

Vehicle	Assembly type	Type	Engine
RENAULT 18	1	1344 - 1354 - 2354	852..710
RENAULT 20	1	1276	852..700
RENAULT 21	2	L 486 - K 486 - S 486	J8S..704
RENAULT 25	2	B 296	J8S..706

Description	Make and Type	Special details
Injection pump	BOSCH VE 4/9 F 2250 R 41 1 VE 4/9 F 2250 R 158 2	Single piston rotary pump with mechanical centrifugal governor, automatic hydraulic advance, automatic cold start and fast idling system, and solenoid shut-off.
Pump timing (engine at T.D.C., pump lift)	0.70 ± 0.02 mm	
Injectors	BOSCH KBE 48S 5/4	
Pin and seat assemblies	BOSCH DN OSD 189/	Setting 130 ± 8 bars/maximum difference 8 bars
Fuel filter	BOSCH ROTO DIESEL	Quick release filter element with integral water drain. With incorporated priming pump. Note: As from 1987 vehicles are equipped with a ROTO DIESEL filter with a diesel fuel heater which heats the fuel via the engine cooling system.
Injector pipes	—	Outside Ø 6 mm Inside Ø 2 mm Length 290 mm

SETTINGS

Idling	750 ± 50 rpm
..... L, K, S 486	850 ± 50 rpm
Max. speed unladen	4 900 ± 100 rpm
Smoke density	
Approved figure	1.11 ^{m-1} : 36 %
Maximum legal	2 ^{m-1} : 55 %

TIMING TEST (on diagnostic bay)

Injection Pump	Idling speed r.p.m.	Injection commences Before T.D.C.
VE ... R41 VE ... R158	750 ± 50	13.5 ± 1°
L, K, S 486 VE ... R158	850 ± 50	13.5 ± 1°

Vehicle	Assembly type	Type	Engine
RENAULT 18 TURBO	1 2	1346 - 1356	J8S..712
FUEGO TURBO	1 2	1366	J8S..712
RENAULT 20/30 TURBO	1 2	1270	J8S..702
RENAULT 21 TURBO	2	L 488.. K 488	J8S..714
RENAULT 25 TURBO	2	B 290	J8S..708
ESPACE TURBO	2	J 115 - S 115	J8S..240
JEEP CHEROKEE	3	XJ	J8S..814

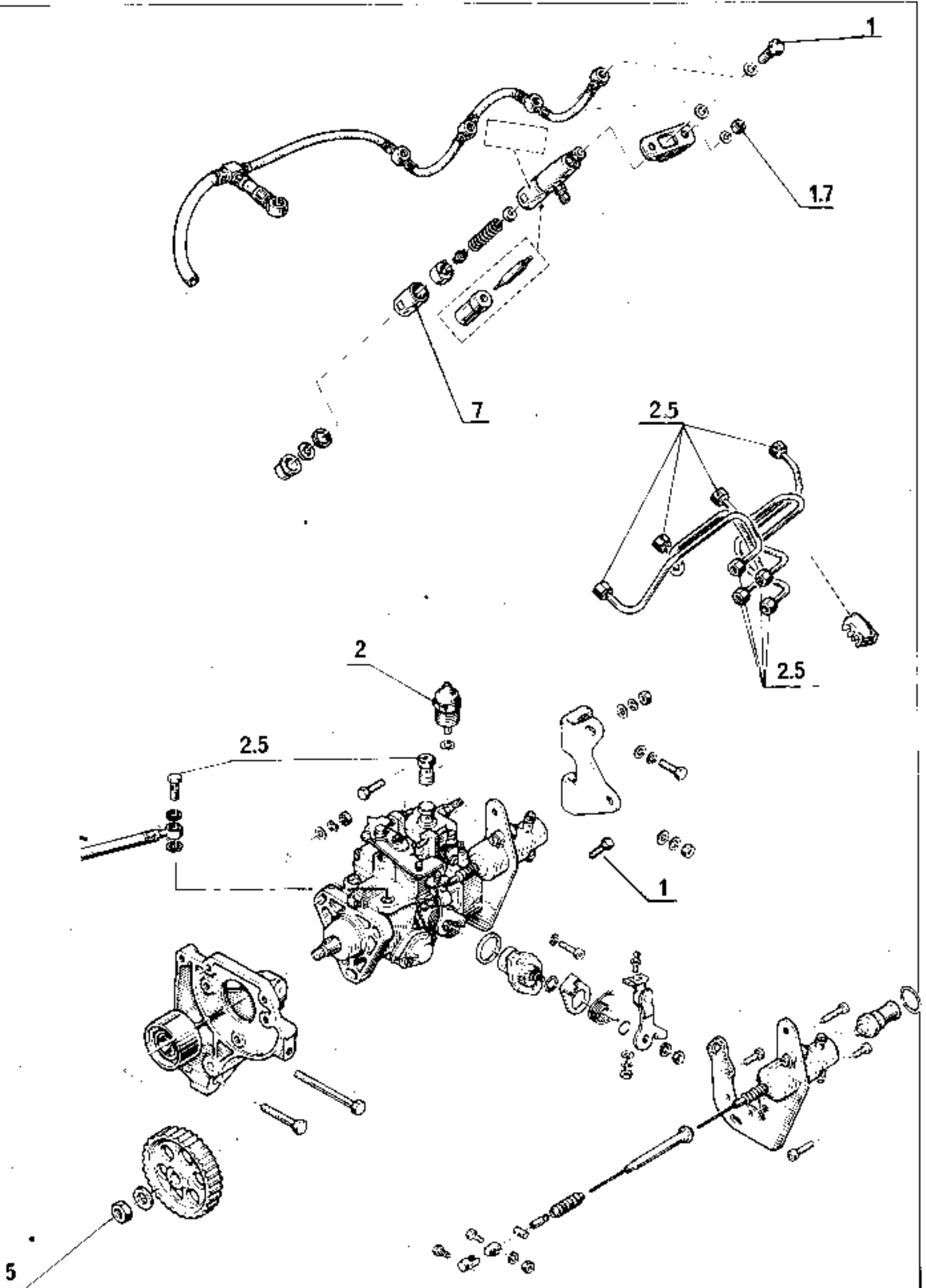
Description	Make and Type	Special details
Injection pump	BOSCH VE 4/9 F 2200 R 69 1 VE 4/9 F 2200 R 153 2 VE 4/9 F 2200 R 183 3	Single piston rotary pump with mechanical centrifugal governor, automatic hydraulic advance, automatic cold start and fast idling system, and solenoid shut-off, delivery correction to suit turbocharging pressure (LDA).
Pump timing (engine at T.D.C., pump lift)	0.70 ± 0.02 mm 1 0.70 ± 0.02 mm 2 0.82 ± 0.02 mm 3	
Injectors	BOSCH KBE 48 S7	
Pintle and seat assemblies	BOSCH DN OSD 193 1 DN OSD 264 1 2 DN OSD 254 3	Setting 130 \pm 8 bars
Fuel filter	BOSCH 1 2 ROTO DIESEL 2 STANADYNE 3	Quick release filter element with integral water drain. With incorporated priming pump. Note: As from 1987 vehicles are equipped with a ROTO DIESEL filter with a diesel fuel heater which heats the fuel via the engine cooling system. Quick release filter element with integral electric heater
Injector pipes		Outside \varnothing 6 mm Inside \varnothing 2 mm Length 275 mm
Turbocharger	GARRETT T3 GARRETT T2 (LK 488 et XJ)	Boost pressure (T2 and T3) 0.6 ± 0.025 bars at 2500 ± 250 rpm Static opening pressure (T2) 730 ± 30 mbars for 0.38 ± 0.02 mm of adjusting rod travel

SETTINGS

Idling	750 ± 50 rpm
L. K. 488	850 ± 50 rpm
XJ	800 ± 50 rpm
Max. speed	4 700 - 4800
Smoke density	
Approved figure	1.6 ^{m-1} : 48 %
XJ	1.52 ^{m-1} : 46 %
Maximum legal	2 ^{m-1} : 55 %

TIMING TEST (on diagnostic bay)

Injection Pump	Idling speed r.p.m.	Injection commences Before T.D.C.
BOSCH	750 ± 50	
VE R69	850 ± 50	13.5 ± 1°
VE R153	(L. K 488)	
VE R183	800 ± 50	15.5 ± 1°



ESSENTIAL SPECIAL TOOLING

Mot. 453-01	Hose clamps
Mot. 854	Injection pump sprocket locking tool
Mot. 856	Dial indicator support
Mot. 861	T.D.C. gauge
Mot. 909-01	Spanner for injection pump nut
Mot. 1053	Injection pump sprocket extractor (replaces B.Vi.28-01, B.Vi.48, B.Vi.859).

REMOVAL

Depending on the version, it may be necessary to remove certain accessories to remove the timing gear casing (see the relevant workshop repair manual for the vehicle in question).

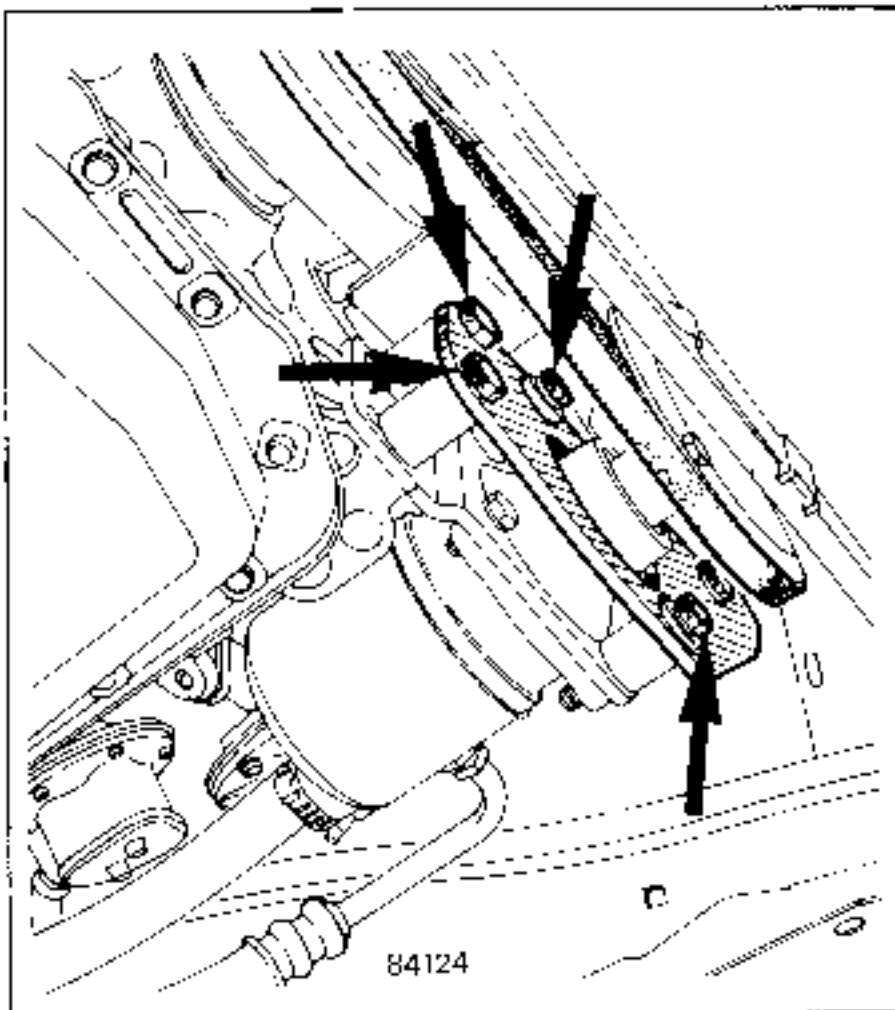
Vehicles with the power-assisted steering pump under the alternator.

Remove the protective panel from under the engine.

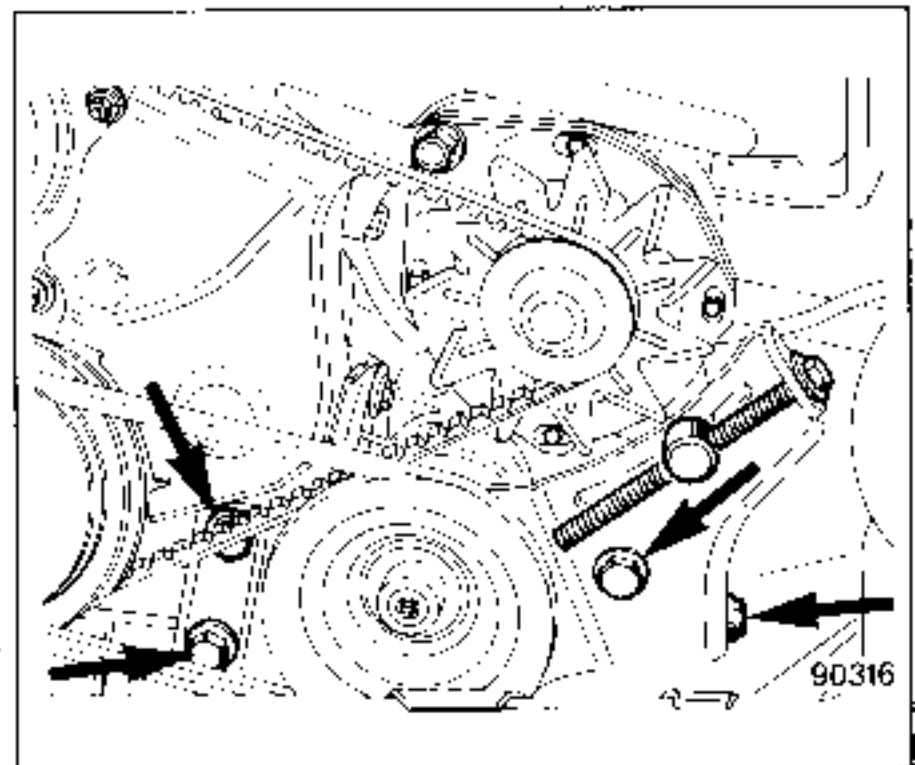
Unscrew the hydraulic pump securing bolts (shown by arrows).

Remove the drive belt and retighten the hydraulic pump securing bolts.

1st type of assembly



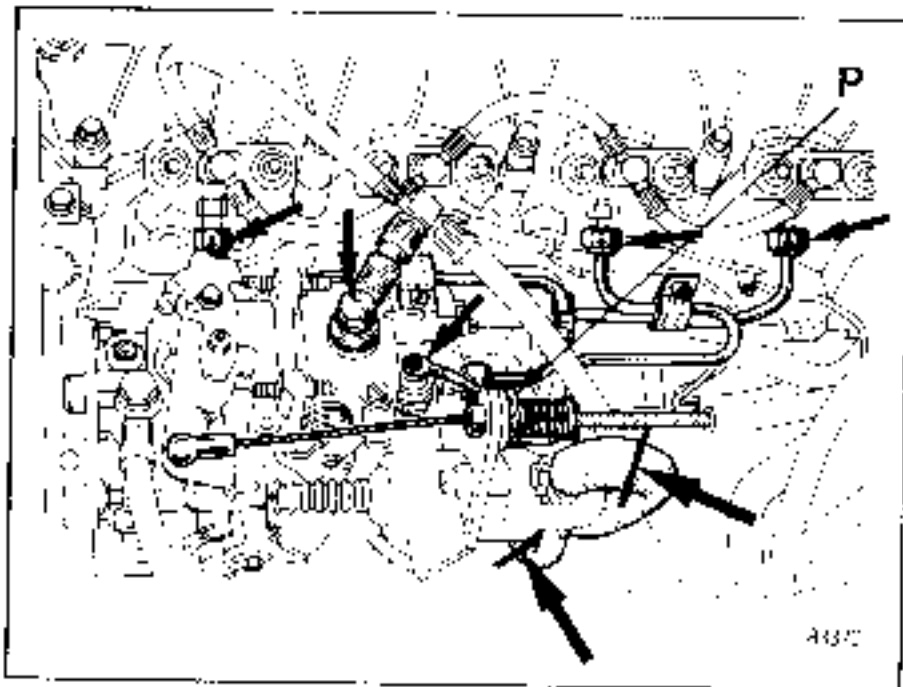
2nd type of assembly



Disconnect the battery.

