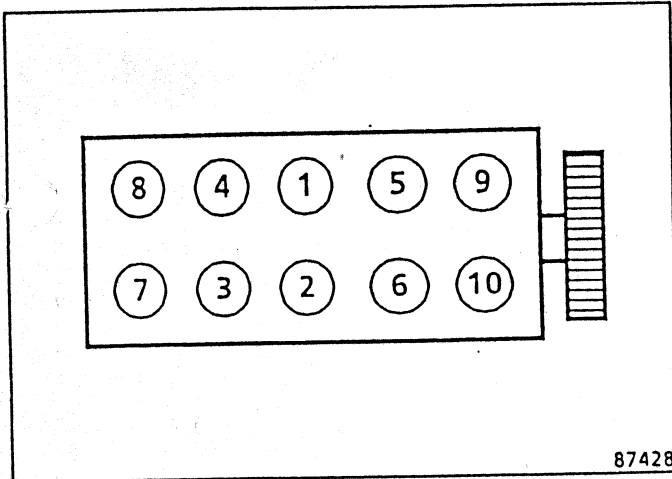
- MAXIMUM RECOMMENDED LEVEL: 160mm
- MINIMUM LEVEL: 120mm

ENGINE Specifications

CYLINDER HEAD

Torque settings for the cylinder head bolts (in daN.m) with cold engine:

- 1st tightening 3
- 2nd tightening $50^{\circ} \pm 4^{\circ}$
- Wait about 3 minutes
- Unscrew all the bolts 180° then:
- 1st tightening 2.5
- 2nd tightening (angle) $123^{\circ} \pm 7^{\circ}$



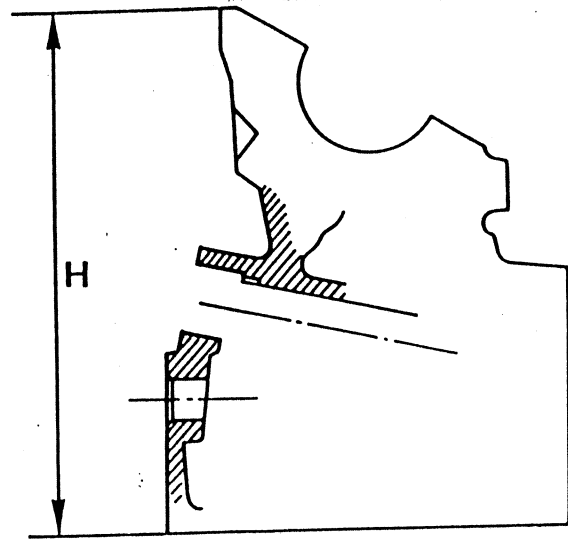
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Valve clearance adjustment (mm) cold:

- Inlet 0.20
- Exhaust: 0.40

Cylinder head height

- Minimum authorised height (mm): $H = 169^*$
- Normal height (mm) $H = 169.5 \pm 0.2^*$



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CYLINDER HEAD GASKET

- Thickness: $1\text{mm} \pm 0.1\text{mm}$

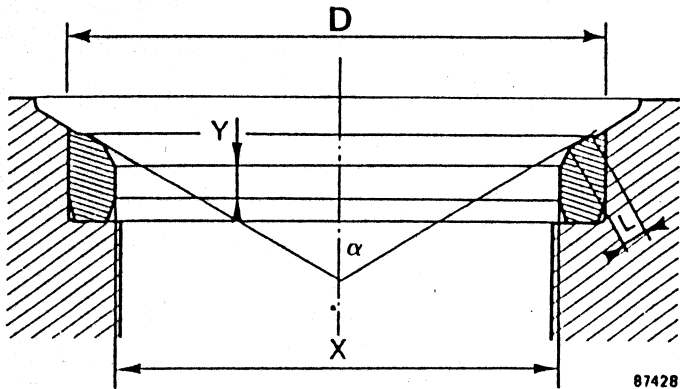
VALVE SPRINGS

- Free length (mm): 47.66
- Length (mm) when subjected to a load of:
 - 31 daN 40.25
 - 76 daN 29.95
- Coils locking 28.1
- Wire diameter (mm) $4.20 \pm 0.03^*$
- Interior diameter (mm) $21.60 \pm 0.02^*$

ENGINE Specifications

VALVES	INLET	EXHAUST
Stem diameter (mm)	8*	8*
Seat angle	90° *	90°*
Head diameter (mm)	40*	32.5*
Valve protrusion (in mm) (measured from valve face to head gasket face)	1.25* (see page A-21)	

VALVES	INLET	EXHAUST
Seat angle (α°)	90° *	90°*
Seat width (L) mm: (recommended)	1.7±0.2	1.7±0.2
External diameter (D) mm	41	38.6
Internal diameter (x) mm MAXIMUM	35.0±0.05*	28.5±0.05*
Height Y (mm)	1*	1*



Y minimum = 1mm*

VALVE GUIDES

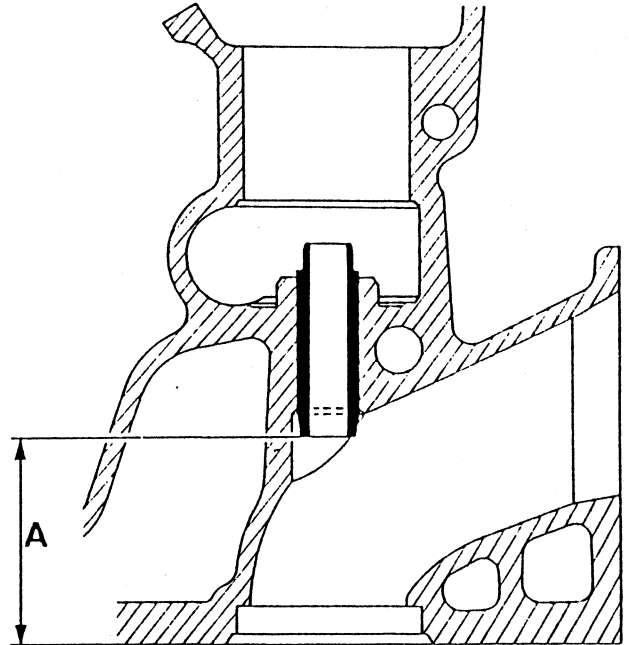
Internal diameter (mm)	8
External diameter (mm)	
– normal	13
– repaired (2 grooves)	13.25

RECOMMENDED PROCEDURE

Position of the guide with respect to the cylinder head gasket face:

A (mm) **43 ± 0.2***

The inlet and exhaust valve guides are equipped with seals for the valve stems.



ENGINE Specifications

CAMSHAFT

The engine is equipped with a single overhead camshaft, driven by a toothed belt. The cams operate the valves via tappets. Valve clearance adjustment is effected by replacing shim discs housed in the tappet crown.

Number of bearings:	5
Diametral play:	0.04 to 0.082
Lengthwise play (mm) checked at the centre bearing:	0.048...0.133

- Inlet opens	28 ^{0*}
- Inlet closes	76 ^{0*}
- Exhaust opens	76 ^{0*}
- Exhaust closes	28 ^{0*}
- With a theoretical play of (mm):	
Inlet: 0.382mm	Exhaust: 0.382mm

Maximum Lift:	Inlet 12
	Exhaust 12

INTERMEDIATE SHAFT

Diametral play (mm)	0.04 to 0.110
Lengthwise play (mm)	0.07 to 0.15

The intermediate shaft is mounted in two bushes.

- inner bush: interior diameter (mm)	39.5
- outer bush: interior diameter (mm)	40.5

TAPPETS

External diameter (mm)	35 ⁺ -0.01
	-0.04

CRANKSHAFT

Number of main bearings:	5*
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Lengthwise play (mm)	0.07 to 0.23
----------------------	--------------

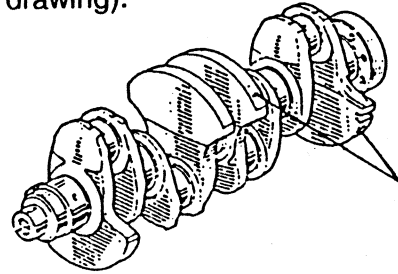
Thrust washer thicknesses (mm):	
2.30 - 2.35 - 2.40 - 2.45 - 2.50	

Main bearing diameter (mm) nominal:	54.795*
Tolerance	
Big end bearing diameter (mm) nominal:	48*

Stroke (mm)	93 ± 0.1*
-------------	-----------

Balancing:

- Only by radial drilling of the counterweights (see drawing).



Weight:

- Minimum authorised, 13.950kg* (thirteen kilos and nine hundred and fifty grammes including bearing and Woodruffe key).

FLYWHEEL

Balancing: by perpendicular cross drilling of the faces is permitted.

Weight:

- Minimum authorised, 4.950kg (four thousand, nine hundred and fifty grammes).
- Machining of face which points towards block is permitted.

DESCRIPTION

ENGINE Specifications

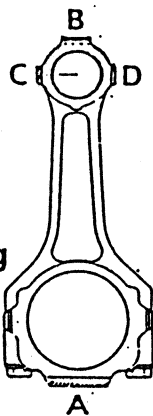
CONNECTING RODS

Balancing by grinding of masses at head and foot. A B C D in drawing

Weight:

- Maximum difference is weight between connecting rods: **3g**

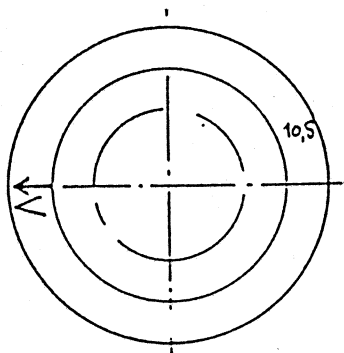
Between centres (mm): **149* ± 0.035**
Lateral play (mm): **0.22 to 0.40**



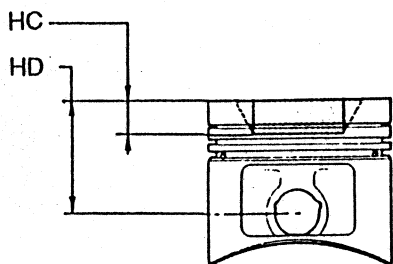
PISTONS FORMULA RENAULT TYPE

Direction of installation:

- arrow pointing towards flywheel.



ratio 10.5	piston marking
---------------	----------------



HC	HD	PIPETTE VOLUME cc
5.9 ± 0.1	35 ± 0.35	15.610 ± 0.4

REMOVAL OF METAL FROM PISTON NOT PERMITTED

Measurement of recess in piston crown will be made with the use of a special tool.

GUDGEON PIN

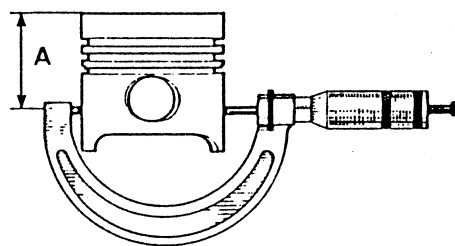
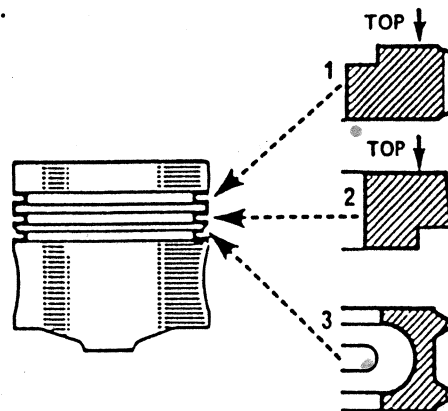
Free fitting in connecting rod and piston (retained by circlips):

Length (mm): **57* +0 / -0.3***
Diameter (mm):
- External **21* +0 / -0.005***
- Internal **12.5 +0.1 / -0.2***

Three rings of thickness (mm):

- Compression (1) **1.5***
- Sealing (conical) (2) **1.75***
- Scraper (3) **3***

Rings are supplied adjusted and gaps must not be altered.



Measurement of piston diameter must be done at (A).

A = 51mm

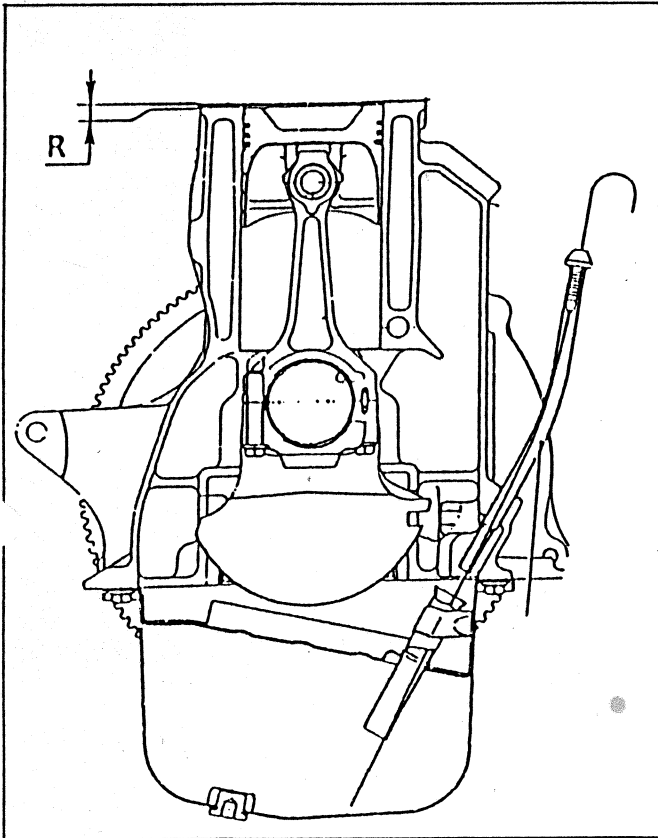
IMPORTANT

Minimum weight of connecting rod including piston, gudgeon pin, circlips, piston rings, shells and bolts:

1145 grammes

ENGINE Specifications

Piston recess in relation to gasket face.

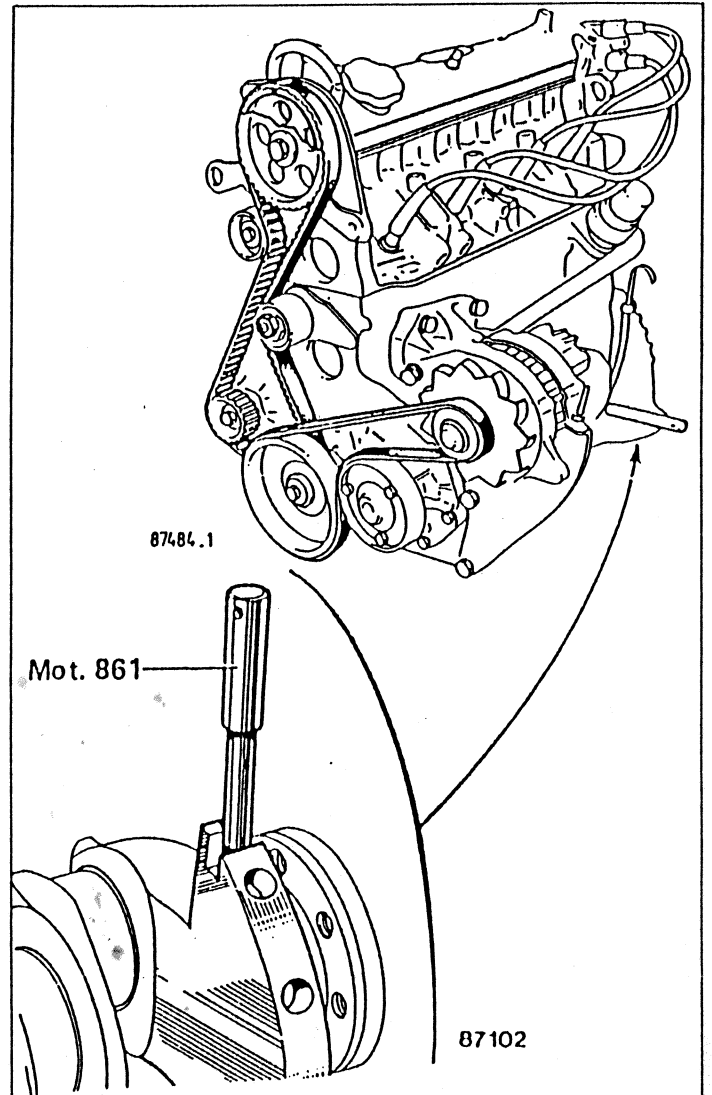


R min: **0.83mm**

It is permitted to machine face of block to achieve required piston recess.

Measurement criteria

- In longitudinal axis of engine
- On the external crown of the piston
- At TDC using locating tool Mot 861
- Dial gauge support plate Mot 251-01 and 252-01



DESCRIPTION

ENGINE Specifications

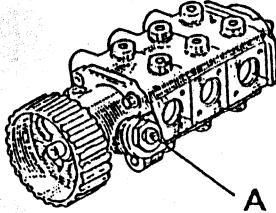
OIL PUMP

Minimum recommended oil pressure at 80°C (in Bars):

- at 1,000 rpm:
- at 3,000 rpm:

0.8
1.8

Adjust pressure at valve A.



TIMING SPROCKETS

These sprocket wheels, made of sintered metal, are extremely brittle.

Their removal and handling must be effected with care. In the case of marks being formed when removing with the aid of an extractor, for example, these must be removed with a fine file.

TIMING

The camshaft, housed in the cylinder head (overhead camshaft) is driven by a toothed belt. Correct tensioning of the belt is vital both for belt life and for proper operation of the camshaft:

- an **under-tensioned** belt risks tooth jumping during operation with the subsequent possibility of contact between valves and pistons,
- an **over-tensioned** belt will deteriorate rapidly and cause noisy operation.

The belt should never be allowed to come into contact with the oil or any kind of grease. It is imperative to replace the belt if this should happen.

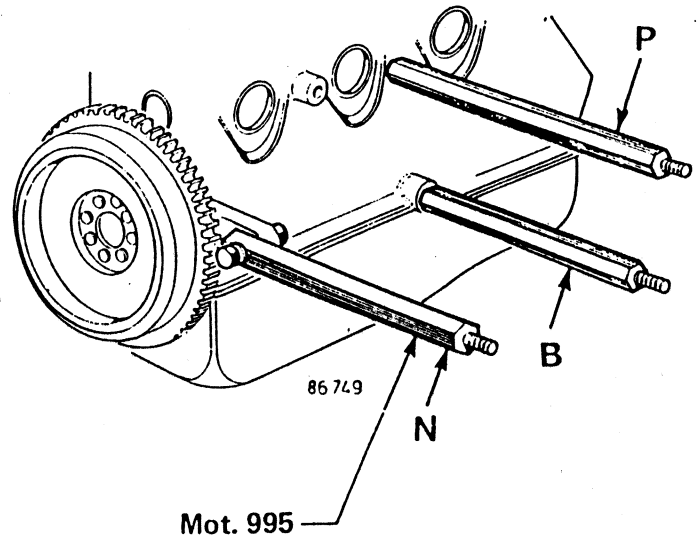
ATTACHMENT OF THE ENGINE TO THE REMOVAL MOUNTING Mot 792-01

Use the links B, N and P.

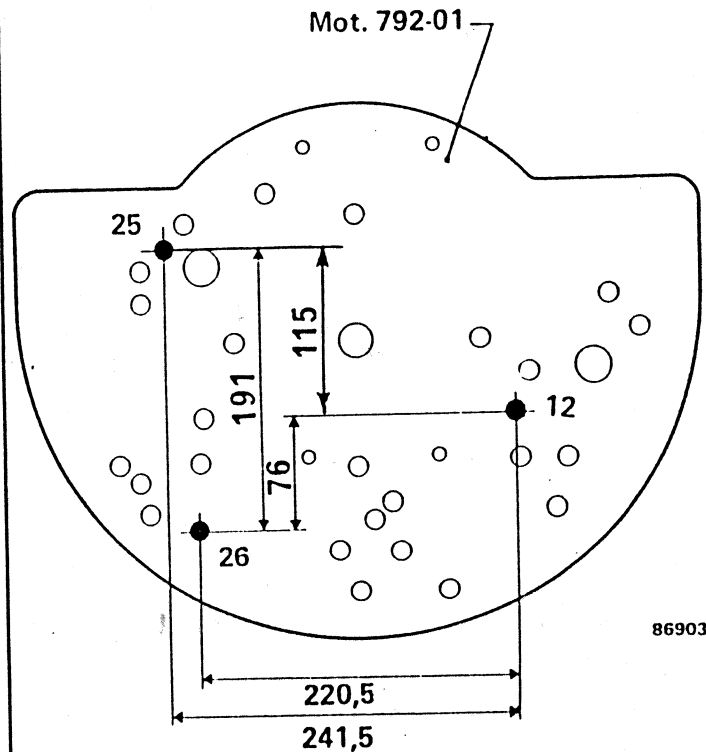
The link B forms part of the equipment delivered with the plate Mot 792-01.

The links N and P are included in the equipment Mot 995.

Screw the locating links into the corresponding holes in the cylinder block.



Present the engine assembly, equipped with the locating links, in such a way that they enter the holes 12, 25 and 26 drilled to a diameter of 14.5mm.



(Cotes en mm.)

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ENGINE Specifications

DESCRIPTION

MATERIALS REQUIRED

Type	Quantity	Part concerned	Renault part No.
Ravitol "X"		Parts cleaning (30 l container)	77 01 392 233
Magnus Magstrip or Decaploc 88	Coating	Cylinder head gasket face cleaning	77 01 390 107
PERMATEX	Coating	Cylinder head gasket face cleaning	77 01 396 228
Loctite Frenetanch	1 to 2 squirts	Attachment bolts: flywheel,	77 01 405 952
			77 01 394 070
Loctite Scelbloc	Coating	Rigid tube coolant circuit to cylinder head, oil pump tube to block	77 01 394 072
Loctite Autoform	Coating	Contact face flywheel to crankshaft	77 01 400 300
F 4/60 THIXO (100g tube)	Coating	Crankshaft seal support plate contact area and bolts holding timing belt cover.	77 01 404 452
Loctite 518	Thin bead	Sump face	7701 421 162

SAFETY

ENGINE WASHING

Protect the toothed belt against the ingress of water and washing products.

Do not allow water to enter the inlet manifold.

USE OF THREAD INSERTS

All the threaded holes in the engine components can be repaired by using thread inserts.

BOLTS

Any bolt may be used so long as:

- it is of the same material as the original,
- it has the same dimensions as the original.

This concession does NOT apply to:

- the connecting rod bolts, the flywheel retaining bolts, the cylinder head and crankshaft securing bolts, camshaft idler pulley, all of which must be standard parts.

COMPONENTS TO BE RENEWED WHENEVER THEY ARE REMOVED

- The flywheel retaining bolts.
- All gaskets.
- All pipework seals.
- Force-fitted rigid tubes in the cooling circuit.
- The intermediate shaft bearing bushes.
- Valve guides.

CAMSHAFT COVER

It is vital to observe the correct torque setting for the retaining bolts, or serious damage to the camshaft centre bearing can result.

DESCRIPTION

ENGINE Specifications

CYLINDER IDENTIFICATION

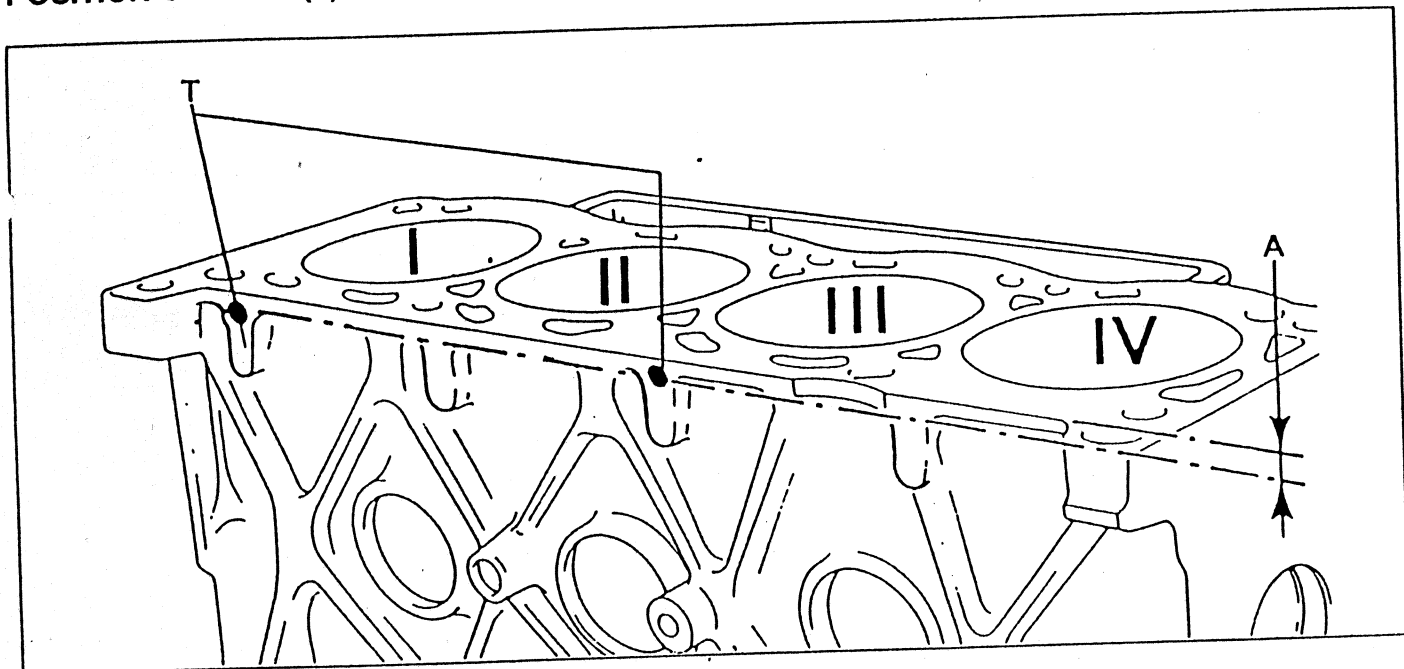
ONLY CLASS A IS PERMITTED

ATTENTION: It is essential to match pistons to cylinders.
Diameter of holes (T) drilled on side of block serves to identify the nominal size of the cylinder.

T = Ø 5

Nominal size: Ø 82.7mm

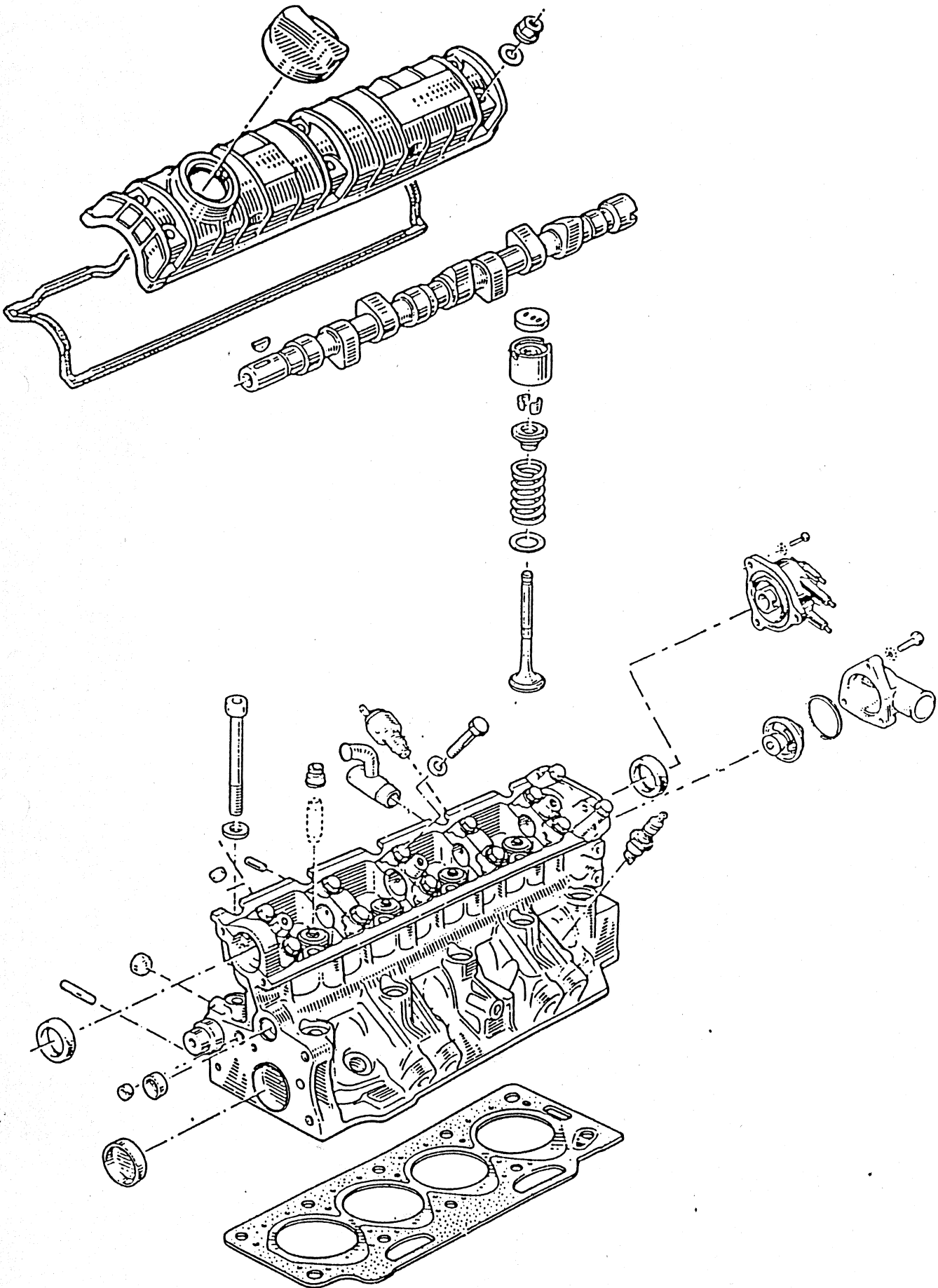
POSITION OF HOLE (T)



Mark	Position of hole	Ø Class of piston (β mark on diagram)	Cylinder diameter in mm	Diameter in mm of piston measured at 51mm from top of piston (dimension A)
T = Ø 5	A = 18mm	A or 1	82.70 to 82.71	82.665 to 82.675
				Play between piston and cylinder 0.025 to 0.045

CYLINDER HEAD

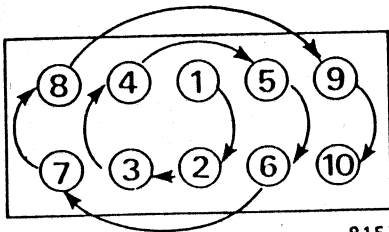
EXPLODED VIEW



CYLINDER HEAD

TIGHTENING DOWN

TOOLS USED	
Mot 591-01	Angular key for cylinder head tightening
Mot 591-02	Indexing attachment
Mot 591-03	Comprises Mot 591-01 and 591-02
Mot 852	Cylinder head bolt socket.



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TIGHTENING DOWN

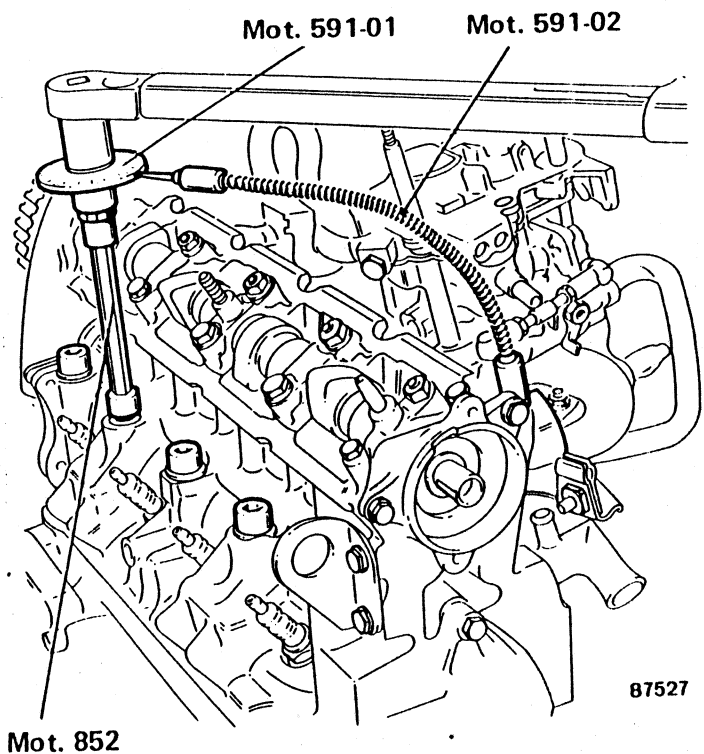
This operation must be carried out cold, with no load on the cylinder head, and in no other circumstance.

It is not necessary to re-torque the cylinder head at the first service between 1,000 and 3,000km.

Reminder:

To achieve correct torque values, it is necessary to syringe out any oil which may have dribbled into the bolt holes in the cylinder block.

Lubricate the washers and the undersides of the bolt heads with engine oil.



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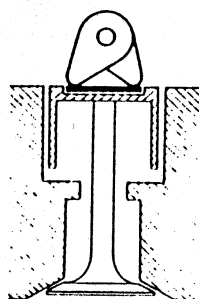
Mot. 852

VALVE CLEARANCE ADJUSTMENT

SPECIAL TOOLS NEEDED	
Mot 992	Shim disc replacement tool
Mot 992-01	Tool baseplate
Mot 992-02	Comprises Mot 992 and Mot 992-01

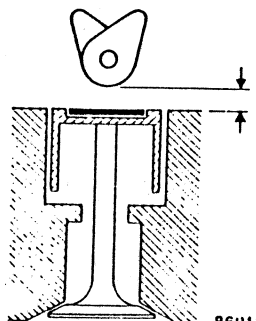
Checking and adjustment

Ensure that the valves of the cylinder concerned are in the position end of exhaust/beginning of inlet.

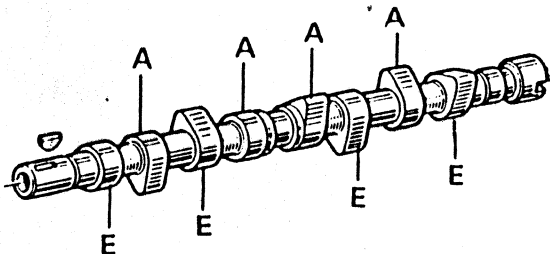


- 1
- 3
- 4
- 2

Check the clearance and if necessary replace the shim discs of the adjacent cylinder as shown below.



- 4
- 2
- 1
- 3



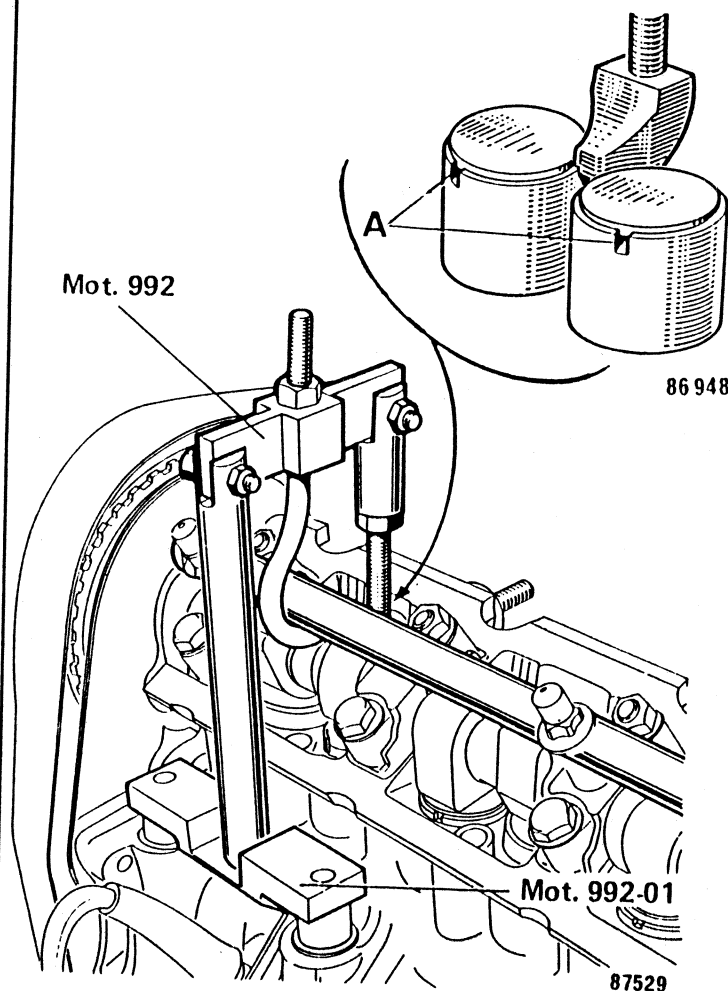
Compare the measured values with the specified value and replace the shim discs concerned.

Shim discs available from Renault Replacement Parts:

Every 5/100 from 3.25 to 4.25mm, then 4.30 – 4.40 – 4.50.

Replacement of shim discs

Use tools Mot 992 and Mot 992-01.



Do not forget to position the slots (A) perpendicular to the camshaft.

Valve clearances (mm) cold:

- Inlet: 0.20
- Exhaust: 0.40

The mark inscribed on the shim disc must be on the lower face, in contact with the tappet.

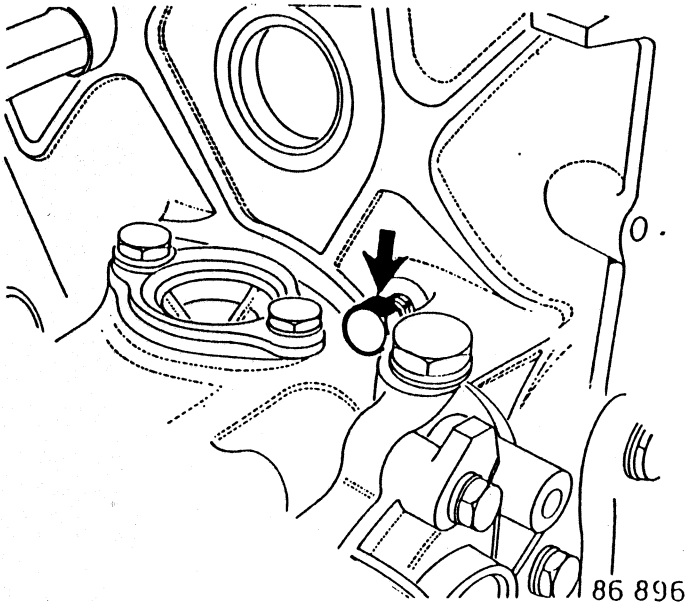
CYLINDER HEAD

REMOVAL, FITTING or REPLACEMENT OF GASKET

SPECIAL TOOLS NEEDED	
Mot 852	Socket for cylinder head bolts with hexagonal recess heads
Mot 861	Top dead centre locator

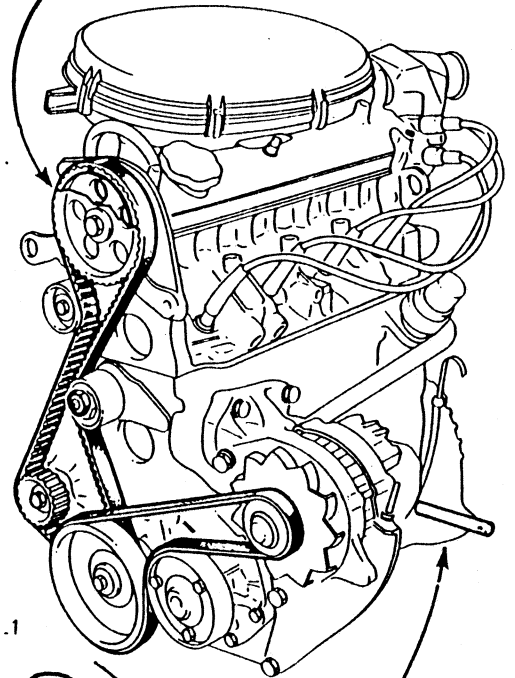
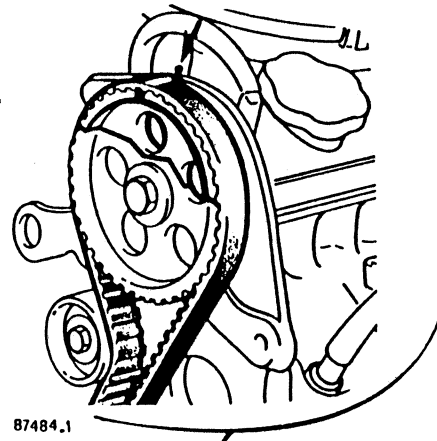
REMOVAL

Drain the cylinder block.