Clamp the pipes (Mot.453-01) and disconnect them (shown by arrows).

Disconnect the pump connections. Mark the position of the clip (P).

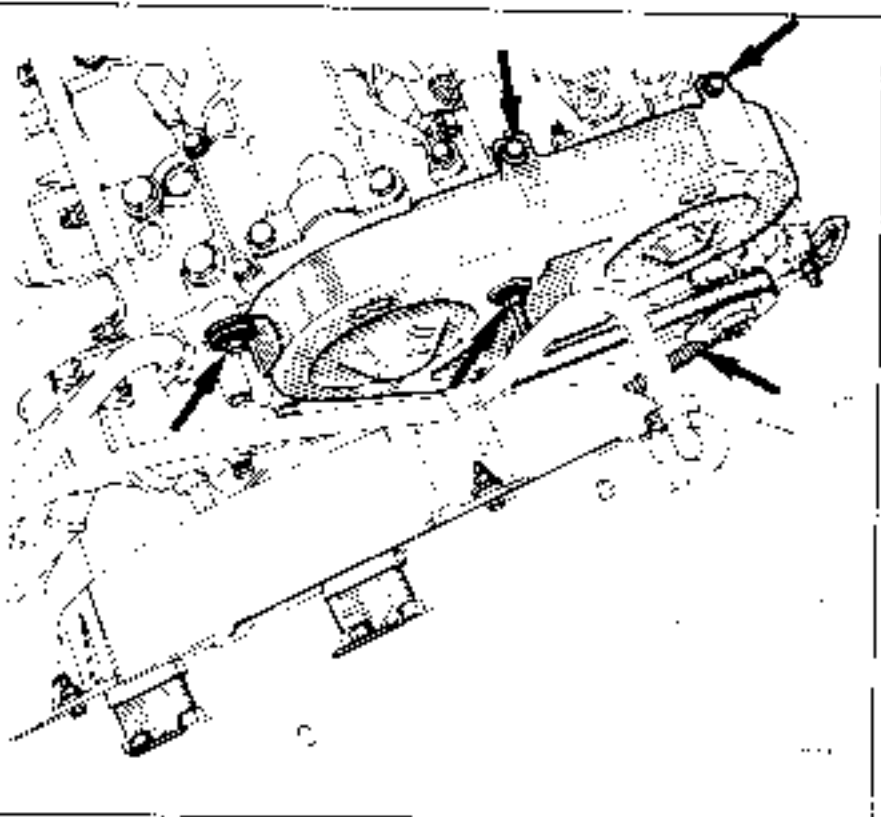


Remove:

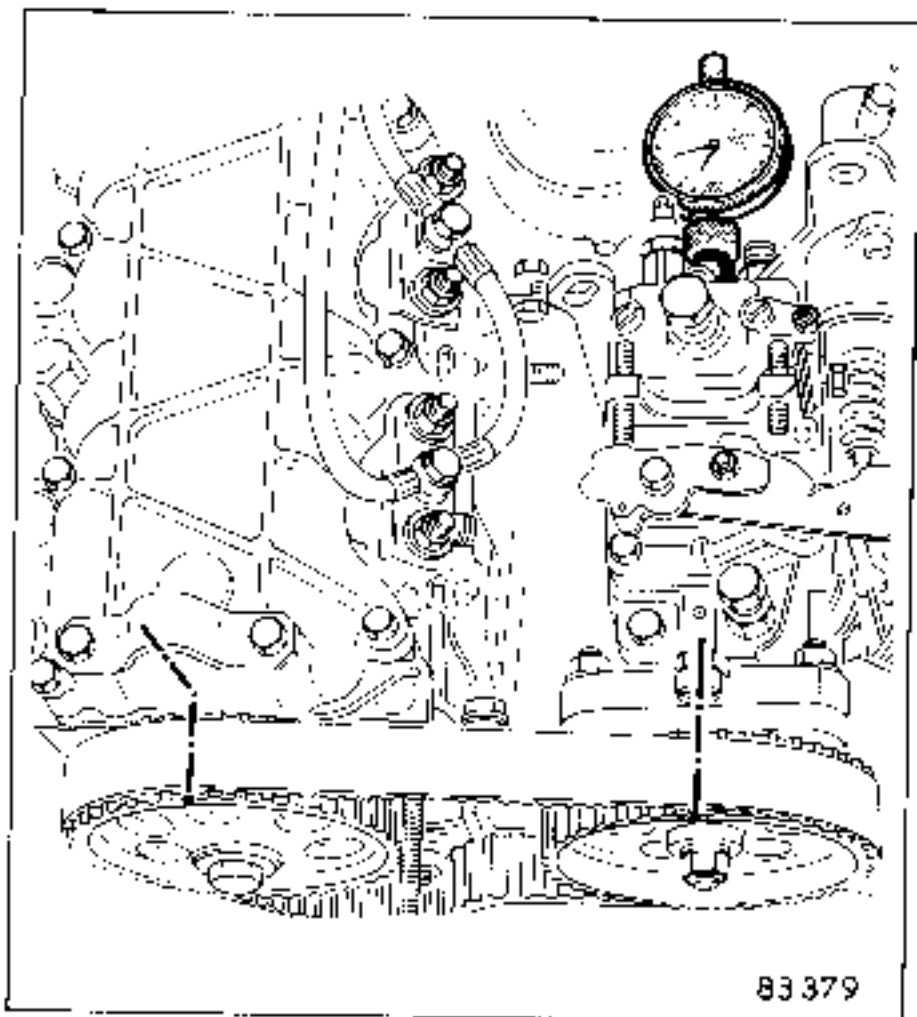
- the alternator drive belt;
- the timing gear casing;
- the spacer ring and remove the timing gear half-casing.

On the Puego

It might be necessary to raise the engine slightly with a jack to remove the bolt near the headlight.



Place the engine on TDC, No.1 cylinder (at flywheel end).

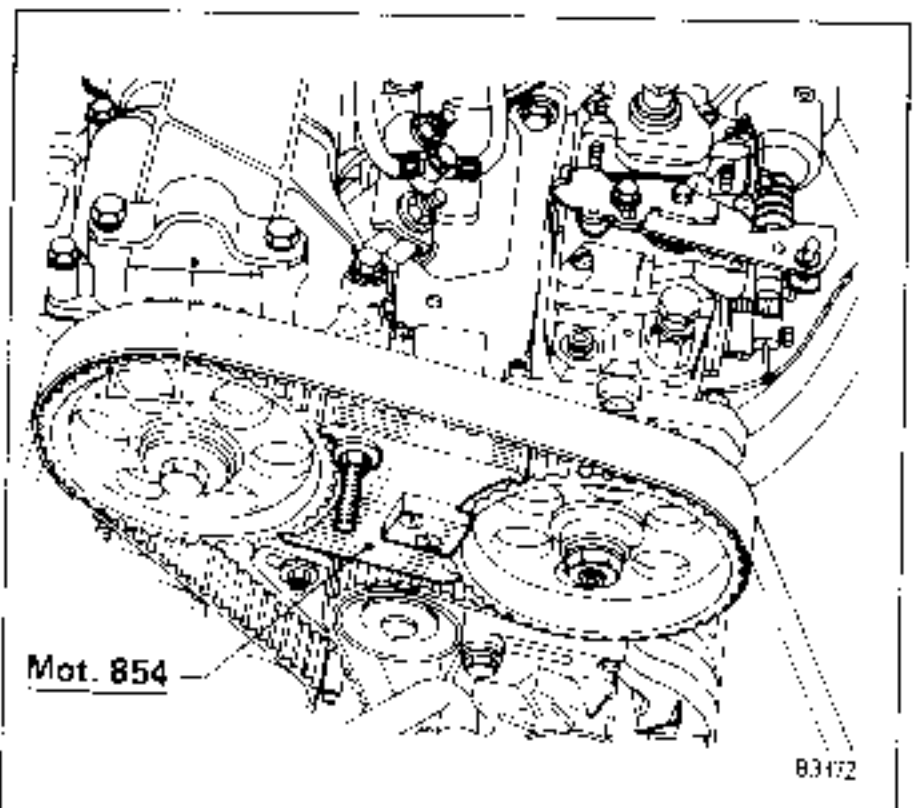


In this position check that:

- the mark on the camshaft sprocket is in line with the centre of the boss on the rocker arm cover;
- the mark on the injection pump sprocket is in line with the centre of the injection pump boss.

Then move back by 3 teeth.

Fit locking tool Mot.854.

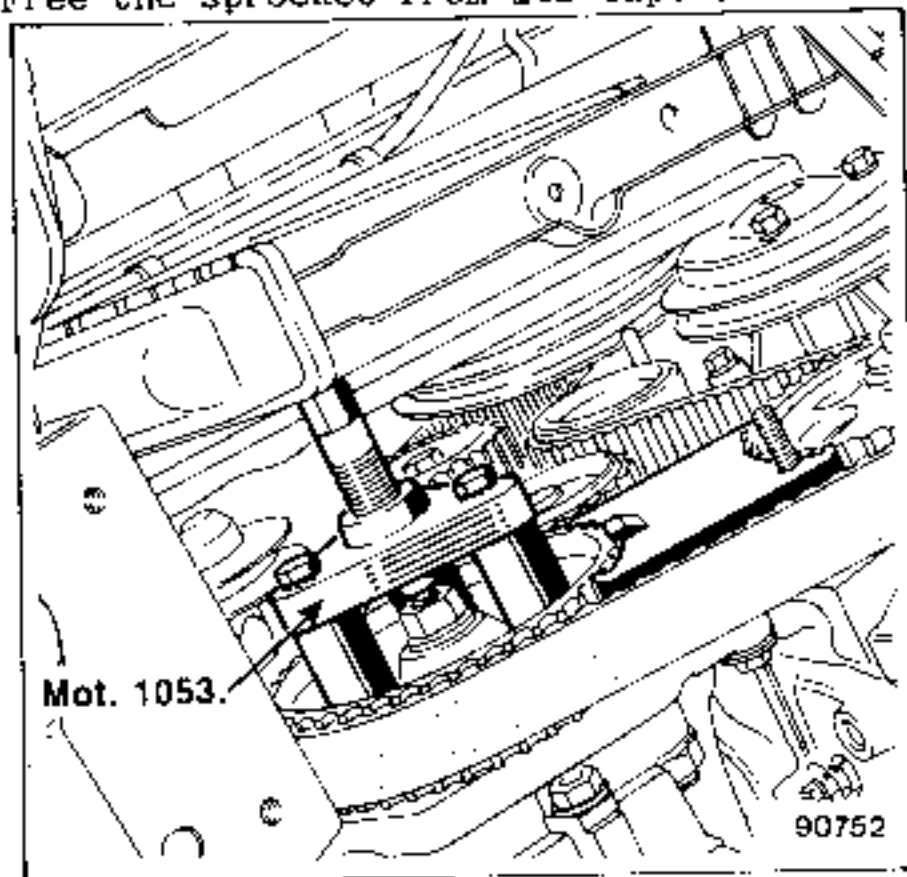


Unscrew the nut on the pump driveshaft until it is flush with the end of the thread.

Fit extractor **Mot.1053** to the pump sprocket. **Never** locate its claws on the sprocket teeth.

Do not strike the assembly with a hammer (risk of internal damage to the pump).

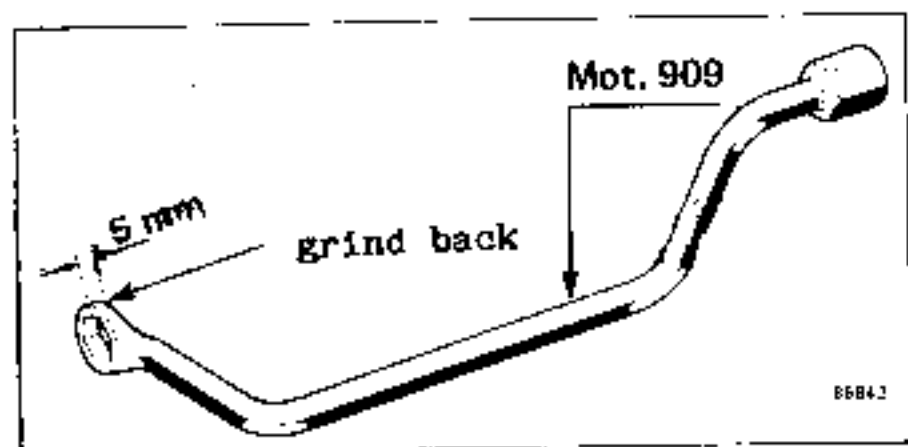
Free the sprocket from its taper.



Remove:

- the protective casing from under the injection pump;
- the pump rear support;
- the pump securing nuts.

To undo the pump lower nut, use spanner **Mot. 909-01** or modify spanner **Mot.909** as shown in the sketch below.



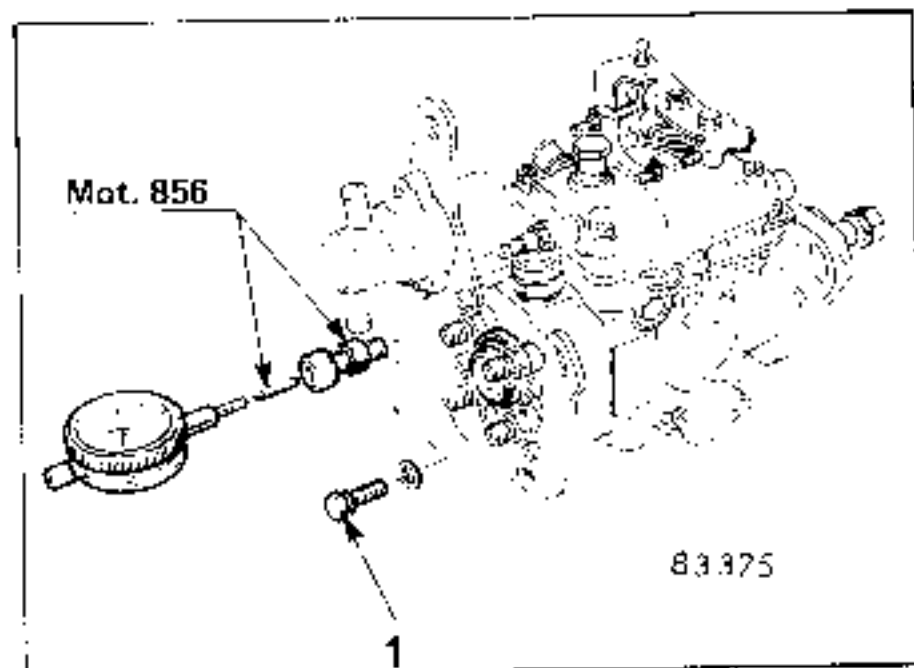
Remove the injection pump and **recover the key from the driveshaft taper.**

TIMING - REFITTING

Screw the dial indicator support **Mot.856** in place of plug (1) and mount the dial indicator and end fitting.

Screw a locknut and nut onto the driveshaft.

Tighten the locknut against the nut away from the bottom of the thread.



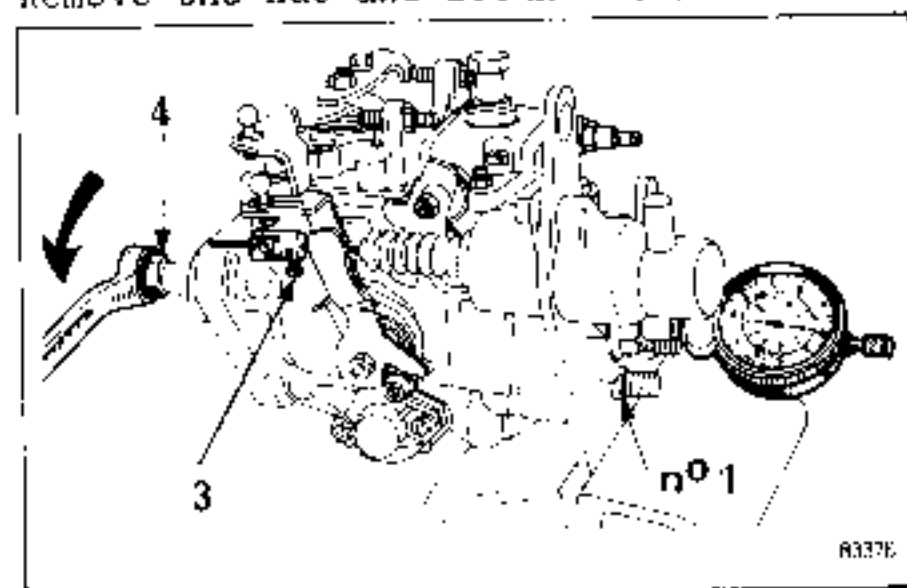
Loosen clevis screw (3), moving the lever back slightly, and turn the clevis by $\frac{1}{4}$ of a turn on the cable clamp to cut out the starting system.

Turn the pump shaft in its correct direction of rotation (arrow) to find the piston BDC.

In this position, adjust the dial indicator half-way along its travel and zero the dial.

Turn the pump shaft in its correct direction of rotation to bring the key just in front of the No.1 outlet centre line, at piston BDC.

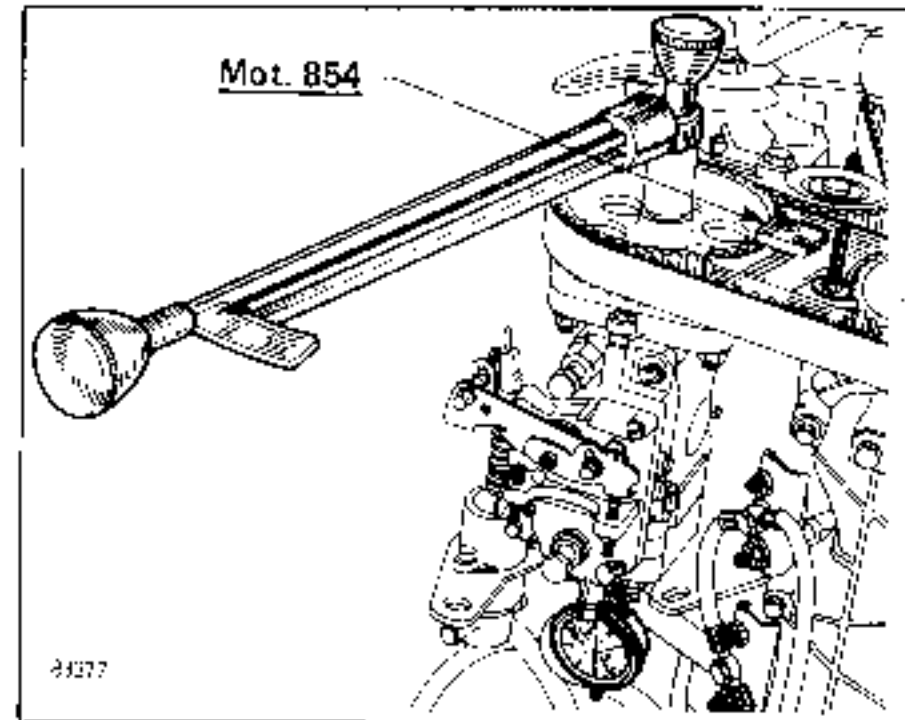
Remove the nut and locknut (4).



Fit the pump, aligning the key with the keyway in the sprocket.

Fit the washers and nuts to the securing flange, without tightening them.

Fit the sprocket securing nut and washer and tighten it to 5 daNm.



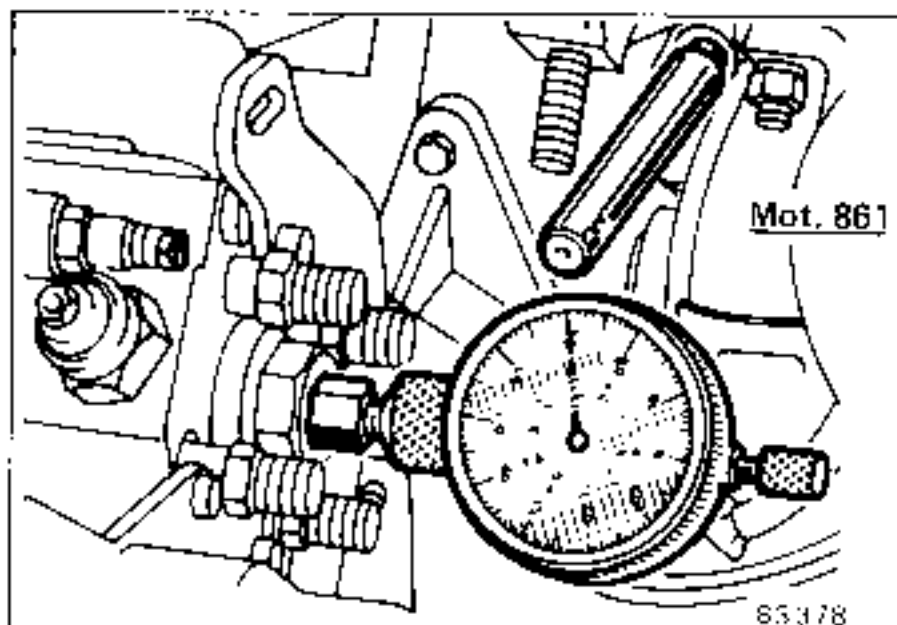
Turn the crankshaft in its normal direction of rotation by two turns and lock it at TDC using gauge Mot.861.

Turn the pump to obtain a piston lift of 0.70 mm (or 0.82 mm for the Jeep XJ) and tighten its securing nuts.

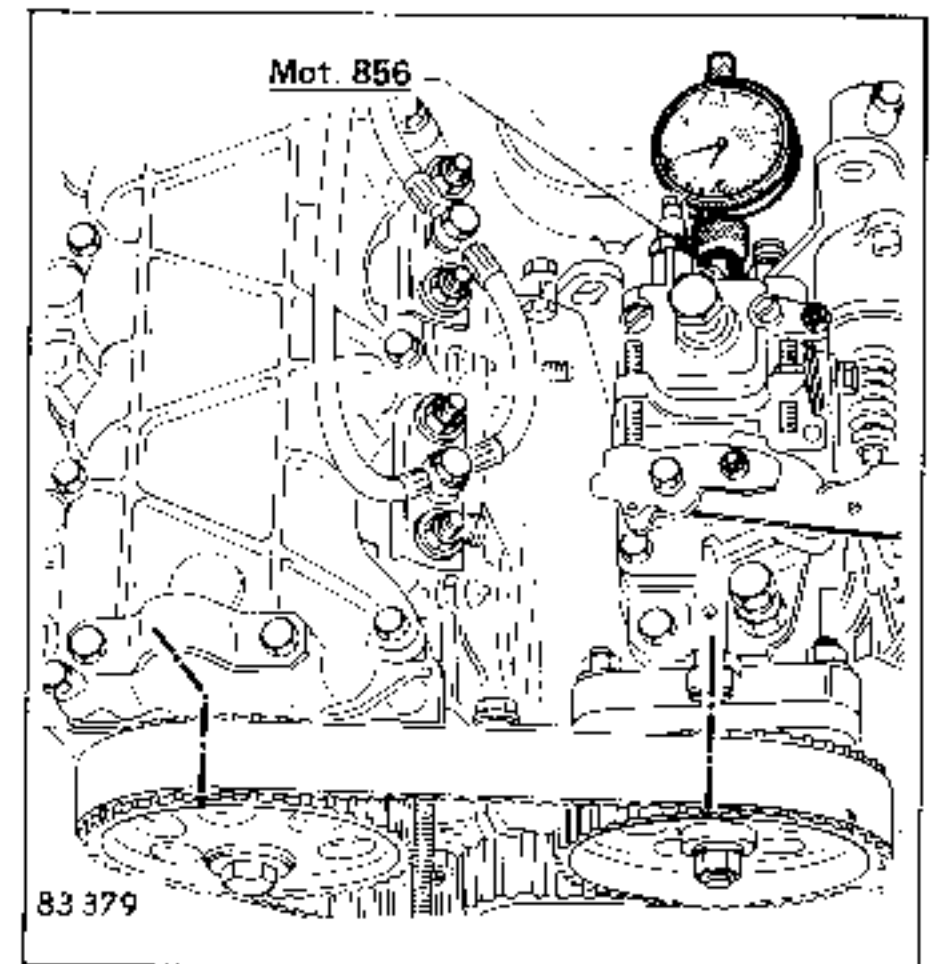
CHECKING THE TIMING

Turn the crankshaft through one and three quarter turns in its normal direction of rotation, check that the dial indicator is in fact on zero at the pump piston BDC, then bring the crankshaft to TDC and lock it with gauge Mot.861.

The dial indicator should show a pump piston lift of 0.69 to 0.71 mm (or 0.81 to 0.83 mm for the Jeep XJ).



Check the timing marks in this position.

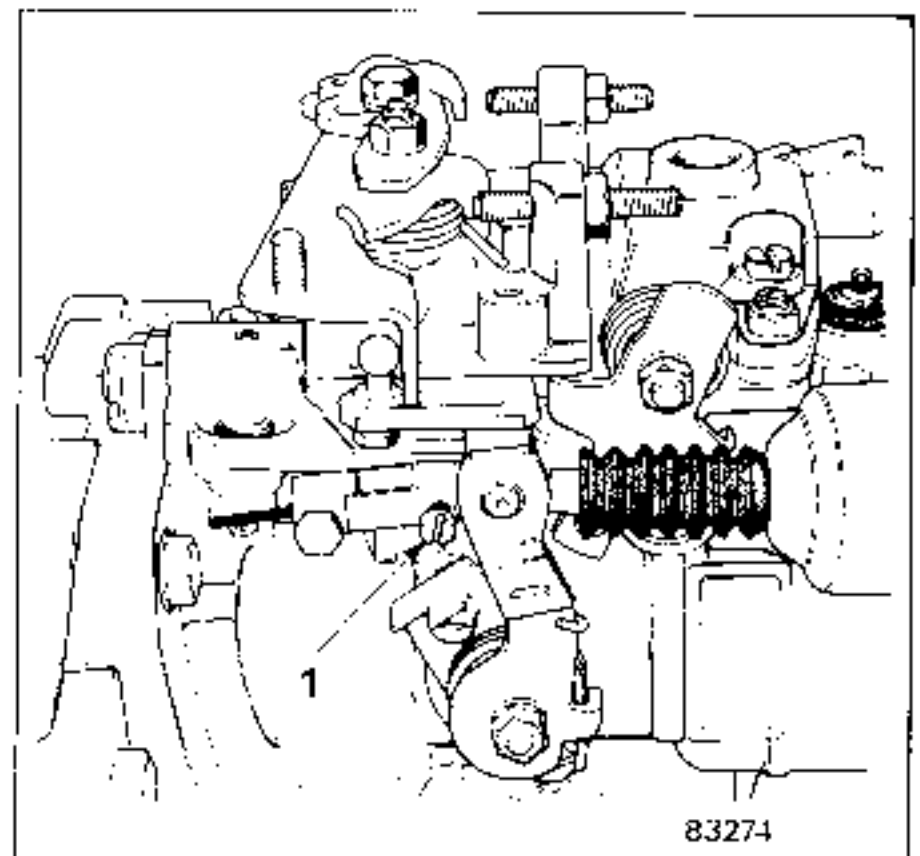


Fit the hydraulic head plug using a new seal.

REFITTING ADJACENT COMPONENTS (Special points)

Compress the cold starting system lever and refit the clevis in its initial position on the cable clamp.

With the lever against the clevis, tighten screw (1).



Adjust the alternator drive belt tension.

Refit the rear support and secure it by tightening its bolts evenly.