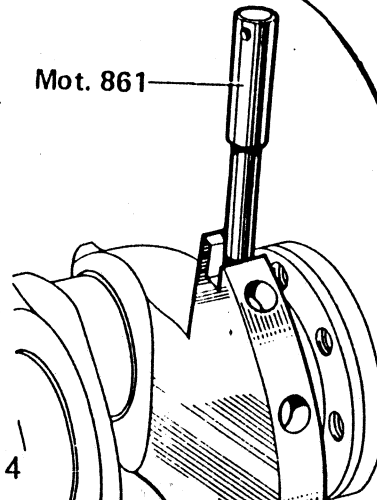


Manoeuvre the No. 1 piston to TDC.

Align the camshaft timing marks and insert the tool Mot 861.

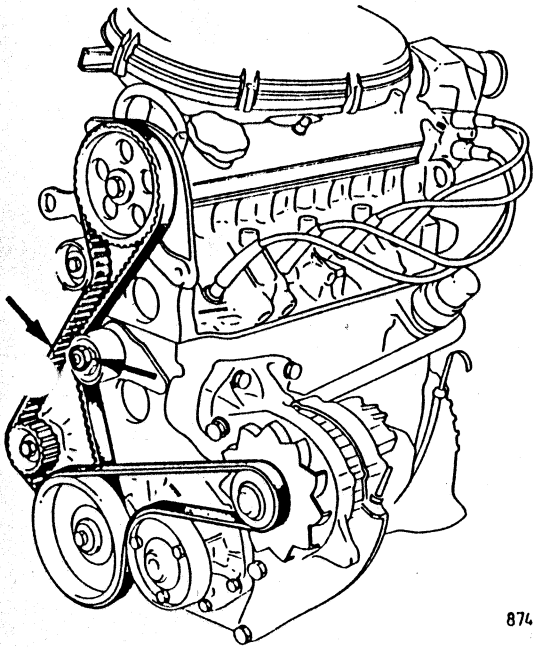


Mot. 861

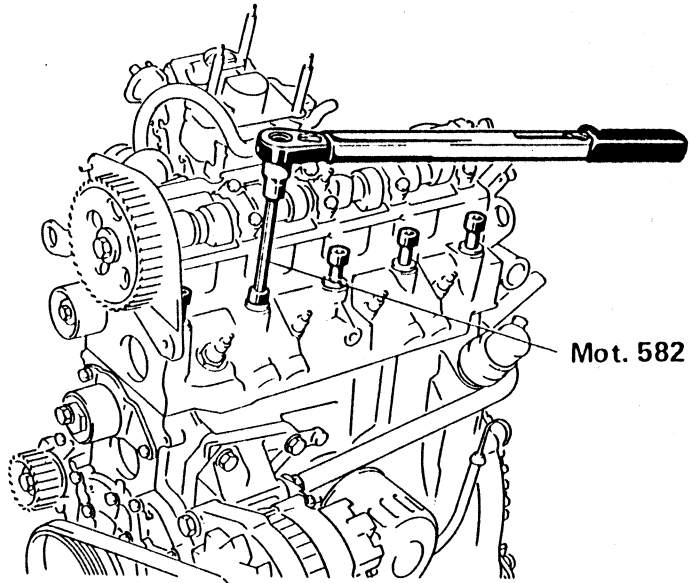
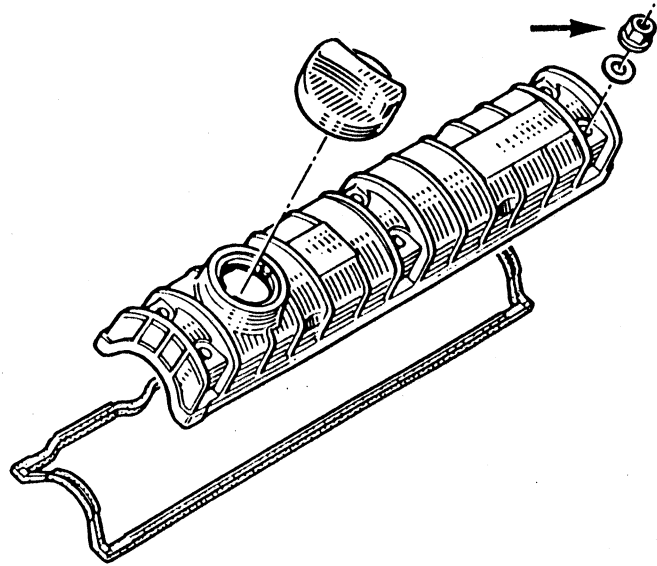


CYLINDER HEAD

REMOVAL, FITTING or REPLACEMENT OF GASKET

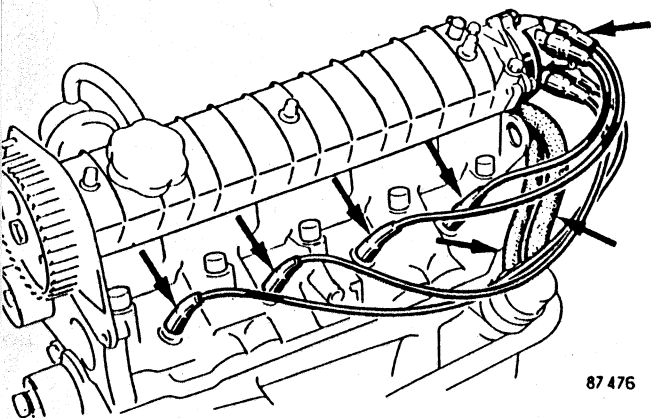


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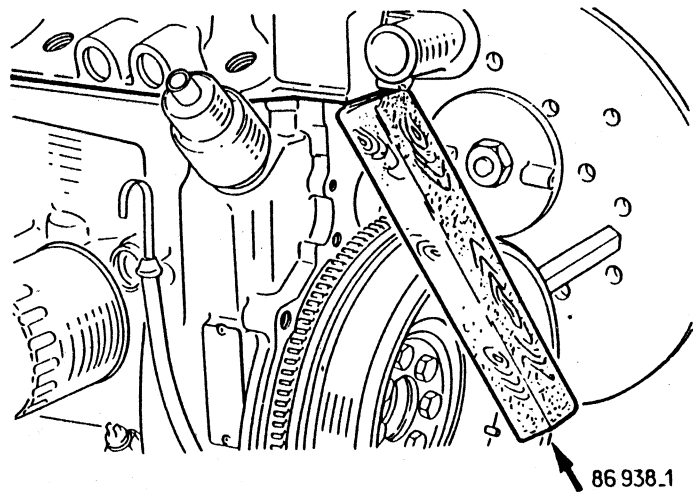
Mot. 582

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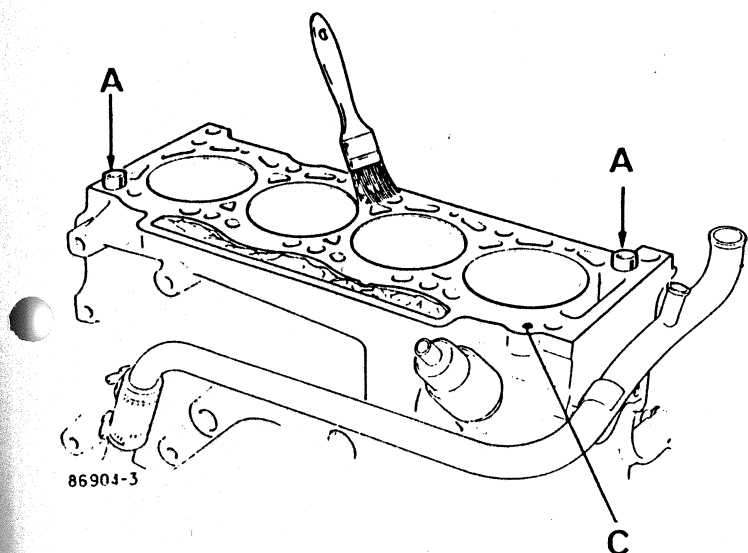
The cylinder head is located by two dowels (A) and cannot be pivoted; it must be lifted off.



86 938.1

CYLINDER HEAD

REMOVAL, FITTING or REPLACEMENT OF GASKET



CLEANING

It is most important not to scrape the aluminium faces on either side of the gasket.

Use Decajoint – Ref. 77-01-405-952 to remove any part of the gasket which remains stuck in place.

Apply the product to the part to be cleaned off. Wait about ten minutes, then lift off with the aid of a wooden spatula.

The wearing of gloves and protective glasses is recommended for this operation.

Do not allow the product to fall on painted surfaces.

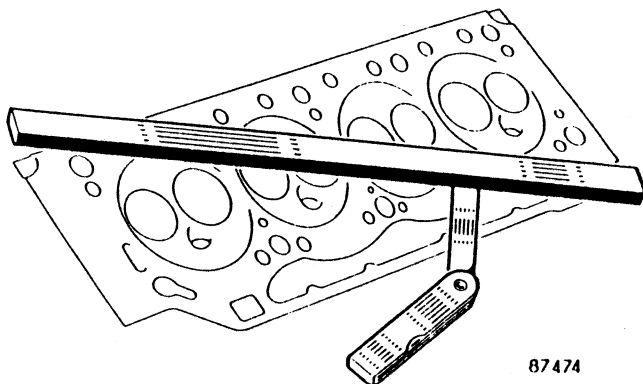
Use a syringe to remove any oil which has entered the cylinder head bolt holes.

This is necessary to achieve correct bolt torque settings.

Cover the oil riser passage (C) to prevent the entry of foreign bodies which could work into the cylinder head oil passages.

Failure to take this precaution could lead to oilway blockage resulting in rapid deterioration of the camshaft and cams.

Checking face flatness.



Use a straight edge and feeler gauge to check for deformation of the mating face.

Maximum permitted deformation: **0.05mm**

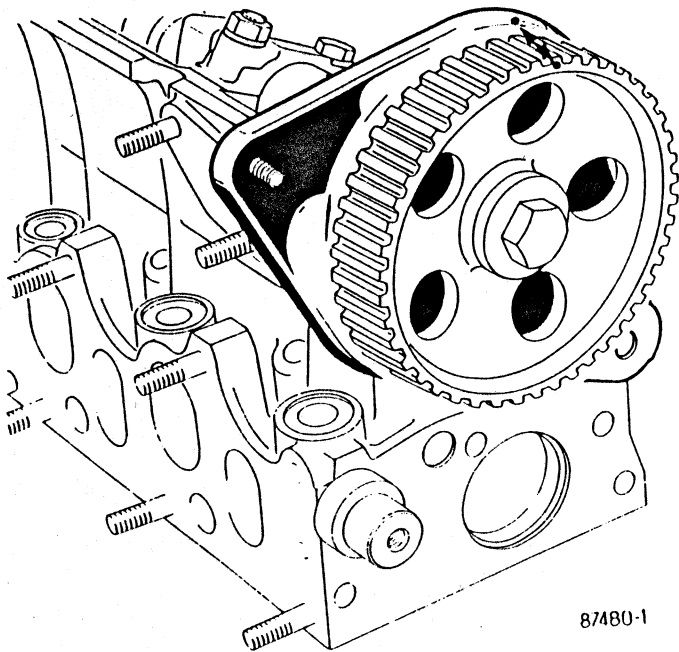
REMOVAL, FITTING or REPLACEMENT OF GASKET

REPLACEMENT

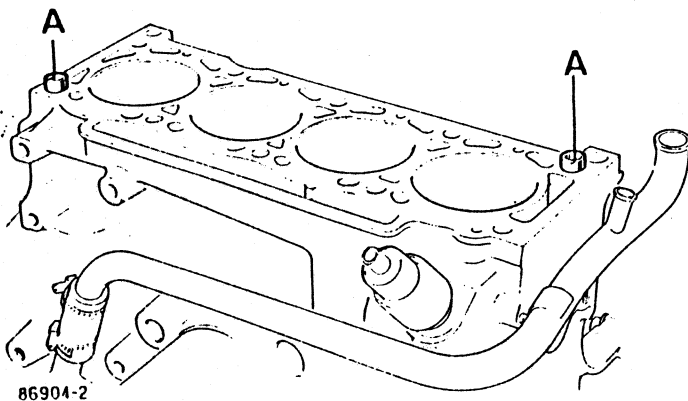
Check that the locator Mot 861 is in place.

Place:

- the cylinder head gasket,
- the mark on the camshaft toothed sprocket to the timing position (as marked) to avoid any contact with the valves while the head is being replaced.



- The cylinder head itself is located on the two dowels (A).



Lubricate all bolt heads and the threads of the cylinder head bolts.

Tighten down the cylinder head (see the section **CYLINDER HEAD** tightening down).

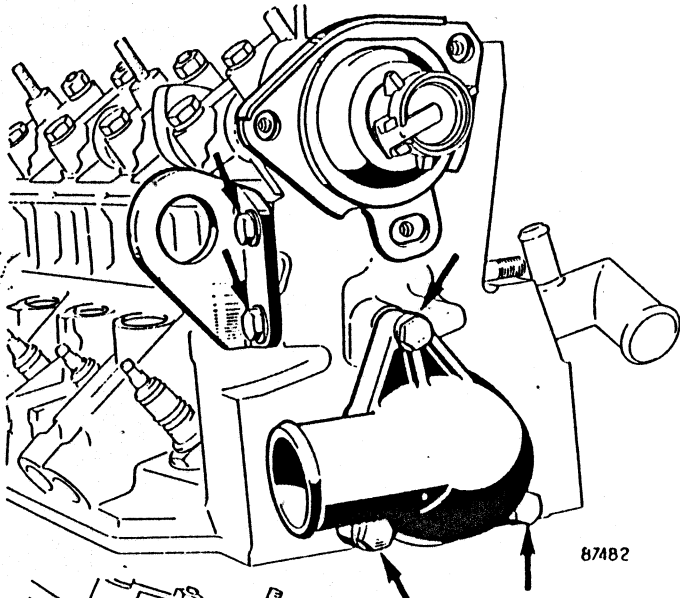
Reset the valve timing (see the section **VALVE GEAR**).

- Do not forget to remove the tool Mot 861 and to replace the oil filler cap
- Refit rocker cover

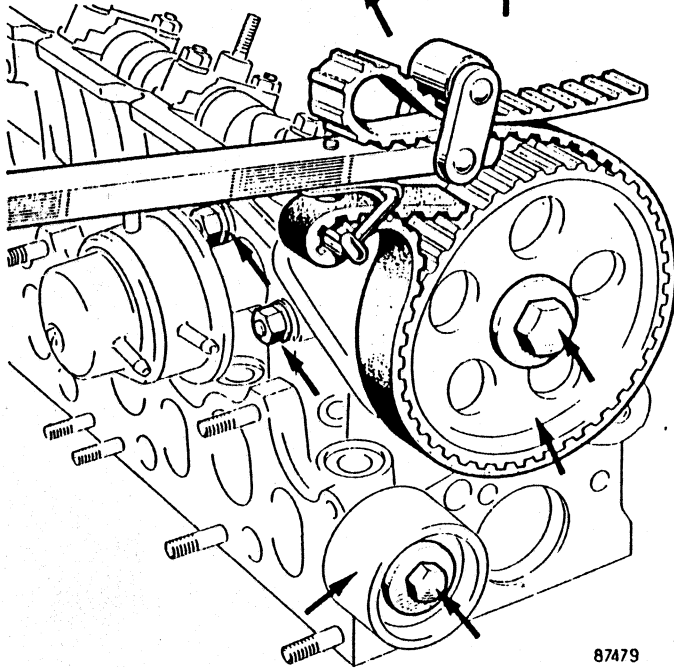
CYLINDER HEAD

REPLACEMENT

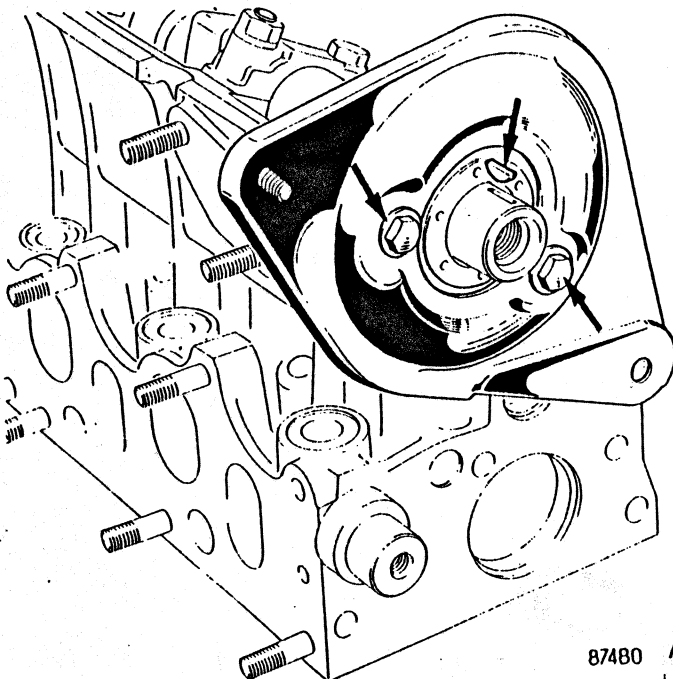
Dismantle arrowed components.



87482

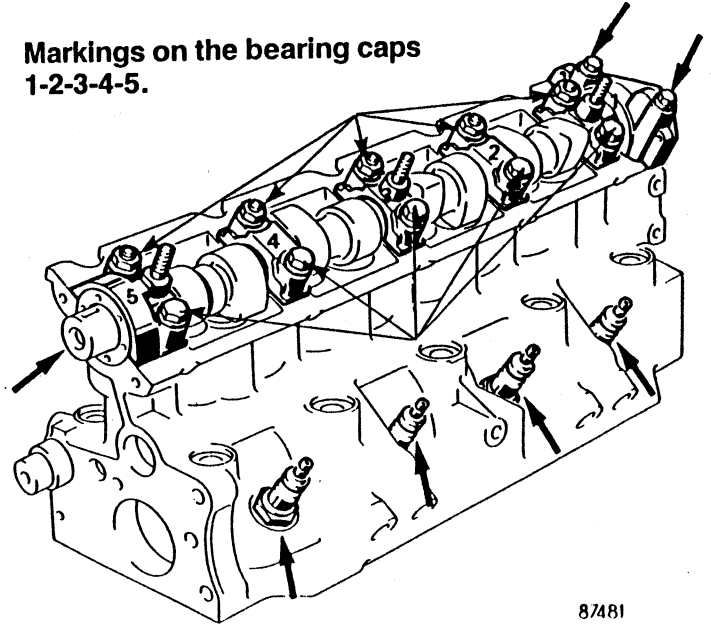


87479

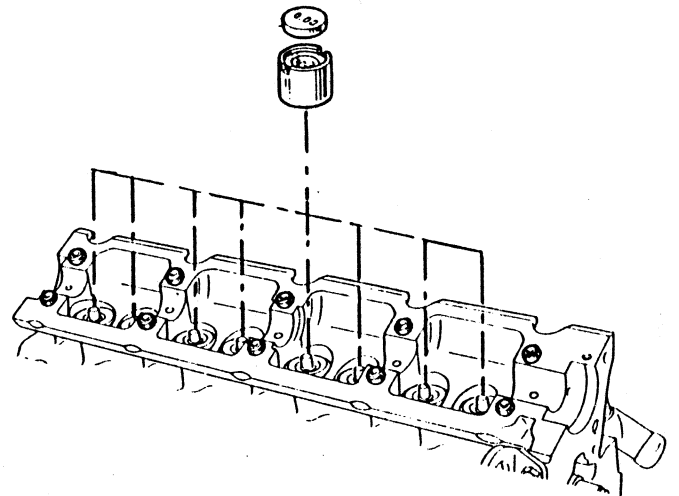


87480

Markings on the bearing caps
1-2-3-4-5.

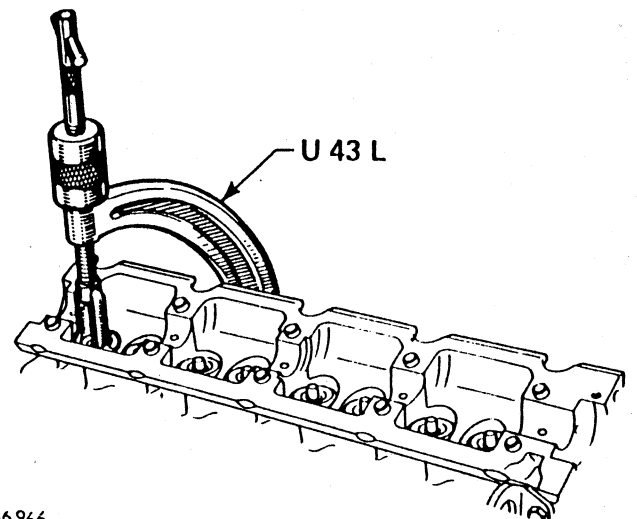


87481



86946

Mark the tappets and shim discs.



86944

REPLACEMENT

INSTALLATION

Fit the new cylinder head with locating studs.

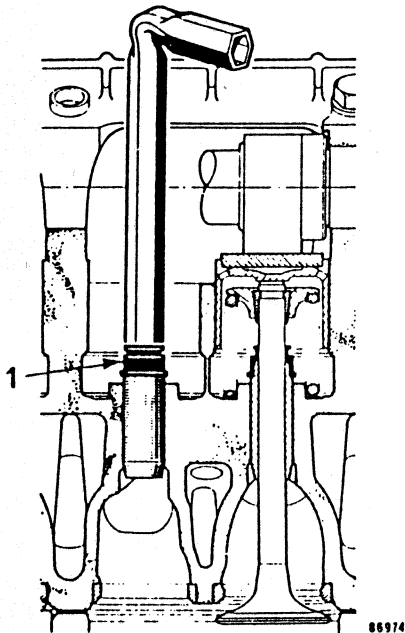
Install new valves (if necessary) and grind them into their seats.

Mark the parts.

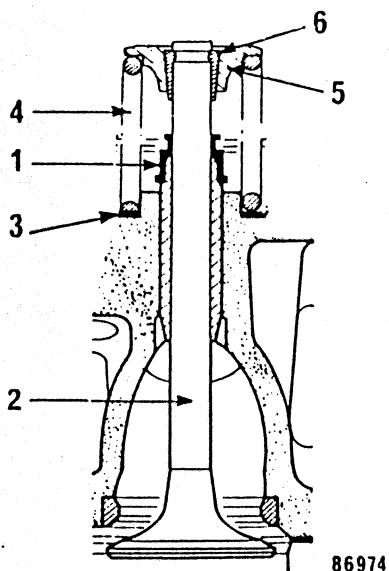
Clean all parts thoroughly before proceeding with installation.

Lubricate the parts with engine oil.

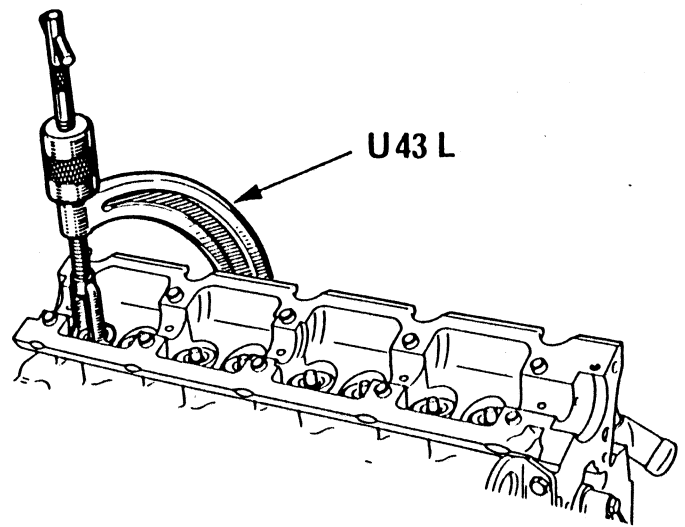
Install the valve stem seals (1). (Optional but recommended.)



Install in this order:

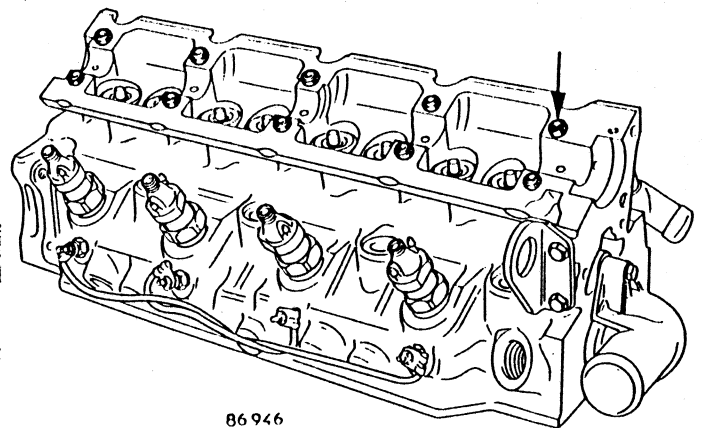
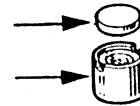


Compress the valve springs with the tool **Facom U43L**. The inlet and exhaust valve collets are identical.



86 944

Install the tappets, observing the markings made during dismantling.



86 946

Check the presence of the bearing cap locating dowels.

Install the camshaft, and the numbered bearing caps.

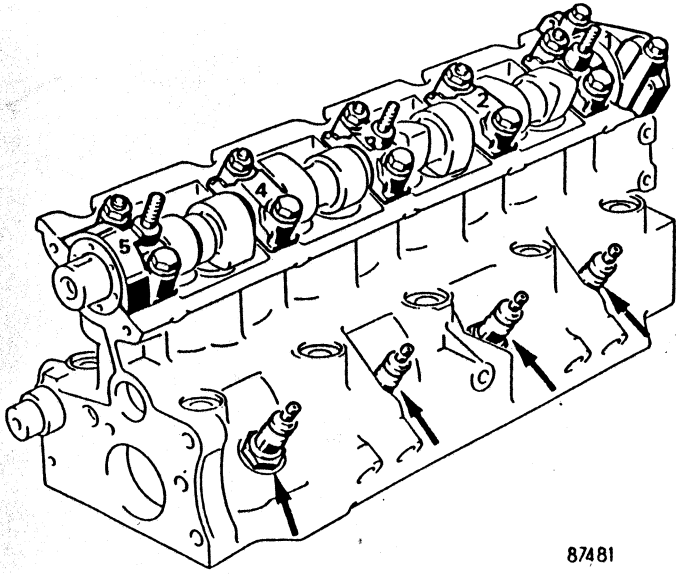
The bearing cap fixing bolts should be smeared with **Loctite Frenetanche** to prevent cylinder head leakage.

Spread a small amount of **CAF 4/60 THIXO** under each of the end bearing caps to ensure sealing between the cylinder head and bearing caps.

Tighten down the assembly progressively. Torque setting: **1 daN.m**.

CYLINDER HEAD

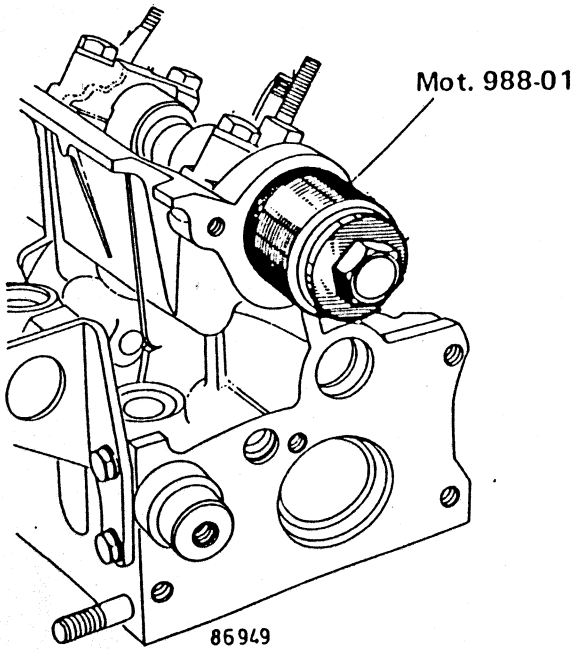
REPLACEMENT



87481

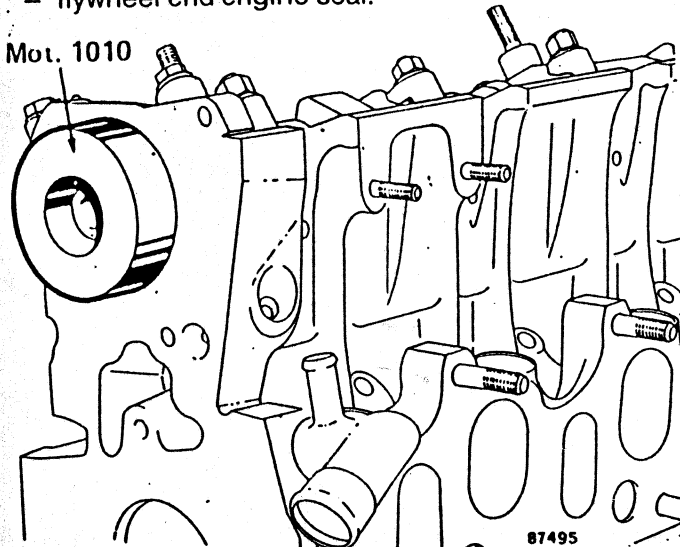
The tools used to install the seals have been designed to offset seal when bearing surface has become worn.

- distributor end seal:

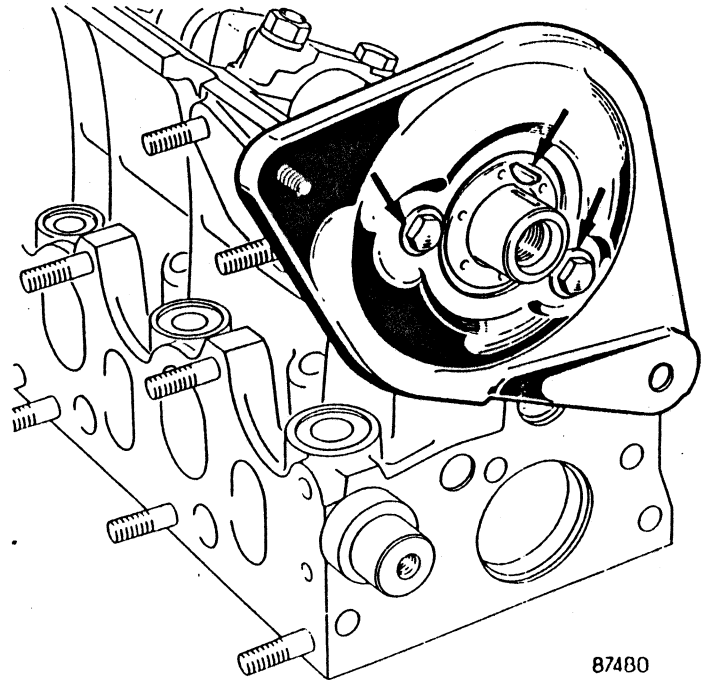


86949

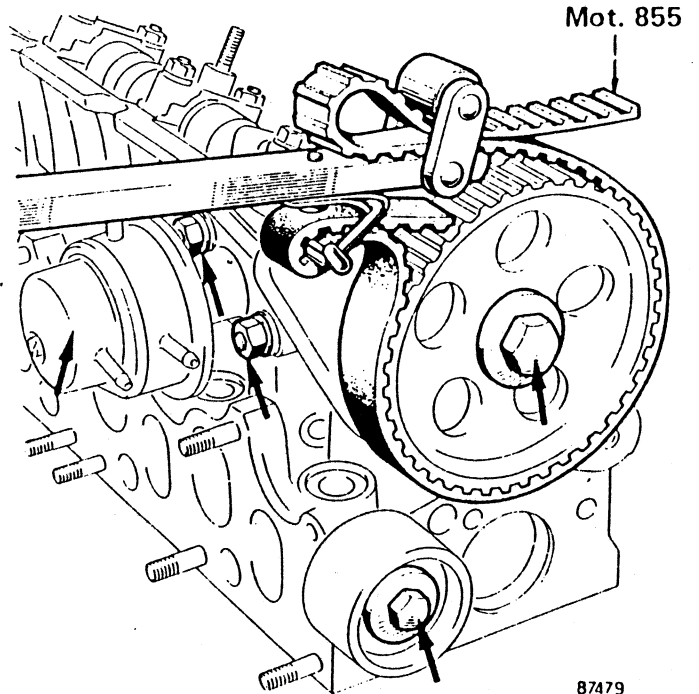
- flywheel end engine seal:



87495

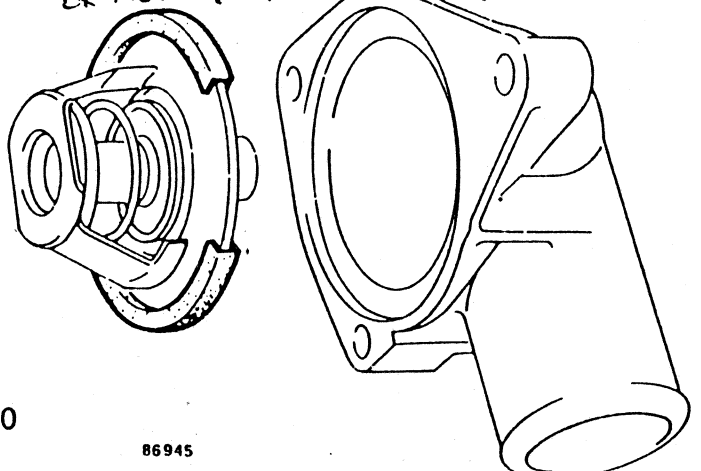


87480



Mot. 855

IT IS PERMITTED TO REMOVE OR MODIFY THERMOSTAT



86945

VALVE SEAT REPAIR

SPECIAL TOOLS NEEDED	
Mot 251-01	Dial gauge support
Mot 252-01	Support plate for Mot 251-01

"NEWAY" Reference	Description
230	Cutter for inlet valve seal rectification. Angle 45°
230	Cutter for inlet valve seat reduction. Angle 60°
150-8	Centering attachment for Inlet and exhaust valve seat cutters.
230	Cutter for exhaust valve seat rectification. Angle 45°.
273	Cutter for exhaust valve seat reduction. Angle 60°.

These tools are available to non-trade customers from:
 CERGYDIS, Immeuble LE PRESIDENT,
 14, Chaussee J. Cesar, 95520 OSNY
 Tel: 30 38 5210. Fax: 30 73 5419.

VALVE SEATS

Seat angles

- Inlet: 90°
- Exhaust: 90°

Seat width (mm): 1.7 ± 0.2

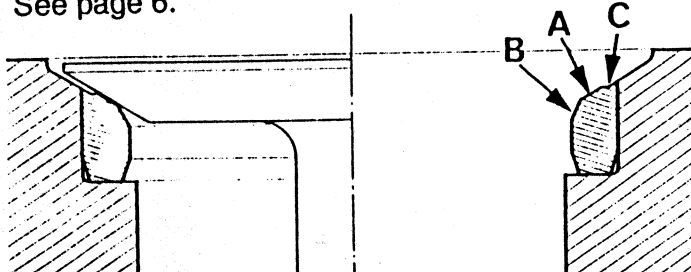
Valve protrusion (mm): Max: 1.25

It is important to maintain the correct protrusion, value because the seats are provided with a cut-away (C) which must be retained.

The valve seat width (A) is obtained by reducing the width (B) while the recommended values: 1.5mm

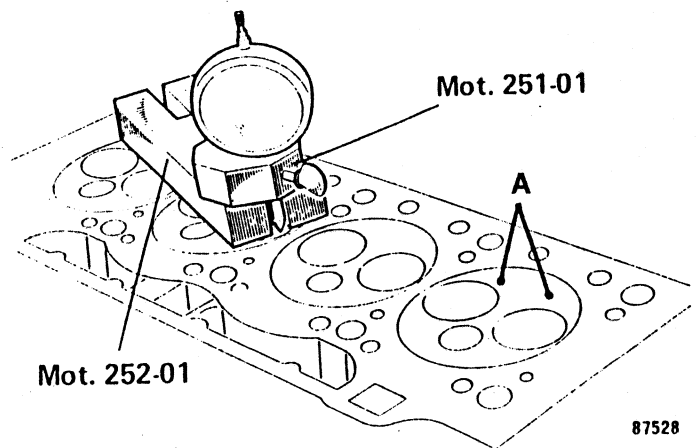
Checking the valve protrusion

See page 6.



87428

- Insert the valves and using the tools Mot 251-01 and Mot 252-01, check the valve protrusion depth with respect to the combustion chamber.

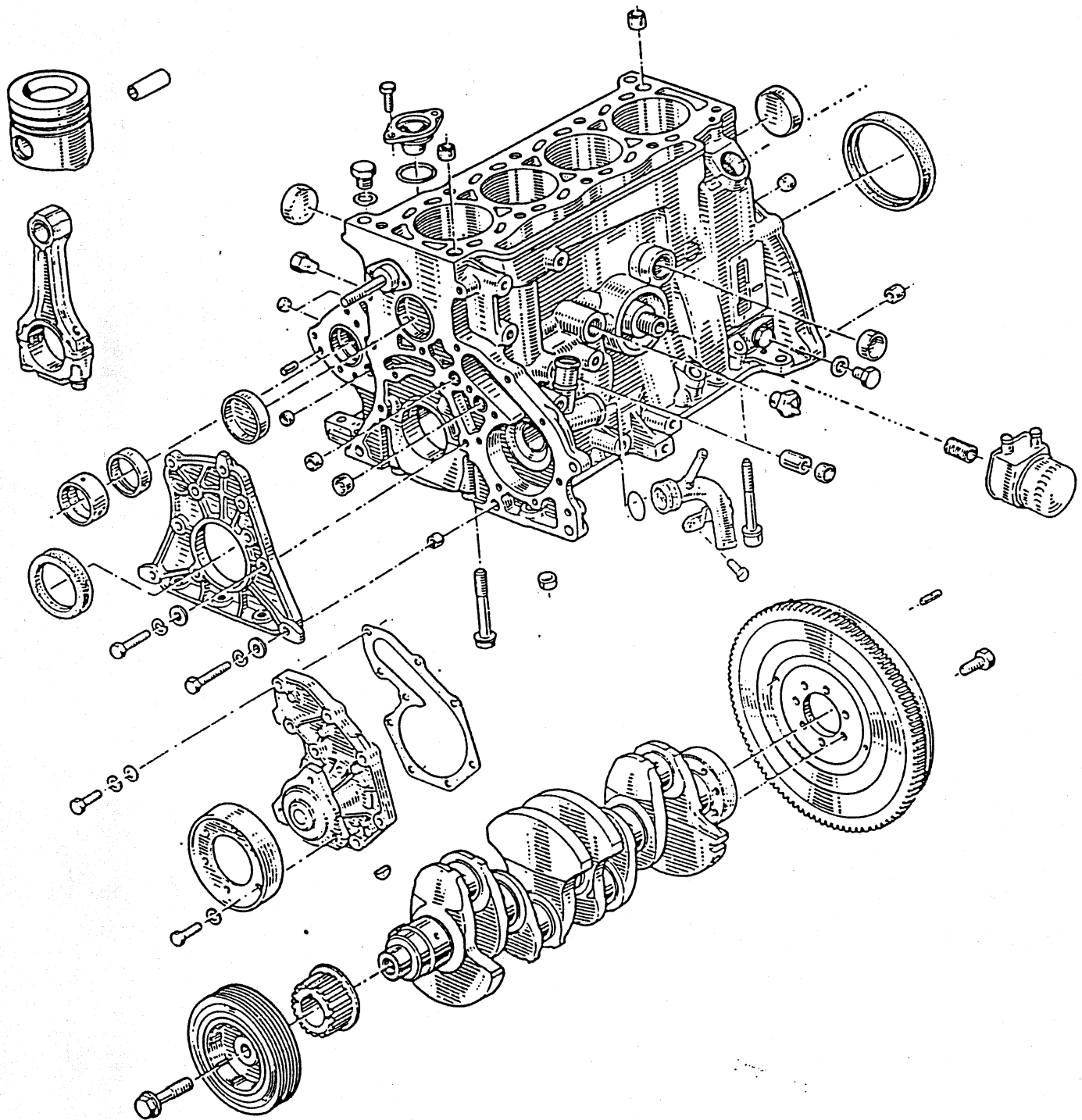


87528

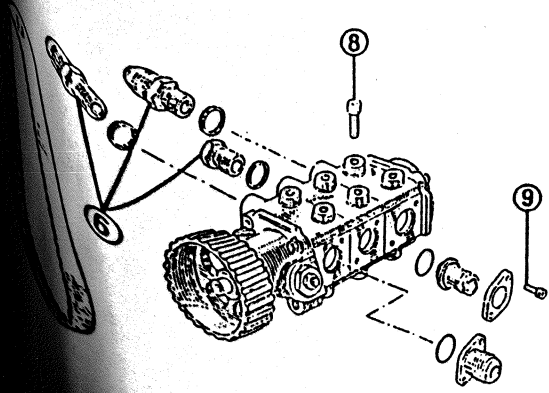
A: Measuring points in combustion chamber.