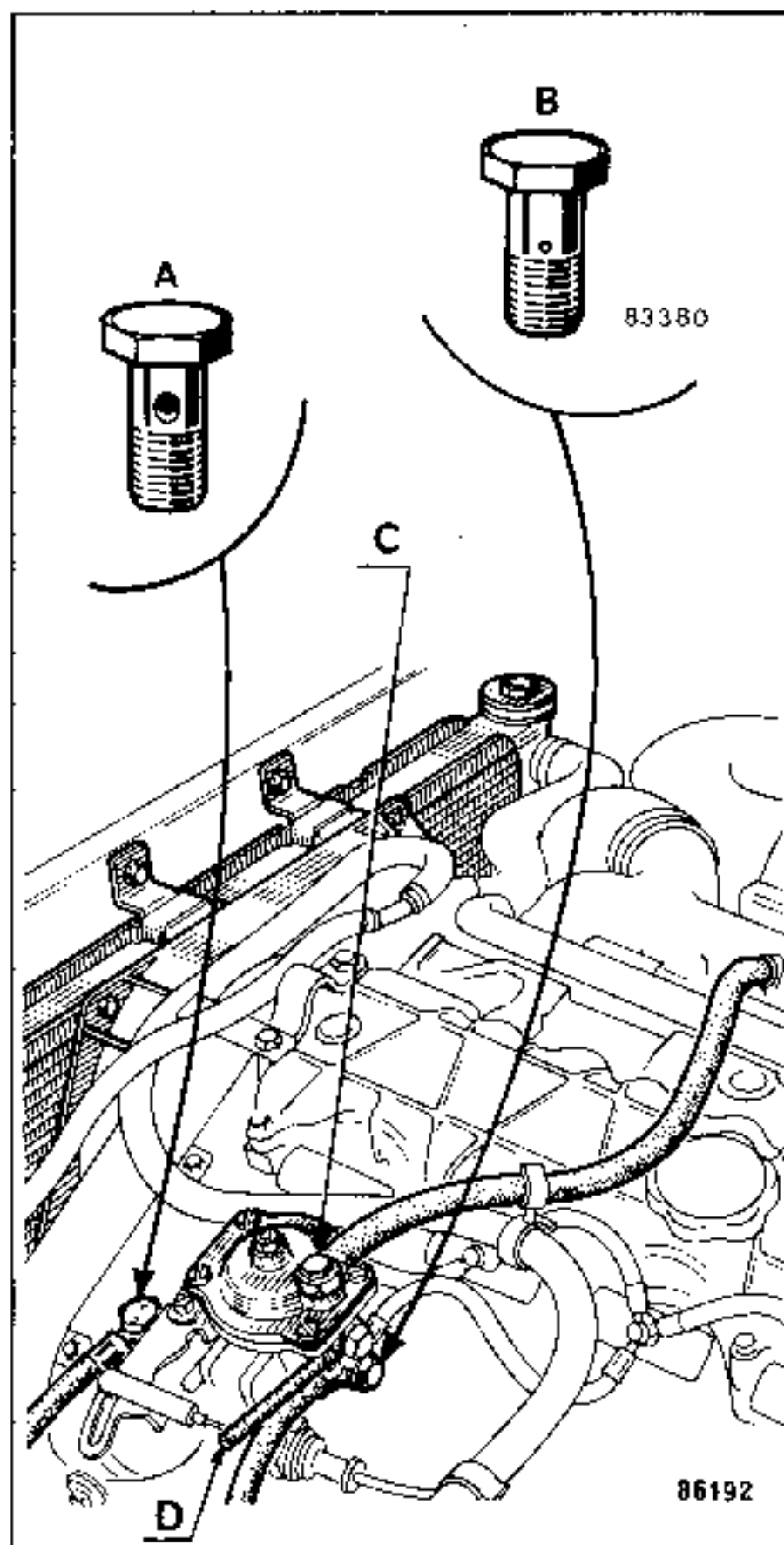
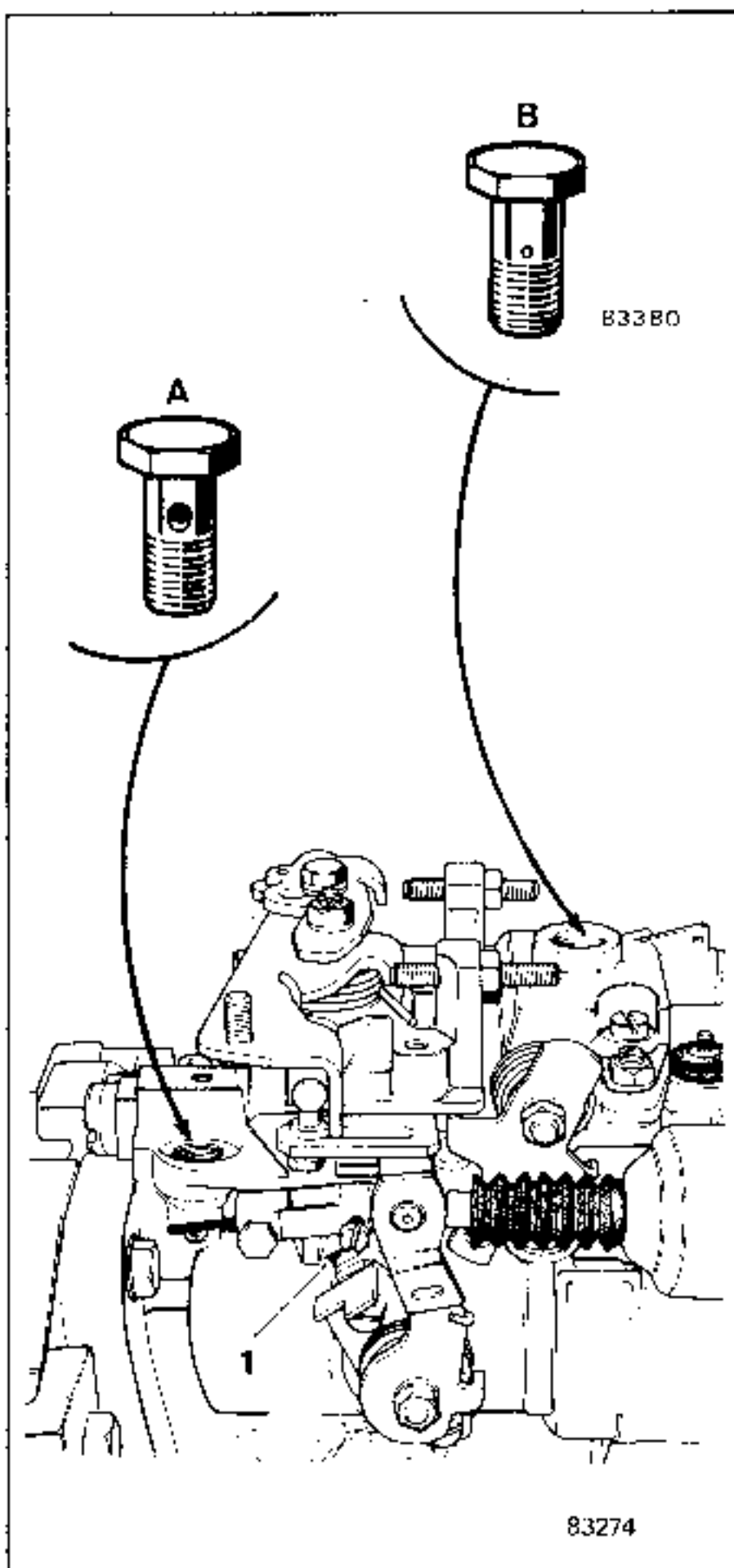
Connect up the feed and return pipes.

WARNING

Do not mix up the banjo bolts:

A - Feed (two 4 mm dia. holes)

B - Return to tank (1 calibrated hole + 1 filter).



TURBO DIESEL.

Refit the turbocharger pressure input union (C).

Note : When new pumps are supplied from the Parts Department there will be a clip blocking the vent hole (D). This is to be removed when the pump is fitted to the vehicle.

ADJUSTING THE THROTTLE CONTROL

Adjust the clip on the cable cover clamp to compress the compensator by approximately 2 mm when the accelerator pedal is at the end of its travel.

Bleed the fuel system.

OPERATION

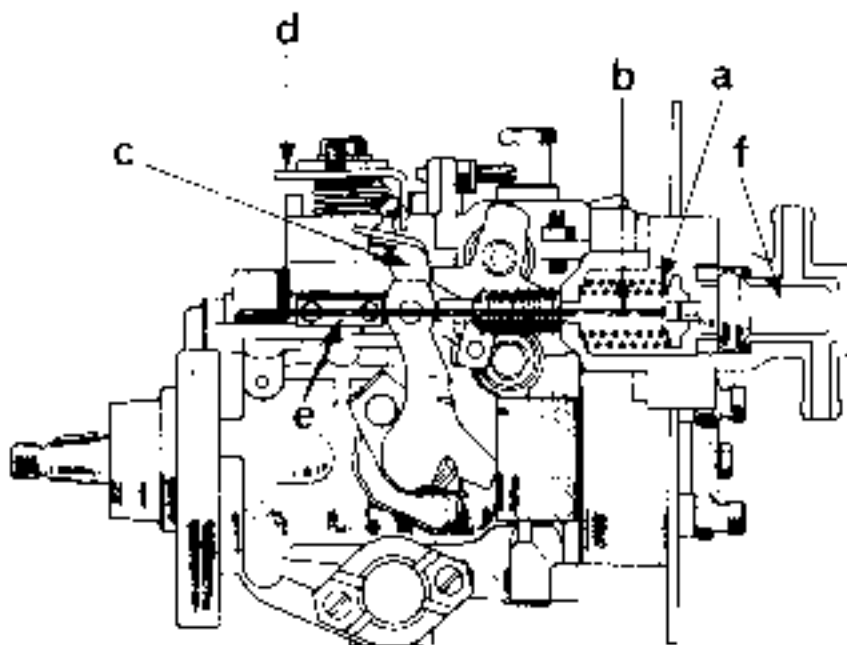
The system is controlled by a thermostatic capsule which detects the temperature of the engine coolant.

The system is also connected to the throttle lever.

When the engine is stationary and cold, springs (a) inside the housing apply tension to a cable (b) which moves control lever (c) into the "ADVANCE" position and throttle lever (d) into the "fast idling" position.

When the engine is started, the coolant temperature rises, thermostatic capsule (f) slowly expands, compresses the springs, cable (b) and control lever (c) move, the advance piston and throttle lever return to their original position.

Note: When timing the pump on the engine, a clevis (e) on cable (b) is used to override the effect of this system.



83280

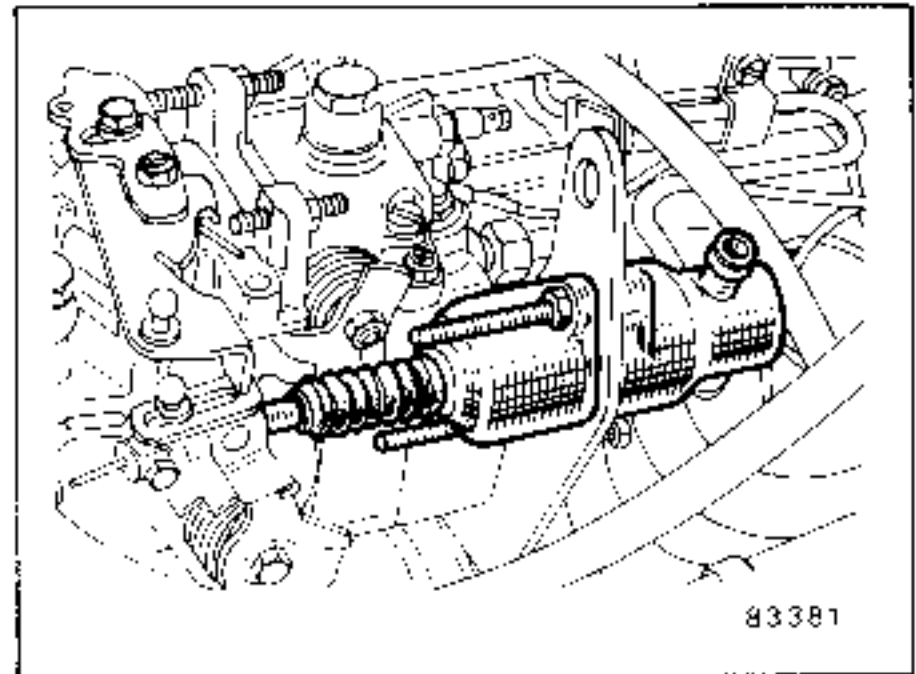
REMOVING

Clamp the pipes on the input and output sides of the capsule (clamps **Mot.453-01**) and disconnect them.

Remove one bolt and fit a threaded rod 6 mm in diameter, 70 mm long and fitted with a nut in its place. Tighten the nut.

Remove the other bolt and fit a second, identical threaded rod and nut.

Then evenly unscrew the two nuts and remove the housing.

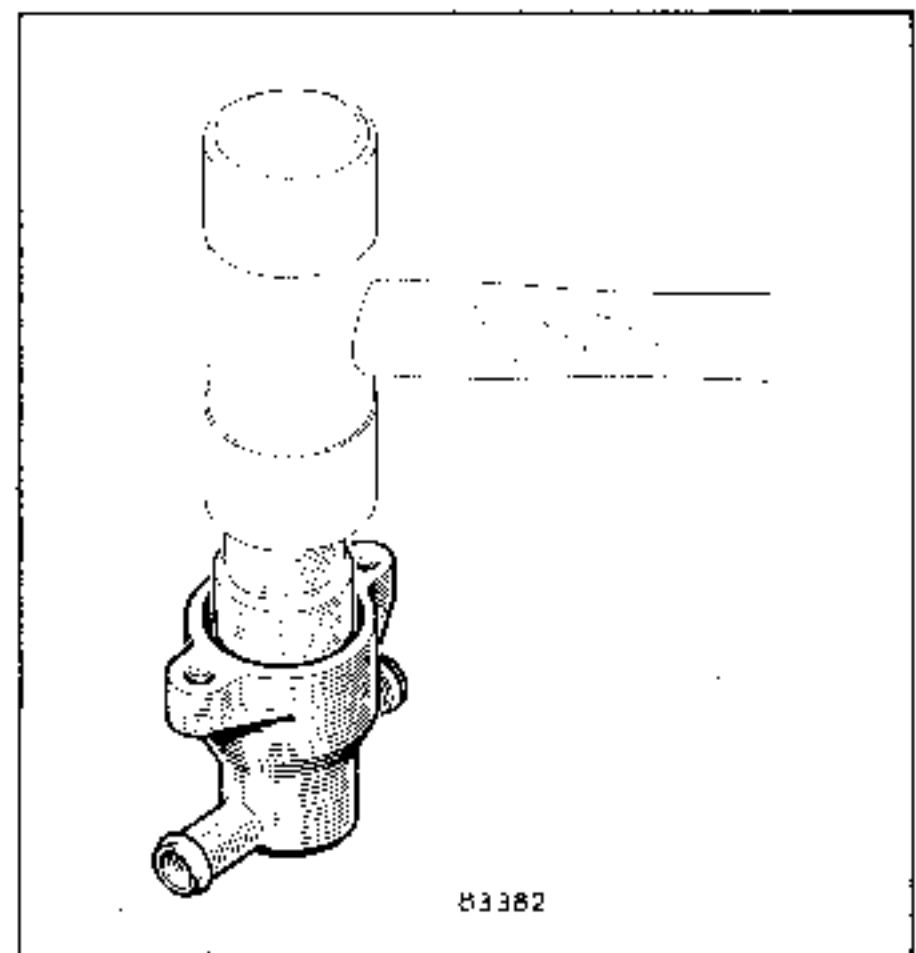


83381

CHANGING

Using a socket with an outside diameter of 26 mm and a mallet, strike the nut sharply to free it.

Then, using the end of an open-ended spanner, unscrew the castellated nut and take out the thermostatic capsule and its seal.



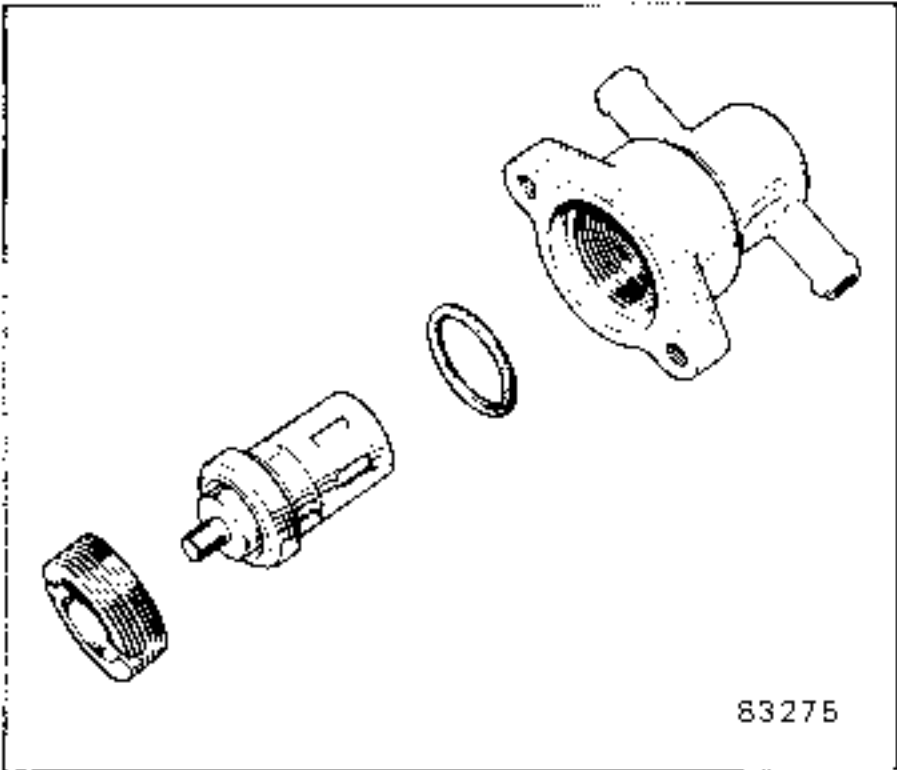
83382

To reassemble:

Grip the capsule body in a vice fitted with soft jaws.

Fit in the following order:

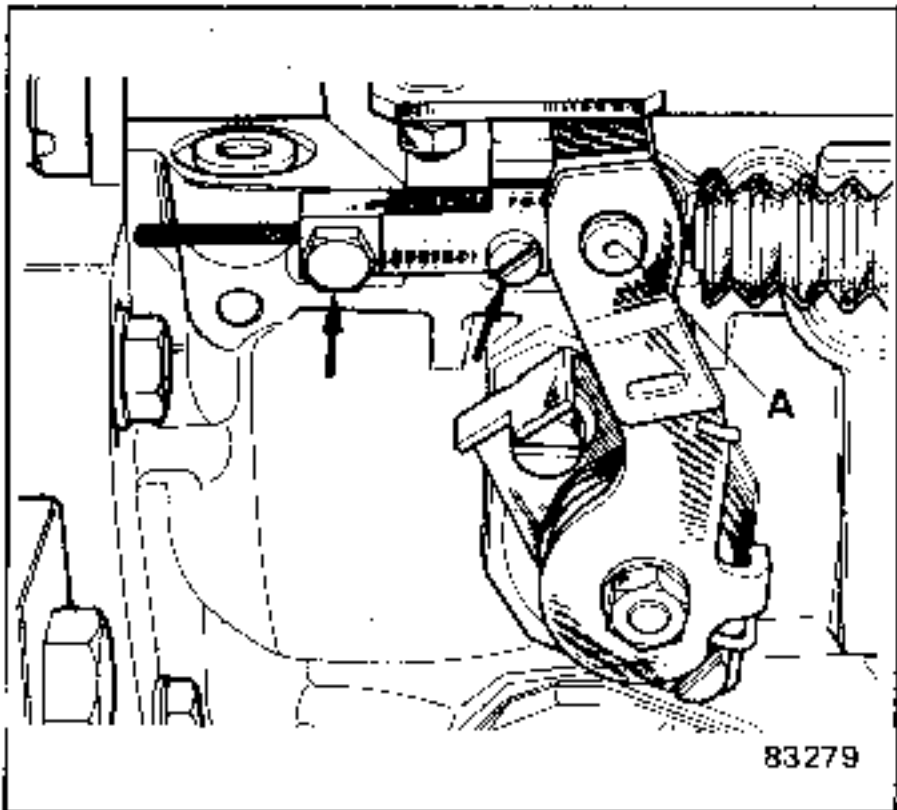
- a **new** "O" ring;
- the thermostatic capsule;
- the slotted nut and tighten it.



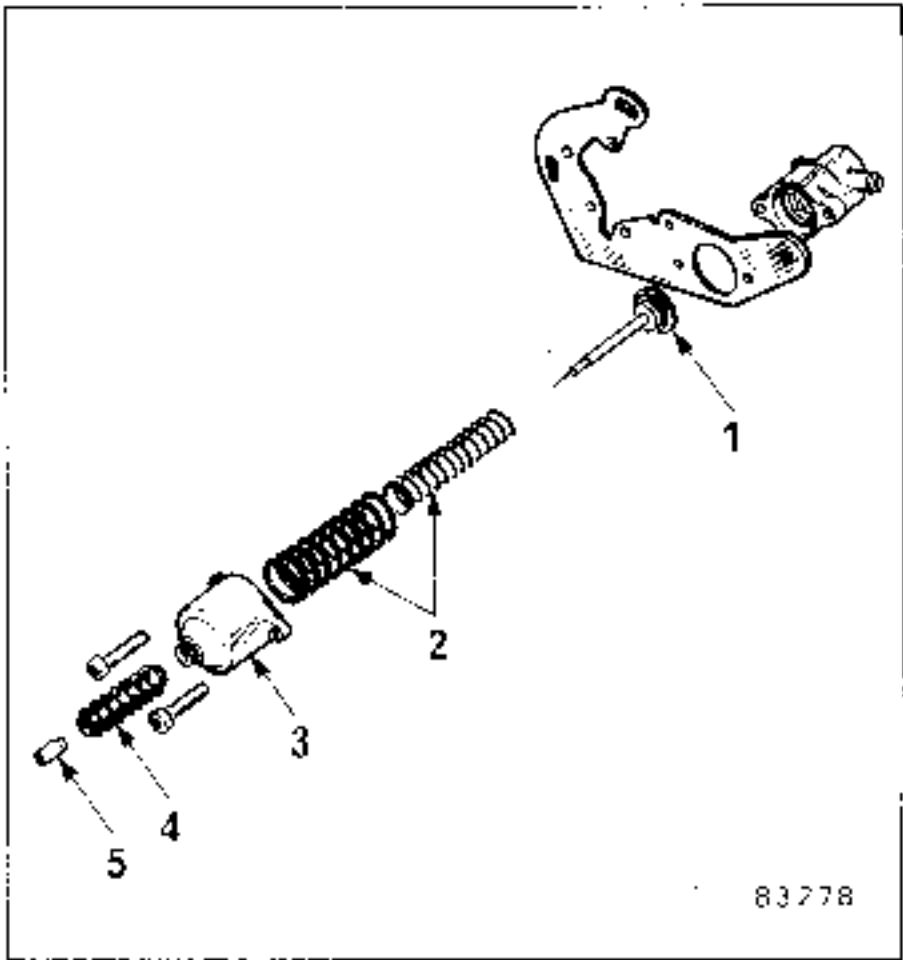
REPLACING THE CONTROL CABLE

Unscrew the screws and remove the cable clamp and clevis.

Take out the cable and separate the various components.



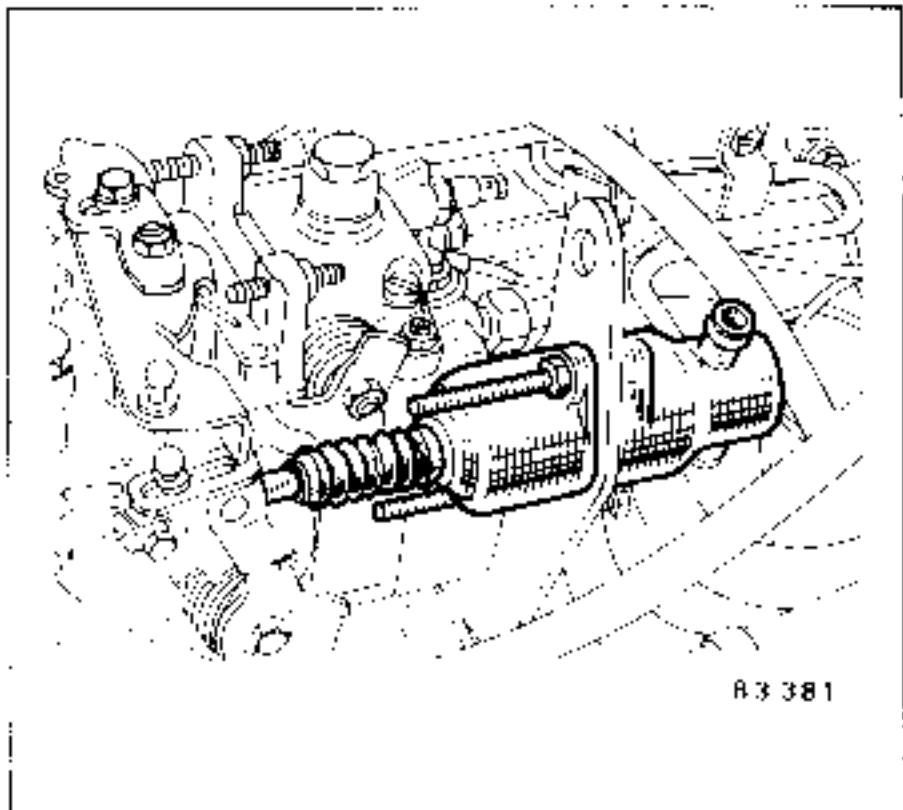
To reassemble, fit components (1) to (5) to the cable in that order.



Screw the screwed rods into the capsule body.

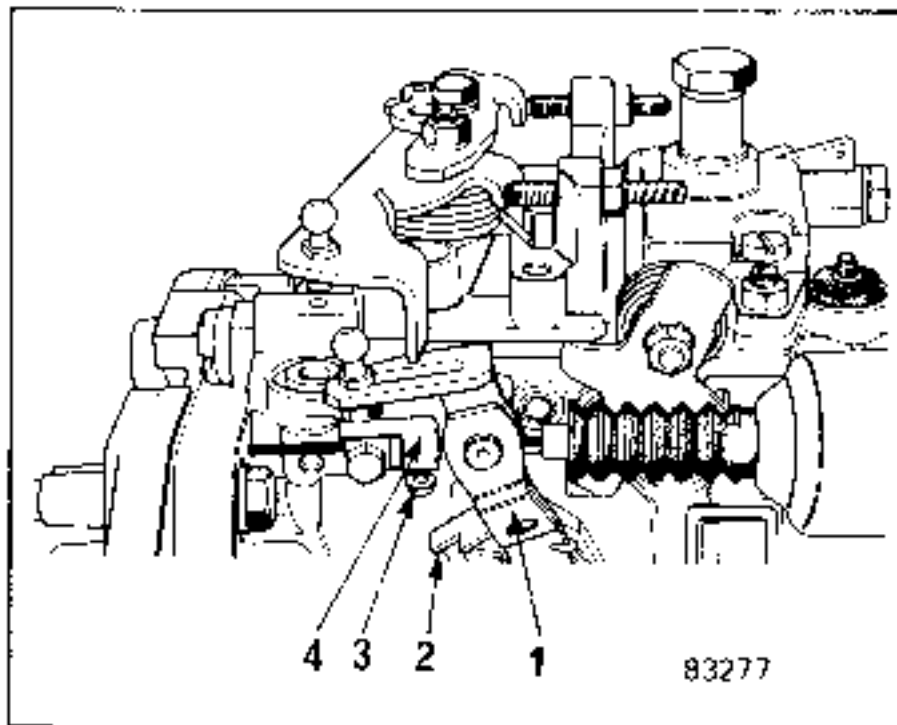
Offer up the capsule body to its support and assemble the two half-bodies by screwing the two nuts evenly down the screwed rods.

Replace each nut and screwed rod by the original bolt, one after the other.



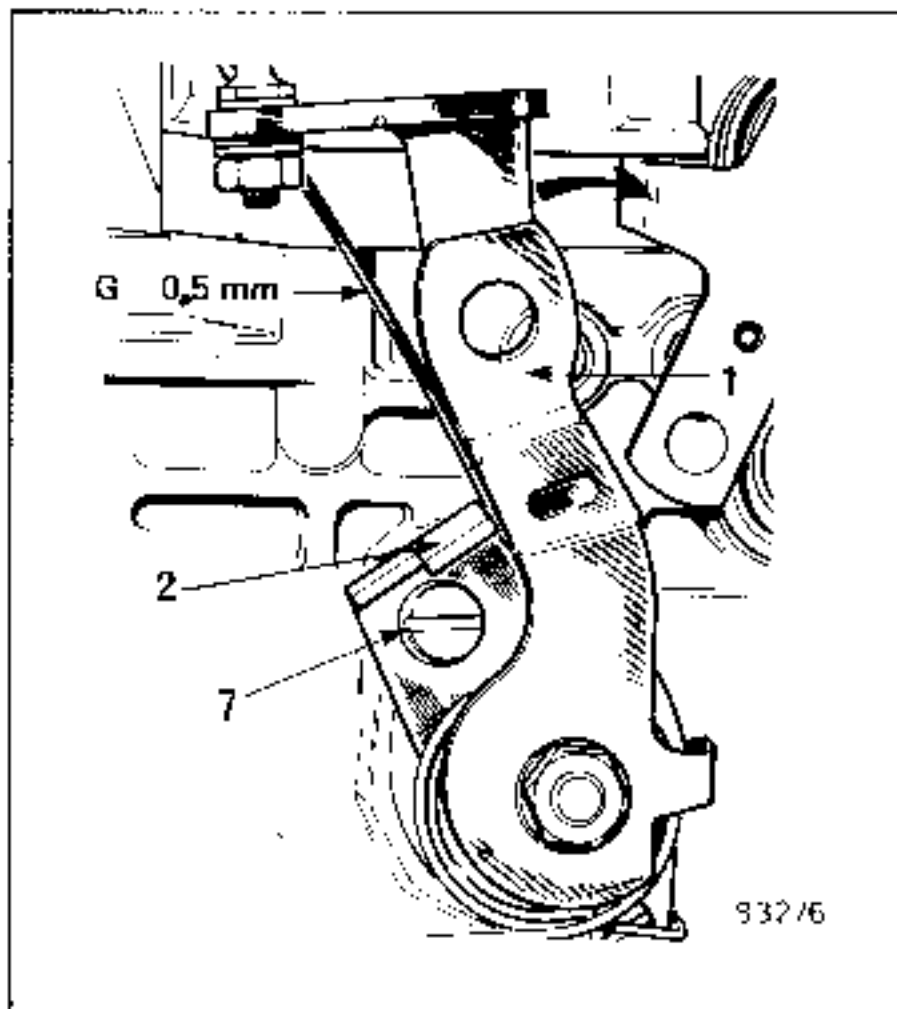
ADJUSTMENT

Check that lever (1) makes proper contact with stop (2). If it does not, loosen screw (3) and turn clevis (4) by $\frac{1}{4}$ of a turn.



Turn the crankshaft through 2 turns in its normal direction of rotation and lock it at No.1 cylinder compression TDC.

Push lever (1) (shown by arrow) to its detent point.



Check that the clearance between (2) and (1), $G = 0.5 \text{ mm}$ [adjust at screw (7)].

Measure the temperature of the capsule (coolant temperature in the cooling system after the engine has been stopped for a minimum of 2 hours 30 minutes) and determine adjustment dimensions "A" and "B" from the graph on the following page.

Adjustment example at an ambient temperature of 22°C:

Dimension "A" = 5.9 mm

Dimension "B" = 3.5 mm.

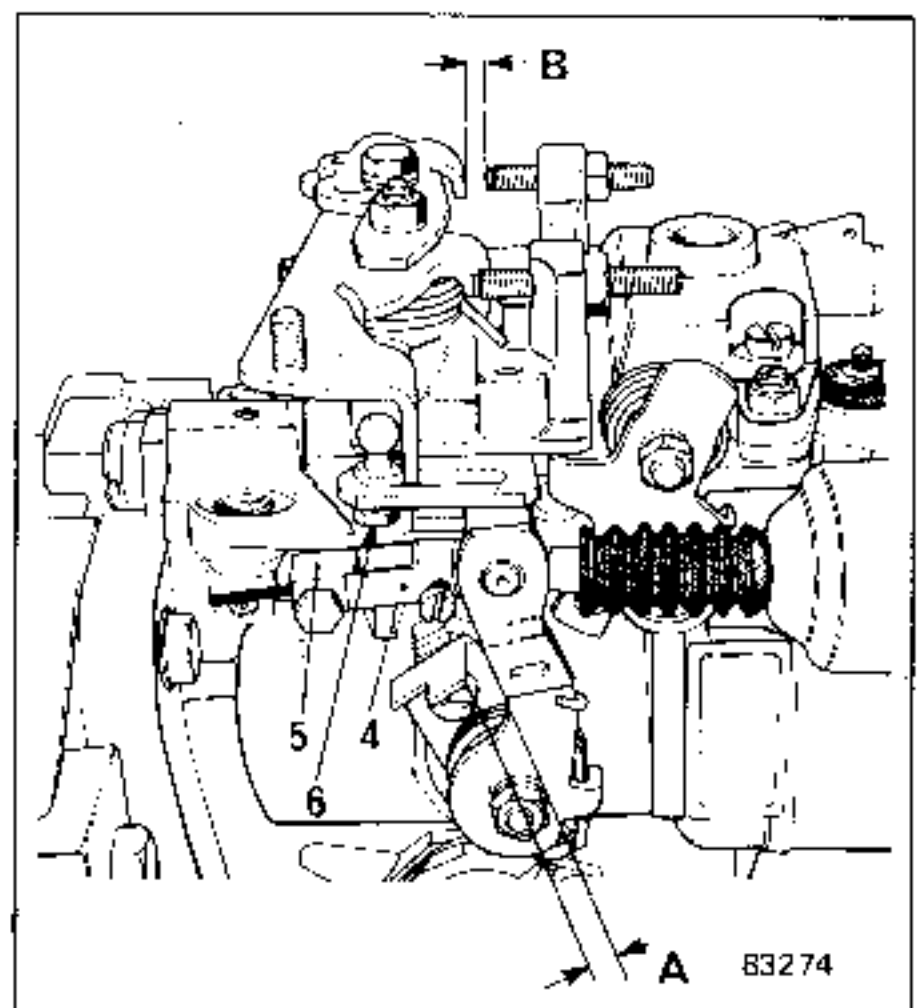
Place shims 5.9 mm thick (dimension "A") between control lever (1) and its stop (do not allow for the 0.5 mm clearance). Tension the cable and bring clevis (4) and cable stop (5) against lever (1).