CYLINDER BLOCK

EXPLODED VIEW



ASSEMBLING DRY SUMP, OIL PUMP AND OIL LINES



Refer to diagram for details of assembly.
Bolts ① and ② must be assembled using a thin
bead of LOCTITE FREIN FILET.

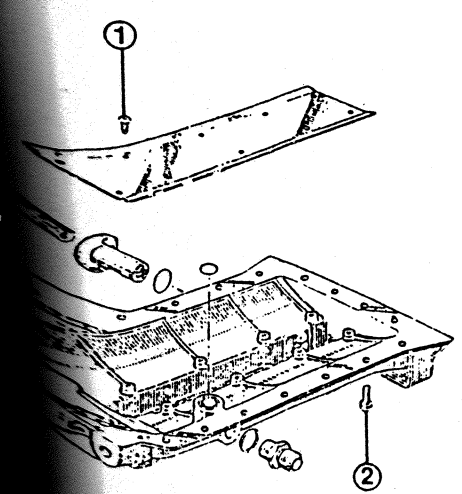
ASSEMBLY:

Fit all unions to oil pump.
Fit unions and cover plate to sump.

Fit oil lines ④ and ⑤ without fully tightening them.

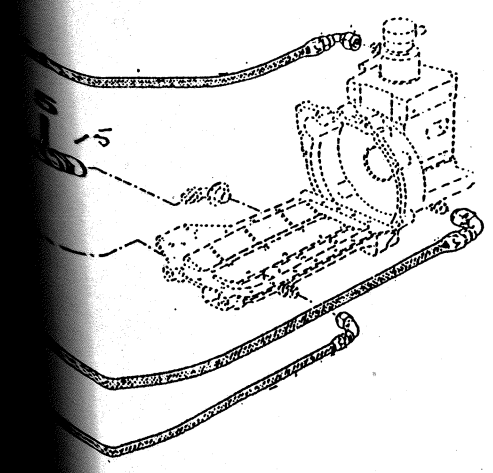
Fit sump to engine. Do not forget to fit O-ring.

Fit oil pump to sump and fully tighten oil lines ④
and ⑤.



TORQUE SETTINGS

- ① 2 to 2.5 daNm
- ② 1.2 to 1.5 daNm
- ⑥ 6.5 to 7 daNm
- ⑦ 3.5 to 4 daNm
- ⑧ 1.3 to 1.4 daNm
- ⑨ 0.8 daNm



CYLINDER BLOCK

Renewal or Replacement

REPLACEMENT

Please refer to the following sections when replacing or dismantling cylinder block:

- 1) VALVE GEAR
- 2) CYLINDER HEAD
- 3) CYLINDER BLOCK

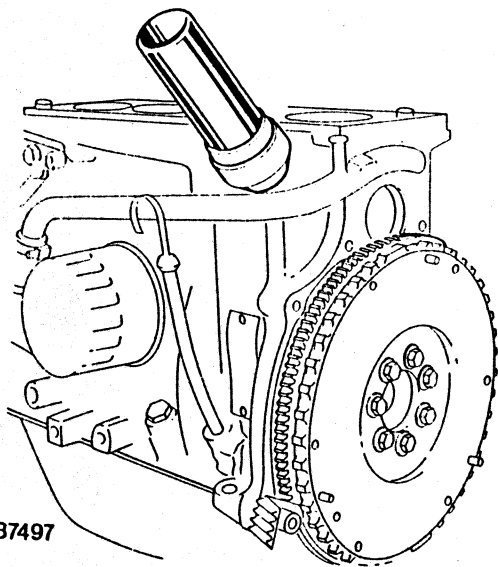
- piston/connecting rod assemblies,
- crankshaft,
- intermediate shaft.

PREPARATION

Ensure cylinder head bolts will screw in smoothly. Screw and unscrew several times to break in threads.

Fitting oil decanter:

- Smooth outer surface of tube with emery cloth.
- Smear tube with Loctite Frenetanch.
- Drift decanter into place using a 38mm internal \varnothing tube.



87497

OIL CATCH TANK

Minimum capacity: 2 litres.

FITTING THREAD INSERTS

Thread inserts may be used in main engine components (but not for moving parts).

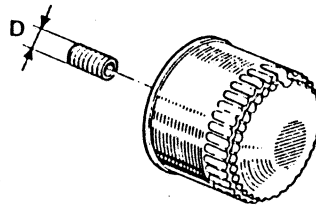
INTERCOOLER

Compulsory.

OIL PIPES

Resistance: 230°C minimum.
70 kg/cm² minimum.

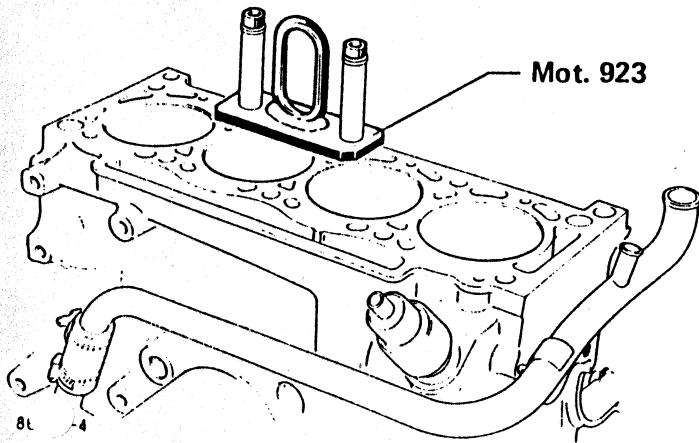
OIL FILTER



REPLACEMENT

ATTACHING THE CYLINDER BLOCK TO THE ENGINE SUPPORT Mot 792-01.

Use the tool Mot 923.



CLEANING

Use Decapoint – Ref. 77-01405 952 to remove any parts of the head gasket which remain stuck to the surface.

Apply the product to the part to be cleaned off. Wait about ten minutes, then lift off with the aid of a wooden spatula.

The wearing of gloves and protective glasses is recommended for this operation.

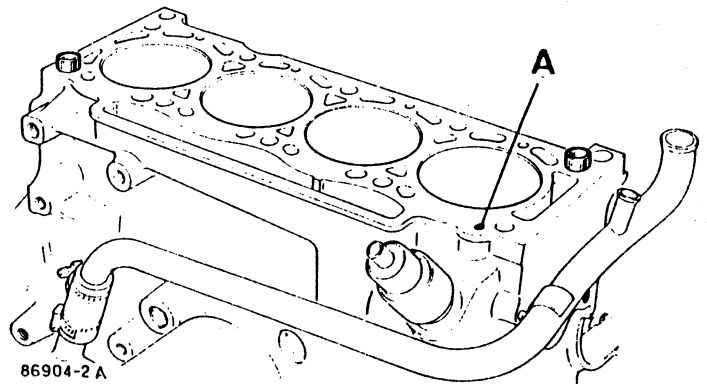
Do not allow the product to fall on painted surfaces.

Use a syringe to remove any oil which has entered the cylinder head bolt holes.

This is necessary to achieve correct bolt torque settings.

Cover the oil riser passage (A) to prevent the entry of foreign bodies which could work into the cylinder head oil passages.

Failure to take this precaution could lead to oilway blockage resulting in rapid deterioration of the camshaft and cams.



PISTON/CONNECTING ROD ASSEMBLIES

TORQUE SETTINGS (daN.m)

- Connecting rod bolts: 4.5 to 5

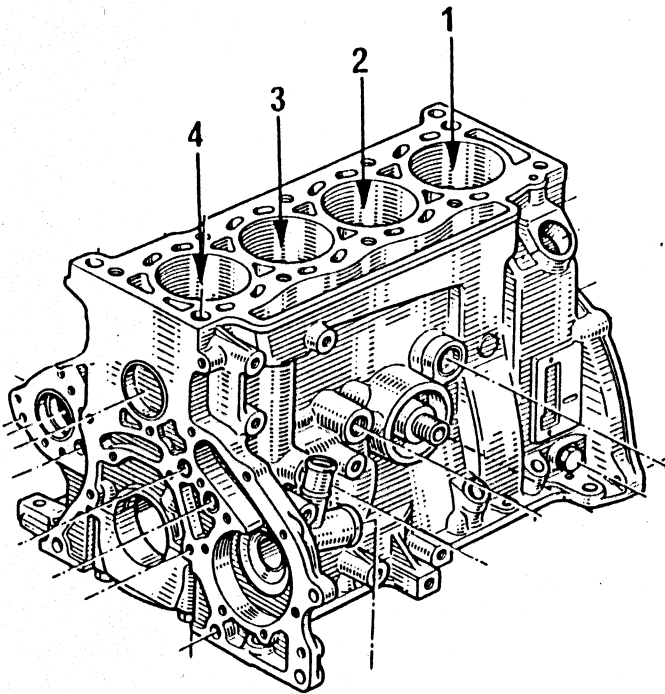
REMOVAL

Remove (referring to chapters concerned):

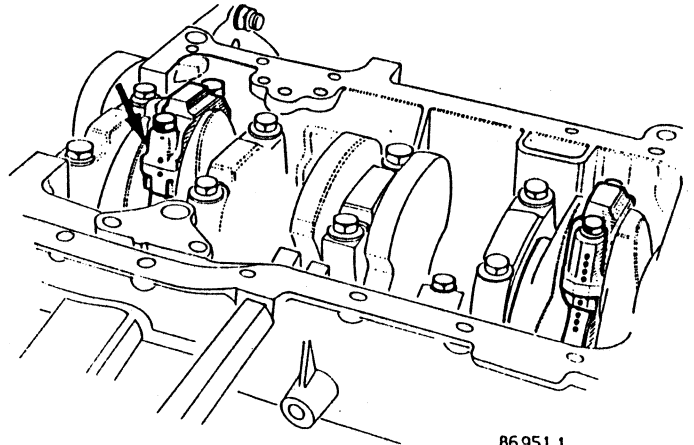
- the valve gear
- the cylinder head
- dry sump and oil pump

Mark:

- The piston corresponding to each cylinder (if necessary).



- The connecting rods corresponding with their caps.



86951.1

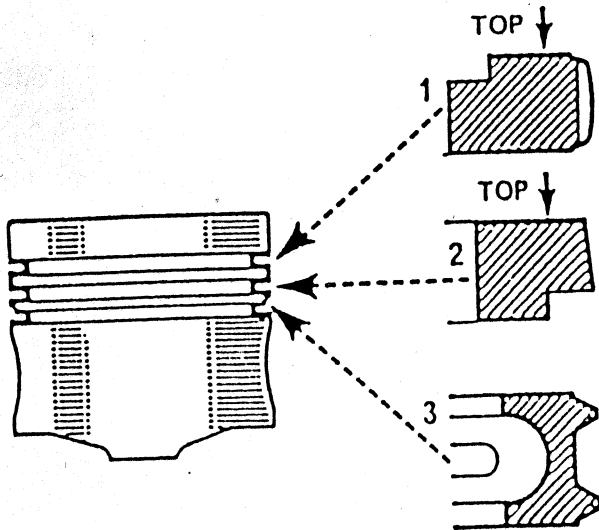
Remove the connecting rod caps and bearing shells, and remove the piston and connecting rod assemblies.

PISTON/CONNECTING ROD ASSEMBLIES

Installing the piston rings

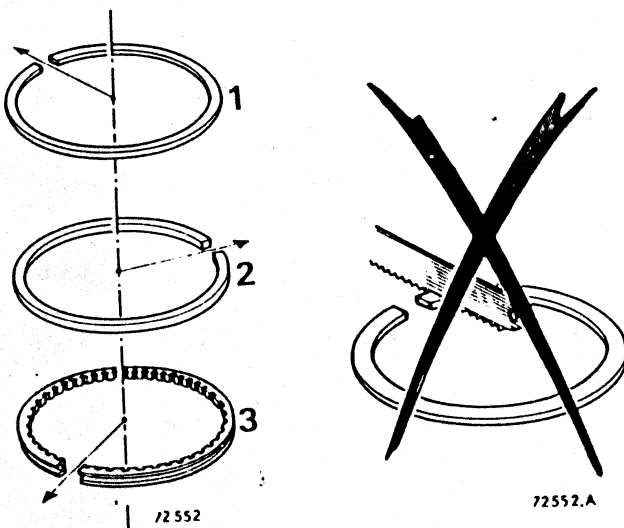
The rings, which are correctly adjusted as supplied, must be free in their grooves.

Gudgeon pin lubricating hole: opposite side to oil filter.



96478

Slots in piston rings should be oriented as shown below.



72 552

72552.A

Install:

– new big-end bearing shells (all identical),

Fitting pistons to connecting rods:
Arrow on piston crown should be face away from slots in connecting rod and towards flywheel.

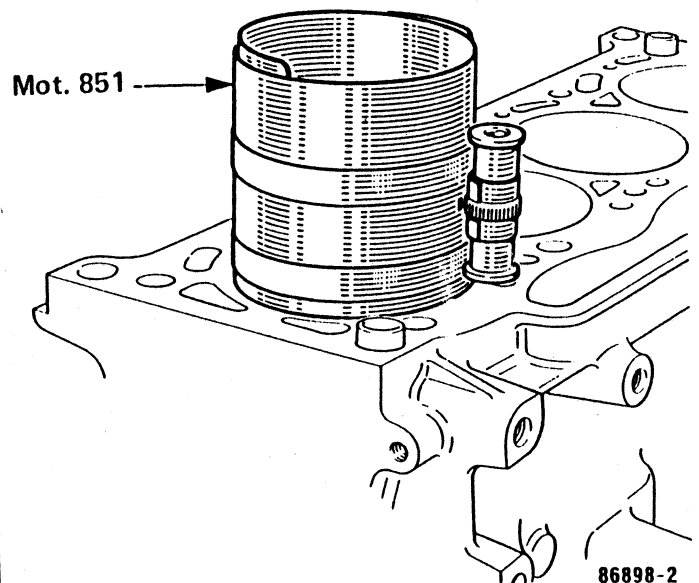
– the piston/connecting rod assemblies into the cylinder bores, observing all markings made during disassembly, and those on newly supplied blocks and pistons (No. 1 cylinder is the flywheel end). See page 27.

A 6

Oil the pistons and rings liberally.

Put each assembly into place with the ring compressor **Mot 851**.

The V-mark on the piston crown should face towards the flywheel.



86898-2

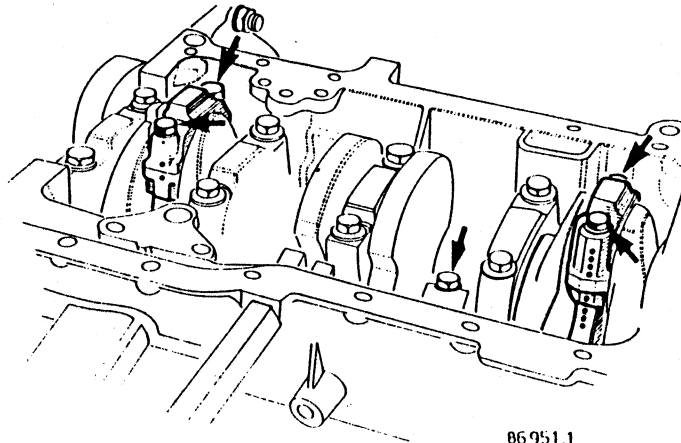
CYLINDER BLOCK

PISTON/CONNECTING ROD ASSEMBLIES

Install the connecting rod caps complete with their bearing shells, observing their markings with respect to the connecting rods (as applied during disassembly).

Tighten the new bolts to a torque setting of:

Setting: **4.5 to 5 daN.m**



ENSURE THAT THE MOVING ASSEMBLY IS FREE TO ROTATE

Insert the pin **Mot 861** in position and check that it is properly engaged with the crankshaft.

Replace:

- The sump complete with a 1.5mm bead of **Loctite 518** (having first cleaned and degreased the mating faces).
- The oil level sensor.
- The cylinder head (see the chapter **CYLINDER HEAD - Removal - Replacement**).
- The toothed camshaft drive belt (see the chapter **VALVE GEAR**).

CRANKSHAFT – REPLACEMENT

SPECIAL TOOLS NEEDED	
Mot 582	Flywheel locking insert
Mot 593	Drain plug key
Mot 792-01	Engine disassembly support plate
Mot 990-01	Timing case gasket installation tool
Mot 991	Flywheel face gasket installation tool
Rou. 15-01	Thrust bearing

TORQUE SETTINGS (daN.m)

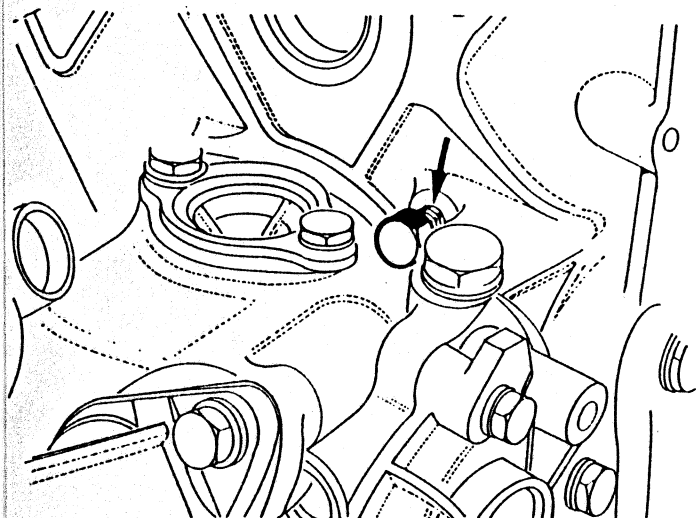
Big-end bolts:	4.5 to 5
Main bearing cap bolts:	6 to 6.5
Crankshaft pulley retaining bolts:	9 to 10
Flywheel retaining bolts:	5 to 5.5

REMOVAL

Attach the engine to the support Mot 792-01 (see the Chapter **DESCRIPTION**).

Drain:

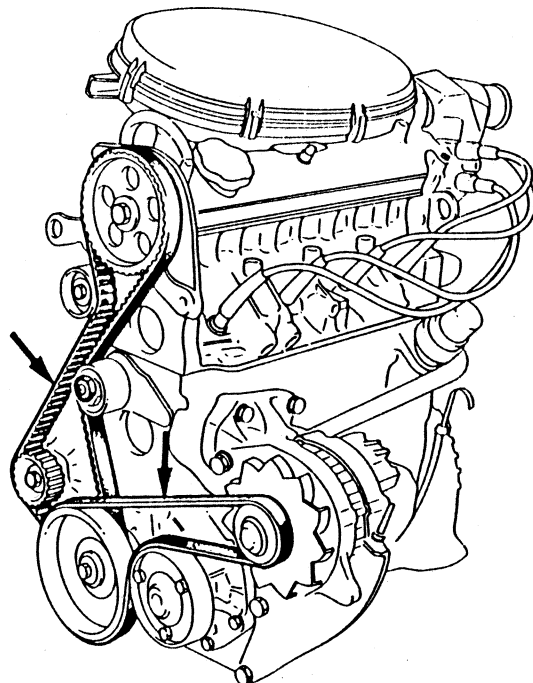
- the cooling system,



86 896

Remove:

- the toothed camshaft drive belt: note the markings (see the chapter **VALVE GEAR**),



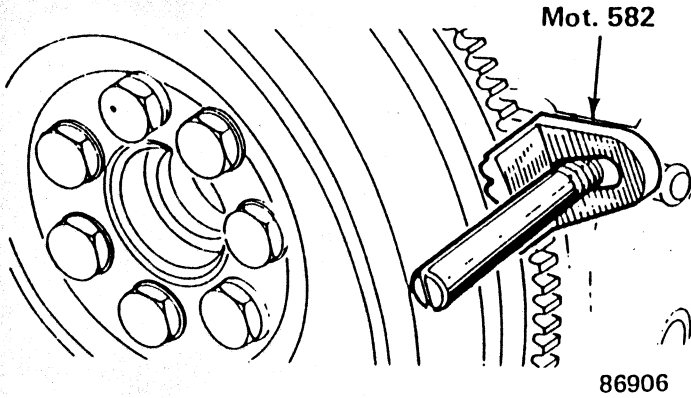
87484

- the cylinder head, if necessary (see the chapter **CYLINDER HEAD**).

CYLINDER HEAD

CRANKSHAFT – REPLACEMENT

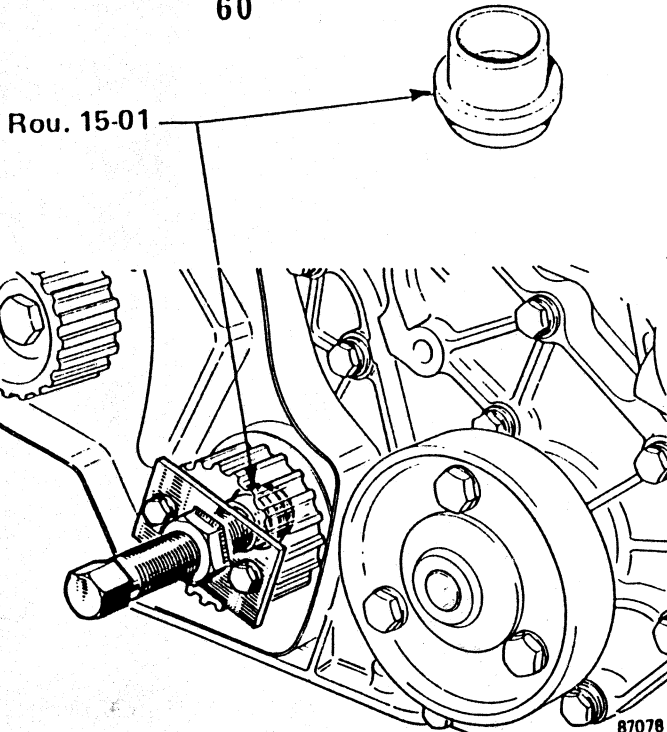
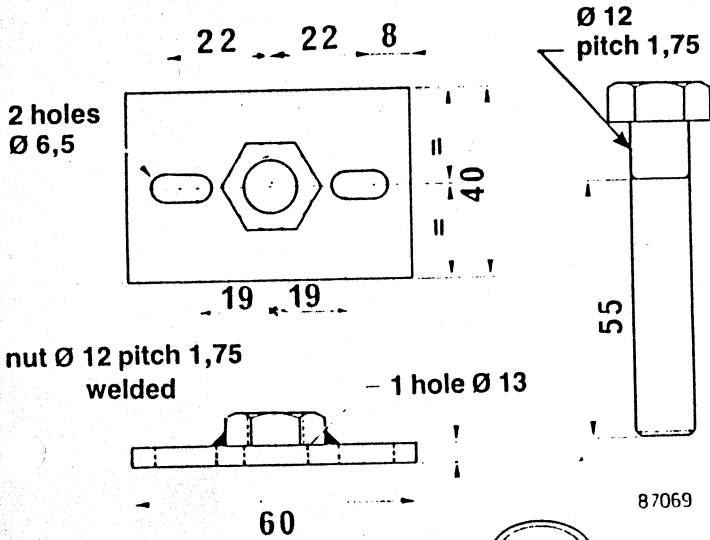
Immobilise the flywheel using Mot 582.



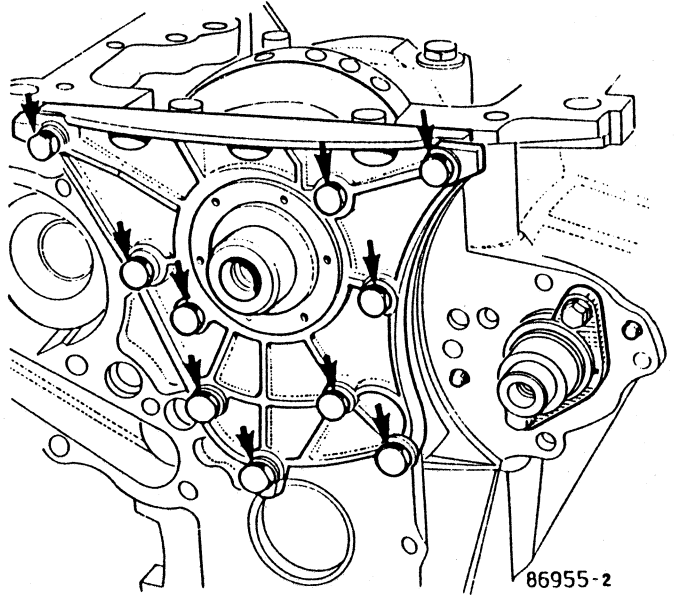
Remove:

- The crankshaft pulley,
- The toothed belt drive sprocket from the crankshaft.

If necessary, use a locally manufactured tool with the thrust bearing Rou 15-01 (dimensions in mm).



- The flywheel,
- The oil level sensor,
- The sump,
- The seal retaining plate.

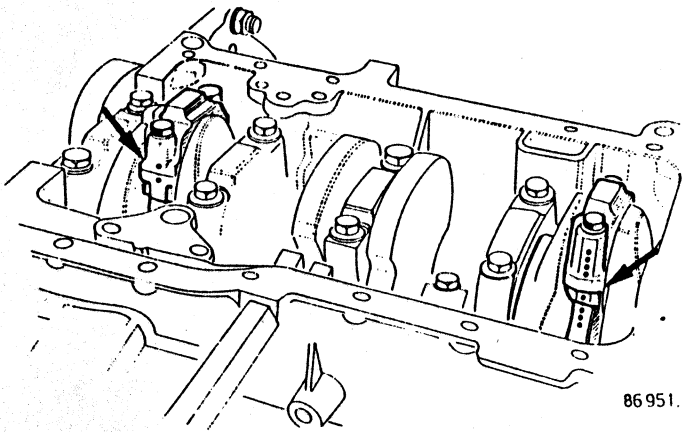


CRANKSHAFT – REPLACEMENT

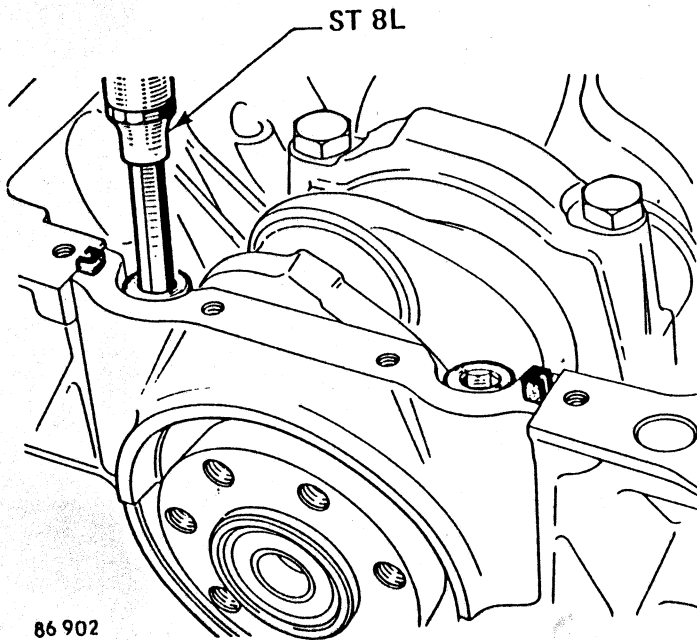
Mark the connecting rods on the intermediate shaft side, making No. 1 the flywheel end.

Remove:

- The big-end caps and the bearing shells.



- The oil seal from No. 1 main bearing (flywheel end),
- The main bearing caps. Use the key Facom ST 8 L on the No. 1 main bearing.



- The crankshaft,
- The longitudinal thrust washers,
- The bearing shells.

CLEANING

Clean the mating surfaces of the cylinder block joints.

If the crankshaft is to be re-used, clean out the oil passages by passing a length of wire through them.

REPLACEMENT

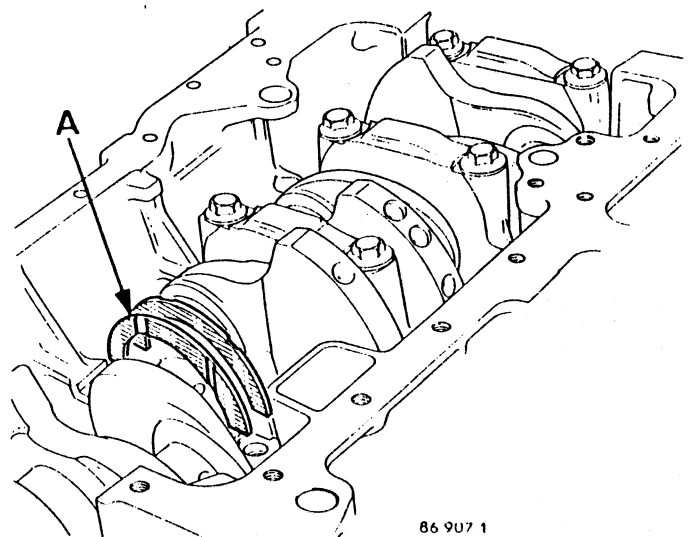
Oil new bearing shells and insert them.

Bearing shell identification:

- slotted shells in the main bearings,
- smooth shells in the big-end bearings.

Install:

- The crankshaft.
- The longitudinal thrust washers into No. 2 main bearing, with their slotted faces (A) towards the crankshaft.

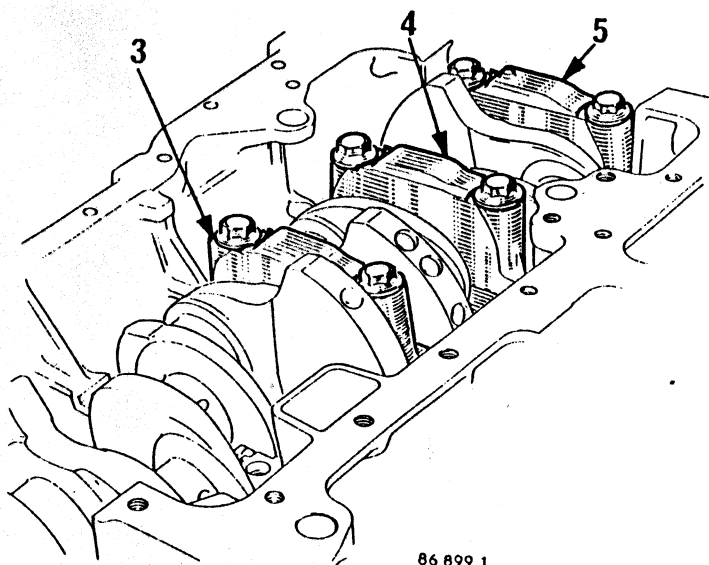


CYLINDER BLOCK

CRANKSHAFT – REPLACEMENT

- The main bearing caps (3), (4) and (5).
Torque setting: 6.5 daN.m

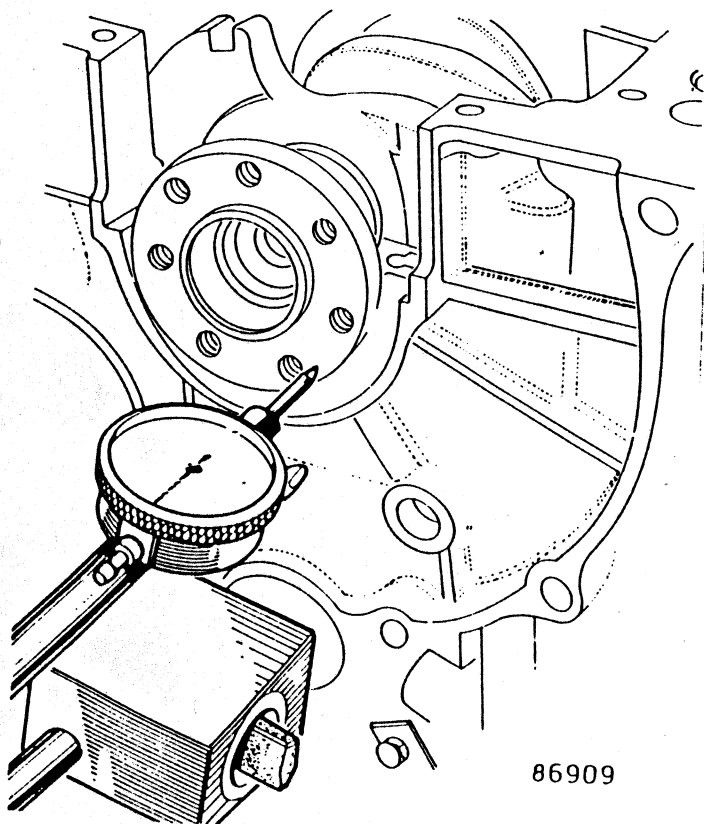
Markings should be seen on the intermediate shaft side.



86 899.1

Longitudinal play of crankshaft (mm):
 $J=0.07$ to 0.23 . Recommended play: 0.1

Different thrust washers exist with thicknesses of:
 $2.30 - 2.35 - 2.40 - 2.45 - 2.50$ mm.

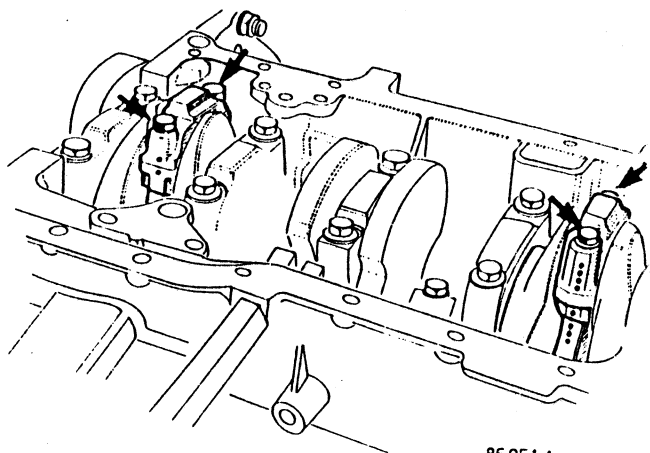


86909

Install:

- The No. 2 main bearing cap.
Torque setting: 6.5 daN.m
- The connecting rods and big end caps complete with new bearing shells (the upper and low shells are identical).

Big end cap bolt torque setting: 4.5 to 5 daN.m



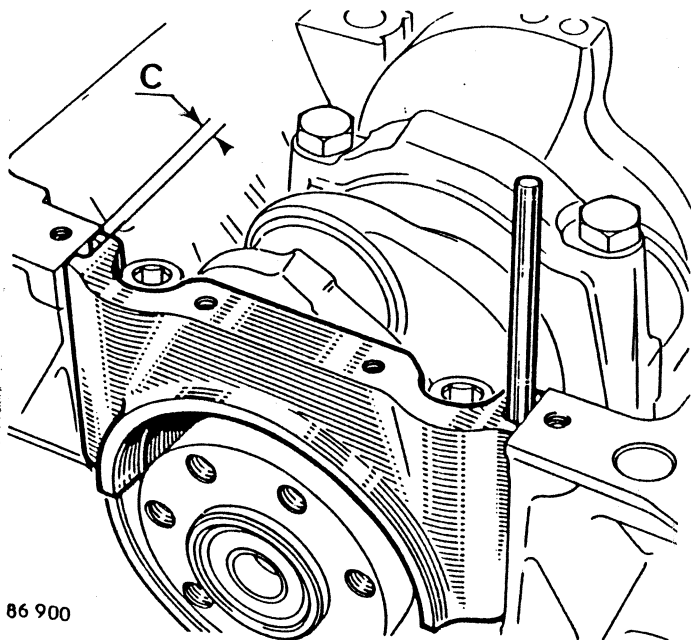
86 951.1

Insert the No. 1 main bearing cap.

These engines are equipped with silicone seals as standard.

Replace these with butyl rubber seals.

Measure the dimension (C) with the aid of a drill.



86 900

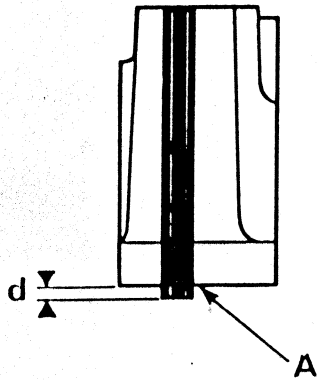
If the dimension (C) is less than or equal to 5mm, select a seal with a thickness of 5.10mm.

- If the dimension (C) is over 5mm select a seal with a thickness of 5.4mm (indicated by coloured marking).

CRANKSHAFT – REPLACEMENT

Once more remove the No. 1 main bearing cap.
Install the seals in it as follows:

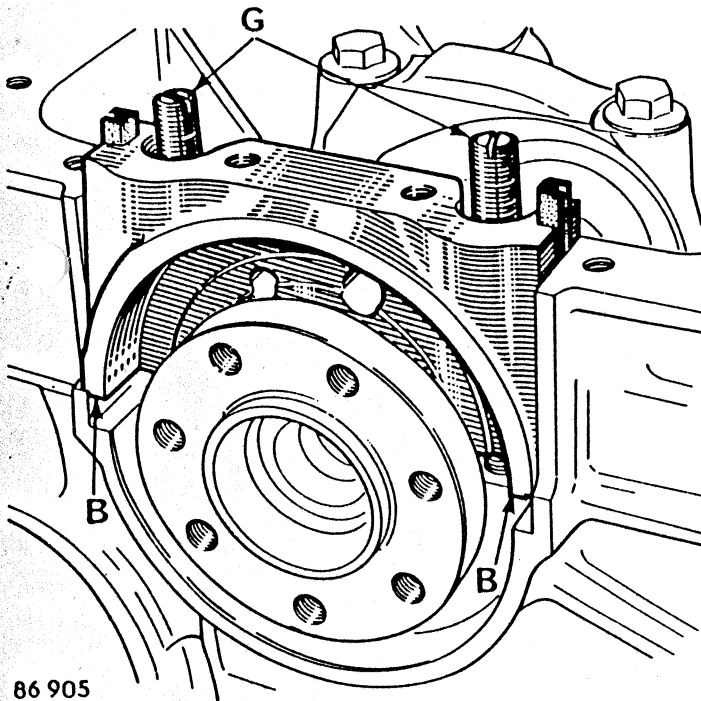
- seal groove facing outwards,
- depth (d) = 0.2mm approximately as at (A).



86993

Screw the centering screws (G) of 10mm diameter and 1.5mm pitch into the cylinder block.

Oil the two seals.



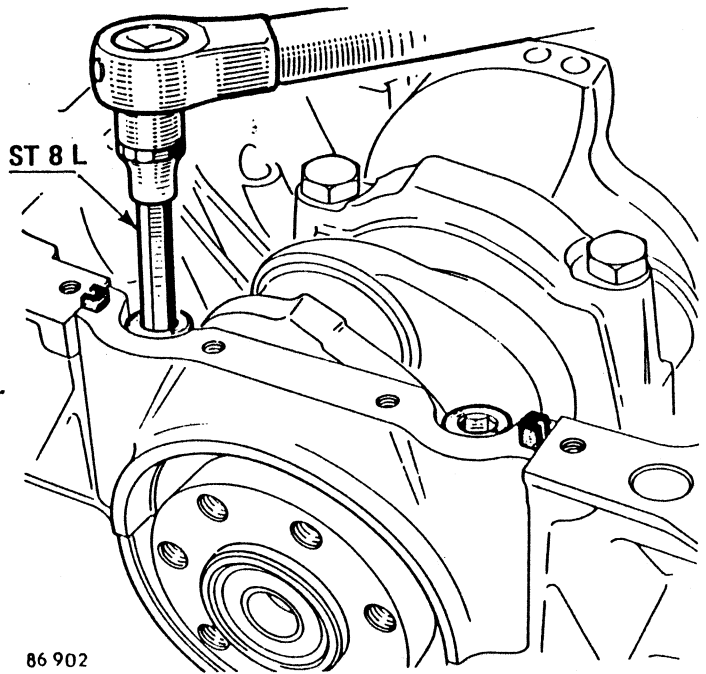
86905

Lightly coat the lower faces (B) of the main bearing cap with CAF 4/60 THIXO.

When the main bearing cap is almost home, check that the seals are in contact at (B).