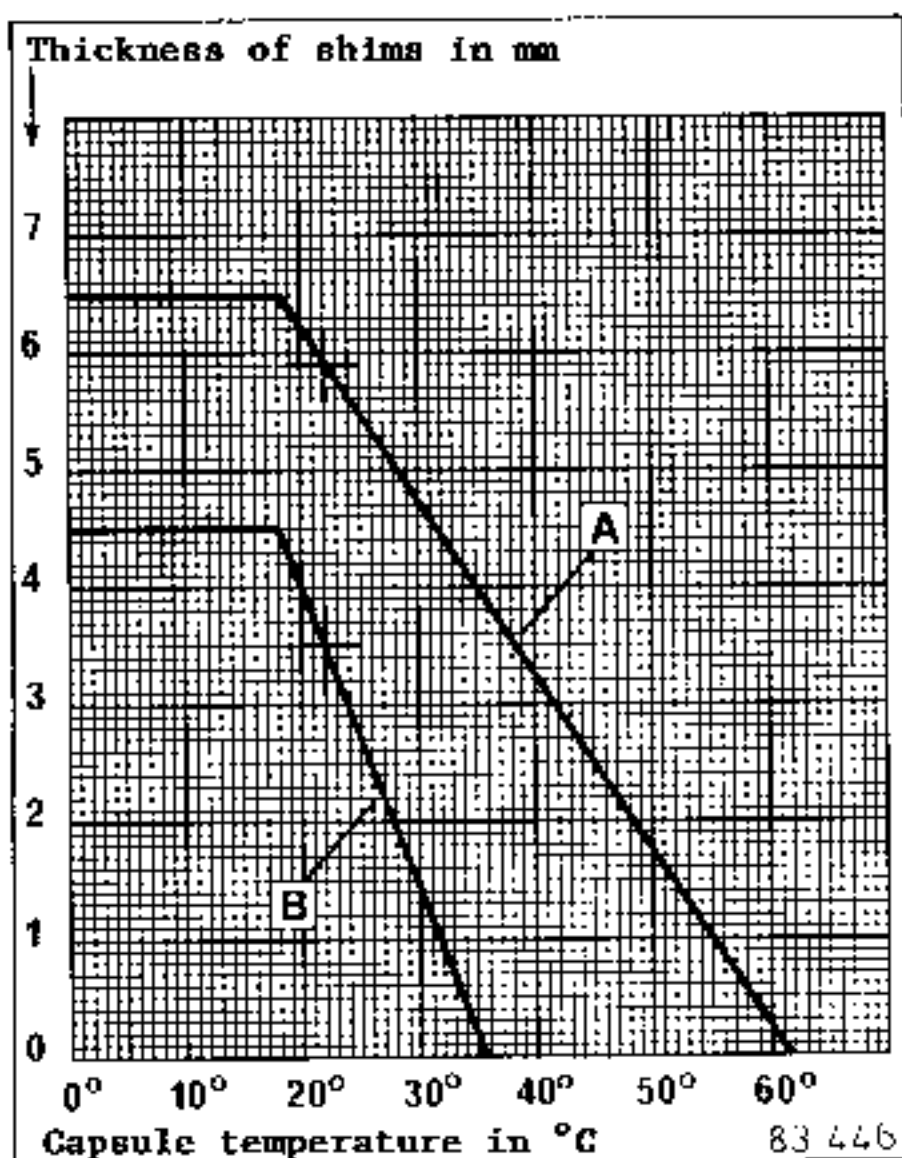
Remove the adjusting shims and check that the clearance between stop (2) and lever (1) is in fact dimension "A". If not, correct it.

Place shims 3.5 mm thick (dimension "B") between the throttle lever and its idling stop.

Loosen the screw on ball joint (6) and bring the ball joint against the control lever, then retighten.

Remove the adjusting shims and check that the clearance between the throttle lever and its idling stop is in fact dimension "B". If not, correct it.





Example of dimensions according to capsule temperature.

Capsule temperature		Dim. A in mm	Dim. B in mm
Less than	18°C	6.5	4.5
	22°C	5.9	3.5
	25°C	5.5	2.7
	30°C	4.75	1.5
	35°C	4	0.2
	40°C	3.25	0

Check the engine speeds.

CHECKING THE ENGINE SPEEDS

Warm up the engine to its normal operating temperature.

Check that the throttle lever and the automatic advance lever are free and against their respective stops.

ADJUSTING THE IDLING SPEED

Idling speed: see "Specifications".

If correction is necessary, turn adjusting screw (7).

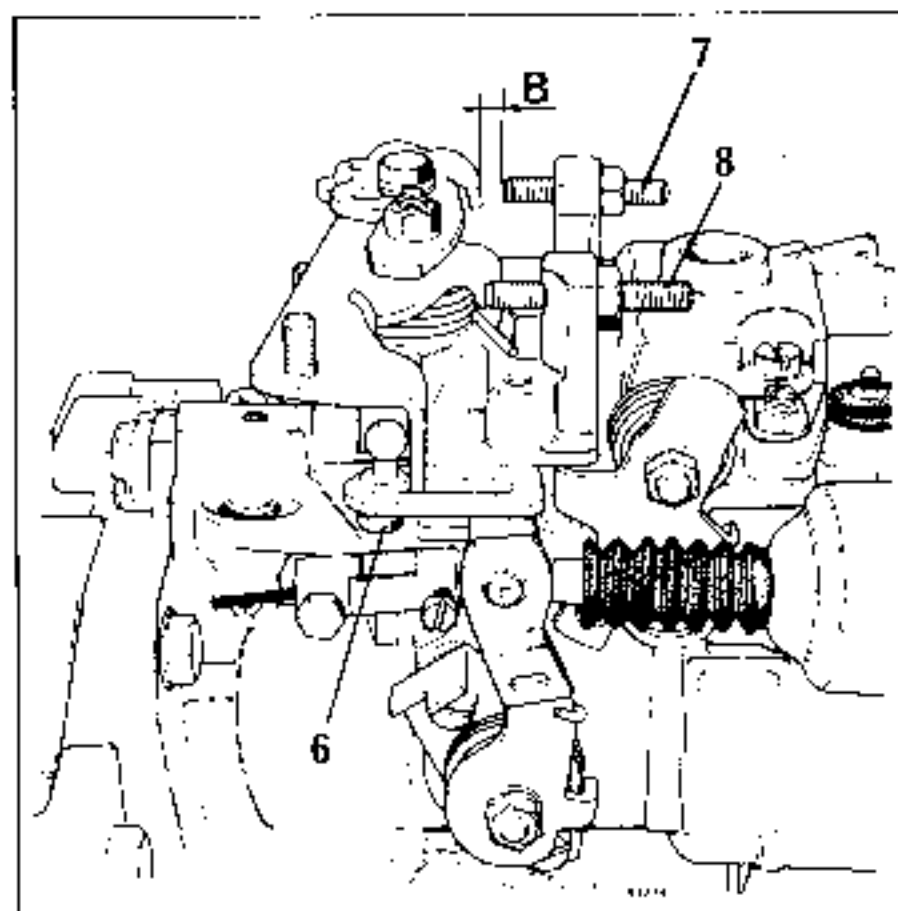
After adjusting the idling speed, recheck dimension (B).

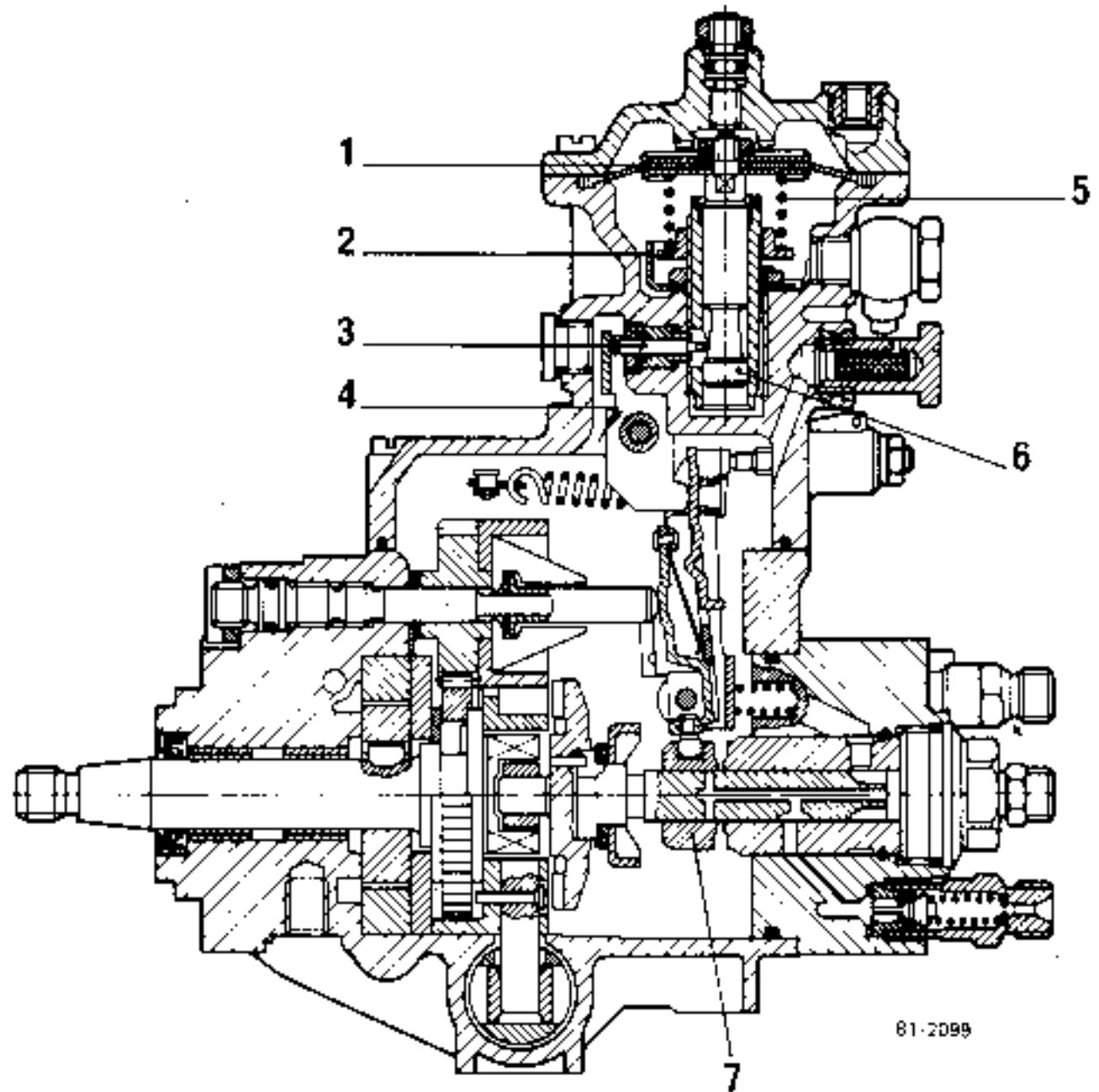
CHECKING THE MAXIMUM SPEED

Warm engine: fully open the throttle with the lever against screw (8).

The speed should be within the specified tolerances.

Maximum speed stop screw (8) is sealed at the factory with a dab of varnish. It should only be adjusted by an injection centre specialist.





81-2099

- 1 = diaphragm .
- 2 = adjusting nut
- 3 = guide pin
- 4 = stop lever

- 5 = compression spring
- 6 = adjusting pin
- 7 = delivery adjusting ring.

The engine is fed by an injection pump fitted with a "LDA" corrector which adjusts the pump delivery according to the boost pressure.

DESCRIPTION

The "LDA" corrector incorporates a diaphragm (1) which is subject:

- at the top to the pressure in the inlet manifold;
- at the bottom to atmospheric pressure or an altimetric corrector (Jeep).

A spring (5) holds the diaphragm in the low delivery position.

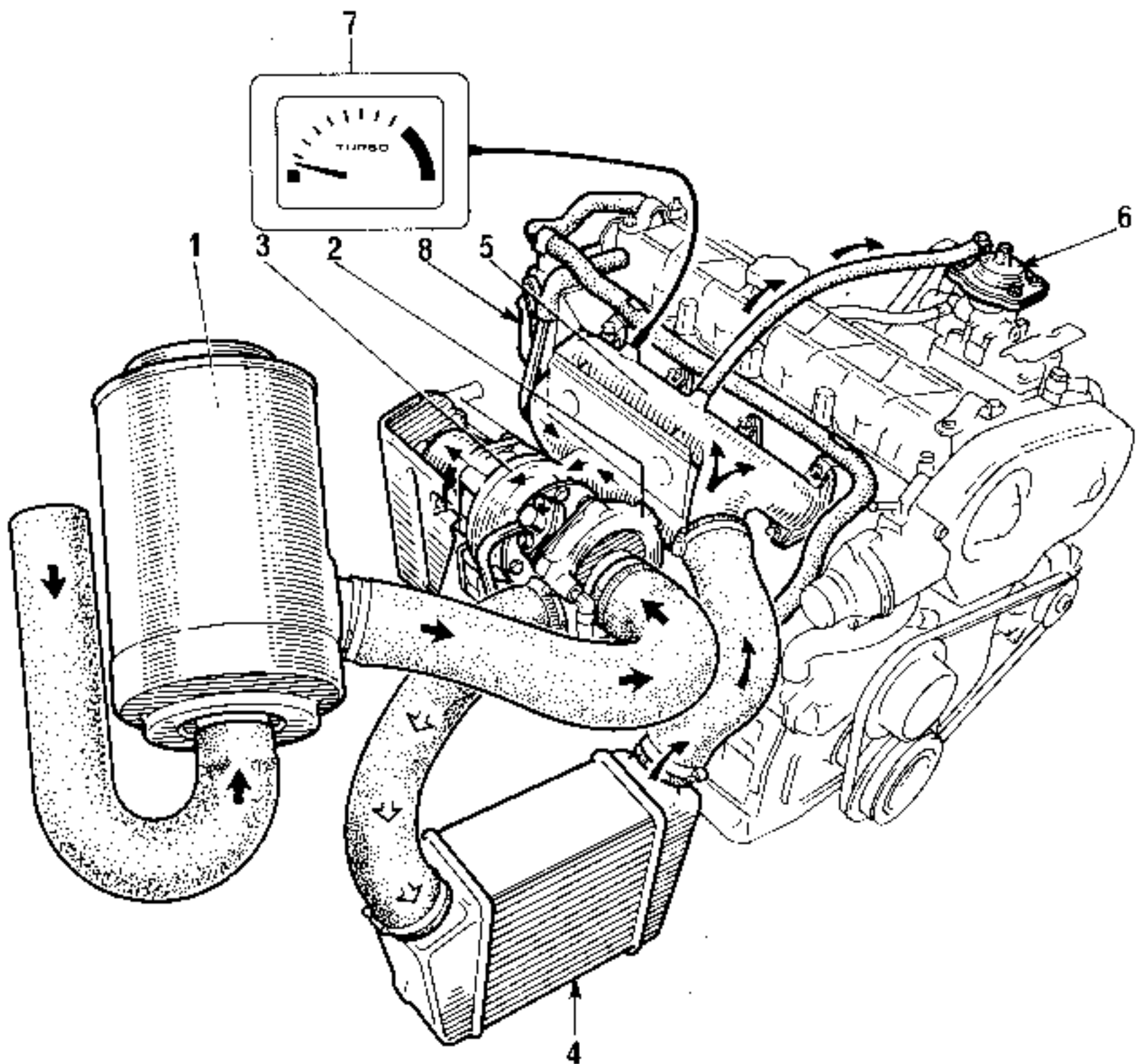
Nut (2) adjusts the tension of spring (5) to vary the delivery according to the boost pressure.