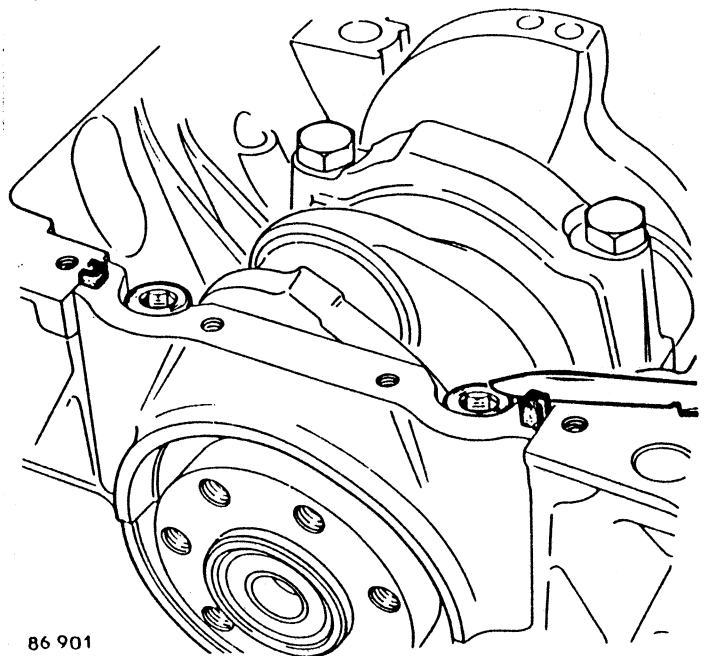
Remove the centring screws and replace with recessed hexagon bolts. Use the Facom ST 8 L socket.

Torque setting: 6.5 daN.m



86902

Cut the seals flush.



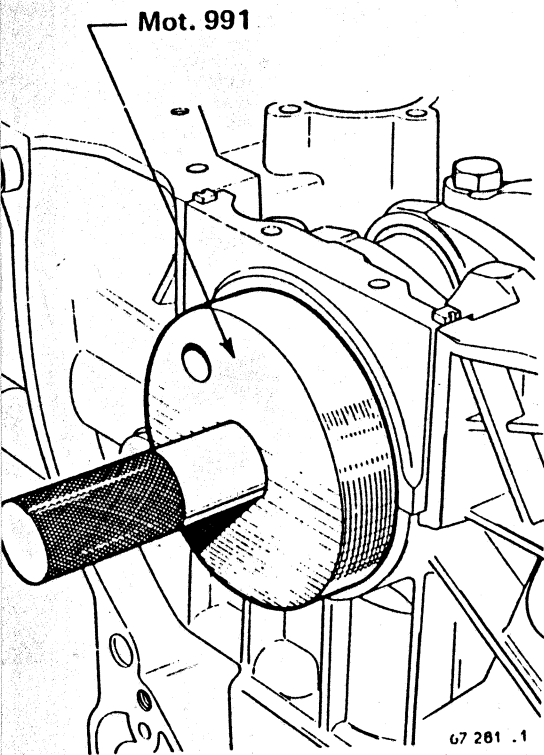
86901

CYLINDER BLOCK

CRANKSHAFT - REPLACEMENT

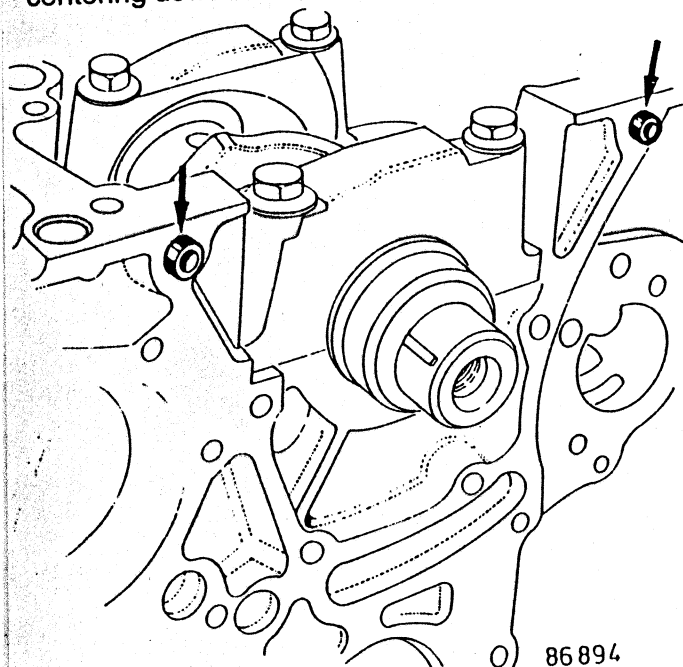
Seal installation

Flywheel end, use the tool Mot 991.

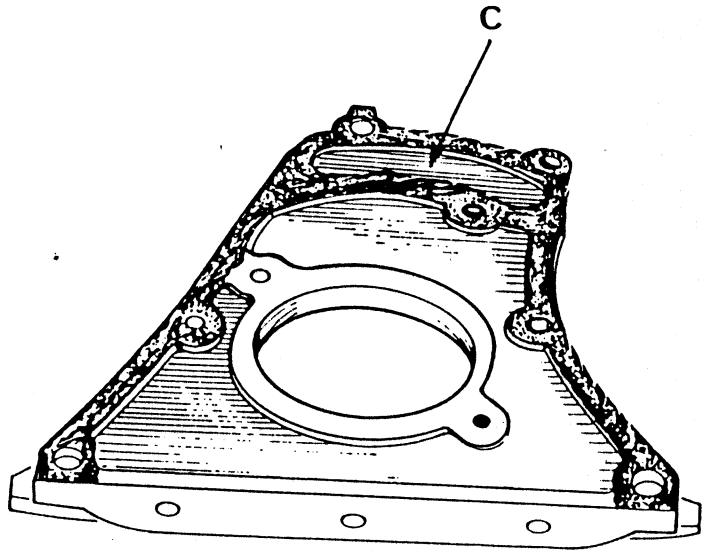


The tool has been designed to offset seal when bearing surface has become worn.

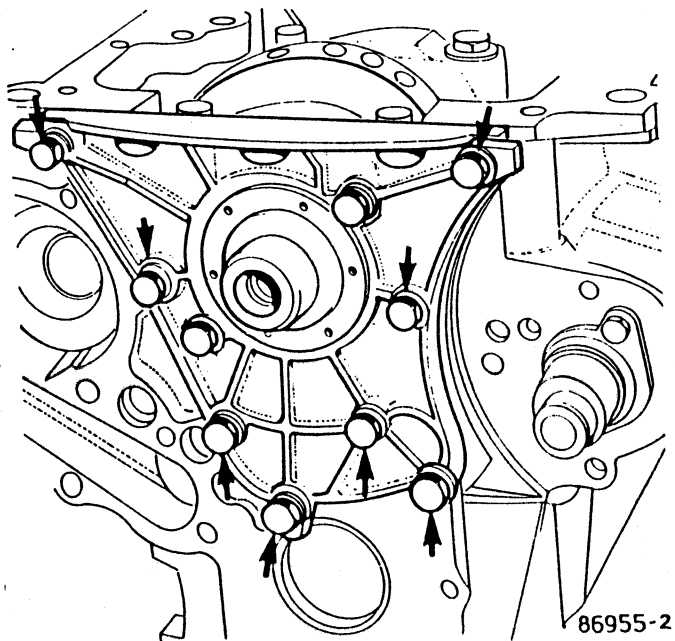
At timing case end, check the presence of the centering dowels.



Fit seal ref. no.
7701 651 124

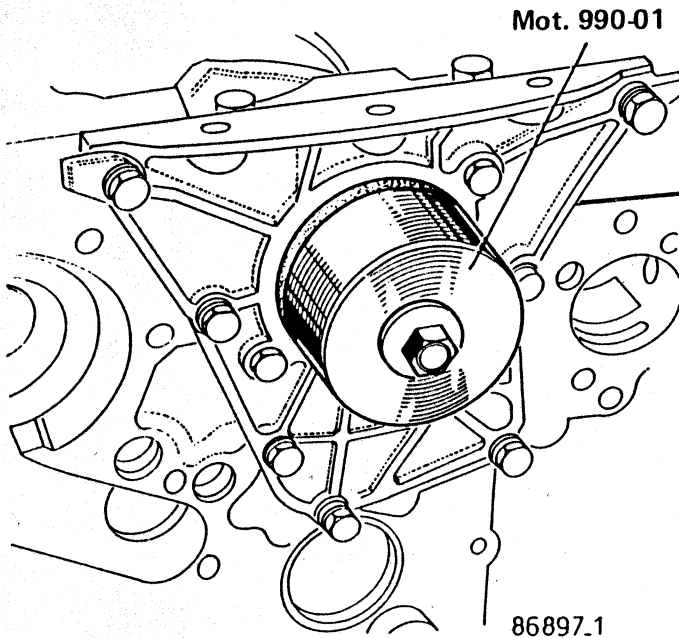


Install the support plate.



CRANKSHAFT – REPLACEMENT

Install the seal using tool Mot 990-01.

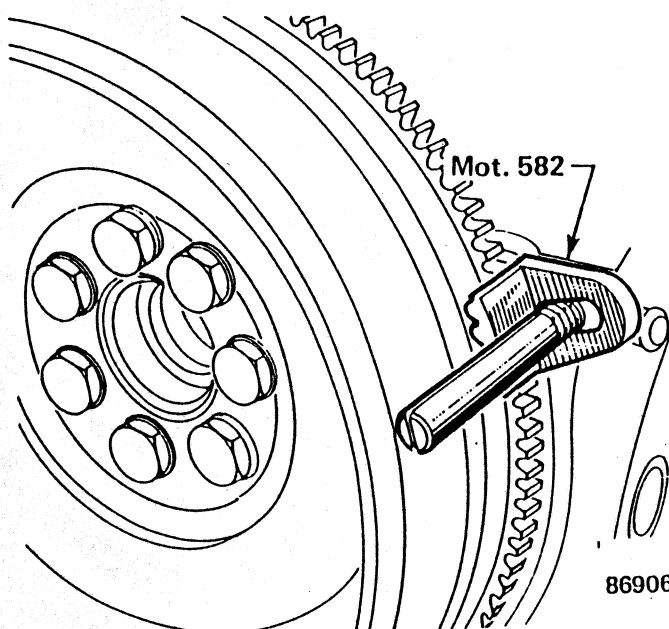


The tool has been designed to offset seal when bearing surface has become worn.

Smear the mating face of the flywheel to the crankshaft with **Loctite AUTOFORM**.

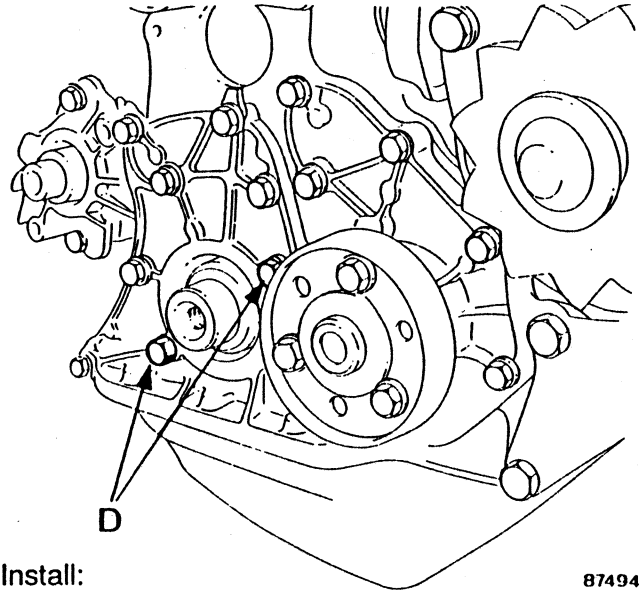
Apply 1 or 2 squirts of **Loctite FRENBLOC** to the flywheel locating bolts.

Install the flywheel and immobilise it using tool **Mot 582**.



Flywheel bolt torque setting: **5 to 5.5 daN.m**

Smear the two bolts (D) entering the cylinder block, with **CAF 4/60 THIXO**.



Install:

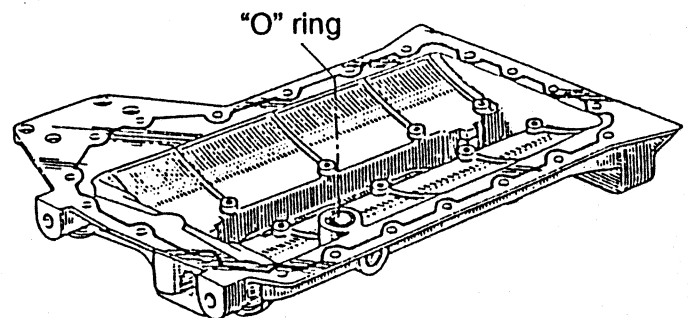
- the toothed belt drive sprocket on the crankshaft.
- the cylinder head if it has been removed (see the chapter **CYLINDER HEAD** removal – replacement).

Retime the valve gear (see the chapter **VALVE GEAR**).

Secure the toothed sprocket and the crankshaft pulley.

Torque setting: **9 to 10 daN.m**
Use the tool **Mot 582** to hold the flywheel.

The sump must be correctly cleaned and degreased.



Apply a bead of **Loctite 518** to sump face as per diagram.

Ensure "O" ring is in position (see diagram).

CYLINDER BLOCK

FORMULA RENAULT TECHNICAL BULLETIN NO. 1

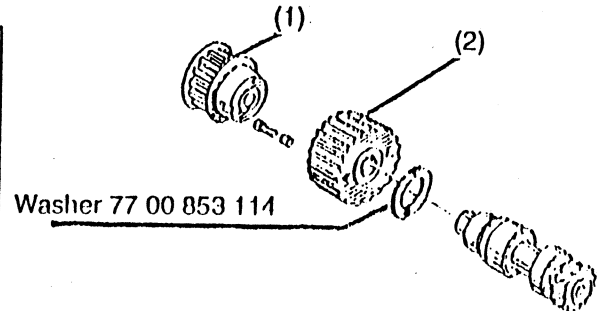
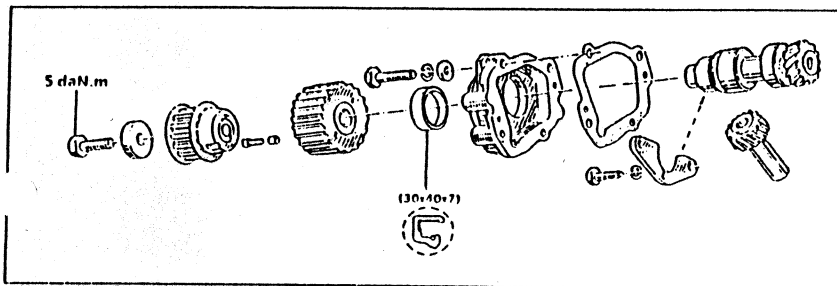
F3R – Formula Renault Engines

1. Intermediate shaft pulley

In order to ensure proper seating and tightness of pulley (2) below, it is necessary to fit a washer – RENAULT ref: 77 00 853 114 between the pulley and the intermediate shaft driving the oil pump.

PROCEDURE

- Loosen timing belt tensioner
- Remove pulleys 1 & 2
- Fit washer ref. no. 77 00 853 114
- Replace the two pulleys
- Re-tension timing belt
- Check timing



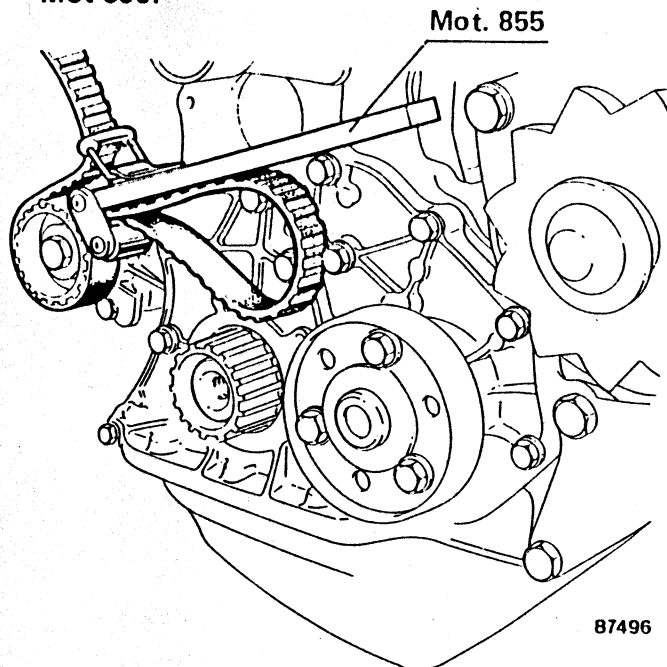
SPECIAL TOOLS NEEDED

Mot 885	Toothed sprocket locking insert
Mot 989	Installation tool for intermediate shaft seal

REMOVAL

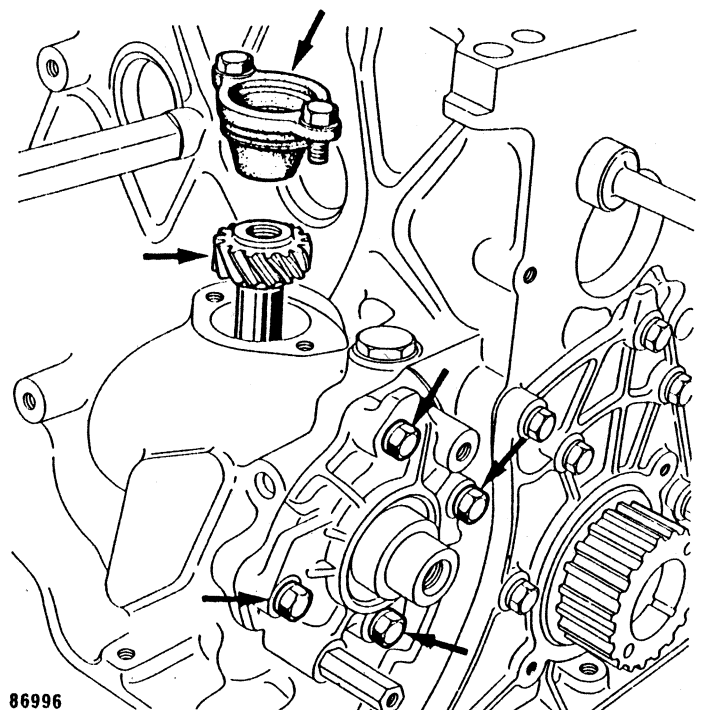
Remove:

- The toothed camshaft drive belt (see the chapter **VALVE GEAR**).
- The intermediate shaft toothed drive sprocket and the oil pump drive sprocket using tool **Mot 855**.



- The seal support plate.
- The filler cap.
- The oil pump drive pinion.

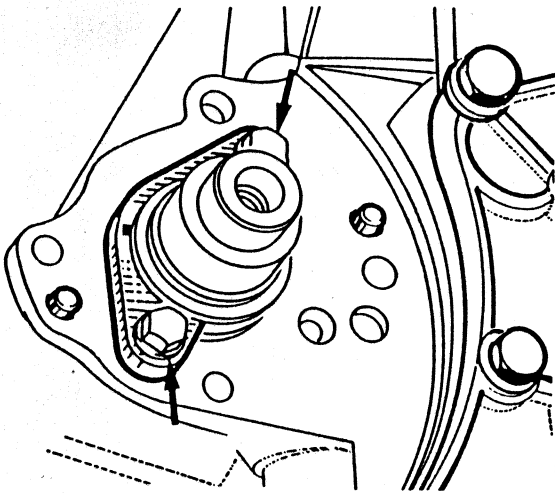
Use a 12mm diameter threaded drift with a 1.5mm pitch.



If the sprocket proves difficult to remove, use the manufactured tool shown on page 35.

INTERMEDIATE SHAFT

- The intermediate shaft locating yoke.



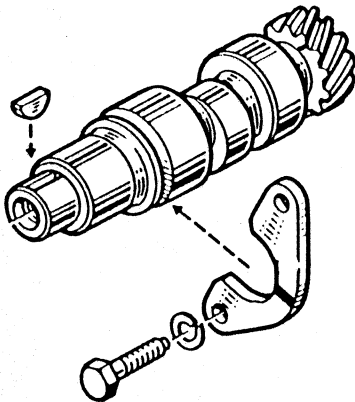
86955-1

- The intermediate shaft and its key.

Check the state of the intermediate shaft bushes in the cylinder block. Replace them if necessary (see paragraph "Bush Replacement").

REPLACEMENT

Oil and install the intermediate shaft.

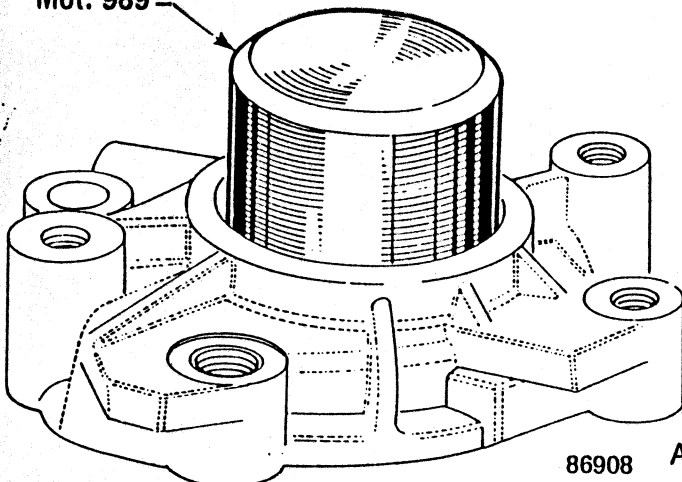


Seal installation.

Place the seal support plate on a flat surface.

Insert the joint until the tool Mot 989 is in contact with the support.

Mot. 989



86908

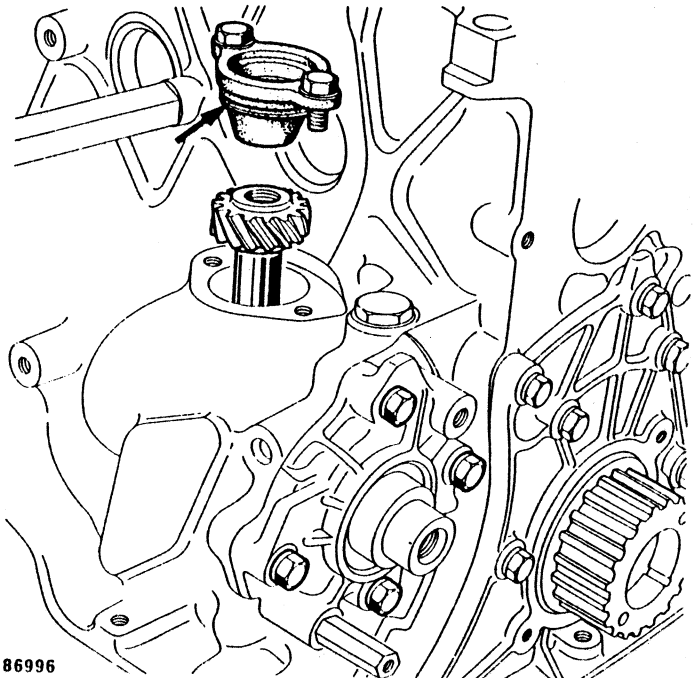
A - 37

The tool has been designed to offset seal when bearing surface has become worn.

Check the presence of the centring pins in the cylinder block.

Install the plate, with either a gasket or a coating of CAF 4/60 THIXO.

Install the oil pump drive pinion and its stop-valve complete with ring seal.



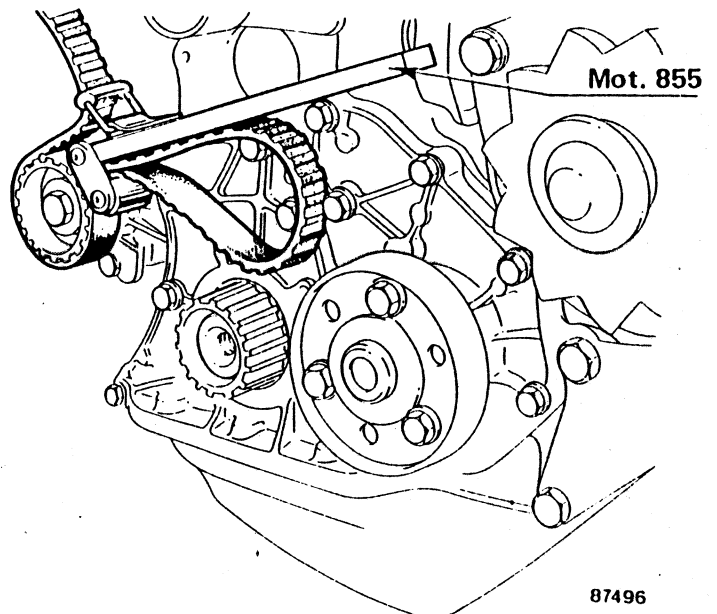
86996

Install:

- The intermediate shaft drive sprocket with its key.
- The oil pump drive sprocket.

Torque setting:

5 da N.m



Mot. 855

87496

- The camshaft drive belt (see the chapter VALVE GEAR).

CYLINDER BLOCK

REPLACEMENT OF INTERMEDIATE SHAFT BEARING BUSHES

SPECIAL TOOLS NEEDED	
Emb 880	Inertia extractor
Mot 993	Inner bush installation mandrel
Mot 994	Outer bush installation mandrel
Mot 998	Bush extractor

TORQUE SETTINGS (daN.m)

- Intermediate shaft drive sprocket: retaining bolt 5
- Crankshaft pulley bolt: 9 to 10
- Tension idler attachment bolt: 4

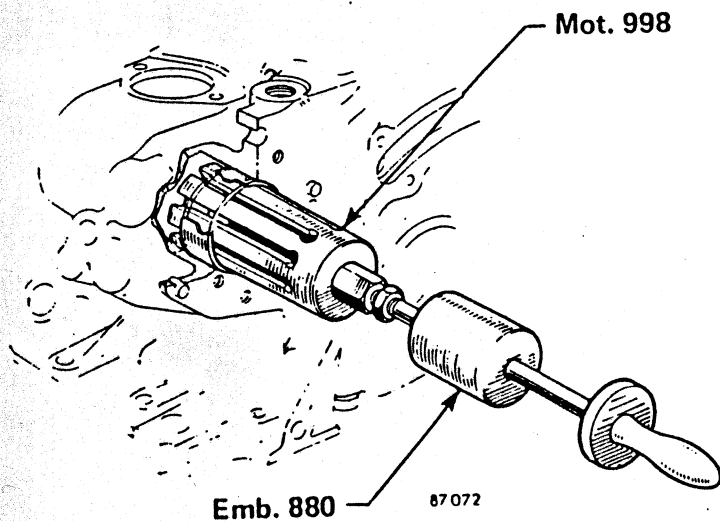
The two bushes MUST be replaced together.

REMOVAL

Remove:

- The intermediate shaft (see the paragraph INTERMEDIATE SHAFT).

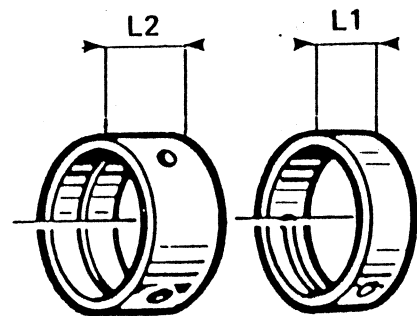
Extract the inner and outer bushes with the tool Mot 998 attached to the inertia extractor Emb 880.



REPLACEMENT

Installing the bushes

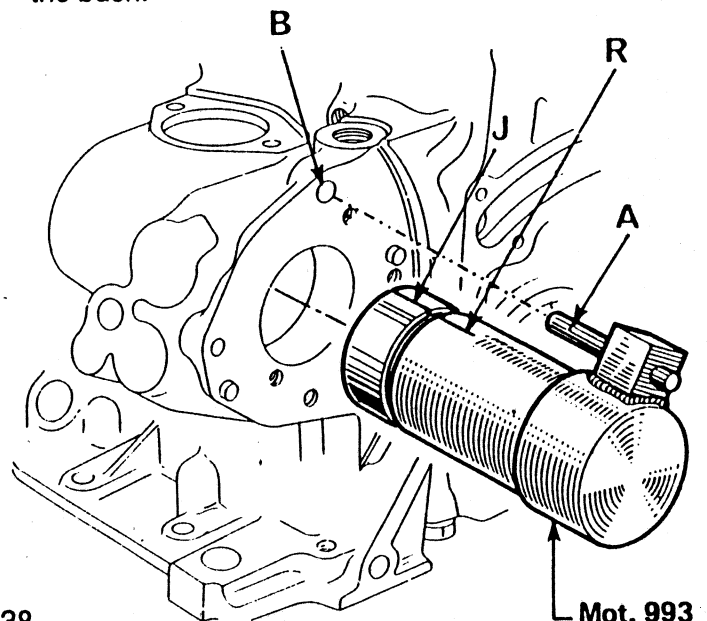
- Inner bush L1: 12.5mm
- Outer bush L2: 19mm



Place the inner bush on the tool Mot 993.

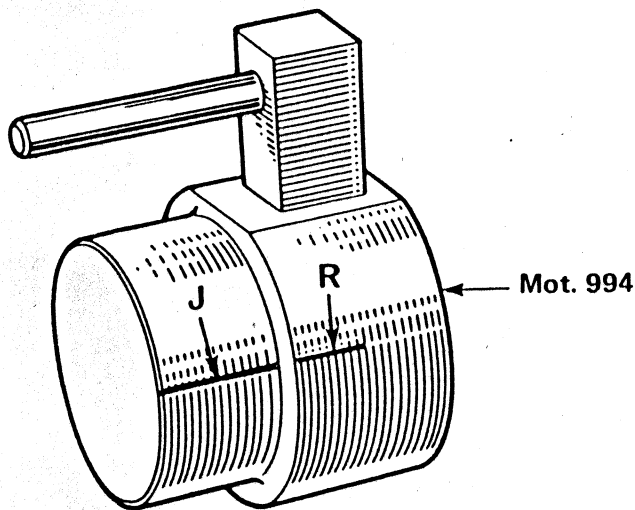
The slot (J) in the bush MUST be aligned with the marking (R) on the tool.

Thereafter, line up the spindle (A) of the tool with the hole (B) in the cylinder block and then press home the bush.



REPLACEMENT OF INTERMEDIATE SHAFT BEARING BUSHES

Proceed in the same manner for the outer bush, using the tool **Mot 994**.

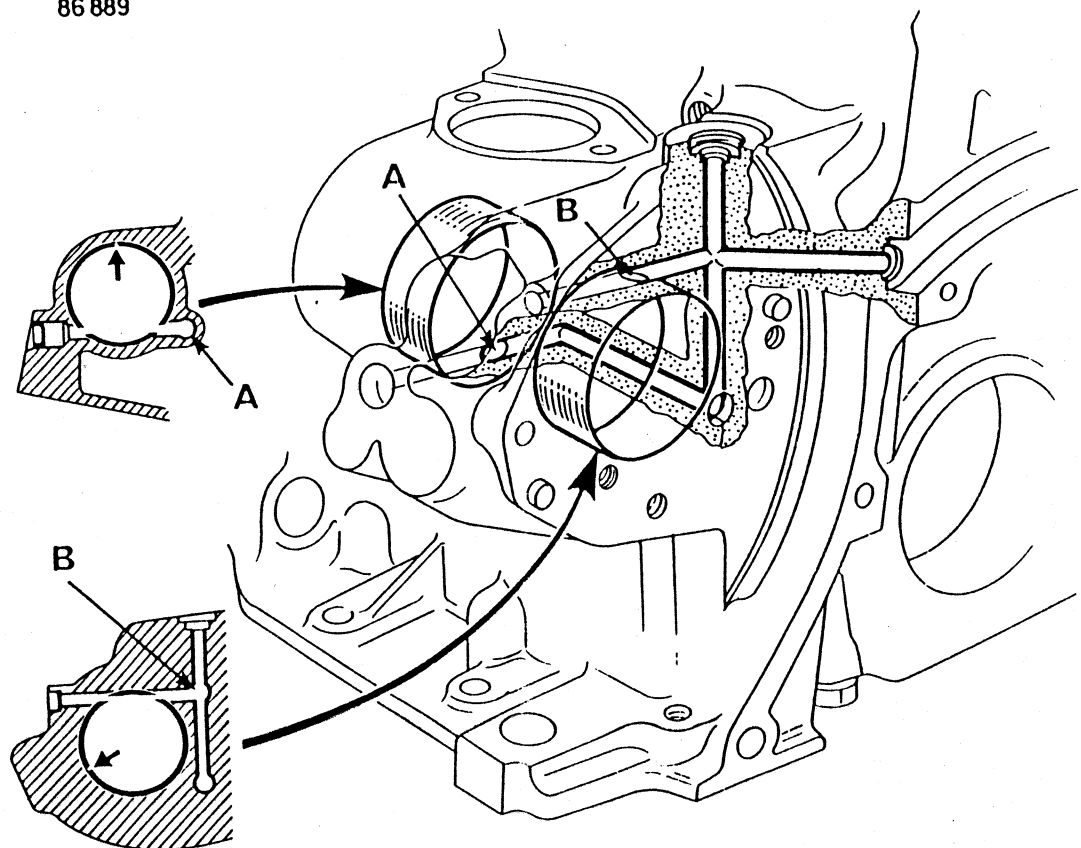


86 889

Check

With the aid of a wire of diameter 1.2mm approx., check that the oil passages line up with the drillings in the bushes.

- Inner bush, lower drilling (A),
- Outer bush, upper drilling (B).



87 034

Oil the bearing bushes.

Re-install the intermediate shaft (see the paragraph **INTERMEDIATE SHAFT**).

CYLINDER BLOCK

REPLACEMENT OF WATER PUMP TUBE

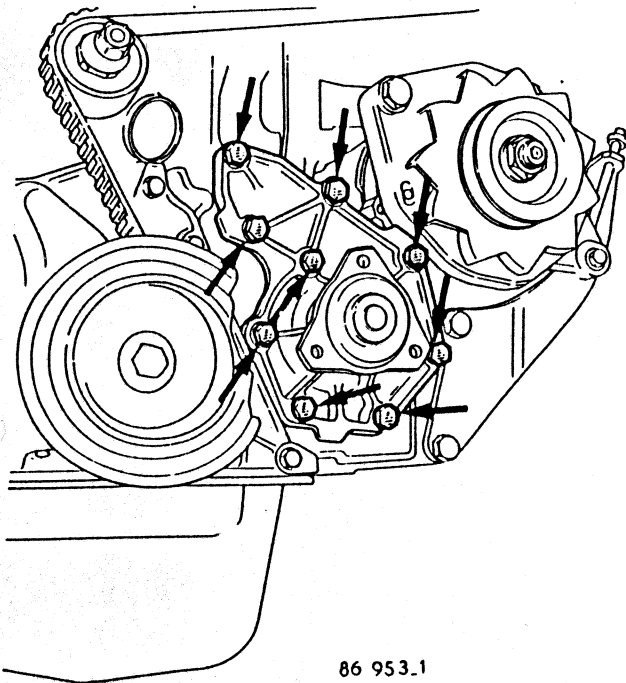
SPECIAL TOOLS NEEDED	
Mot 445	Oil filter wrench
Elé 346	Belt tension checker

REMOVAL

Drain the cylinder block.

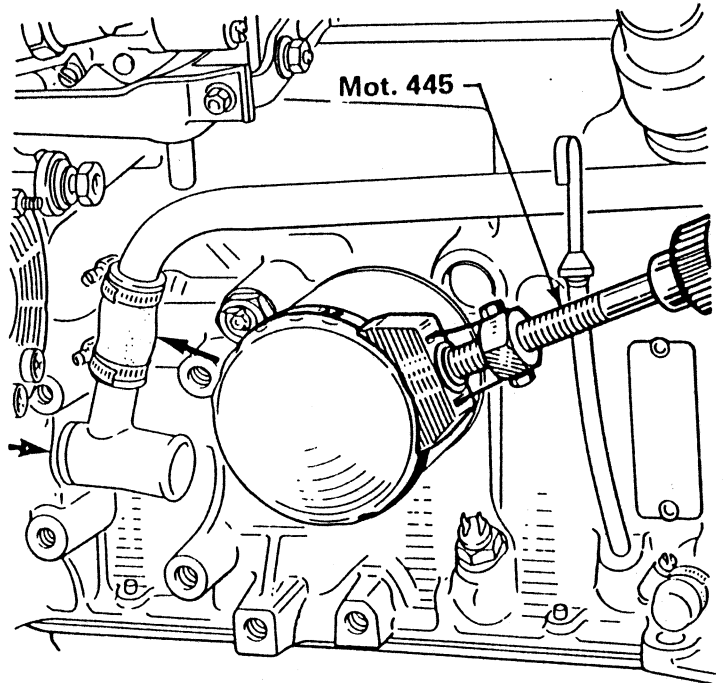
Remove:

- The water pump drive belt.
- The water pump drive pulley.
- The water pump.



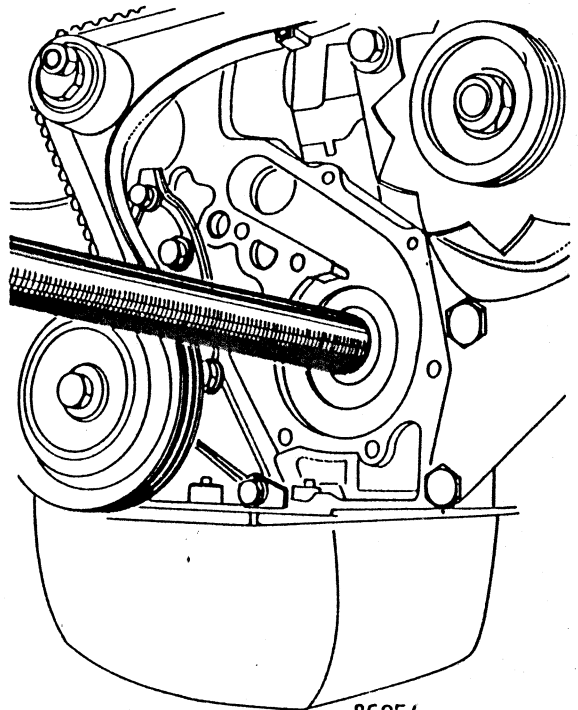
86 953.1

- The flexible water hose.
- The oil filter (using tool Mot 445).



86 933

Drift out the rigid tube with the aid of a 28mm diameter tube.



86 954

REPLACEMENT OF WATER PUMP TUBE

REPLACEMENT

Clean the housing in the cylinder block.

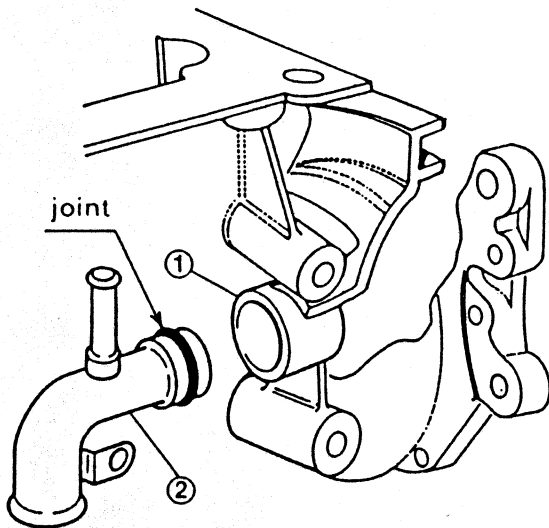
Smear the tube ① with **Loctite Scelbloc** and slide it fully home.

Install tube ②, taking note of its correct position.

Fitting tube no. ②.

Fit "O" ring.

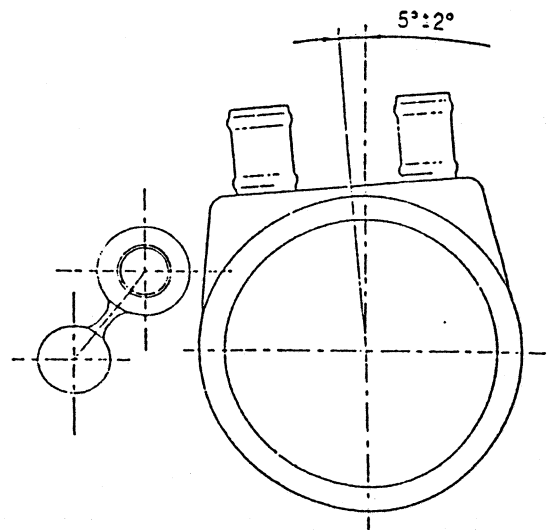
Lubricate tube ② and slide it into tube ① ensuring correct seating of "O" ring.



86978

Re-install:

- Heat exchanger as per diagram below.
- The flexible hoses.
- The oil filter (using tool Mot 445).
- The water pump, which is mounted dry-jointed.
- The pulley.

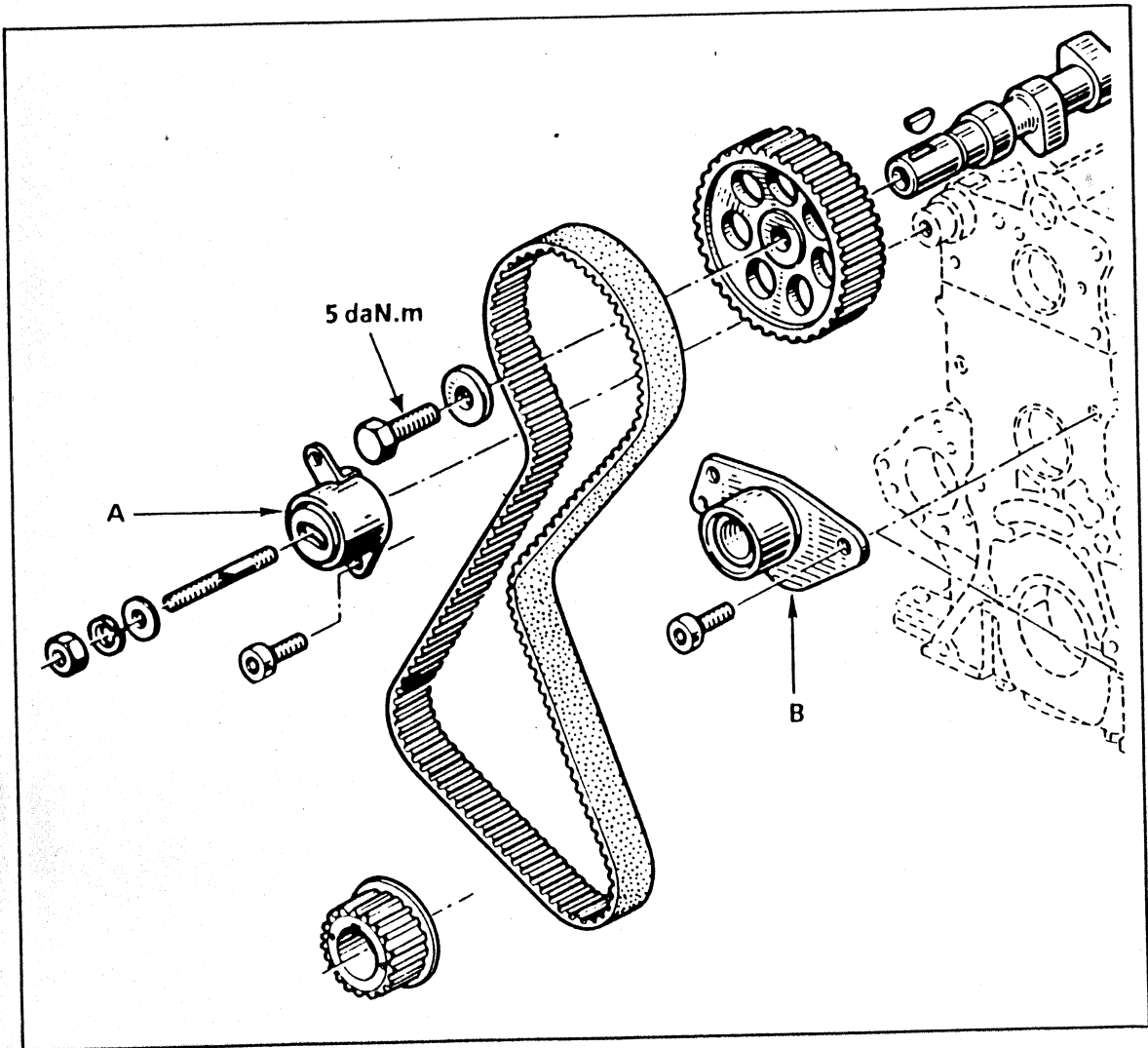


86954

VALVE GEAR

EXPLODED VIEW

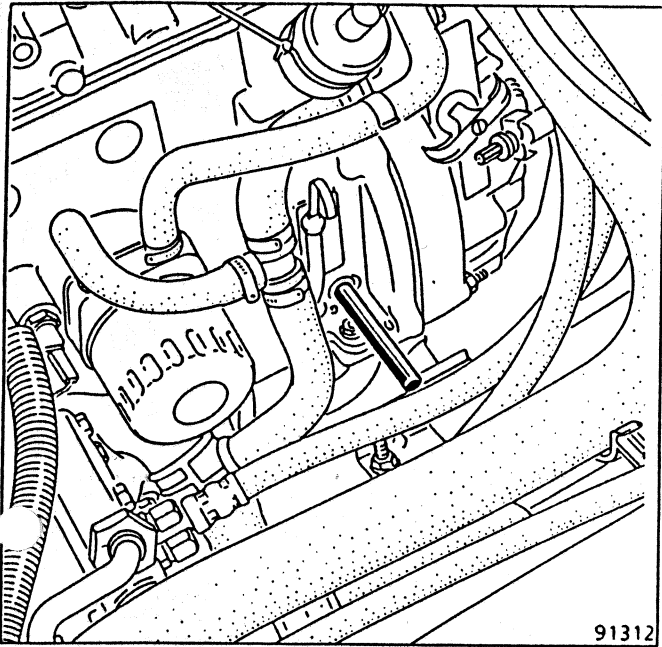
ESSENTIAL SPECIAL TOOLS	
Elé 346-04	Belt tension checker assembly comprising: Elé 346, Elé 346-01 and Elé 346-03
Mot 861	Top dead centre locator



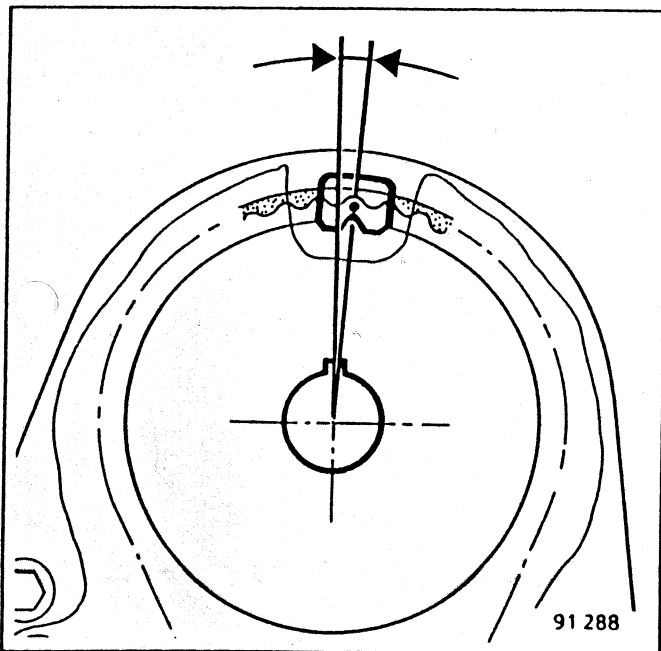
A: tensioner
B: pulley

IMPORTANT:
IDLER PULLEYS A AND B MUST BE FIXED IN PLACE USING THE STANDARD
RENAULT BOLTS

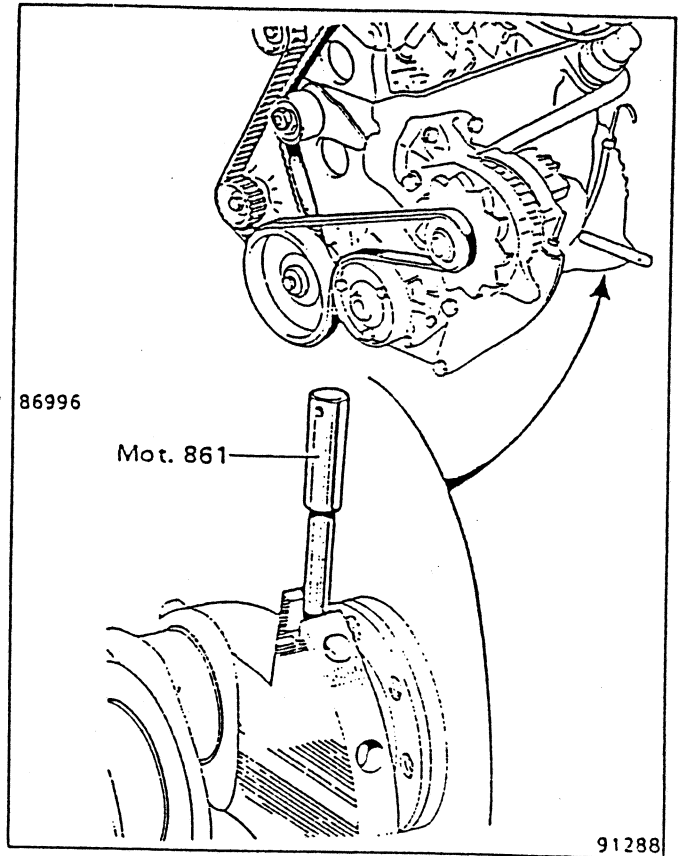
REMOVAL – REPLACEMENT OF DRIVE BELT



Position No. 1 cylinder at TDC. The marking on the toothed camshaft drive sprocket should face upwards.



Install the locator Mot 861 (make sure it has not been inserted into a balancing drilling).



Release the tensioner pulley.
Remove the belt.

VALVE GEAR

REMOVAL – REPLACEMENT OF DRIVE BELT

REPLACEMENT

Check that the locator **Mot 861** is in place.

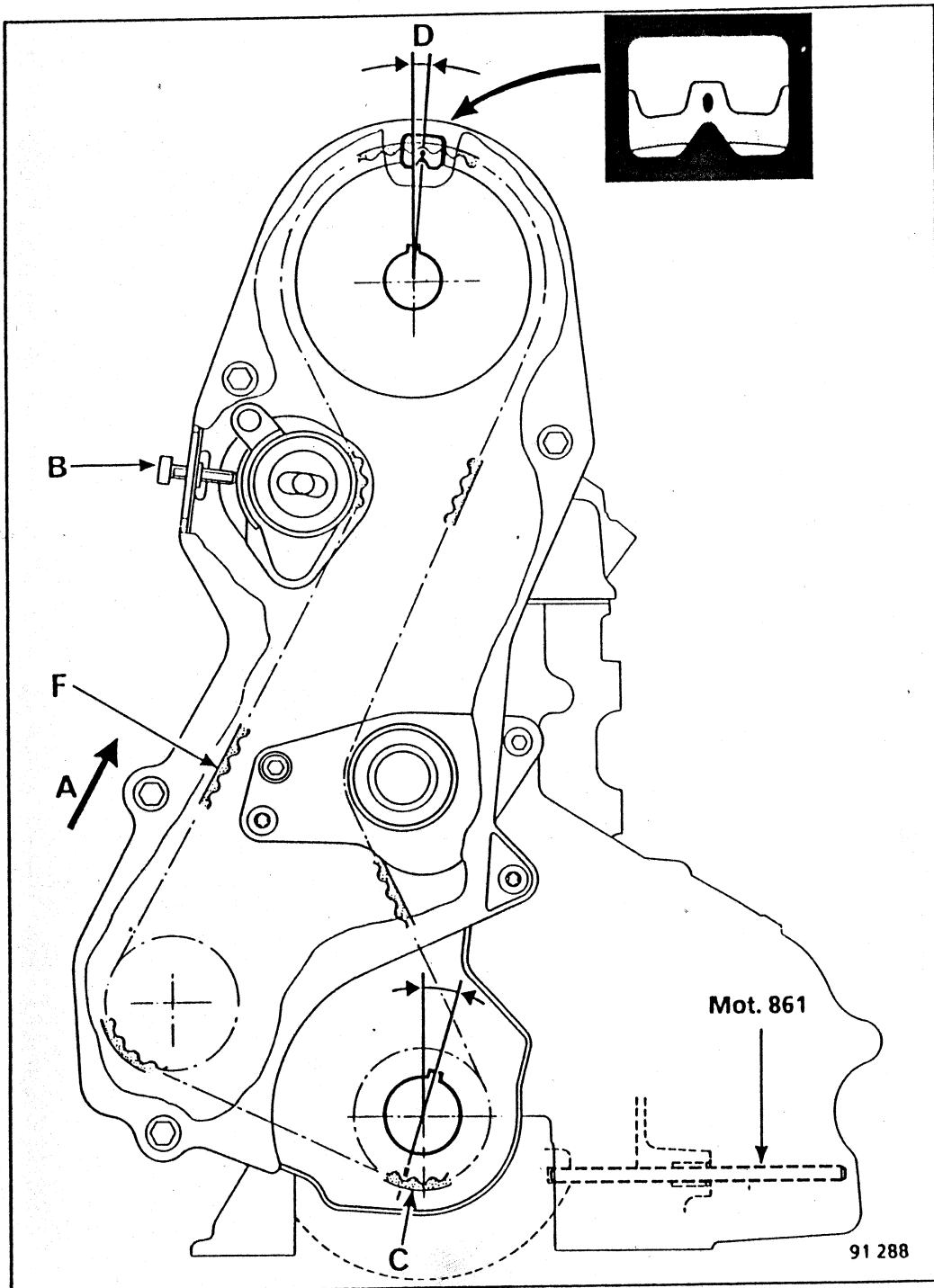
Align the mark on the toothed camshaft drive sprocket with that on the casing (see previous page).

Instal the belt, observing:

- The direction of installation indicated by the arrow **(A)** between the camshaft sprocket and the tensioner pulley.

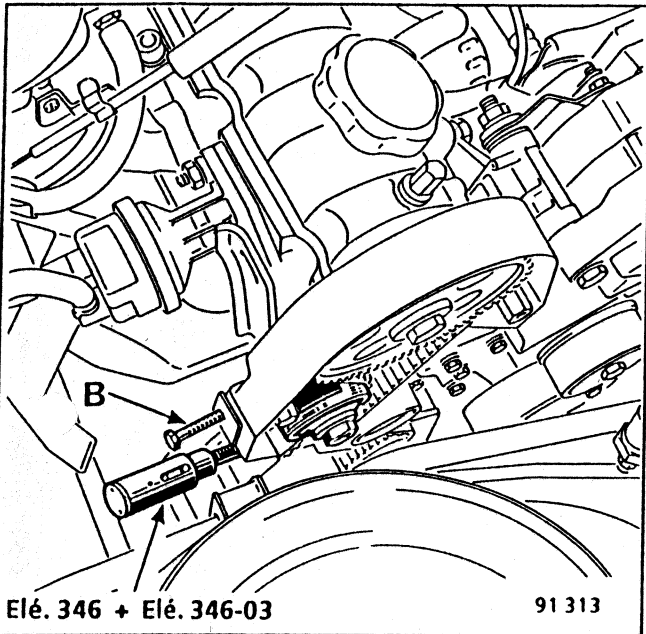
- The alignment of the markings on the belt with those on the toothed sprockets (where engines have been dismantled or the crankshaft drive pulley has been removed) **between D and C, 61 teeth measured on opposite side to tensioner.**

With the aid of a bolt **(B)** 6mm in diameter and 45mm long, apply roughly the correct tension to the belt via the tensioner pulley.



REMOVAL – REPLACEMENT OF DRIVE BELT

Install tool Elé 346 + Elé 346-03.



Check the flexure of the toothed belt and adjust with the aid of the bolt (B).

Timing belt flexure:

Cold: $F = 7.5\text{mm}$
 Hot: $F = 5.5\text{mm}$

Lock the tensioner pulley.

Remove the tool Elé 346 + Elé 346-03.

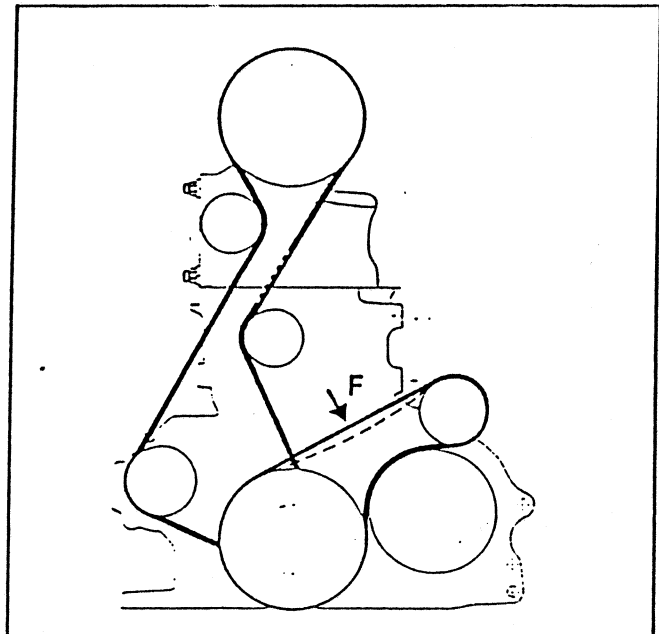
Remove the locator Mot 861.

CHECKING

Turn the engine over twice.

Replace the locator Mot 861 and ensure that the marking on the camshaft drive sprocket is still aligned with those on the belt.

Remove the locator Mot 861.



Alternator/water pump drive belt.

Tension measured cold: new belt.

Flexure (F) = 3mm

Turn over the engine and readjust the tension if necessary.

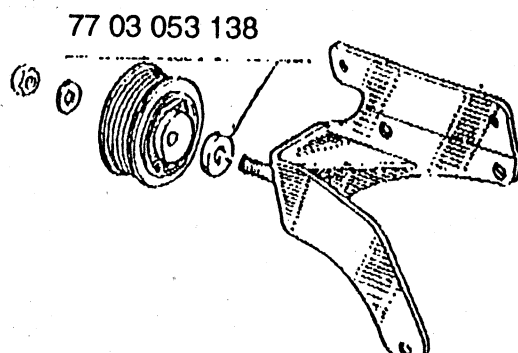
Flexure (F) = 4mm hot

Checking when hot:

Do not adjust the tension as part of the checking process unless the flexure (F) exceeds 4.5mm.

WATER PUMP BELT TENSIONER

In order to improve the alignment of the tensioner as shown in attached diagram, it is necessary to fit a washer ref. no. 77 03 053 138 between the mounting bracket and the tensioner pulley.

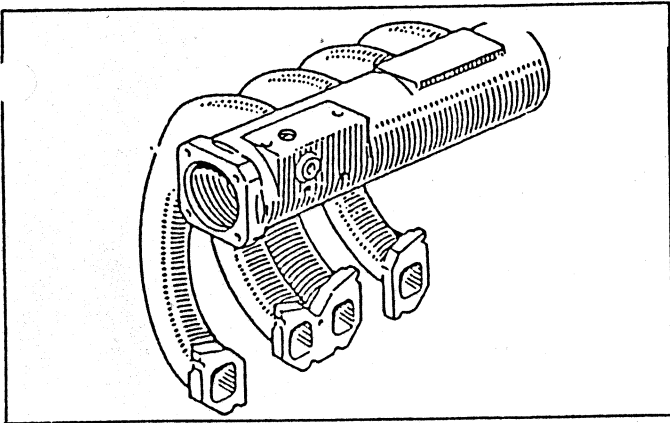


INLET MANIFOLD – GASKETS

AIR BOX

It is permitted:

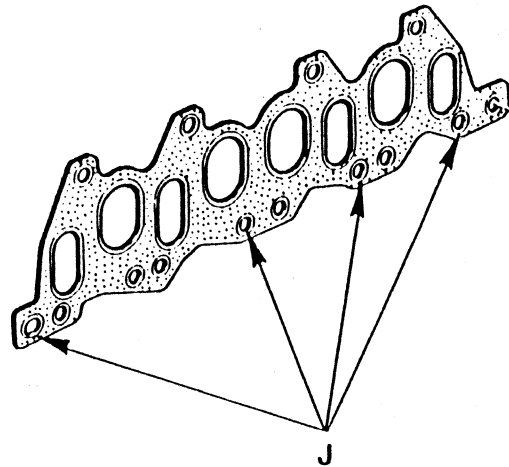
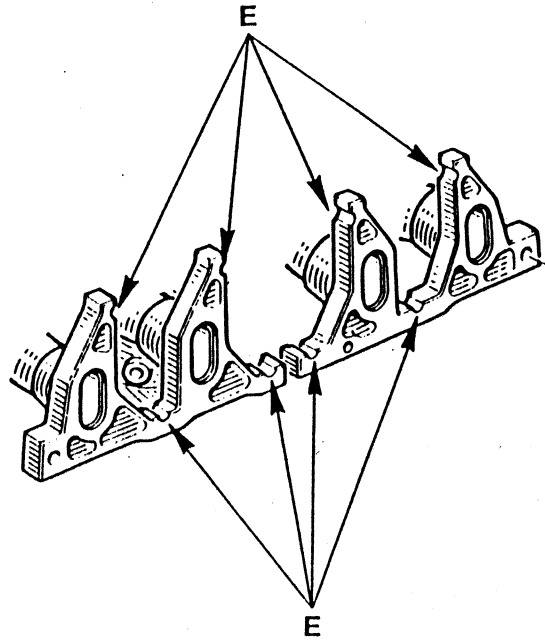
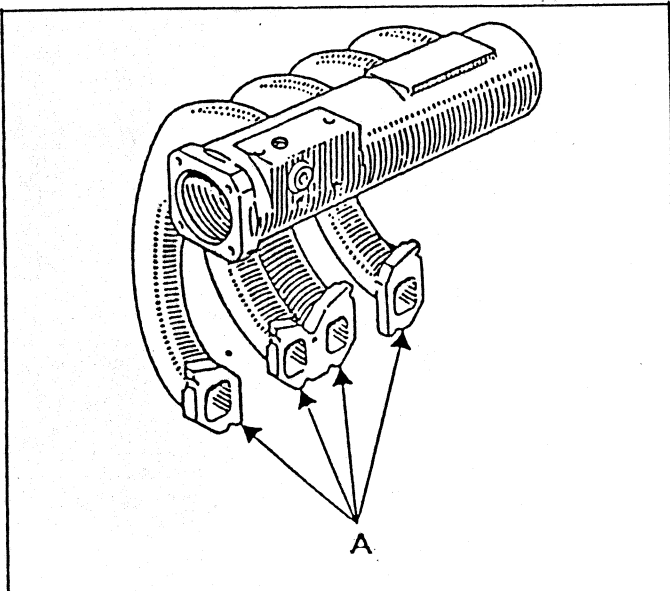
- To use thread inserts in the event of excessive wear of original threads.
- To skim the exhaust and inlet manifold mating surfaces on cylinder head.
- * To modify mounting holes on exhaust and inlet manifold flanges to enable them to be lined up correctly.
- Ensure that the M8 x 125 threaded hole on inlet manifold is drilled to accept pickup from fuel pressure regulator vacuum intake.



EXHAUST

Compulsory use of exhaust manifold.

- Supplied in FR kit.
- During qualifying sessions and races, compulsory use of the silencer and catalytic converter (ORBISOUD) supplied in the FR kit.



1995 FORMULA RENAULT EXHAUST MANIFOLD AND SILENCER

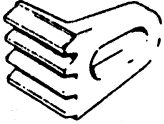
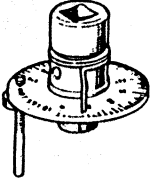
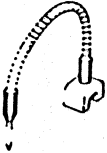
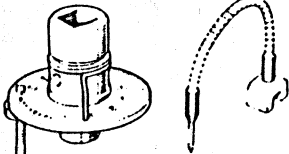
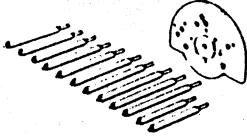
Only the exhaust system described below is permitted:

- The system is made up of the following parts:
- 1 manifold – Ref. no: 77 11 150 502
 - 1 catalytic converter with 4-into-1 built in – Ref. no: 77 11 150 503
 - 1 silencer – Ref. no: 77 11 150 504
 - 1 clamp – Ref. no: 77 11 150 452

None of the above-mentioned parts may be modified.

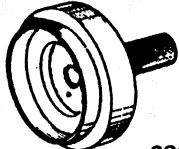

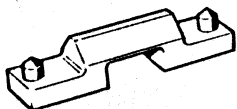
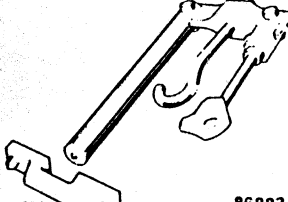
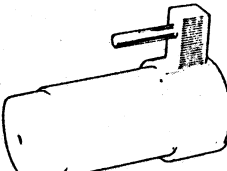
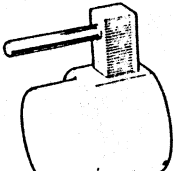
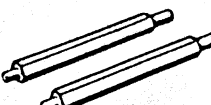
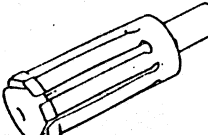
The link pipe between the catalytic converter and the silencer is free.

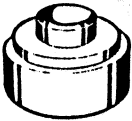

SPECIAL TOOLS

Drawing	Manual Reference	Renault Part No.	Description
	Mot 582	00 00 058 200	Flywheel locking sector
77121			
	Mot 591-01	00 00 059 101	Protractor gauge for cylinder head torque measurement, with 1/2in socket drive
78181			
	Mot 591-02	00 00 059 102	Flexible indexing link
77889			
	Mot 591-03	00 00 059 103	Set comprising Mot 591-01 + Mot 591-02
78181			
77889			
	Mot 792-01	00 00 079 201	Engine mounting plate for Desvil stand
82919			

SPECIAL TOOLS

Drawing	Manual Reference	Renault Part No.	Description
<p>83391</p>	Mot 851	00 00 085 100	Piston + ring bore insertion tool (all types)
<p>83389</p>	Mot 852	00 00 085 200	Socket for cylinder head bolts with recessed hexagon heads
<p>83289</p>	Mot 855	00 00 085 500	Valve gear sprocket lock
<p>83394</p>	Mot 861	00 00 086 100	TDC locator
<p>84757</p>	Mot 923	00 00 092 300	Cylinder block lifting attachment
<p>86893</p>	Mot 988-01	00 00 098 801	Camshaft seal installation tool - Timing cover end
<p>86888</p>	Mot 989	00 00 098 900	Intermediate shaft seal installation tool
<p>86892</p>	Mot 990-01	00 00 099 001	Crankshaft seal (timing end) installation tool

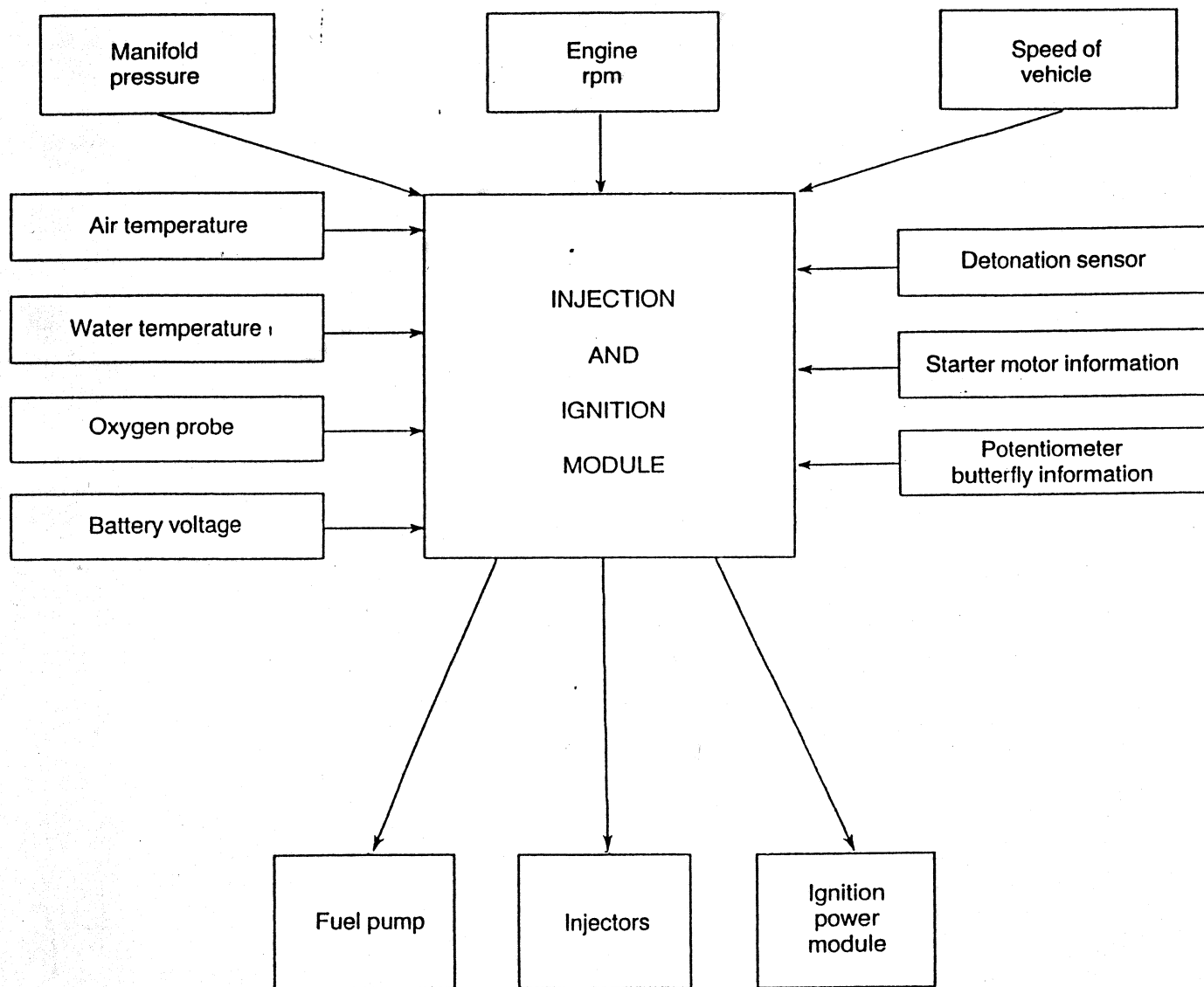
Drawing	Manual Reference	Renault Part No.	Description
 68658	Mot 991	00 00 099 100	Crankshaft seal (flywheel end) installation tool
 86883	Mot 992	00 00 099 200	Tool for replacement of valve clearance adjustment shims
 87531	Mot 992-01	00 00 092 201	Additional to Mot 992
 87531 86883	Mot 992-02	00 00 092 202	Set comprising Mot 992 and Mot 992-01
 86887	Mot 993	00 00 099 300	Intermediate shaft inner bush installation mandrel
 86889	Mot 994	00 00 099 400	Intermediate shaft outer bush installation mandrel
 84900	Mot 995	00 00 099 500	Set of two struts (used with engine support plate Mot 792-01)
 86891	Mot 998	00 00 099 800	Intermediate shaft bush extractor

Drawing	Manual Reference	Renault Part No.	Description
 87569	Mot 1010	00 001 010 00	Camshaft seal (flywheel end) installation tool
 69306 -1	Rou 15-01	00 01 331 601	Inner shaft protector sleeve, 16mm diameter

Supplier Reference	Supplier	Description
U 43 L	FACOM	Valve lifter
ST 8 L	FACOM	Wrench for bolts with recessed hexagon heads
835 JU8	FACOM	Wrench for bolts with recessed hexagon head - In inches

MIXTURE Method of Operation

METHOD OF OPERATION OF MULTIPOINT INJECTION SYSTEM



MIXTURE

Method of Operation

The fuel injection system comprises the following elements:

I – THE FUEL CIRCUIT

- Electric fuel pump
- Fuel filter
- Fuel pressure regulator

II – THE INJECTION COMPUTER AND ITS PERIPHERALS

- Injection computer
- Coolant temperature sensor
- Air temperature sensor
- Flywheel with TDC sensor
- Speed sensor
- Absolute pressure sensor
- Detonation sensor
- Oxygen sensor

III – POWER

- Ignition power module
- Electromagnetic fuel injector

IGNITION AND INJECTION COMPUTER

Printed circuit board with microprocessor.

Two AEI integrated circuits are used as peripherals to the microprocessor.

Module is located in left hand side of car.

THE STANDARD ENGINE MANAGEMENT PROGRAMME AS SUPPLIED IN THE MODULE MUST NOT BE MODIFIED.

- All sensors which govern the operation of the engine management computer must remain standard. They must all be functional and may not be repositioned in any way.

FUEL CIRCUIT

Description – Operation

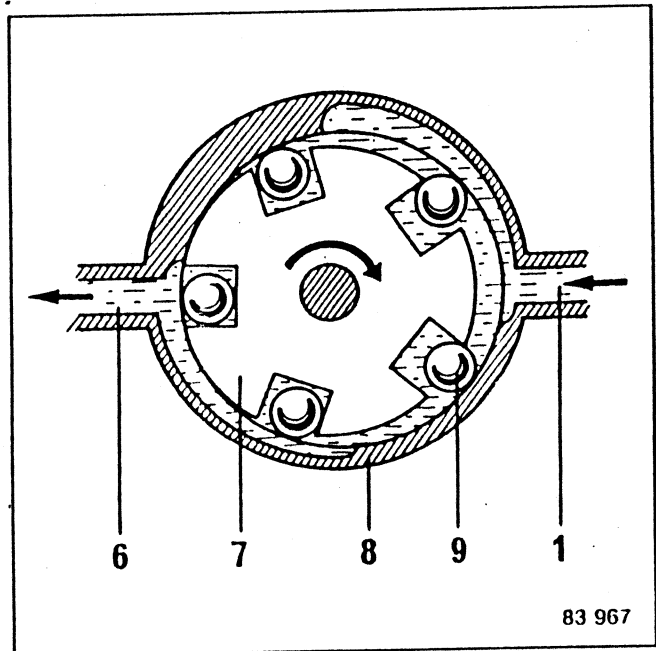
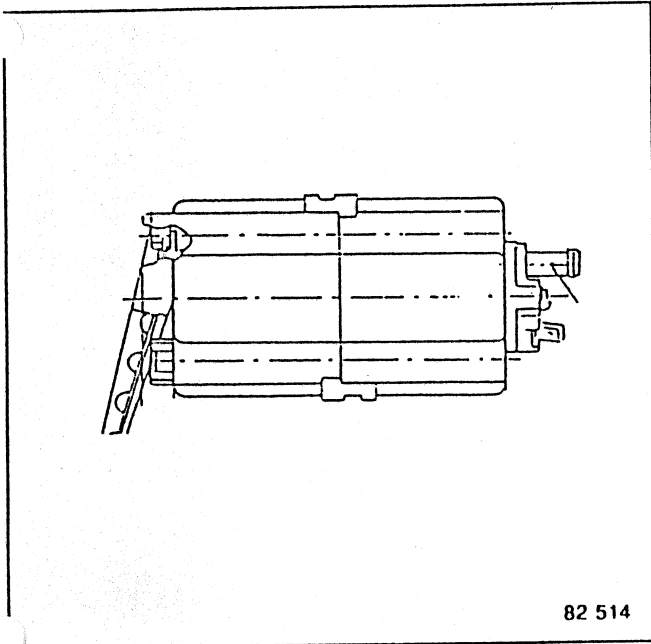
Electric fuel pump

The pump is of multicellular type with ball races that are driven by an electric motor functioning by excitation. A safety valve is built in to the pump and operates when the internal fuel pressure becomes too high.

A non-return valve is fitted at the exit end of the pump to prevent interruption of fuel supply when engine is switched off.

The pump's role is to supply fuel to the injectors under pressure. Its rate of output is much greater than the maximum fuel consumption of the engine in order that the fuel pressure in the circuit is always correct. The surplus fuel is pumped back to the tank via the regulator.

The pump is situated near the fuel tank and the connections are marked with + and - to ensure pump rotates in correct direction.



- 1 - Fuel entry
- 6 - Fuel exit
- 7 - Pump rotor
- 8 - Pump body
- 9 - Ballrace

INJECTION

FUEL PUMP CIRCUIT

Description – Operation

Fuel pressure regulator

The pressure regulator regulates the amount of fuel that is returned to the tank in order that a constant pressure is maintained regardless of the fuel supply to the injectors.

The fuel pressure in the battery of injectors is corrected in relation to the depression in the inlet manifold in order that the injectors operate at a constant pressure.

The spring housing is connected to the inlet manifold by a pipe. The difference between the pressure in the manifold and the fuel pressure is thus maintained at a constant level.

At any loading level, the pressure drop at the injectors is therefore the same.

Example: at idle with a spring rated at 3 bar.

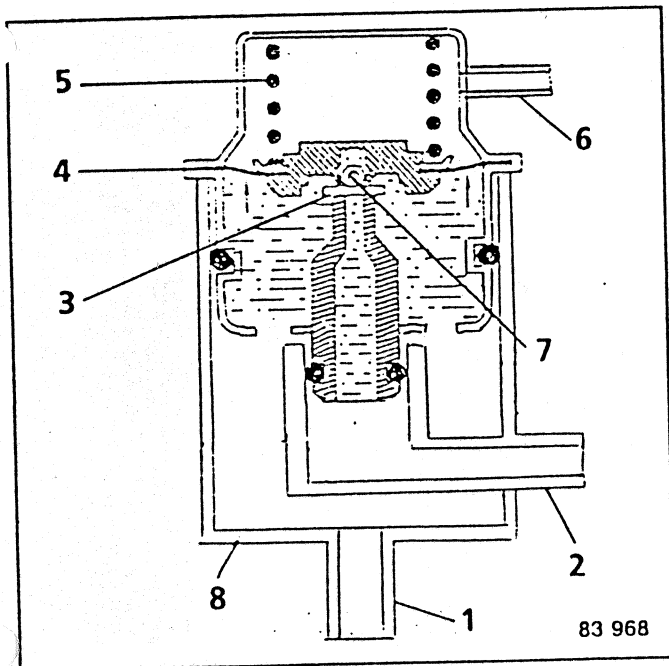
– Depression of 500 mbar. Fuel pressure = $3.0 - 0.5 = 2.5$ bar.

– Injectors will operate at a pressure of: $3 - (-0.5) = 2.5$ bar.

Fuel filter

The fuel filter, situated after the fuel pump, is designed to catch and retain any impurities which might be present in the fuel system which could cause a malfunctioning of the injectors or the regulator.

An arrow on the fuel filter indicates the direction that fuel should flow through it. Filter should be replaced periodically.



- 1 - Fuel pipe connection
- 2 - Return to tank
- 3 - Valve seat
- 4 - Membrane
- 5 - Compression spring
- 6 - Connection to inlet manifold
- 7 - Valve
- 8 - Injector rail

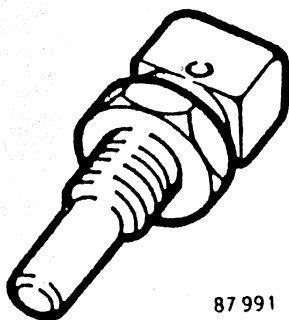
MIXTURE

Method of Operation

II - INJECTION MODULE AND ANCILLARIES (continued)

Water temperature sensor

The water temperature sensor is mounted on the cylinder head. Sensor transmits an electrical image of the water temperature to the module to enable it to determine the necessary corrections to the mixture and timing.

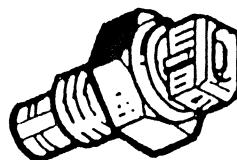


Air temperature sensor

The air temperature sensor operates in the same way as the water temperature sensor.

Located on the inlet manifold or throttle body, it provides an electrical image of the air temperature.

The module thus receives information about the density of the air at the inlet, when the air temperature decreases, its density increases and the module increases the volume of fuel injected to restore the correct fuel/air ratio.



PLEASE NOTE:

Depending on the application of the engine module, the water and air temperature sensors can have a positive temperature coefficient (C.T.P.) or a negative temperature coefficient (C.T.N.):

- C.T.P. The sensor's resistance increases with temperature
- C.T.N. The sensor's resistance decreases as temperature increases

It is important to match up the correct sensor with the correct module (see table showing test data and spare part ref. Nos. on the P.R.

In case of doubt, temperature readings should be taken with a cold engine using the XR25.

MIXTURE

Method of Operation

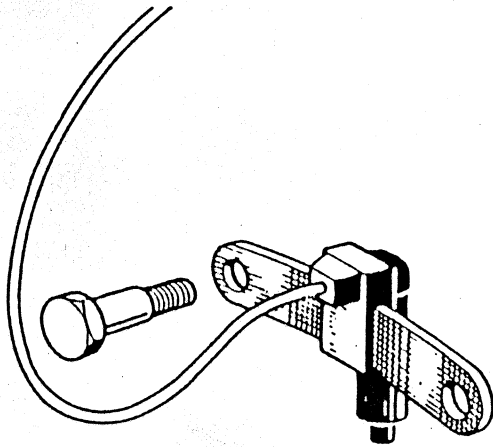
III - INJECTION MODULE AND ANCILLARIES (continued)

T.D.C. sensor

It measures:

- T.D.C. and B.D.C. positions
- engine rotational speed

It must be mounted on the clutch bell housing with sleeved bolts.