Note: The pump settings are sealed with dabs of paint. These adjustments are only to be touched by an injection centre specialist.

PRINCIPLE OF OPERATION




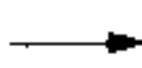
The "LDA" corrector limits the injection pump delivery to reduce smoke emission during acceleration or at low speed and full load.

As soon as the boost pressure acts on the diaphragm, it moves and takes with it adjusting pin (6) and guide pin (3), lever (4) pivots and thus allows delivery ring (7) to move in the increased delivery direction.



B6127

- 1 = Air filter
- 2 = Intake air compressor
- 3 = Drive turbine driven by exhaust gases
- 4 = Boosted air cooler
- 5 = Boosted air manifold
- 6 = Injection pump with "LDA" delivery corrector
- 7 = Pressure gauge on instrument panel (showing boost pressure)
- 8 = Drain casing

-  Air at atmospheric pressure
-  Compressed intake air
-  Cooled compressed air
-  Exhaust gases

Note: Oil vapour from the crankcase is passed into the drain casing (8) which is connected firstly to the sump and secondly to the air intake on the input side of the turbocharger.

Vehicle	Assembly type	Type	Engine
RENAULT 5	2 3	B - C - S 404	F8M..720
EXPRESS	2 3	F 404	F8M..720
RENAULT 9	1 2	L 424	F8M..700
RENAULT 11	1 2	B - C - S 374	F8M..700

Description	Make and Type	Special details
Injection pump	BOSCH VE 4/9 F 2400 R95	Single piston rotary pump with mechanical centrifugal governor, automatic hydraulic advance, electrically controlled hydraulic cold start, and solenoid shut-off.
Pump timing (engine at T.D.C., pump lift)	0.65 ± 0.02 mm	
Injectors	BOSCH KCA 30 S 44	
Pintle and seat assemblies	BOSCH DN OSD 189/	Setting 130 + 8 - 5 bars
Fuel filter	BOSCH ROTO DIESEL PURFLUX	1 Quick release filter element with integral water drain. 2 With incorporated priming pump. 3 With incorporated priming pump and diesel fuel heater. Note: As from 1987 vehicles are equipped with filters with a diesel fuel heater which heats the fuel via the engine cooling system.
Injector pipes	—	Outside Ø 6 mm Inside Ø 2 mm Length 275 mm
Thermostat (fast idle)	CALORSTAT	Travel 7 to 8.5 mm between 30° and 67°C
Cold start advance system feed thermal switch	EATON 45°C (1) EATON 60°C (2)	Activating temperature : closed circuit = 50 ± 3°C (1) 65 ± 3°C (2) De-activating temperature : open circuit = 40 ± 3°C (1) 55 ± 3°C (2)
Cold start advance system	Built into pump	Operating time 0.30 minutes at + 20°C to 2.45 minutes at - 20° C
Thermal element		Resistance - 23 ohms.

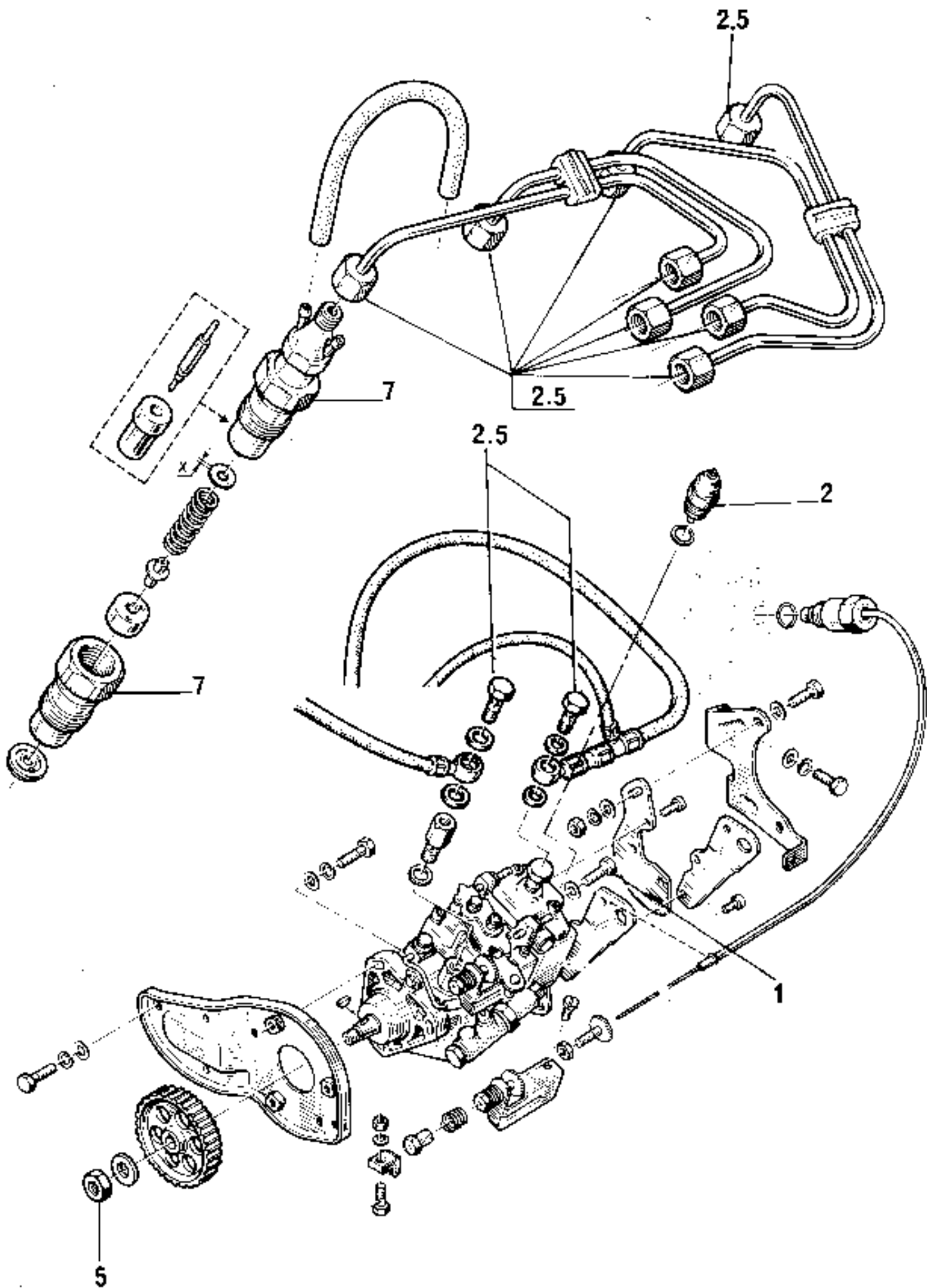
SETTINGS

Idling	850 ± 25 rpm
Fast idle	1 150 ± 50 rpm
Max. speed	5 300 ± 100 rpm
Smoke density	
Approved figure	1.20^{m-1} : 39 %
Maximum legal	2^{m-1} : 55 %

TIMING TEST (on diagnostic bay)

Injection Pump	Idling speed r.p.m.	Injection commences Before T.D.C.
BOSCH VE ... R95	850 ± 25	11.5° ± 1°

Readings taken with a strobe light across the flywheel/clutch housing timing marks.

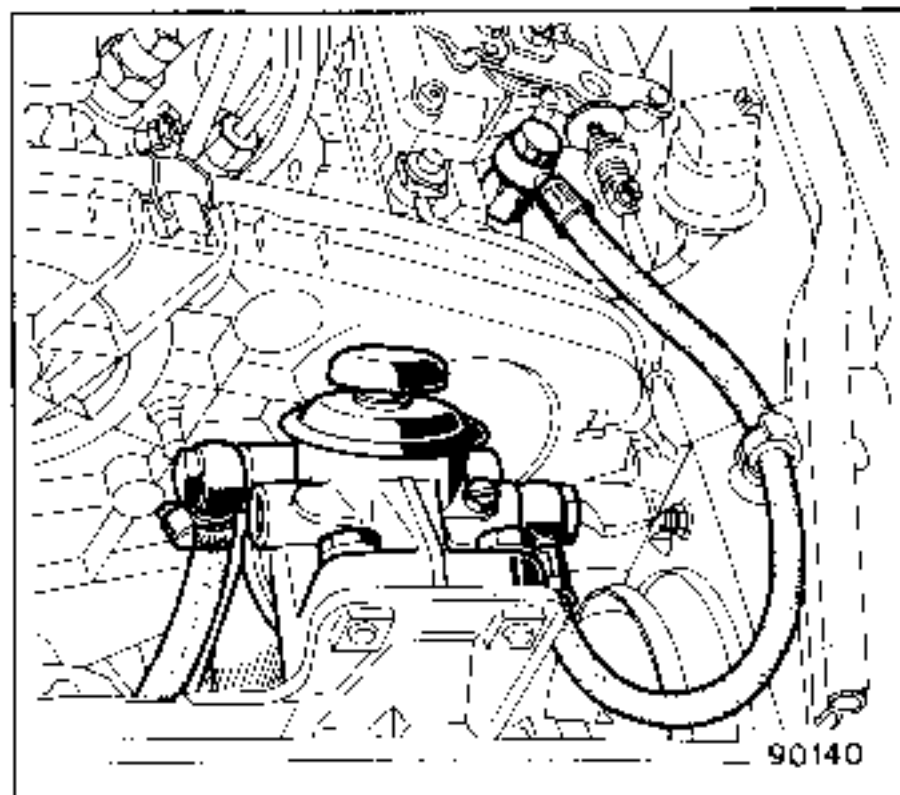


ESSENTIAL SPECIAL TOOLING

Mot. 856	Dial indicator support
Mot. 861	Top dead centre gauge pin (40 mm shorter for B-C-F-S 404)
Mot. 996	Injection pump sprocket locking tool
Mot. 1053	Injection pump sprocket extractor
Mot. 1054	Top dead centre gauge (replaces Mot.861 on B - C - F - S 404)

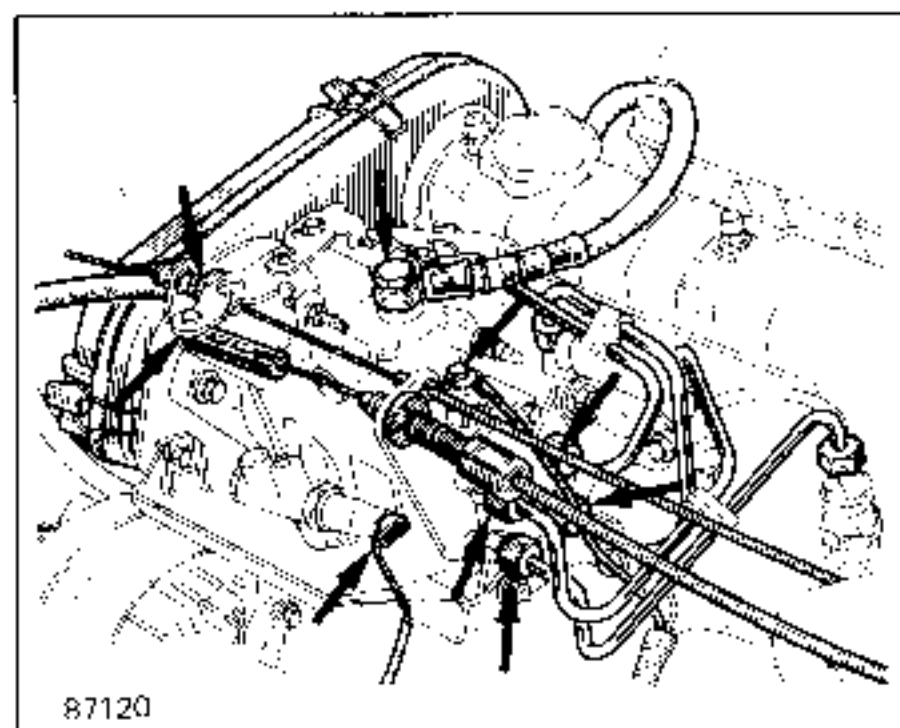
Removal:

NOTE: On vehicle types B - C - F and S 404 the fuel filter must be disconnected and removed in order to remove the injection pump.

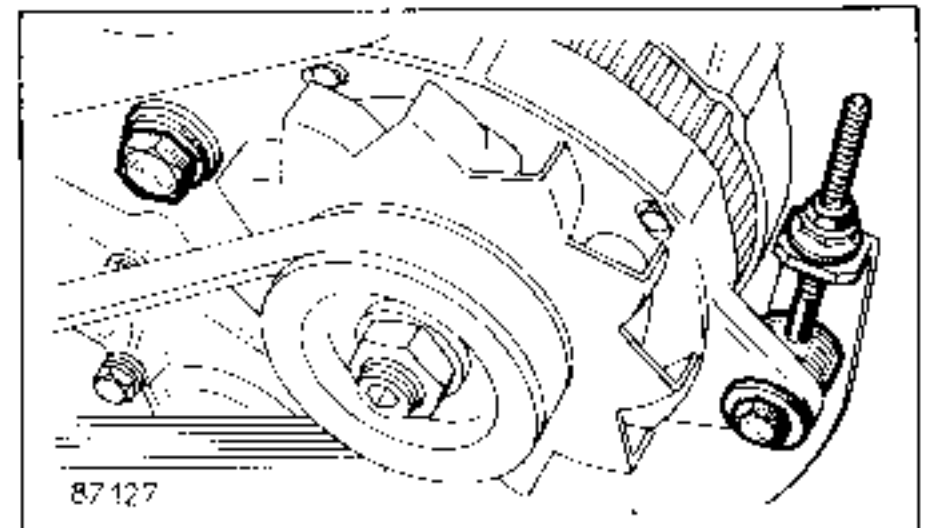


Disconnect the battery.

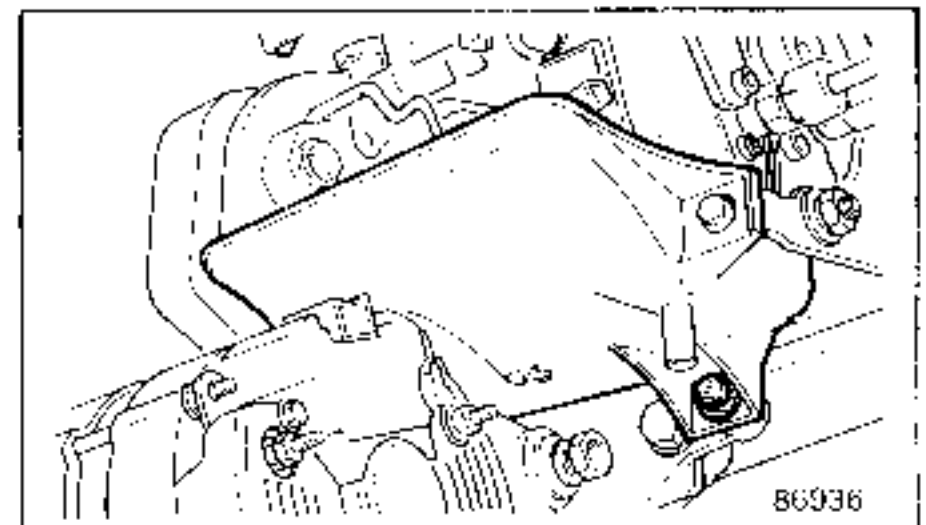
Disconnect or remove the cables, wires and pipes from the pump.