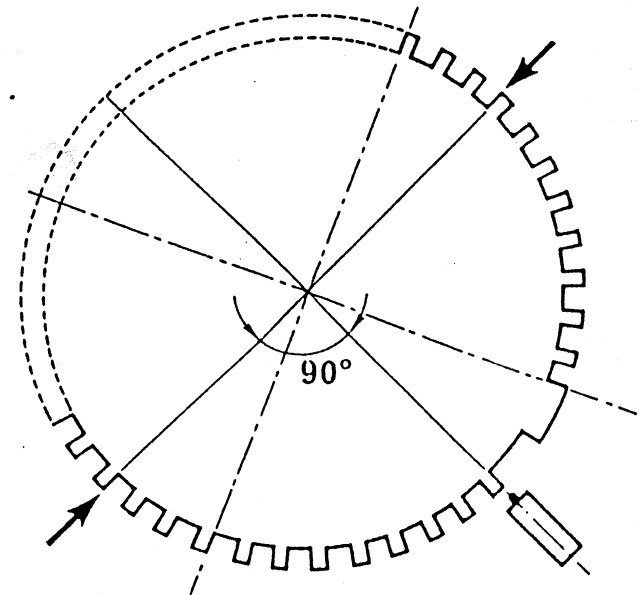
84 491

Role of reference mark

- to determine angular speed of engine
- to locate and report on the angular position of the flywheel.

Flywheel

The flywheel has 60 equally spaced teeth one of which has been removed thereby establishing an absolute location method situated at 90° before T.D.C. of cylinders 1 and 4.



86 065

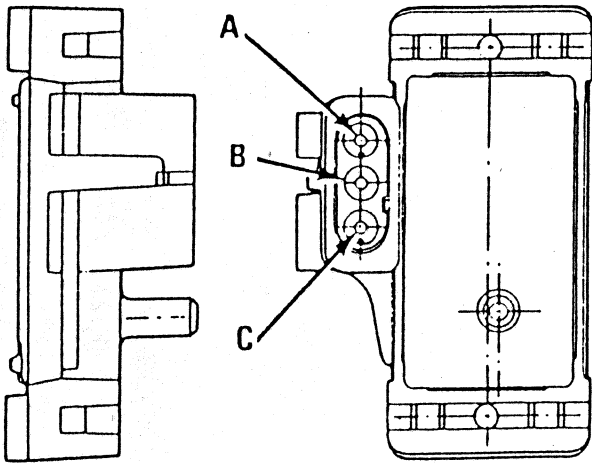
MIXTURE

Method of Operation

III – INJECTION MODULE AND ANCILLARIES (continued)

Absolute pressure sensor

The inlet manifold pressure is measured by a sensor which produces an electrical image of the manifold pressure. The signal is one of the principal parameters which determine the moment of injection.



88 076

A. Earth B. Outlet Voltage C. + 5 volts

The sensor is of the piezo-resistance type. The pressure modifies the resistance of the zones equipped with silicium crystals.

The measurement of these variations of resistance with a current of around 5 volts creates an electrical image of the pressure.

Load potentiometer

The load potentiometer replaces the 'Nil throttle – Full Load 'Switch'. It provides precise information on the position of the throttle butterfly throughout its full range from the throttle idle position to the throttle fully open position.

MIXTURE Method of Operation

OPERATING PRINCIPLE OF MIXTURE REGULATION BY THE OXYGEN PROBE, OR LAMBDA PROBE

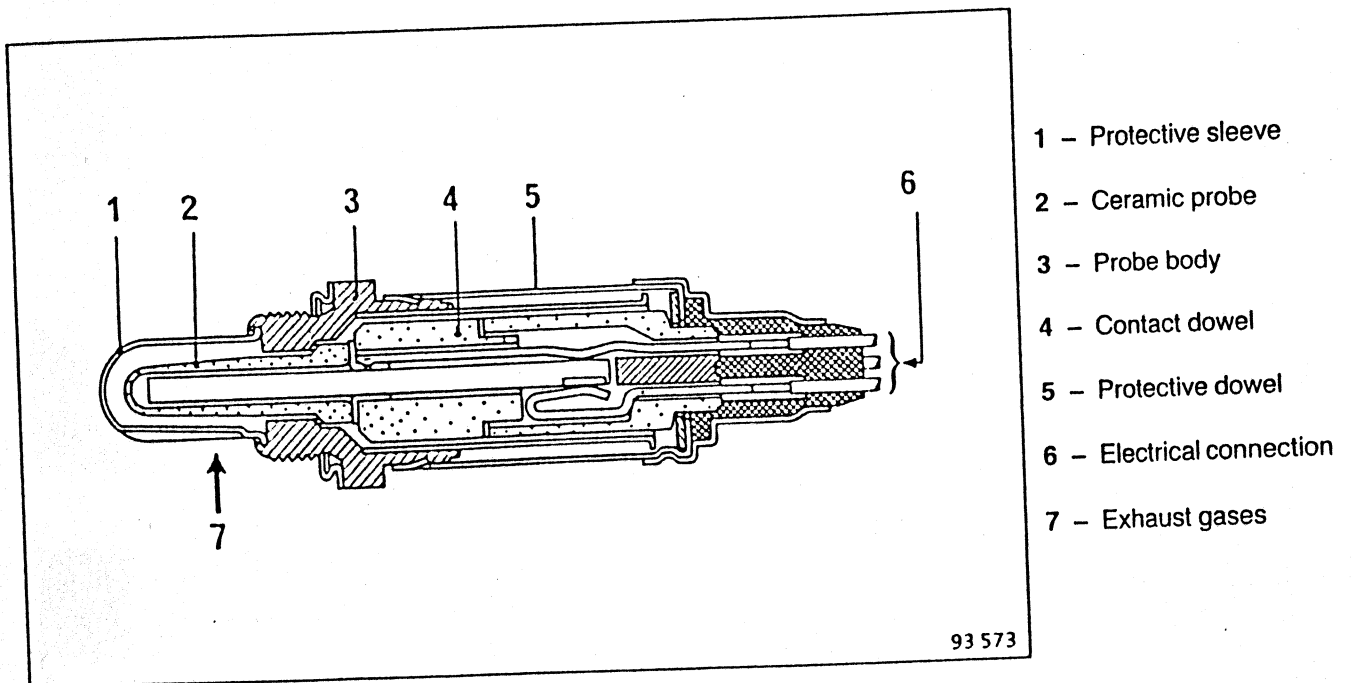
The oxygen probe determines the amount of oxygen present in the exhaust gases. This amount varies in relation to the richness of the mixture. The probe operates in such a way that a variation in the fuel mixture, in relation to the stoichiometric ratio ($\text{Lambda} = 1$), is converted into a variation in the probe's output voltage.

The module corrects the air/fuel ratio so that the fuel mixture always corresponds as closely as possible to the stoichiometric ratio ($\text{Lambda} = 1$) which, in conjunction with the use of catalytic convertors, allows exhaust gases to be significantly depolluted.

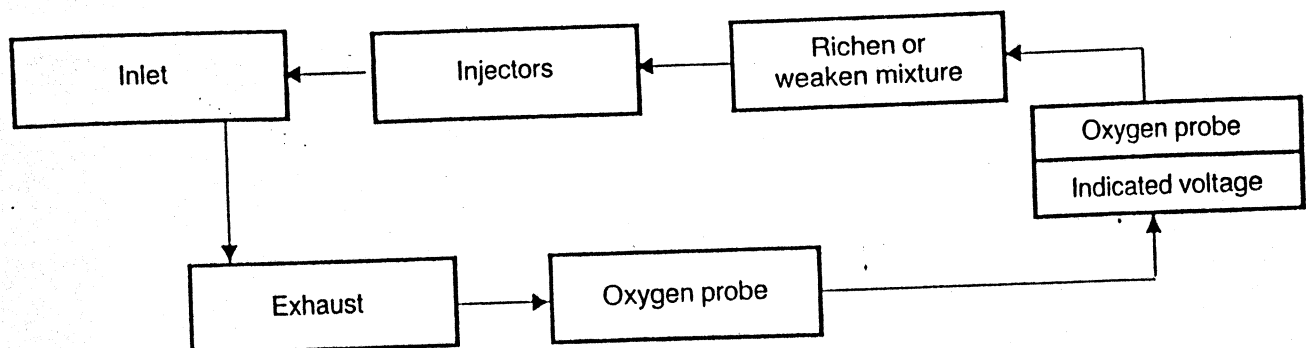
The principle of operation lies in the property of the ceramic employed conducting oxygen ions above a temperature of around 250°C . If the oxygen content is not identical on either side of the probe, an electrical current is established between the two surfaces by reason of the properties of the material employed. This current enables the oxygen content on either side of the probe to be measured.

N.B.

The oxygen probe is equipped with a resistance supplied by a positive (+) current when engine is switched on. The probe is thus heated to enable it to function more rapidly when engine is switched on.



PRINCIPLE OF REGULATION BY OXYGEN PROBE OR LAMBDA PROBE



MIXTURE

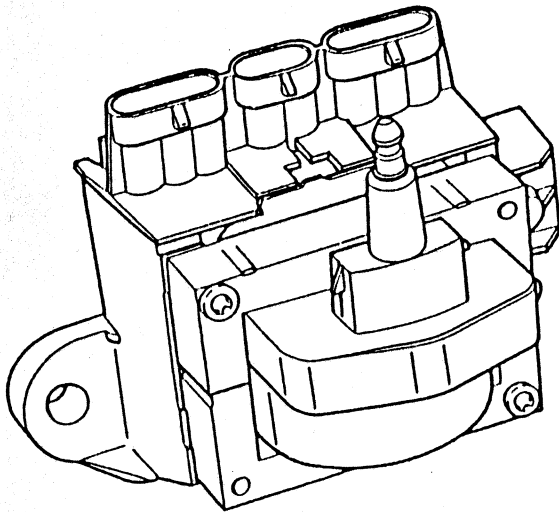
Method of Operation

IV - POWER

Ignition module

As the module enables the ignition function to be integrated, the system contains an ignition module which comprises a coil and a power control activated by the module.

The advantages of integral electronic ignition (A.E.I.) are inherent to this system: correct timing is obtained through a mapping of the pressure/speed type which best defines the requirements of the engine.



87 992

Regulation of ignition advance (anti-detonation function).

Function of the system:

The high performance of modern engines requires a combustion which is very near to the detonation point (detonating combustion). This is what enables this system of timing advance at ignition.

Principle

In the ignition mapping, two zones are taken into account:

- the so-called 'non critical' zone which corresponds to low throttle inputs and low engine revolutions.
- the so-called 'critical' zone which corresponds to medium and high throttle inputs and high engine revolutions.

When detonation occurs, 2 strategies are possible depending on the operation zone of the engine.

- In the non-critical zone, the system makes a rapid correction of -6° and reverts in stages to the nominal setting after 10 seconds.
- Within the critical zone, a primary phase similar to that described above occurs, with a reversion to the nominal value -6° , thereafter a secondary phase, called 'slow correction' occurs whereby the nominal advance value of the cylinder in question is only re-established several minutes after the occurrence of the detonation.

Moreover, if the detonation sensor or its circuit should malfunction (no signal emitted), the system goes into downgraded mode within the critical zone, and makes a correction of -6° in relation to the nominal values. Although a single detonation sensor is used, the system regulates each cylinder individually.

Constituting Components

The detonation sensor:

The sensor is a piezo-electrical component, and its method of operation is based on the following notion: When a variation of pressure is exerted on a body which is of crystalline construction, an electrical current is produced. A cable made up of 2 insulated wires conducts this current to the module. If detonation should occur, vibrations occur at determined frequencies and create electrical pulses of similar frequencies. When alerted in this manner, the module reduces ignition advance.

The module:

- calculates the ignition in relation to engine speed and load (cartographic calculation)
- detects detonation in each individual cylinder by means of the sensor
- makes corrections by memorising the number of detonations detected in each cylinder.

CARBIDE MIXTURE Method of Operation

IV - POWER

Electromagnetic Injector

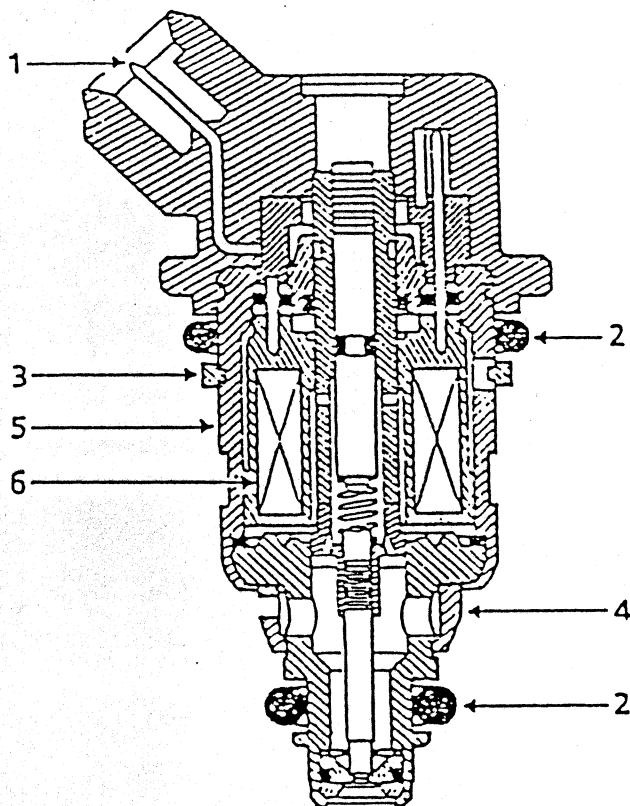
The electromagnetic injector basically consists of an injector body and a needle with a magnetic core. This assembly is compressed by a spring fitted on the airtight seat of the injector body.

At the back, the injector body has a magnetic winding, and at the front, a guide for the injector needle. The electrical connection from the module creates a magnetic field in the winding.

The magnetic core is attracted and the needle is retracted from its seat thus enabling fuel to pass through under pressure. When the electrical circuit is broken, the spring pushes the needle against its seat and fuel circuit is closed.

FUEL INJECTOR

- 1 Connector (Colour Green)
- 2 'O' rings
- 3 Upper 'O' ring retaining circlip
- 4 Insulation
- 5 Injector body
- 6 Coil



Fuel flows constantly around the circumference of the injector body. This feature prevents fuel vapour bubbles from forming and improves hot starting.

Each injector is fitted to the fuel rail via 2 'O' rings.

Injectors can thus be operated as a group, which makes for simplicity. Fuel is injected twice for every engine cycle, i.e. once for every engine revolution except for starting when a special procedure is adopted to ensure the best possible conditions for starting.

MIXTURE

General Points

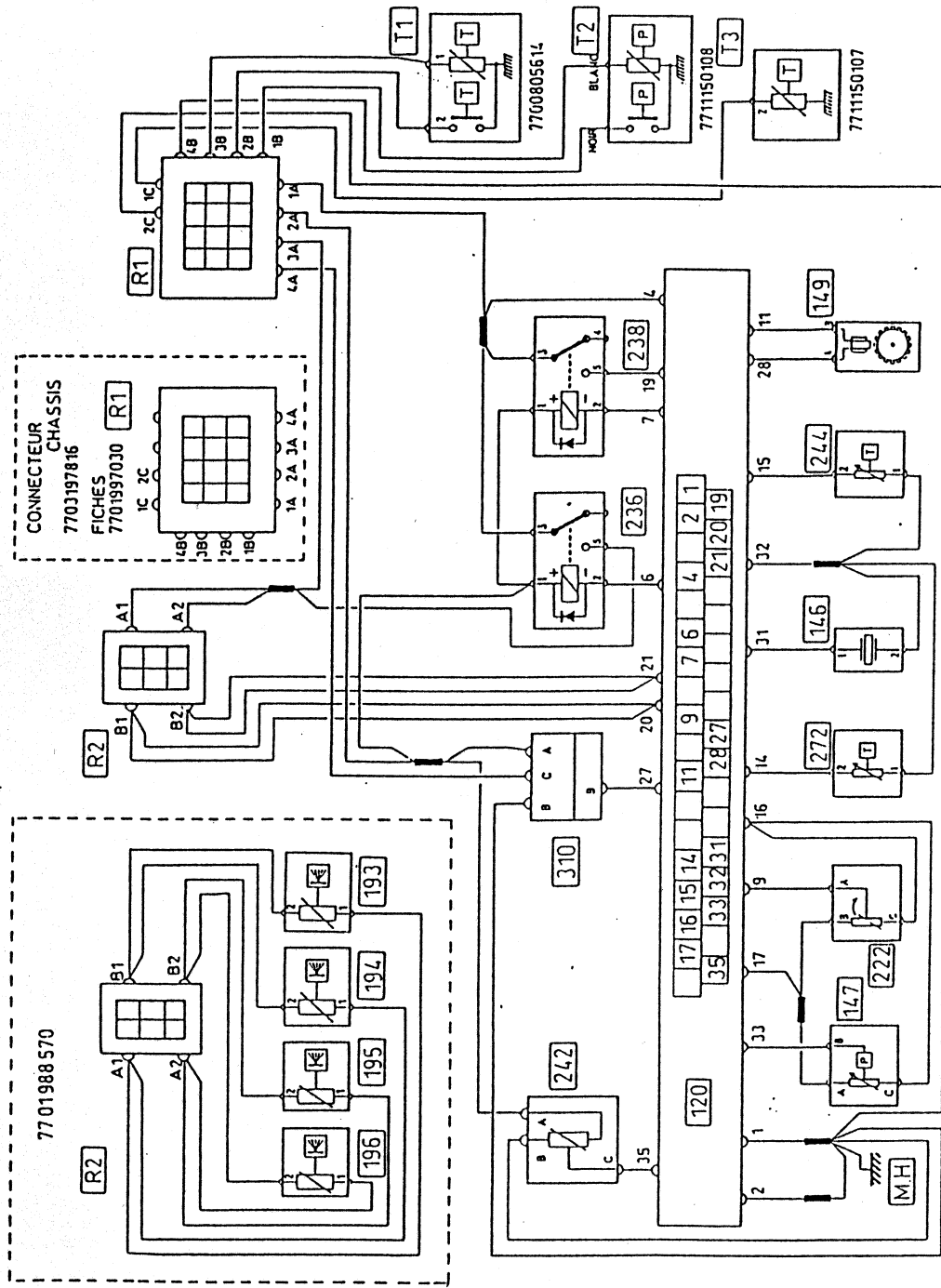
Module	R.N.U.R. Ref. No.
SIEMENS	7711 150 098

Air temperature sensor	Bendix type CTN
Water temperature sensor	Bendix type CTN

Oxygen probe (Lambda probe)	Make: NGK OZA55R1 Model: Heated (3 wires) Voltage delivered at 850°C Rich mixture: Probe voltage ≥ 625 MV Lean mixture: Probe voltage 0 to 80 MV
Catalytic converter	7711150 408 Ø 100 channels/inch
Paper air-filter element	Type 5R 7003
Ignition	Curves: Integrated in injection module M.P.A.: Ignition power module with detonation detector
CHAMPION spark plugs	Gap: 0.9mm Type C61C

Fuel supply	Regulated Multipoint Injection
Fuel pump: BOSCH	Voltage: 12 Volts Pressure: 3 bars Output: 80 to 150 l/h
Fuel filter:	Output: 80 l/h Ref: 7700820 375
Pressure regulator: BOSCH 0280160 515	Pressure: – with nil depression 3.0 ± 0.15 bars – with 500m bar depression: 2.5 ± 0.15 bars
Electromagnetic injectors: SIEMENS	DEKAZ TYPE (Yellow connector) Voltage: 12 volts Resistance: 14.5 ± 0.5 Ω
Throttle Butterfly Body : SOLEX Single Choke	Ø 58
Potentiometer DVG Ref: 5326 7705	A – Idling: XR25 value = 8 to 13 B – Partial load: XR25 value = 20 to 190 C – Throttle fully open: XR25 value = 235 ± 15

MIXTURE



WIRING DIAGRAM

TERMINAL NO.	DESIGNATION
120	Injection module
146	Anti-knock sensor
147	Absolute pressure sensor
149	TDC sensor
193-196	Injectors
213	Fuel pump
222	Throttle potentiometer
236	Fuel pump relay
238	Injection fuel supply shut off relay
242	Oxygen sensor
244	Coolant temperature sensor
247	Dashboard (rev counter and service light)
272	Air temperature sensor
310	Ignition power module
MH	Engine earth
R1	Chassis connector
R2	Injector connector
T1	Temperature gauge - coolant warning
T2	Pressure gauge - oil warning
T3	Temperature gauge - oil
CHASSIS CONNECTOR	
TERMINAL NO.	FUNCTION
1A	+12 volts before ignition
2A	+12 volts after ignition
3A	+12 volts fuel pump feed
4A	Rev counter
1B	Oil pressure
2B	Coolant temp warning
3B	Coolant temp
4B	Oil pressure warning
1C	Oil temp
2C	Earth

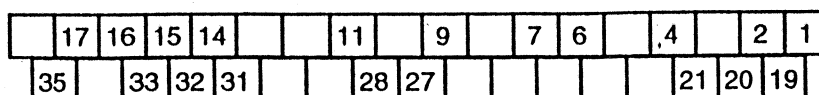
MIXTURE

Module Wiring Information

INJECTION MODULE WIRING DIAGRAM

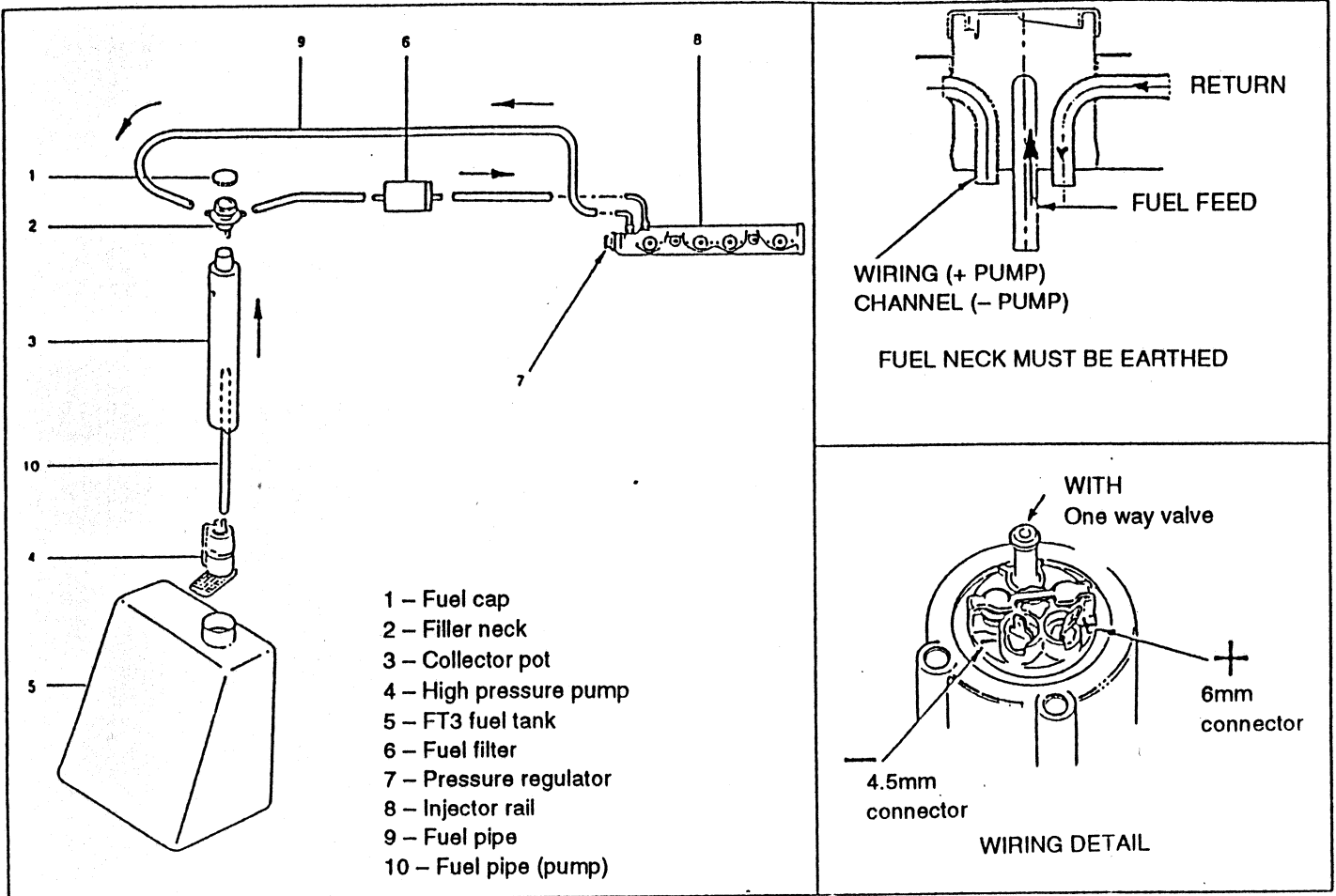
Terminal	Description	
1	Power feed earth	
2	Electronic earth	
4	+ Pre-ignition (permanent) module memory	
6	Pump relay feed (via terminal no. 2)	
7	Injection shut off relay (via terminal no. 2)	
9	Throttle potentiometer position information Terminal 4 on 222	Wire A on 222
11	TDC sensor signal (wire B)	
14	Air temperature information	
15	Coolant temperature information	
16	5 volt + feed for absolute pressure sensor and throttle potentiometer	
17	Common earth for absolute pressure sensor and throttle potentiometer	
19	Main power feed to module via injector shut off relay	
20	12 volt + feed to ignition switch information	Feed to injectors via earth
21	Feed to injector via earth	Feed to injectors via earth
27	Power module feed signal	
28	TDC sensor signal (wire A)	
29	Not used	
31	Anti-knock sensor signal	
32	Common earth for coolant, air + anti-knock sensors	
33	Manifold pressure detected by air pressure sensor	
35	Voltage supplied by oxygen sensor	

DIAGRAM OF THE CONNECTOR



INJECTION

MIXTURE Fuel circuit



REMOVAL

Disconnect:

- the battery
- the return pipe
- the feed pipe
- + and - leads on filler neck.

Remove:

- filler neck
- collector pot

Renew fuel pump

REPLACEMENT

Precautions:

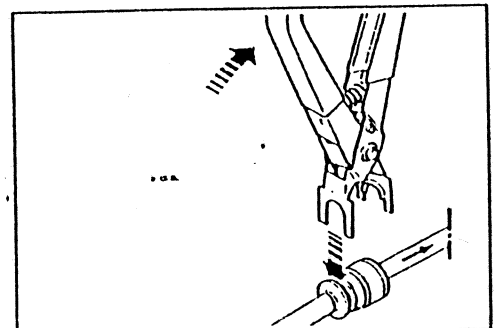
Ensure that the fuel pipe (10) is longer than the collector pot so that it can be connected easily to the filler neck.

Reconnect:

- fuel pipes
- return pipes
- leads to filler neck
- the battery.

FUEL FILTER

Pipe unions cannot be separated without the use of special tool MOT 1265.



MIXTURE Injector rail

SPECIAL TOOLS REQUIRED

Mot. 836-05

Hose clamps

TORQUE SETTINGS (in daNm)



Injector rail retaining nut	1
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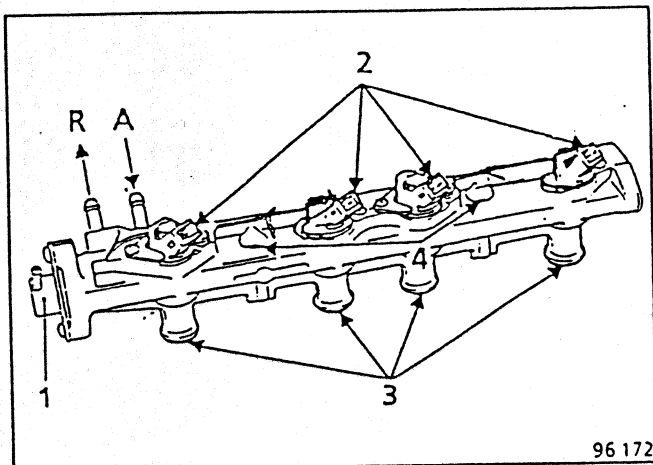
REMOVAL

Disconnect battery, fit hose clamps (Mot. 453-01) on fuel supply and return pipes to avoid fuel spillage.

Move the following parts out of the way:

- wiring loom protective cover
- rebreathing pipe
- Disconnect injectors.

The injector rail is mounted to the manifold by two nuts.



96 172

- Fuel feed
- Fuel return

- 1 - Fuel pressure built into rail
- 2 - Injectors regulator
- 3 - Flat seals
- 4 - Rail to manifold mountings

RE-ASSEMBLY

Replace flat seals (3) using silicone-free grease to retain them.

Ensure injectors are located correctly.

Follow dismantling procedure in reverse order.

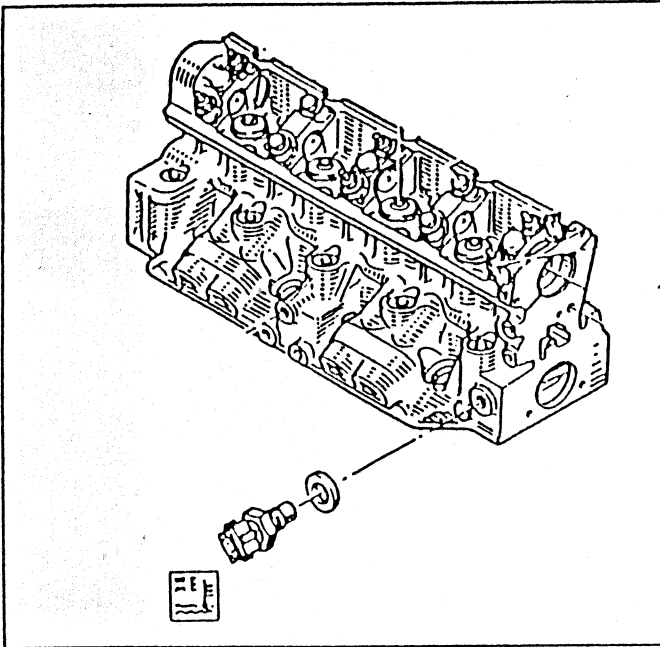
Ensure the various connectors are securely pressed home and that hose clips are tight.

FUEL INJECTION

Testing – Adjustment

COOLANT TEMPERATURE SENSOR

Sensor is screwed into left hand side of cylinder head near cylinder no. 1.

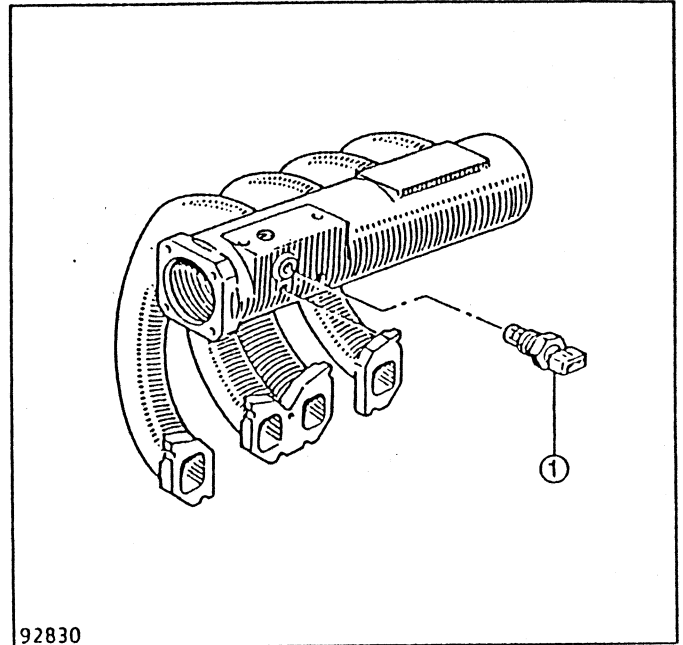


Sensor specifications

Temp. 0°C	20 ± 1	80 ± 1	90 ± 1
Resistance in Ω	3060 to 4050	300 to 370	210 to 270

AIR TEMPERATURE SENSOR

Sensor is screwed into inlet manifold.



Sensor specifications

Temp. 0°C	0 ± 1	20 ± 1	40 ± 1
Resistance in Ω	7470 to 11970	3060 to 4050	1290 to 1650

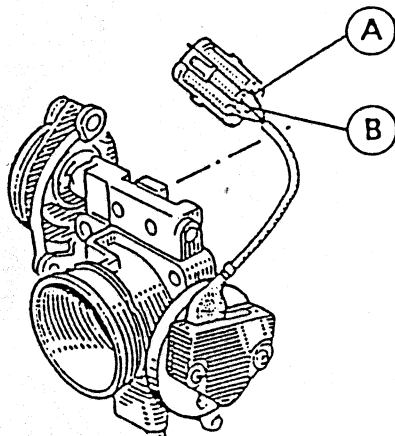
FUEL INJECTION

Testing – Adjustment

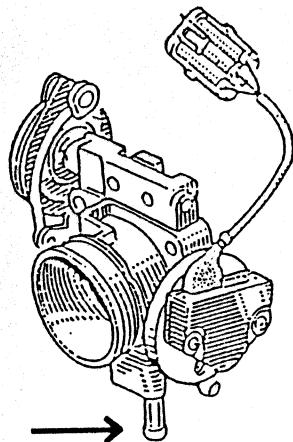
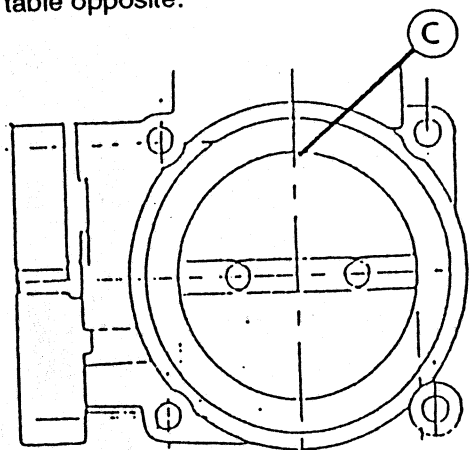
ADJUSTMENT

Connect an ohmmeter to the two wires

- A: white
- B: red



Place a drill bit in C and measure resistance by referring to the table opposite.



Pipe arrowed in diagram must be blanked off.

MEASUREMENT TABLE

Ø of drill bit	Resistance Ω
2	2900
4	3200
8	3700
12	4000
Fully open	5200

REPLACEMENT

Locate the potentiometer in relation to the throttle body.

Remember to fit "O" rings between mounting bracket and the potentiometer and between the mounting bracket and the throttle body.

INJECTOR

Supply voltage: 12V

Resistance: $14.5 \Omega \pm 0.5 \Omega$

Operating pressure: 3 bar

Static output: 2,023 g/s

With N-heptane: 0.684 g/cm^3
 $2.96 \text{ m}^3/\text{s}$

177.60 cm³/minute

CHECKING OUTPUT

Remove injector rail from cylinder head.

Disconnect injector loom.

Hold each injector above a 100cm³ measuring container.

Connect fuel supply and return pipes to rail (the fuel pressure regulator located at the end of the rail will maintain the correct fuel pressure, namely 3 bar).

Connect a 12 volt power source to each injector.

Measure

- the condition of the fuel jet (visually)
- the quantity of fuel that has been produced during a period of 1 minute (175cm³ approx).

FUEL INJECTION

Testing – Adjustment

ABSOLUTE PRESSURE SENSOR

- Check condition of depression pipe and its connections.

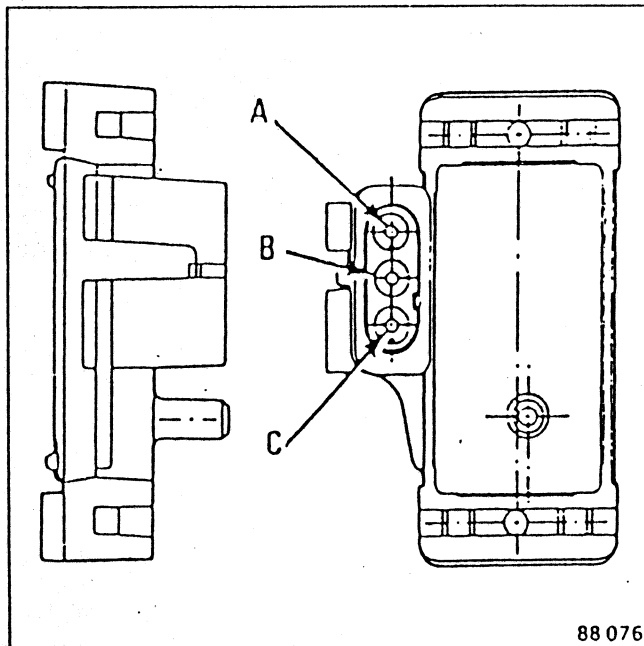
Replace if necessary.

- Check wiring between terminal A on sensor to terminal 17 on module.

Repair if necessary.

- Check the earth at terminals 1 et 2 on module and compare with a good earth (engine).

Repair if necessary.



- A - Earth.
- B - Output voltage.
- C - +5 Volts.

FUEL INJECTION

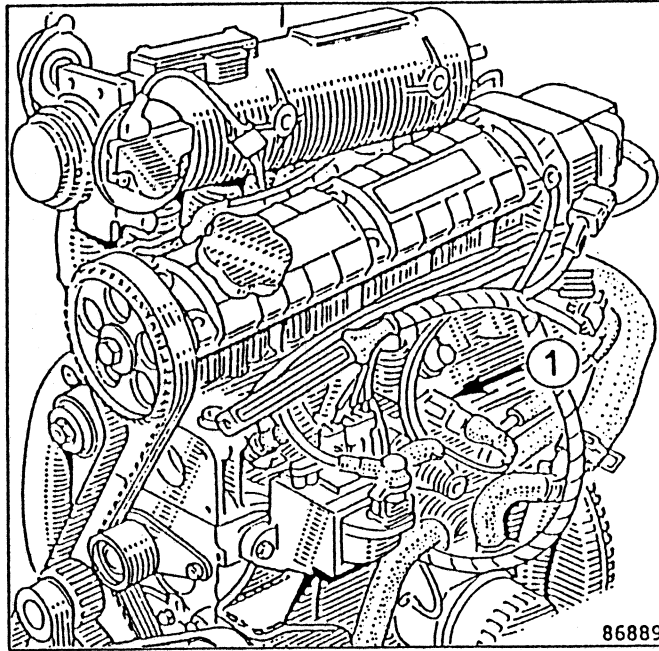
Testing – Adjustment

DETONATION SENSOR

Detonation sensor is located towards the bottom of cylinder head between cylinders 2 and 3 on spark plug side of engine.

Removal

Disconnect wires from sensor and unscrew using socket spanner **Mot 1155**.



On re-assembly:

Tighten sensor to **0.8 daN.m** and ensure connector is pushed fully home.

INJECTION

Testing – Adjustment

OXYGEN PROBE

REPLACEMENT

The probe (2) is located on the side of the catalytic converter.

Removal

Disconnect probe wire from loom.

Unclip the probe shield.

Unscrew probe and clean the thread.

Replacement

Screw in probe and tighten to 2.7–3.4 daN.m.

Replace shield.

Reconnect wires.

NB:

In the event of damage to any of the wires connected to the probe, a replacement of the probe is essential.

FUEL SYSTEM

Fuel Pressure

CHECKING FUEL PRESSURE AND FUEL PUMP OUTPUT PRESSURE

Checking fuel pressure

Disconnect fuel supply to injector rail, fit T piece Mot. 904 and the 0-6 bar pressure gauge.

Engine off:

Connect terminals 3 and 5 (see page 13-02) to fuel pump relay (236).

Check pressure and compare with value shown in 'specifications section'.

Apply a depression of 500 mbar to the pressure regulator: fuel pressure must drop by same amount.

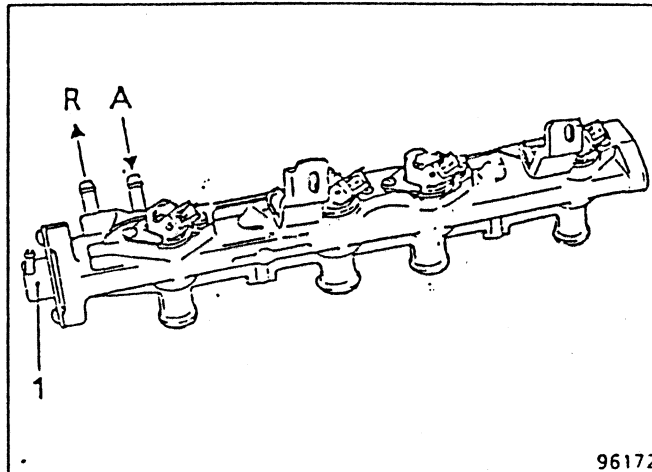
Checking pump pressure

Pinch fuel return pipe for a few seconds. pressure should exceed 5 bar. If not check electrical circuit, fuel pump and fuel filter.

CHECKING FUEL PUMP OUTPUT PRESSURE

Disconnect flexible fuel return pipe (R) from injector rail.

Fit a length of flexible piping (50cms) to injector rail (R) and insert other end in a 2000ml graduated container.



A: Fuel supply (green).

B: Fuel return to tank (red).

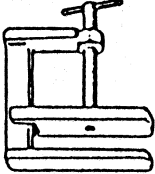
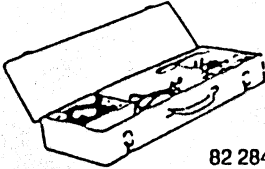
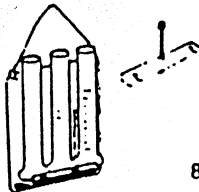
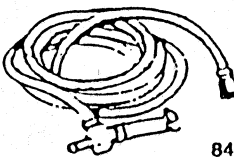
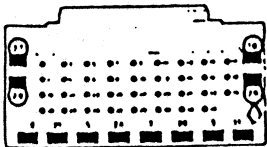

Operate pump by connecting terminals 3 and 5 onto pump relay connector (236) – 5mm Ø wires red to terminal 3 and brown to terminal 5.

Minimum output: 130 l/h at 3 bar (greater than 1 litre per 30s).

N.B. If output is low, check power supply to pump (10% loss of output pressure for a voltage drop of 1 volt).

Example: Voltage: 10 volts.
Pressure: 3 bars.
Output: 95 l/h.

FUEL INJECTION Special Tooling

Symbol	Reference No.	Renault Part No.	Description
 85 654	Mot. 453-01	0000 045301	Clamp set for flexible hoses.
 82 284	Mot. 843	0000 084300	Fuel injection diagnostic set. 0-6 bar manometer.
 82 774	Mot. 845	0000 084500	100ml test tube.
 84 868	Mot. 904	0000 090400	Fuel pressure measuring kit.
 89 024	MS 1048	0000 104800	Terminal board.
 90 028-1	XR 25	0000 101900	Microprocessor diagnostic kit.
	Mot. 1155	0000 115500	Socket spacer for removal/replacement of detonation sensor.
Supplier ref. no.	Supplier	Description	
NAUDER 7059-2 465	NAUDER BP 740 GARONOR 93613 AULNAY SOUS BOIS	Manual vacuum pump	
-	-	2000ml graduated container 2000Ω OHMS/volts voltmeter/ohmmeter	

REMOVAL – REPLACEMENT

SPECIAL TOOLS NEEDED

EIé 346 Belt tension checker

The water pump is not repairable.

Should any of its parts have deteriorated, the entire unit must be replaced.

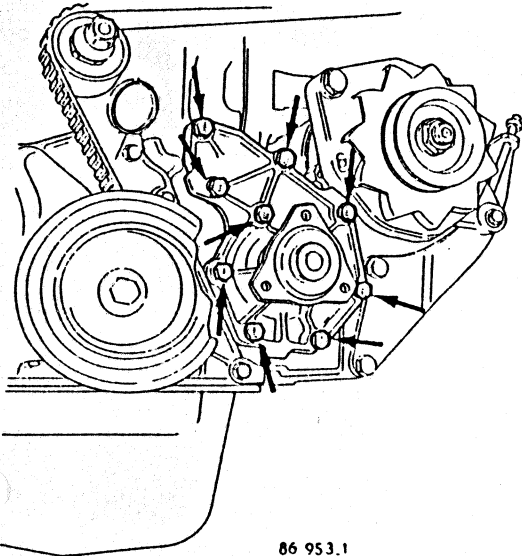
Check that the cylinder block is completely drained.

REMOVAL

Remove:

- The water pump pulley.
- The water pump

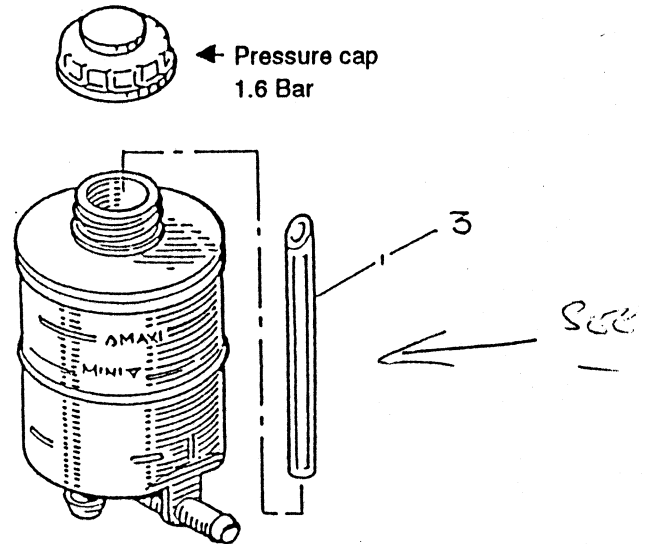
Remove the water pump.



REPLACEMENT (Special points)

The seal is dry-mounted.

Check the tension of the water pump drive belt (see the chapter **DRIVE BELT TENSION**).



Fitting procedure for coolant expansion tank.

- Fit tube (3) inside tank as per diagram.
- Ensure that the base of the tank is fitted at a higher level than the cylinder head bleed pipe.

~~ATT~~ A 73

DASHBOARD

Operating Instructions

IMPORTANT: Should any problem occur, please contact: A. Régis ou M. Morelière, THARSYS,
Tel: (33) 61.75.15.87; Fax: (33) 61.75.15.89, France.

COMMANDS

- IGNITION: power ON/OFF.
- MAXI: display of the maximum value of the parameters.
- START: starter.
- RAIN: lights ON/OFF.

TACHOMETER

- Range: 0 to 9950 rpm, resolution 50rpm.
- "Shift gear" light turns on above 6500 rpm.

SENSORS

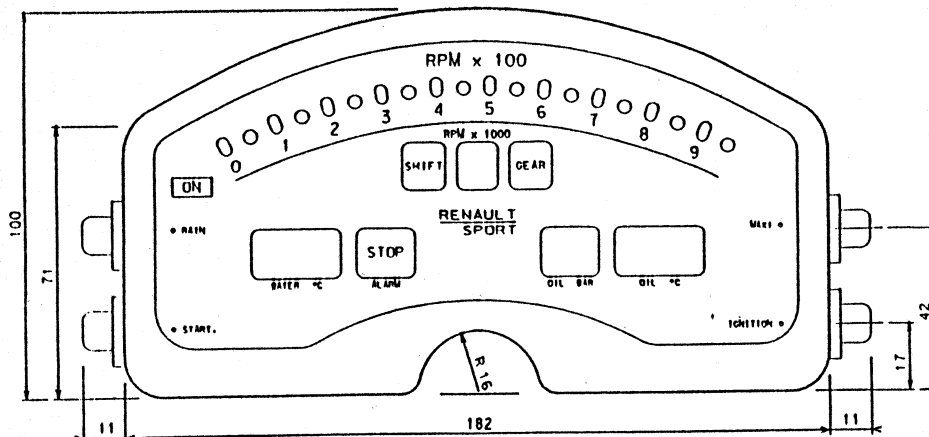
- Water temperature range: 40°C to 130°C; resolution 1°C, updated every two seconds.
- Oil temperature range: 40°C to 150°C; resolution 1°C, update every two seconds.
- Oil pressure range: 0 to 6 bars; resolution 0.1 bar, update every second.
- Alarm when the 2 central lights and the display of the faulty sensor are blinking.
- Sensors:
 - water temperature: ELBI TRC 200 or RENAULT 7700805614, alarm set for 120°C.
 - oil temperature: JAEGER 078890 or RENAULT 7711150107, *without alarm*.
 - oil pressure: JAEGER 333078 or RENAULT 7711150108, alarm set for 0.6 bar.
- IMPORTANT: no sensor acquisition above 6500 rpm.

The "MAXI" function:

- Allows to read the maximums of every parameter memorised since the last power down of the dashboard.
- IMPORTANT: automatic reset of the MAXIMUM VALUE function when power down for more than 3 minutes.

CONNECTOR INTERFACE

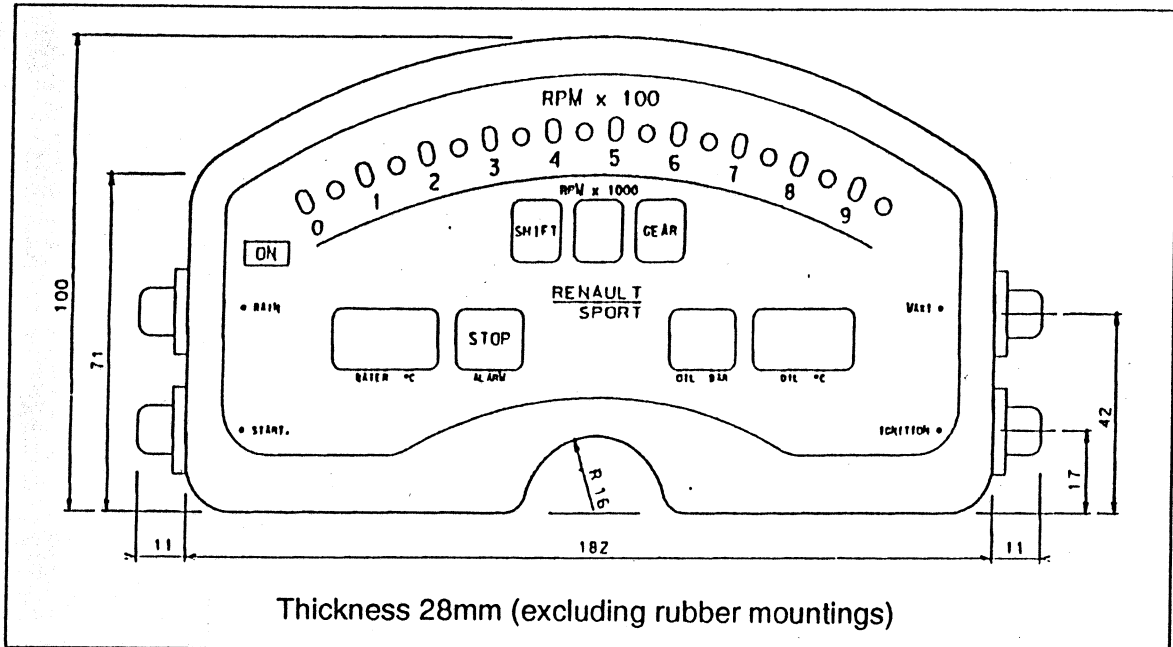
Pin	Function
1A	+ 12 volts before ignition switch
2A	+ 12 volts after ignition switch
3A	set light intensity (option)
4A	coil
1B	oil pressure
2B	water temperature alarm
3B	water temperature
4B	oil pressure alarm
1C	oil temperature
2C	chassis/ground
3C	START (starter)
4C	RAIN (lights)



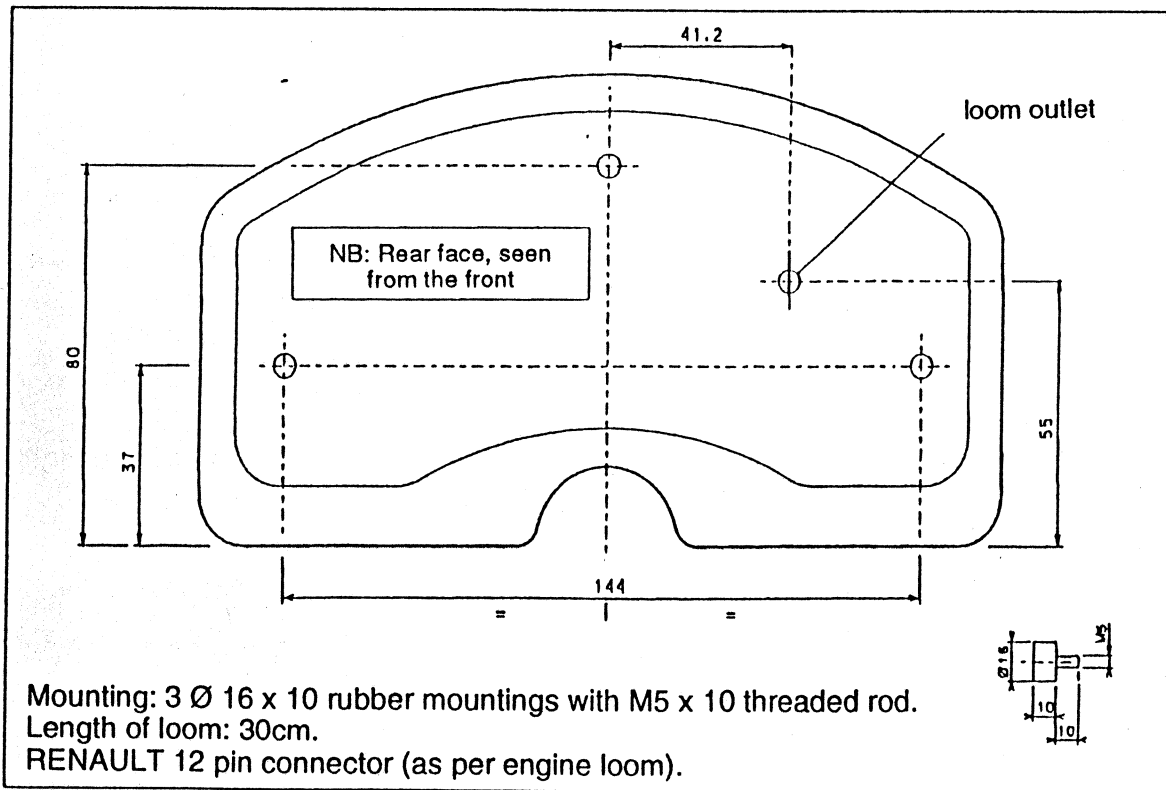
~~A-70~~ A.74

DASHBOARD Measurements

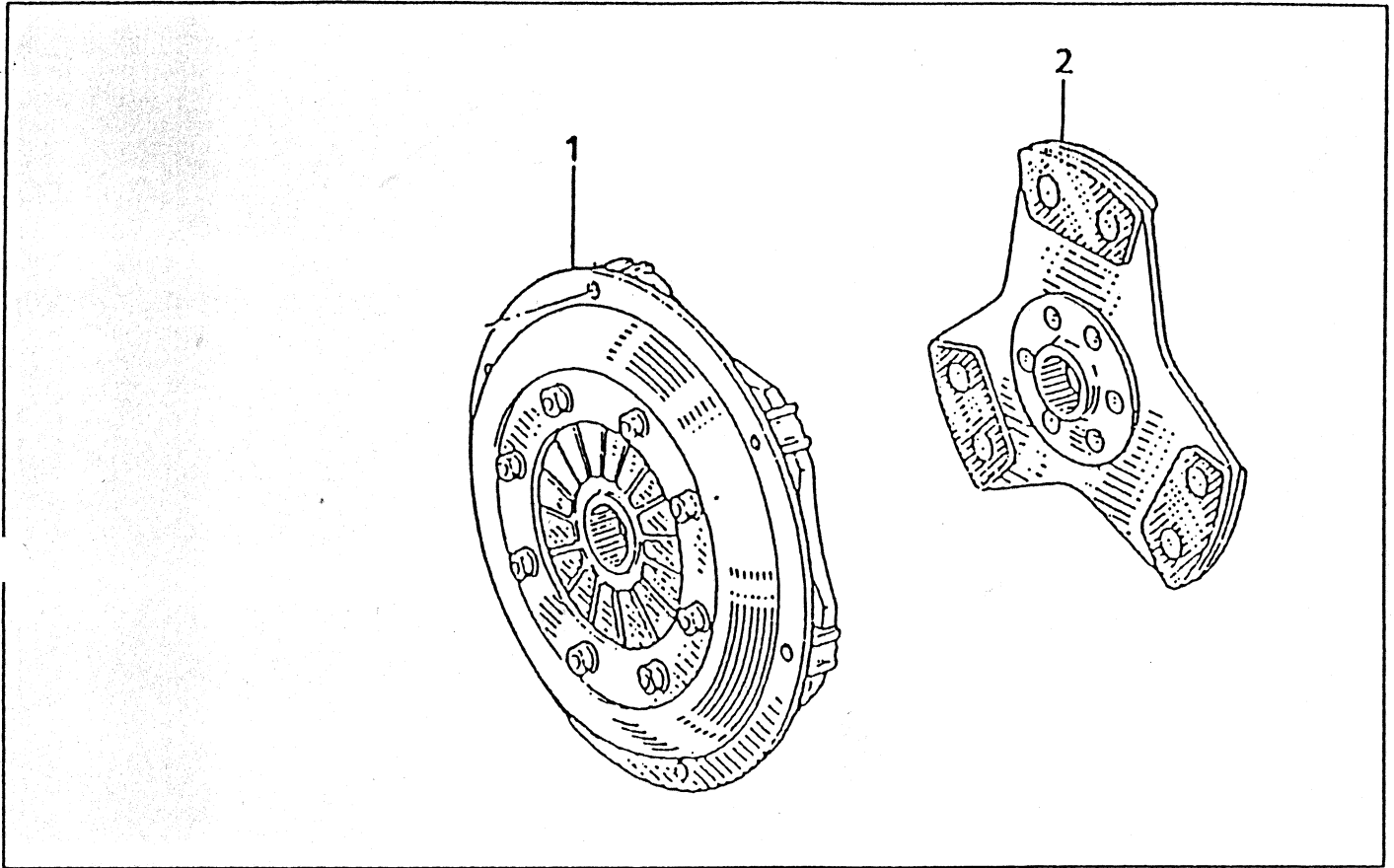
FRONT VIEW



REAR VIEW AS SEEN THROUGH DASHBOARD FROM THE FRONT



CLUTCH



1 Mechanism: TILTON. Spring colour: green.

2 Centre plate: TILTON. External \varnothing : 185mm. Number of splines: 23. Friction surface thickness: 2.60mm.

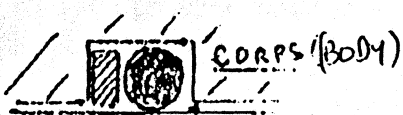
Clutch master cylinder:

Make: GIRLING

\varnothing : 0.7 inches.

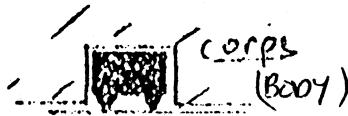
3 CLUTCH SLAVE CYLINDER

Please note the modification of the seal shown below.



piston

1st generation
with "O" ring and
washer

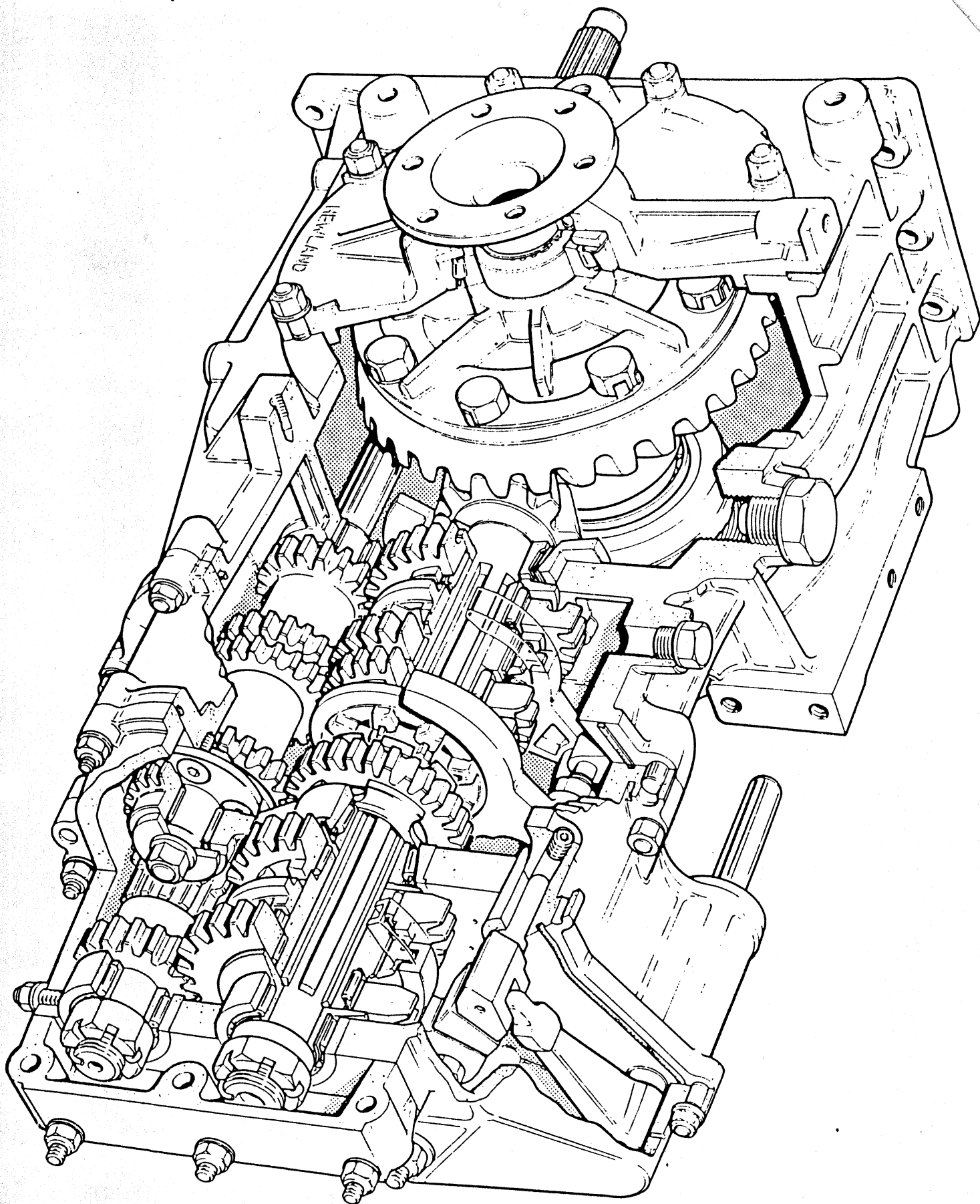


piston

2nd generation
with square
edged seal

GEARBOX

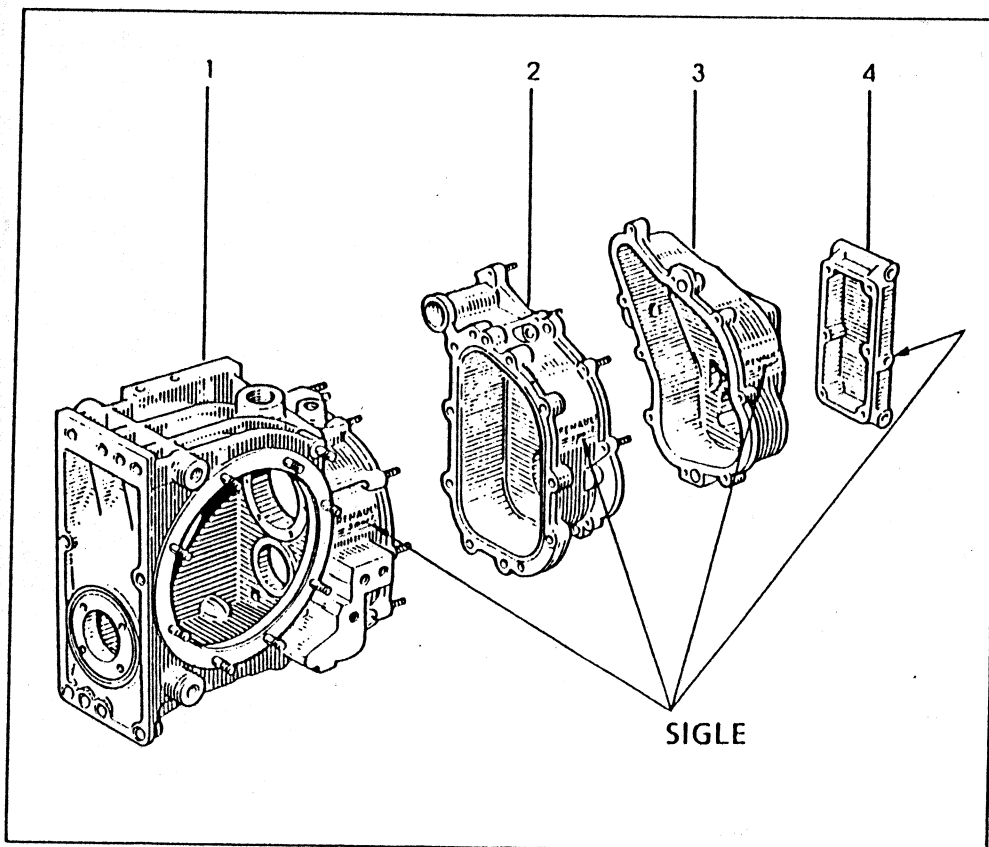
LD5-200 - 5 Speed Gearbox



GEARBOX Identifying the casings

- The gearbox casings:
- 1 Ref: 77 11 150 181
 - 2 Ref: 77 11 150 180
 - 3 Ref: 77 11 150 179
 - 4 Ref: 77 11 150 206

must bear the RENAULT SPORT badge. 



Permitted gear ratios

1st	2nd	3rd - 4th - 5th
14 x 36	16 x 35	18 x 33
	17 x 35	19 x 32
	18 x 33	20 x 30
		21 x 30
		22 x 29
		23 x 29
		23 x 28
		24 x 28
		21 x 24
		24 x 26
		23 x 24

Final Drive: 10 x 31

Gear ratios are available from:

HEWLAND ENGINEERING LTD.
BOYN VALLEY INDUSTRIAL ESTATE
BOYN VALLEY ROAD
MAIDENHEAD
BERKSHIRE
ENGLAND
 Tel: 01628 32033
 Fax: 01628 39013 (Technical)
 01628 26424 (Sales)

Final Drive 10 x 31

ONLY THE ABOVE RATIOS MAY BE USED.

ELECTRICAL INTERFACES

1. RELAYS

RELAY NO.	SIZE	USE
R1	40A	+12V accessories
R2	40A	starter
R3	40A	power to the computer
R4	40A	fuel pump and injectors

2. FUSES

FUSE NO.	SIZE	USE
F1	10A	+12V after ignition switch engine
F2	5A	rain light
F3	15A	+12V before ignition switch engine
F4	15A	+12V before ignition switch test
F5	10A	+12V accessories

3. CONNECTORS

C1: Dashboard connector

PIN NO.	SIGNAL
A	+12V AVC
B	+12V APC
C	ground
D	starter
E	rain
F	tachometer
G	oil pressure for dashboard
H	oil temperature for dashboard
J	water temperature for dashboard
K	oil pressure alarm
L	water temperature alarm
M	not connected (dimmer)

C2: Engine harness connector

PIN NO.	SIGNAL
A	+12V AVC
B	+12V APC
C	ground
D	starter
E	rain
F	tachometer
G	oil pressure for dashboard
H	oil temperature for dashboard
J	water temperature for dashboard
K	oil pressure alarm
L	water temperature alarm
M	fuel pump

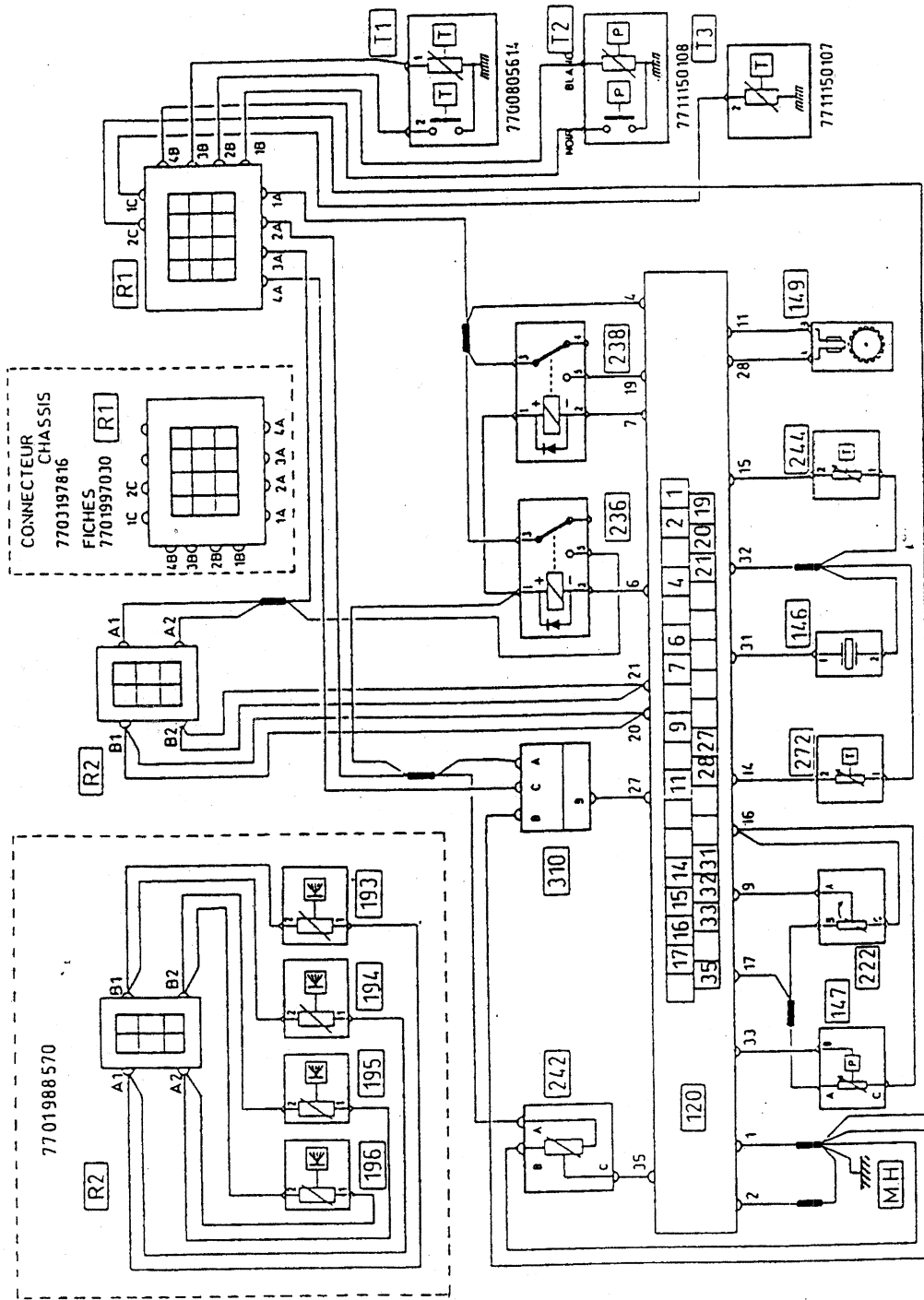
C3:Electrical power harness connector

PIN NO.	SIGNAL
A	+12V before ignition switch
B	+12V before ignition switch
C	+12V before ignition switch
D	not connected
E	ground
F	ground
G	ground
H	+12V before ignition switch for dashboard

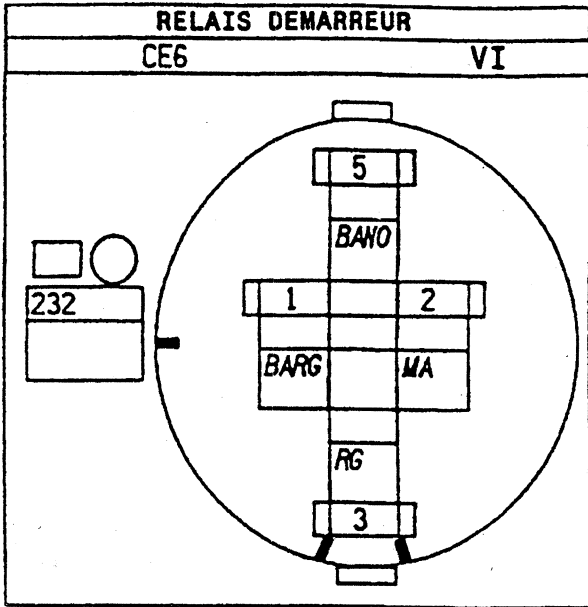
C4: Test connector

PIN NO.	SIGNAL
A	+12V before ignition switch (power)
B	+12V before ignition switch (power)
C	+12V before ignition switch (command)
D	ground
E	ground
F	ground
G	tachometer
H	oil pressure for dashboard
J	oil temperature for dashboard
K	water temperature for dashboard
L	oil pressure alarm
M	water temperature alarm
N	diagnostic computer: pin 18
P	default computer: pin 13
R	engine revolution sensor -
S	engine revolution sensor +
T	not connected
U	not connected
V	not connected

MIXTURE

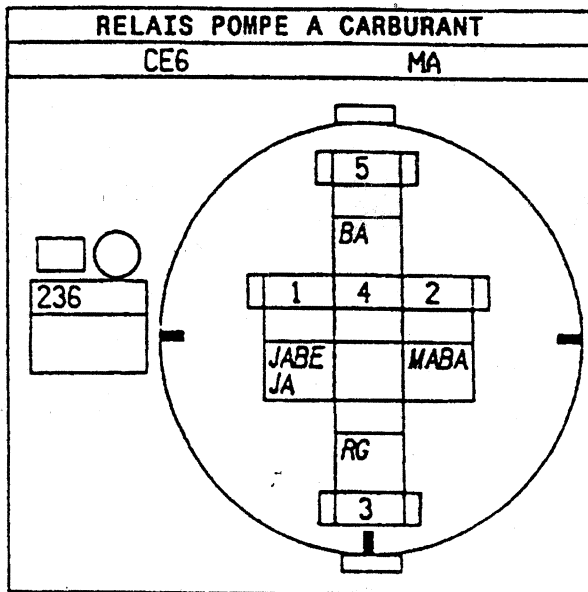


TERMINAL NO.	DESIGNATION	FUNCTION
120	Injection module	+12 volts before ignition
146	Anti-knock sensor	+12 volts after ignition
147	Absolute pressure sensor	+12 volts fuel pump feed
149	TDC sensor	Rev counter
193-196	Injectors	Oil pressure
213	Fuel pump	Coolant temp warning
222	Throttle potentiometer	Coolant temp
236	Fuel pump relay	Oil pressure warning
238	Injection fuel supply shut off relay	Oil Temp
242	Oxygen sensor	Earth
244	Coolant temperature sensor	
247	Dashboard (rev counter and service light)	
272	Air temperature sensor	
310	Ignition power module	
MH	Engine earth	
R1	Chassis connector	
R2	Injector connector	
T1	Temperature gauge - coolant warning	
T2	Pressure gauge - oil warning	
T3	Temperature gauge - oil	
CHASSIS CONNECTOR		FUNCTION
1		+12 volts before ignition
2		+12 volts after ignition
3		+12 volts fuel pump feed
4		Rev counter
5		Oil pressure
6		Coolant temp warning
7		Coolant temp
8		Oil pressure warning
9		Oil Temp
10		Earth



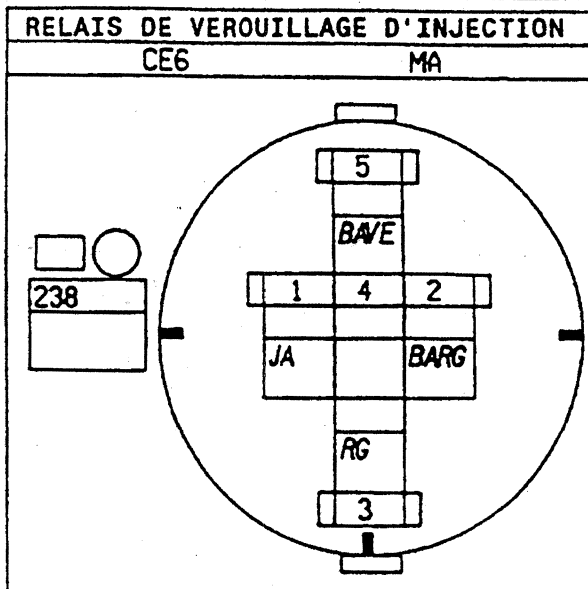
STARTER RELAY

- 1: + Starter
- 2: Starter Relay Switch
- 3: + Battery/Fuse Protection Cockpit 3
- 5: + Solenoid Starter Relay



FUEL PUMP RELAY

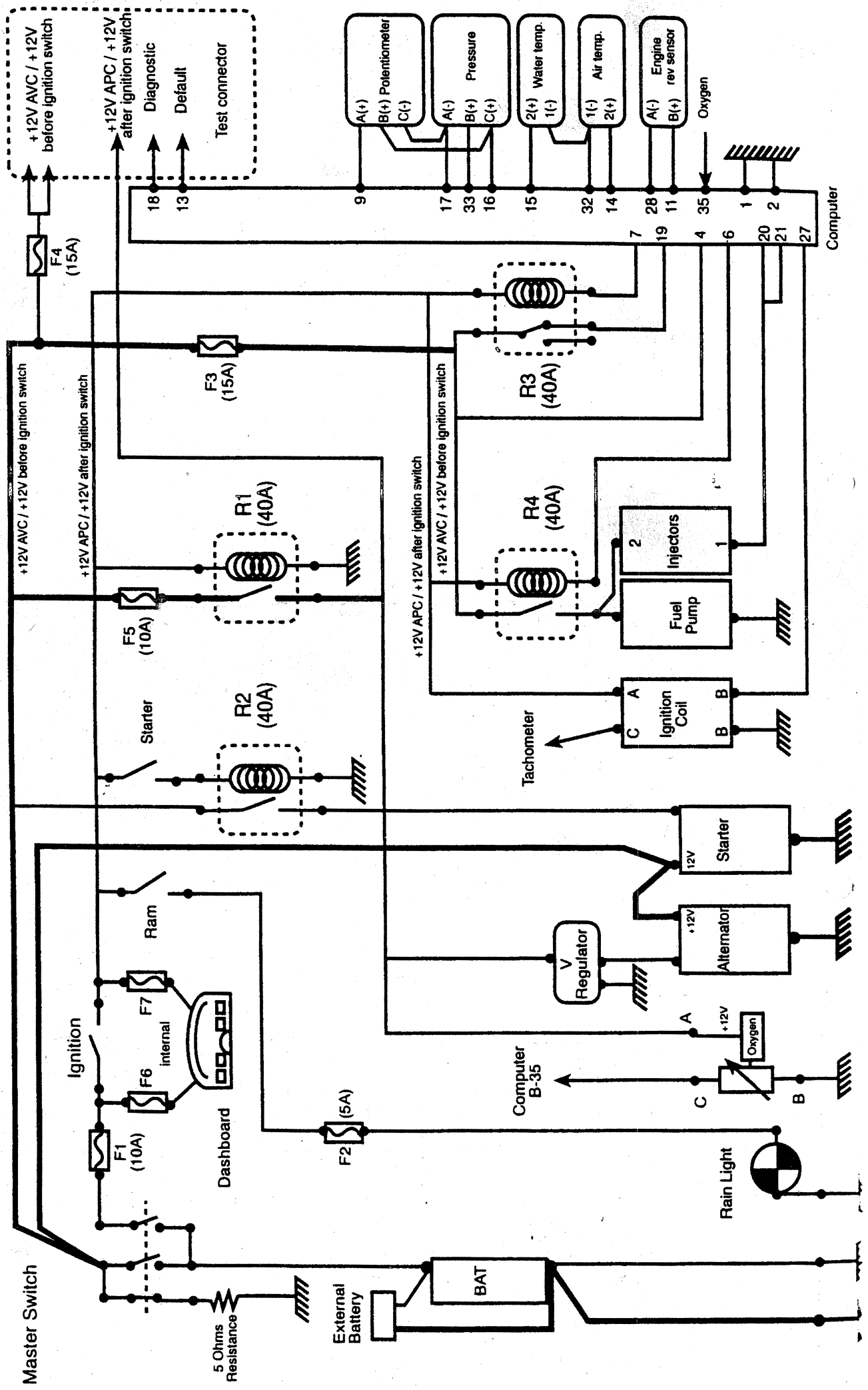
- 1: + Post-ignition Fused Protection Engine Functions
- 1: + Post-ignition Fused Protection Engine Functions
- 2: - Fuel Pump Relay Switch
- 3: + Battery Fused Protection Injector Pre-heat
- 5: + Pump and or Injectors



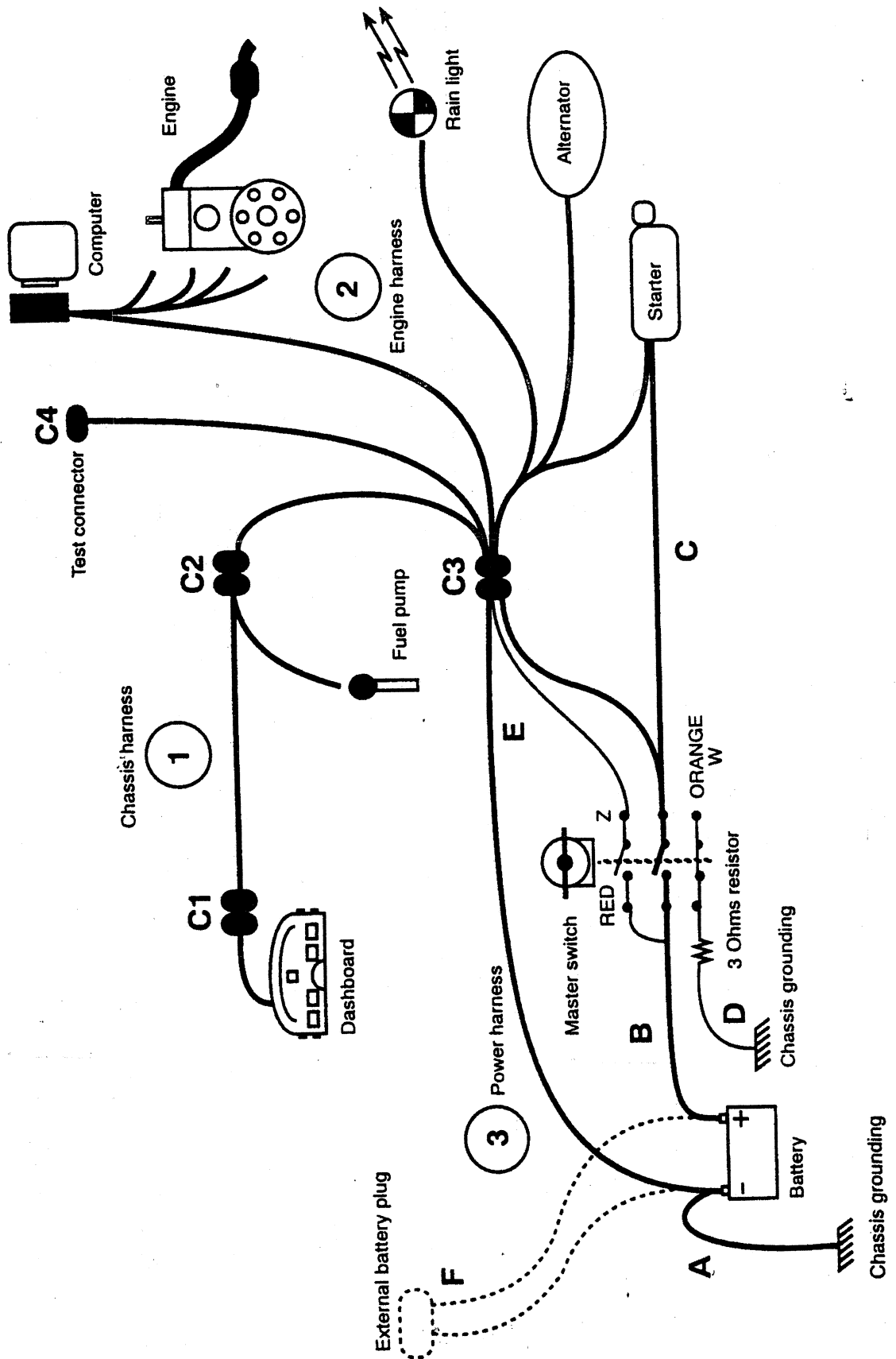
INJECTION SHUT-OFF RELAY

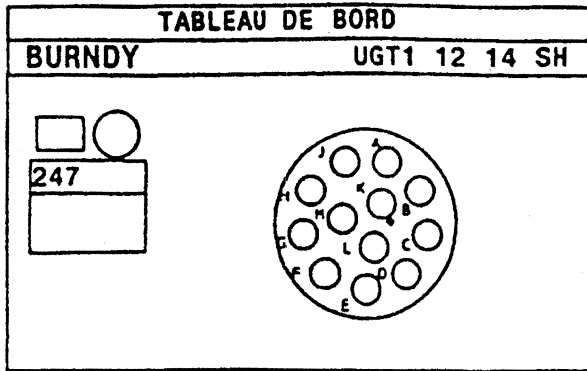
- 1: + Post-ignition Fused Protection Engine Functions
- 2: - Injector Shut Off Relay Switch
- 3: + Battery Fuse Protection Memory/Injection Shut-Off
- 5: + Module

FR 96 Electrical Layout



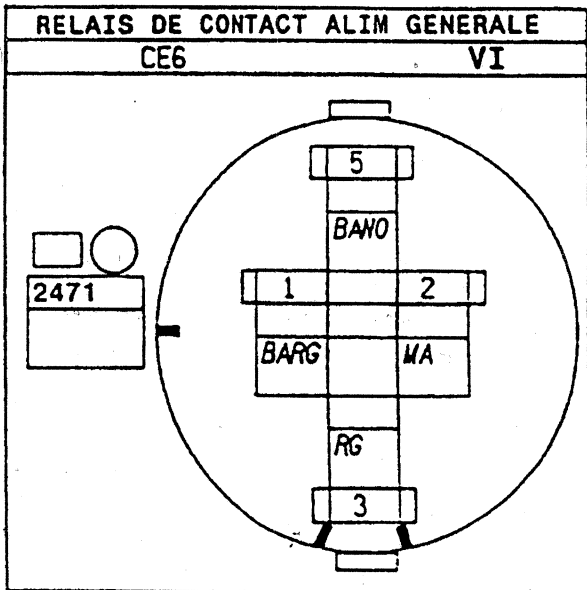
FR 96 FASCIA KIT





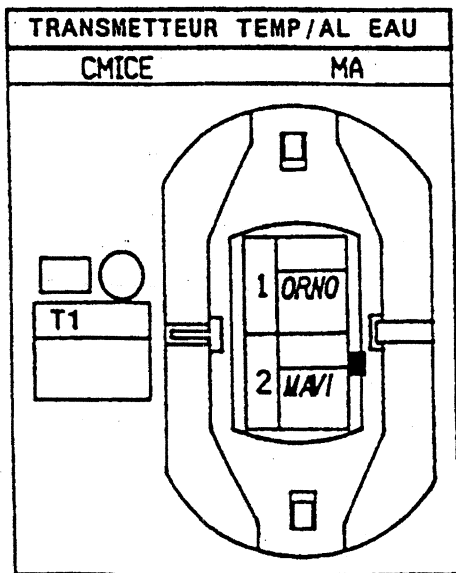
DASHBOARD

- A: + 12v Pre-ignition
- B: + 12v Post-ignition
- C: Earth
- D: Starter
- E: Fog Light
- F: Rev Counter
- G: Oil Pressure Sensor
- H: Oil Temperature Sensor
- J: Coolant Temperature Sensor
- K: Oil Pressure Warning Lamp
- L: Coolant Temperature Warning Lamp



MAIN POWER SWITCH

- 1: + 12v Pre-ignition – Dashboard
- 2: Earth
- 3: + 12v Pre-ignition
- 5: + 12v Post-ignition



**TEMPERATURE SENDER
 COOLANT TEMPERATURE WARNING**

- 1: Coolant Temperature Info
- 2: Coolant Temperature Warning

ELECTRICAL HARNESS KIT

The FR96 electrical system is made of 3 harnesses (cf harness kit figure):

1 – chassis harness

2 – engine harness

3 – power harness

3A - ground power cable, length to be adjusted by the car maker,

3B – +12V power cable, length to be adjusted by the car maker,

3C – starter cable, length to be adjusted by the car maker,

3D – 3 Ohms resistor cable,

3E – harness to be connected to the engine harness and made of:

3Ea – electronics ground, length to be adjusted by the car maker,

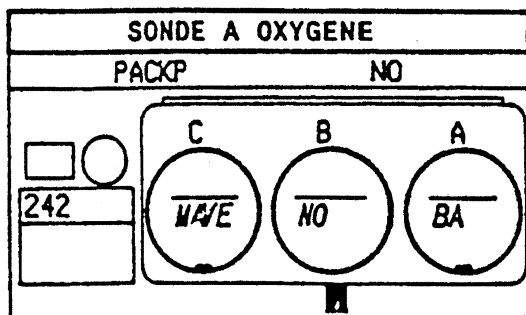
3Eb – electronics +12V power cable, length to be adjusted by the car maker,

3Ec – electronics +12V command cable (dashboard), length to be adjusted by the car maker,

3F – external battery cable and plug: not furnished.

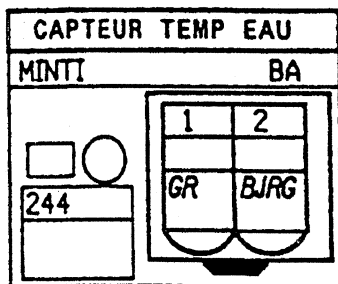
BEWARE:

1. TAKE CARE to properly identify the the terminals of the master switch before installation (cf electrical layout and harness kit figure).
2. resistor on master switch is mandatory.
3. if an electrical fire extinguisher is used, a layout is proposed with the harness documentation, as advice for proper installation.
4. the electrical terminals of fuses and relays shall be installed face down in order to prevent possible water penetration.
5. fuses and relays shall be protected against vibrations. A good solution consists in attaching them directly to the harness itself.
6. when electrically checking the harness (with an ohmmeter, or a voltmeter), the pins of the connectors shall not be forced.



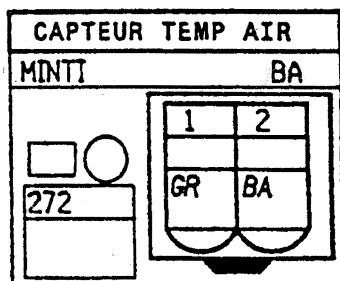
OXYGEN PROBE

A: + Pump and/or INJECTORS
B: Earth O2 Probe
C: O2 Probe Info



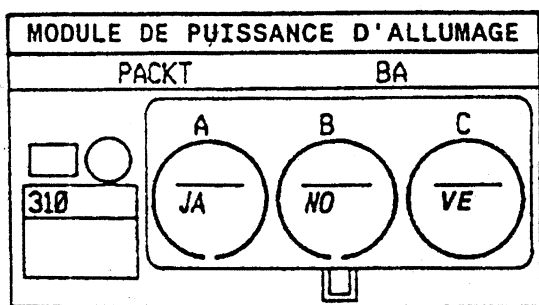
COOLANT TEMPERATURE SENSOR

1: Air/Coolant Temp. Sensors
2: + Coolant Temp. Sensors



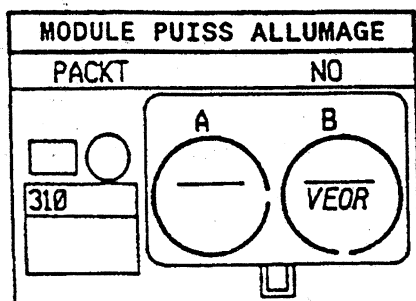
AIR TEMPERATURE SENSOR

1: Air/Coolant Temp. Sensors
2: + Coolant Temp. Sensors



IGNITION POWER MODULE

A: + Post-ignition Fuse Engine Functions
B: Ignition Power Module Earth
C: Rev. Counter Info

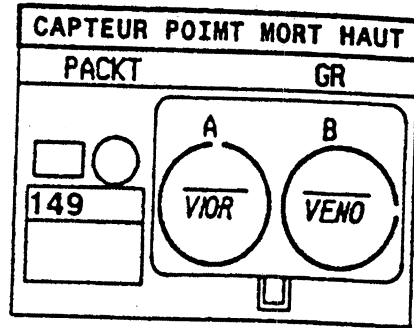


IGNITION POWER MODULE

B: Ignition Power Module Info 1

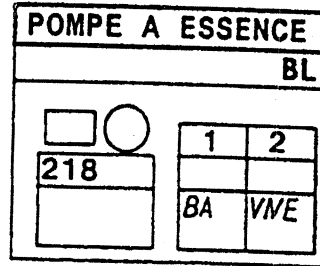
TDC SENSOR

- A: TDC Sensor Info 2
- B: TDC Sensor Infor 1



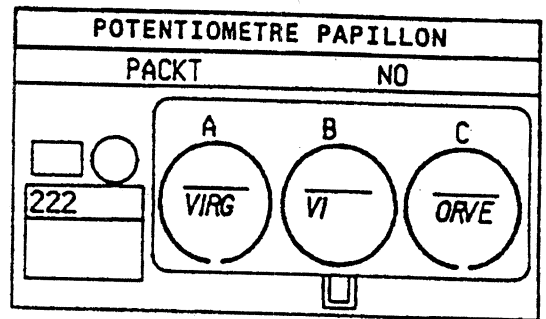
FUEL PUMP

- 1: Earth
- 2: + Injectors



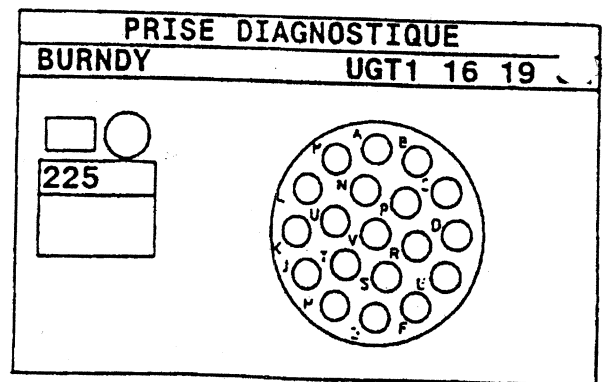
THROTTLE POT

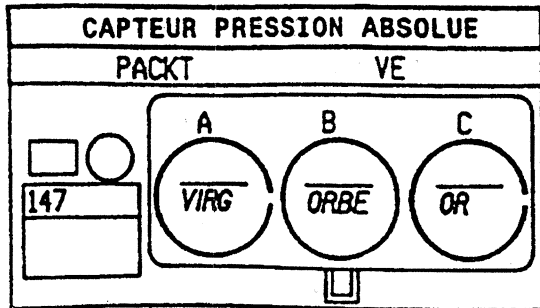
- A: Throttle Pot. Info
- B: Earth Throttle Pot. Mixture/Oxygen Pressure Sensor
- C: Pressure Sensor, Throttle Pot Feed



DIAGNOSTIC PLUG

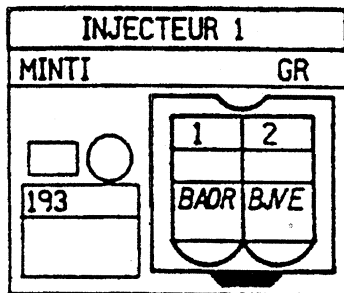
- A: Pre-Ignition
- B: Pre-Ignition
- C: Pre-Ignition
- D: Earth
- E: Earth
- F: Earth
- H: Oil Pressure
- J: Oil Temperature
- K: Coolant Temperature
- L: Oil Pressure Warning
- M: Oil Temperature Warning
- N: Module Diagnostics
- R: TDC A
- S: TDC B



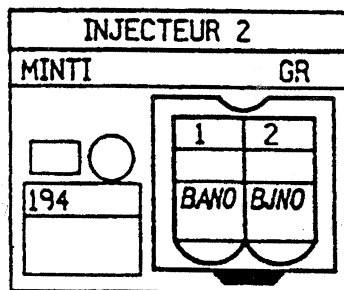


ABSOLUTE PRESSURE SENSOR

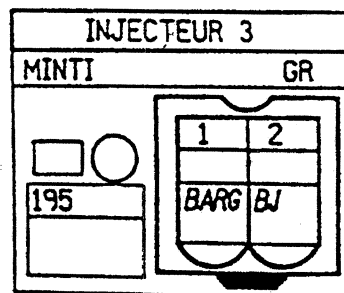
- A: Earth Throttle Pot/Mixture, Oxygen Pressure Sensor
- B: Pressure Sensor In
- C: Pressure Sensor/Throttle Pot Feed



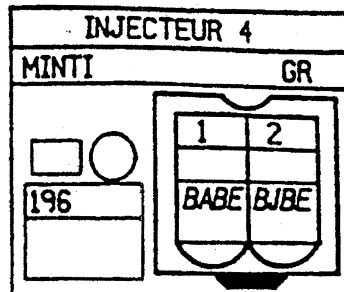
- 1: + Pump and/or Injectors
- 2: - Injector - Module



- 1: + Pump and/or Injectors
- 2: - Injector - Module



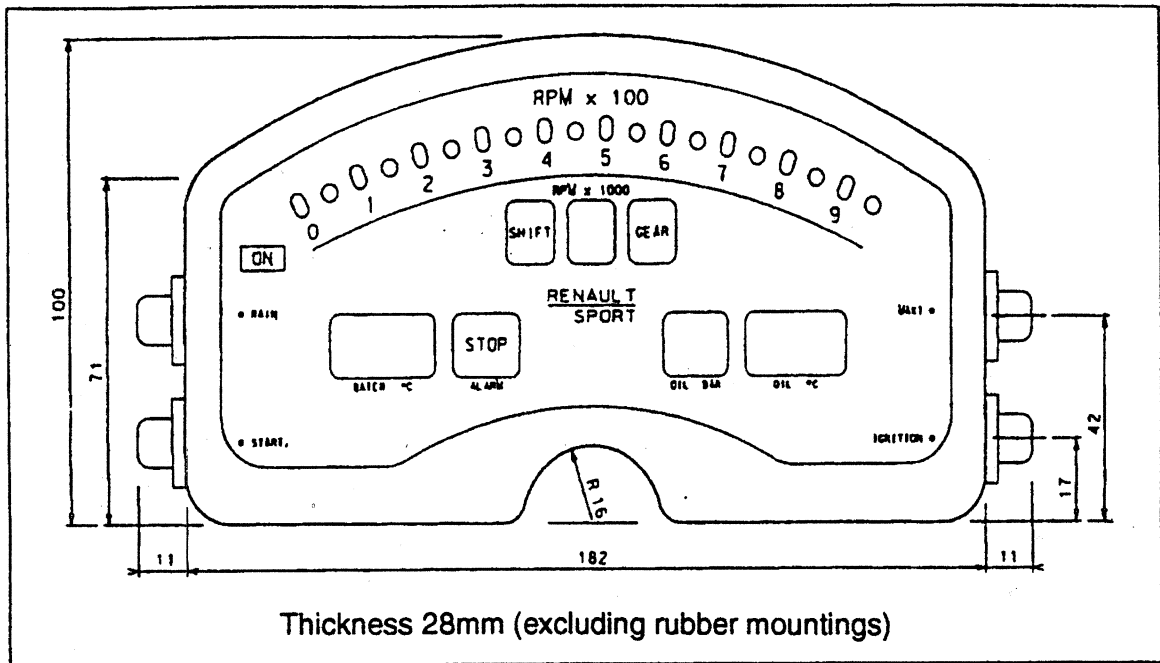
- 1: + Pump and/or Injectors
- 2: - Injector - Module



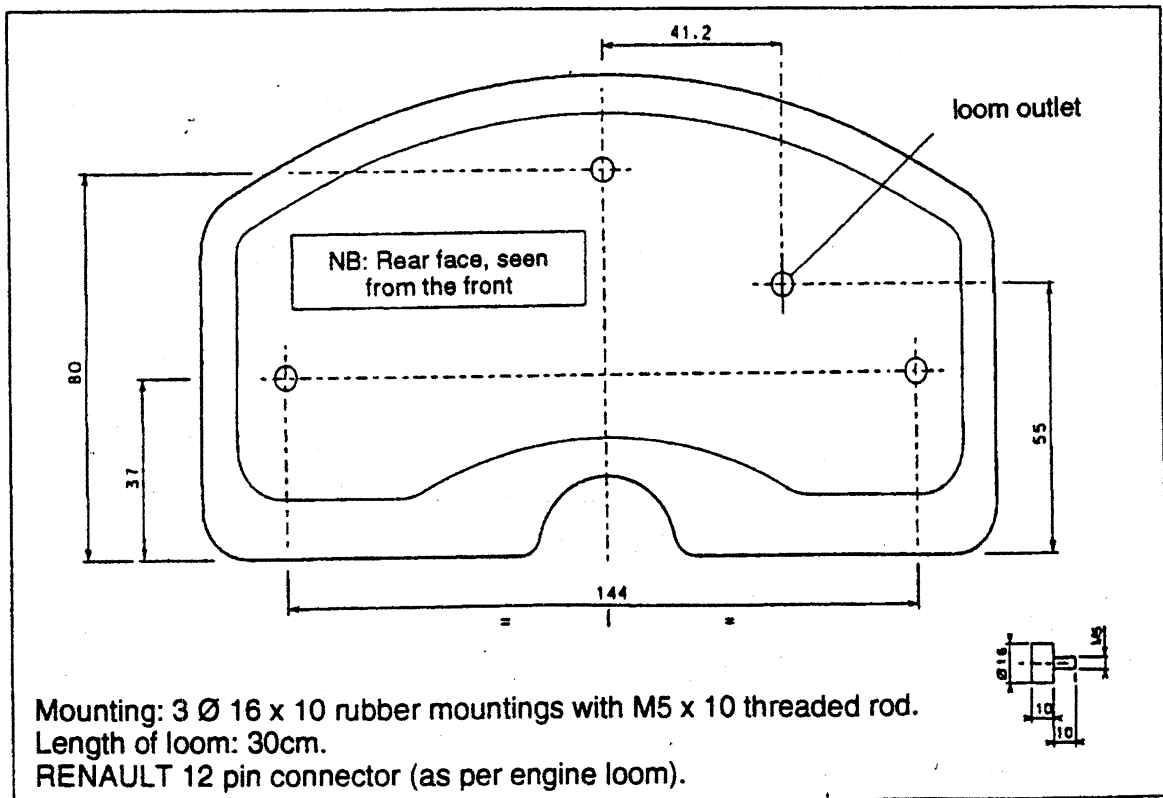
- 1: + Pump and/or Injectors
- 2: - Injector - Module

DASHBOARD Measurements

FRONT VIEW



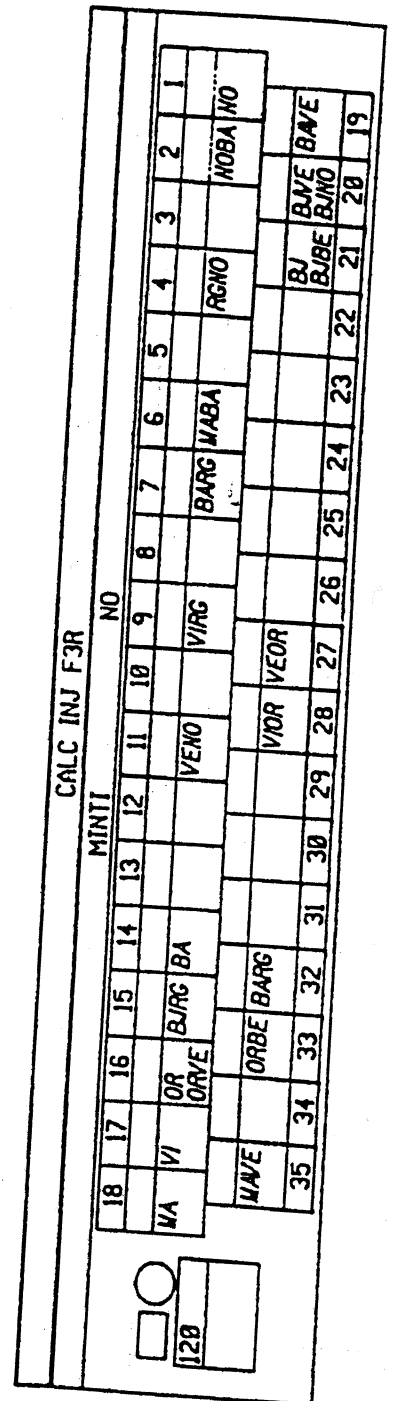
REAR VIEW AS SEEN THROUGH DASHBOARD FROM THE FRONT



ENGINE LOOM

- 1: F3R Inj. Module Earth
- 2: Earth
- 4: + Battery Fuse/Protection Memory Injector/
Shut Off
- 6: - Pump Relay Feed
- 7: - Injector Shut Off Relay
- 9: Throttle Pot. Position Info
- 11: TDC Sensor Info 1
- 14: + Air Temperature Sensor
- 15: + Coolant Temperature Sensor
- 16: Feed for Absolute Sensor and Throttle Pot
- 16: Feed for Absolute Sensor and Throttle Pot
- 17: Common Earth for Throttle Pot., Mixture,
Oxygen Sensor, Pressure Sensor
- 18: Fuel Injection Diagnostics
- 19: + Power Feed to Module
- 20: - Injector - Module
- 20: - Injector - Module
- 21: - Injector - Module
- 21: - Injector - Module
- 27: Info 1 Ignition Power Module
- 28: TDC Sensor Info 2
- 32: - Air/Coolant Sensors
- 33: Pressure Sensor In
- 35: O2 Sensor Info

N°	int		
1	2	NO	MASSE CALC INJ F3R
2	2	NO/BA	MASSE-
4	.6	RG/NO.	+ BATT PROT/FUS MEM INJ/VERR
6	.6	MA/BA	- CDE RELAIS POMPE CARB
7	.6	BA/RG	- CDE RELAIS VERROUILLAGE
9	.6	VI/RG	INFO POTEN PAPILLON
11	.6	VE/NO	INFO 1 CAPTEUR PMH
14	.6	BA	+ SONDE TEMPERATURE AIR
15	.6	BJ/RG	+ SONDE TEMPERATURE EAU
16	.6	OR	ALIM CPT PRESS.POT PAPILLON
16	.6	OR/VE	ALIM CPT PRESS.POT PAPILLON
17	.6	VI	MSE POT/PPL/RICH/OXY CPT/PRS
18	.6	MA	DIAGNOSTIQUE INJECTION
19	2	BA/VE	+ BOITIER ELECTRONIQUE
20	1	BJ/VE	- INJECTEUR-CALCULATEUR
20	1	BJ/NO	- INJECTEUR-CALCULATEUR
21	1	BJ	- INJECTEUR-CALCULATEUR
21	1	BJ/BE	- INJECTEUR-CALCULATEUR
27	.6	VE/OR	INFO 1 CALCULATEUR MPA
28	.6	VI/OR	INFO 2 CAPTEUR PMH
32	.6	BA/GR	- CAPTEURS AIR/EAU
33	.6	OR/BE	ENTREE CAPTEUR PRESSION
35	.6	MA/VE	INFO SDE O2



DASHBOARD

Operating Instructions

IMPORTANT: Should any problem occur, please contact: A. Régis ou M. Morelière, THARSYS,
Tel: (33) 61.75.15.87; Fax: (33) 61.75.15.89, France.

COMMANDS

- IGNITION: power ON/OFF.
- MAXI: display of the maximum value of the parameters.
- START: starter.
- RAIN: lights ON/OFF.

TACHOMETER

- Range: 0 to 9950 rpm, resolution 50rpm.
- "Shift gear" light turns on above 6500 rpm.

SENSORS

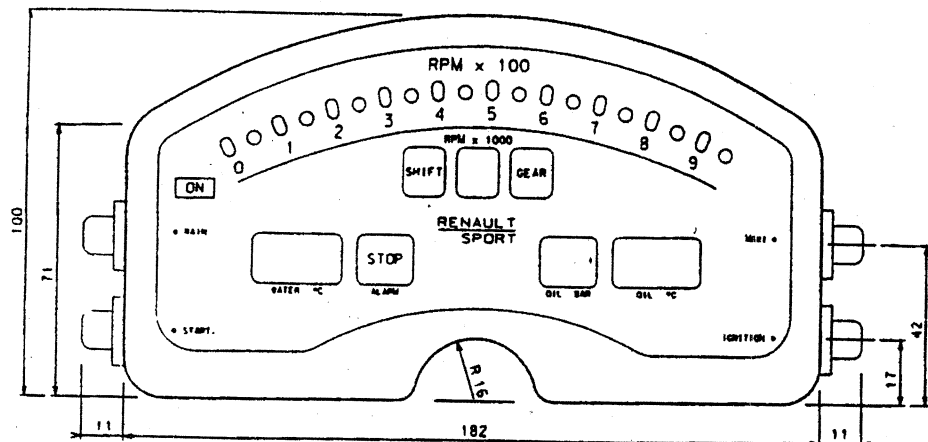
- Water temperature range: 40°C to 130°C; resolution 1°C, updated every two seconds.
- Oil temperature range: 40°C to 150°C; resolution 1°C, update every two seconds.
- Oil pressure range: 0 to 6 bars; resolution 0.1 bar, update every second.
- Alarm when the 2 central lights and the display of the faulty sensor are blinking.
- Sensors:
 - water temperature: RENAULT 7700805614, warning light set for 120°C.
 - oil temperature: RENAULT 7711150107, *without warning light*.
 - oil pressure: RENAULT 7711150108, warning light set for 0.6 bar.
- **IMPORTANT:** no sensor acquisition above 6500 rpm.

The "MAXI" function:

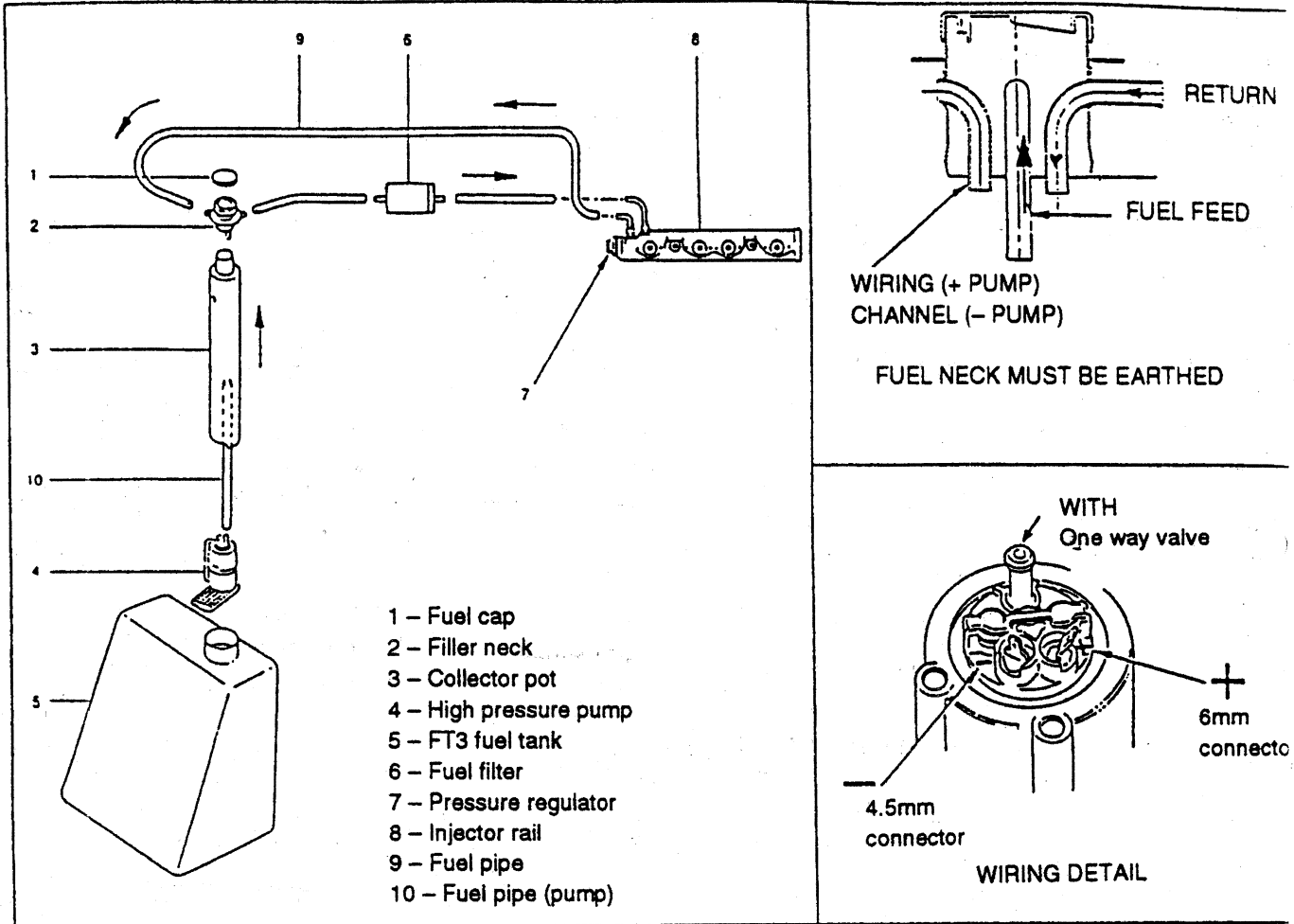
- Allows to read the maximums of every parameter memorised since the last power down of the dashboard.
- IMPORTANT:** automatic reset of the MAXIMUM VALUE function when power down for more than 3 minutes.
- Function is activated by earthing connector terminal 3A to chassis by pushing top right-hand button dashboard.

CONNECTOR INTERFACE

Pin	Function
1A	+ 12 volts before ignition switch
2A	+ 12 volts after ignition switch
3A	
4A	coil
1B	oil pressure
2B	water temperature alarm
3B	water temperature
4B	oil pressure alarm
1C	oil temperature
2C	chassis/ground
3C	START (starter)
4C	RAIN (lights)



MIXTURE Fuel circuit



REMOVAL

Disconnect:

- the battery
- the return pipe
- the feed pipe
- + and - leads on filler neck.

Remove:

- filler neck
- collector pot

Renew fuel pump

REPLACEMENT

Precautions:

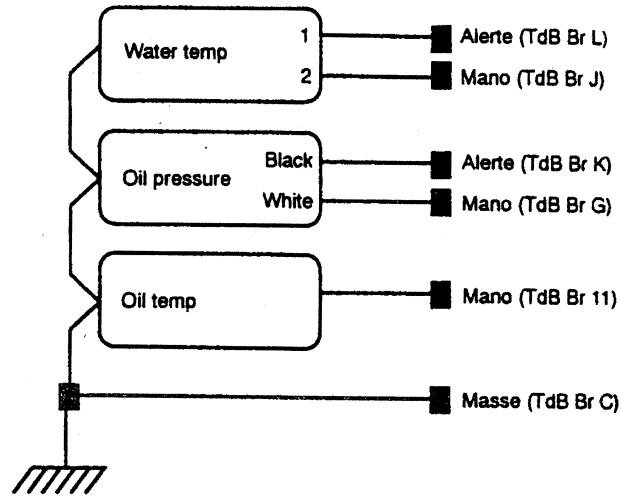
Ensure that the fuel pipe (10) is longer than the collector pot so that it can be connected easily to filler neck.

Reconnect:

- fuel pipes
- return pipes
- leads to filler neck
- the battery.

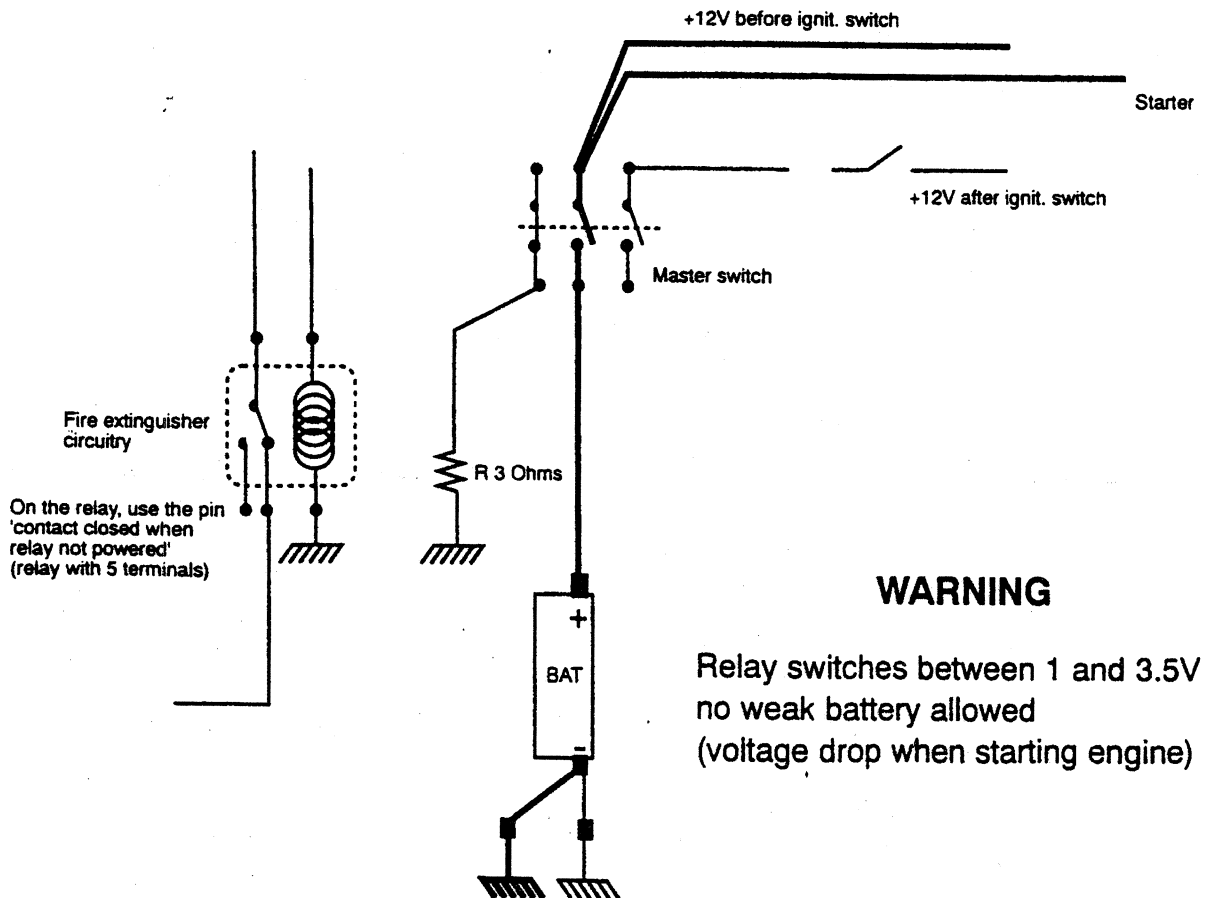
FR 96

Dashboard to Sensors Connection Layout



FR 96

Electrical Fire Extinguisher Installation Advice



WARNING

Relay switches between 1 and 3.5V :
no weak battery allowed
(voltage drop when starting engine)

MIXTURE

General Points

Module	R.N.U.R. Ref. No.
SIEMENS	7711 150 098

Air temperature sensor	Bendix type CTN
Water temperature sensor	Bendix type CTN

Oxygen probe (Lambda probe)	Make: NGK 0ZA55R1 Model: Heated (3 wires) Voltage delivered at 850°C Rich mixture: Probe voltage \geq 625 MV Lean mixture: Probe voltage 0 to 80 MV
Catalytic converter	7711150 408 Ø 100 channels/inch
Paper air-filter element	Type JR 7003
Ignition	Curves: Integrated in injection module M.P.A.: Ignition power module.
CHAMPION spark plugs	Gap: 0.9mm Type C61C

Fuel supply	Regulated Multipoint Injection
Fuel pump: BOSCH	Voltage: 12 Volts Pressure: 3 bars Output: 80 to 150 l/h
Fuel filter:	Output: 80 l/h Ref: 7700820 375
Pressure regulator: BOSCH 0280160 515	Pressure: - with nil depression 3.0 ± 0.15 bars - with 500m bar depression: 2.5 ± 0.15 bars
Electromagnetic injectors: SIEMENS	DEKAZ TYPE (green connector) Voltage: 12 volts Resistance: $14.5 \pm 0.5 \Omega$
Throttle Butterfly Body : SOLEX Single Choke	Ø 58
Potentiometer DVG Ref: 5326 7705	A - Idling: XR25 value = 8 to 13 B - Partial load: XR25 value = 20 to 190 C - Throttle fully open: XR25 value = 235 ± 15