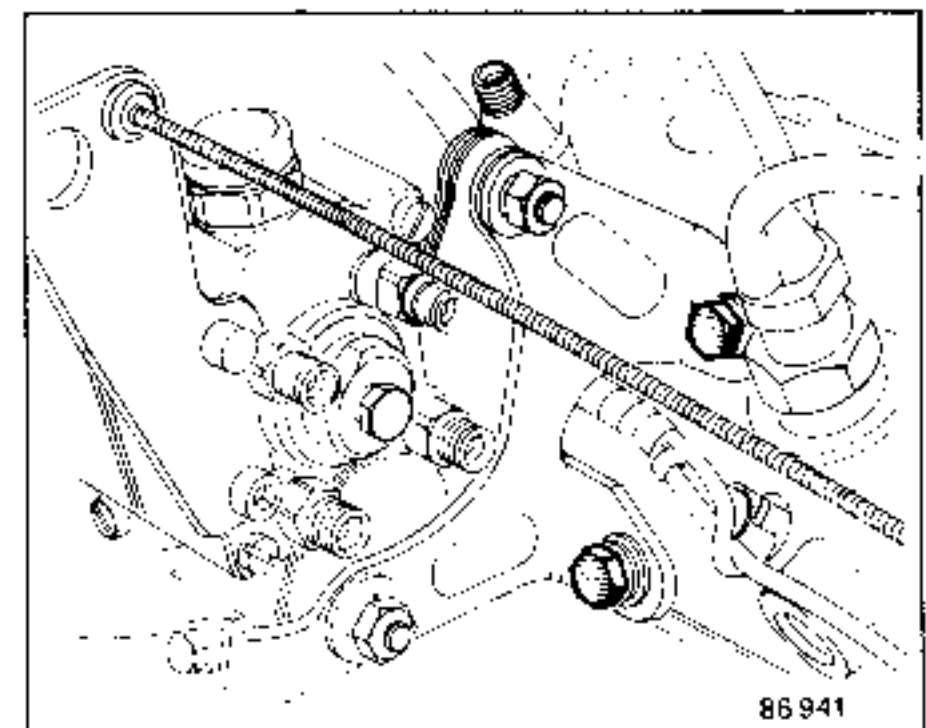
Slacken off the alternator belt.



Remove the alternator protective casing.

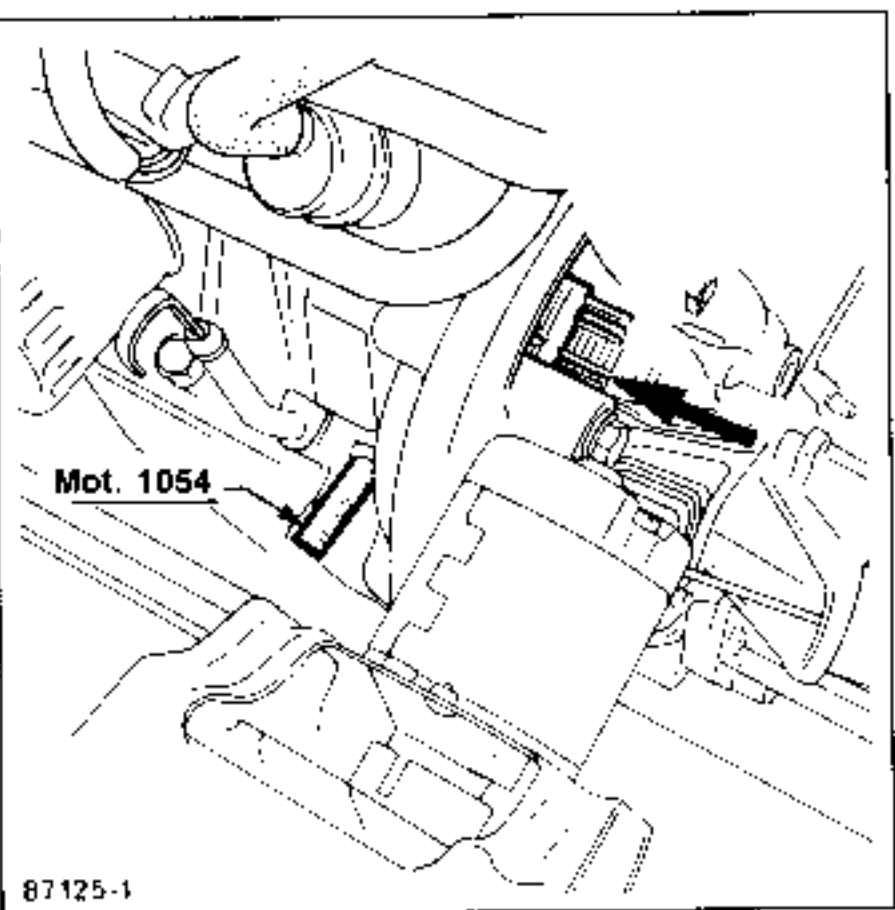


Remove the pump rear support.

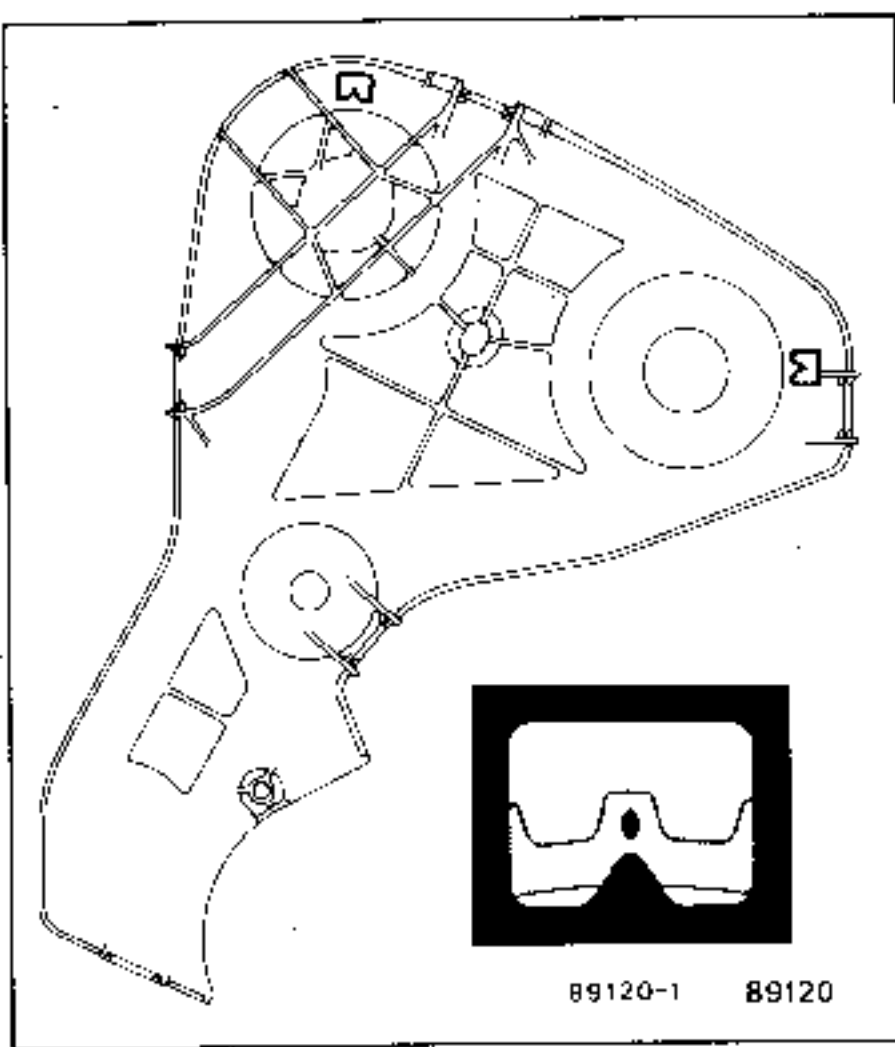


With the gearbox in 5th speed, lift the front righthand wheel.

Turn the wheel to bring the engine to TDC on No.1 cylinder (flywheel end)(check it with gauge Mot.1054).

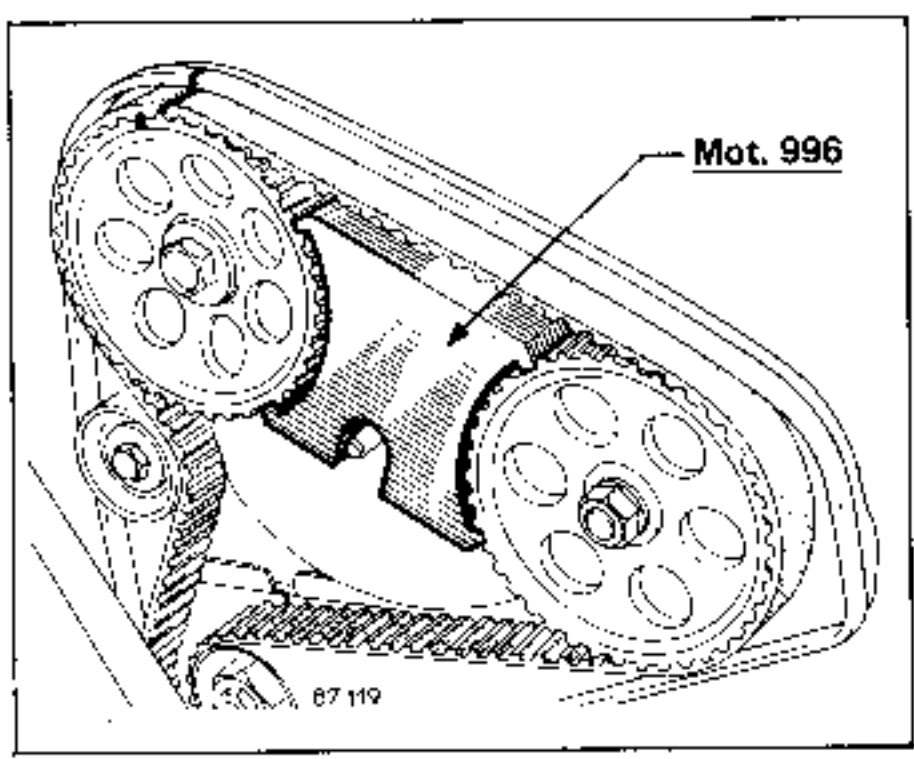


Then move back by 1 tooth.



Remove the timing gear casing.

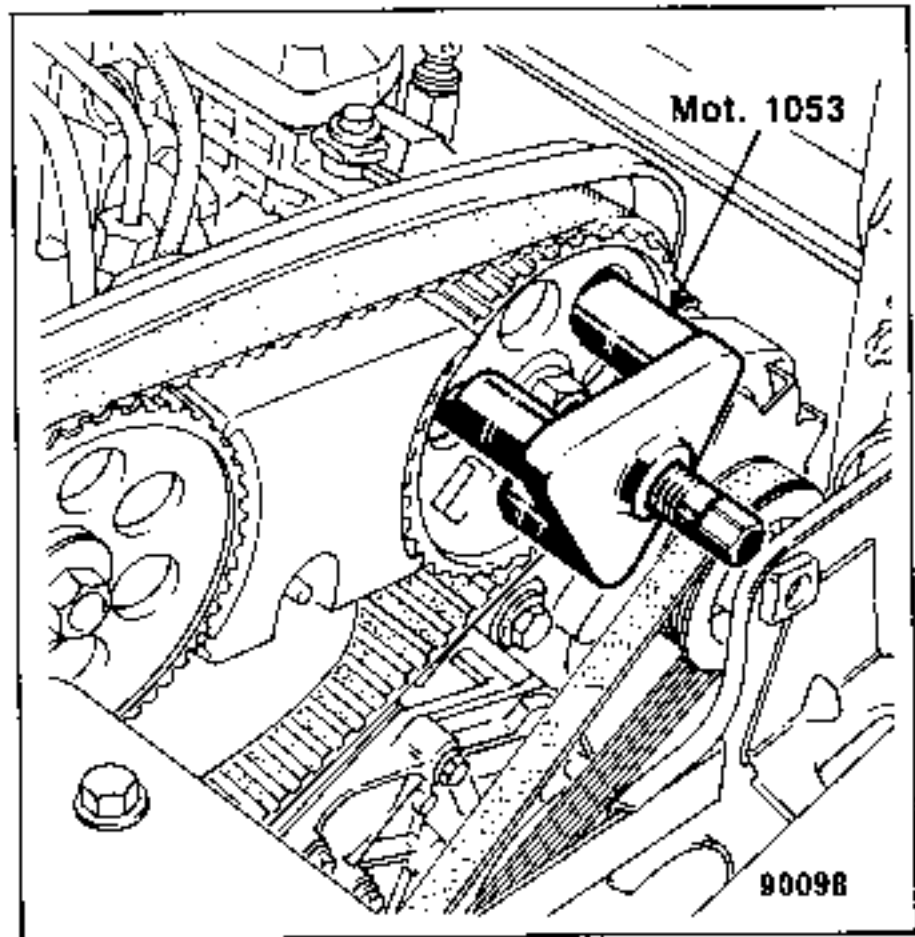
Fit locking tool Mot.996.



Loosen the nut on the pump driveshaft to the end of the thread.

Fit extractor Mot.1053 to the pump sprocket and free the sprocket from its taper. **Never** locate the claws on the sprocket teeth.

Do not strike the assembly with a hammer to free the sprocket (the pump may be damaged internally).



Remove the pump

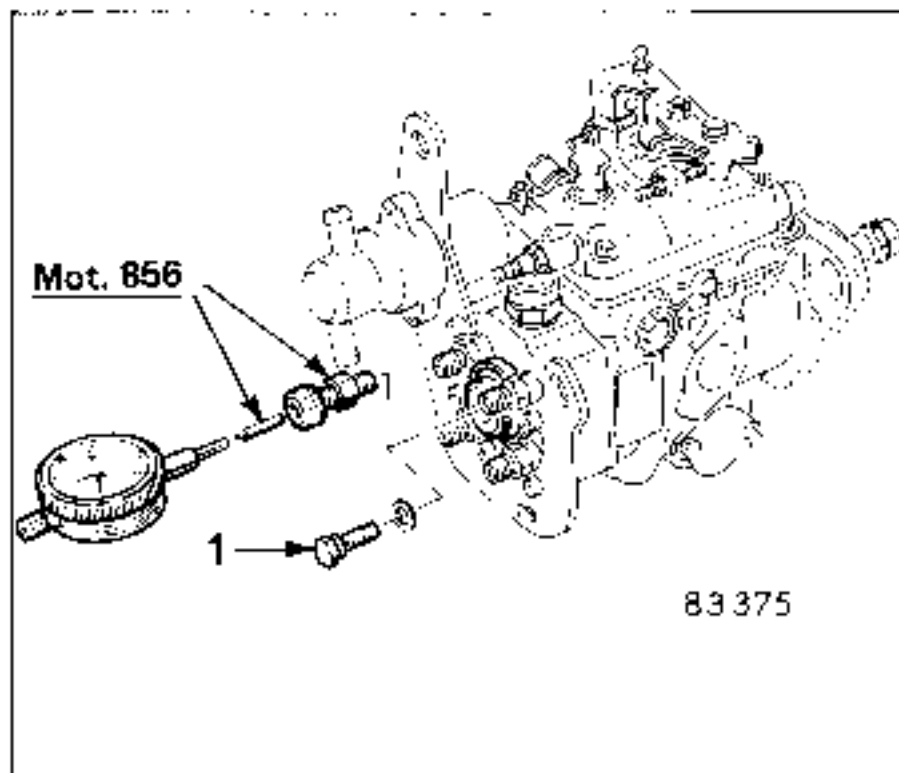
Recover the key from the drive taper.

TIMING - REFITTING

Screw dial indicator support **Mot.856** in place of plug (1) and secure a dial indicator with an extension to it.

Screw a nut and locknut to the driveshaft.

Tighten the locknut against the nut, away from the bottom of the thread.

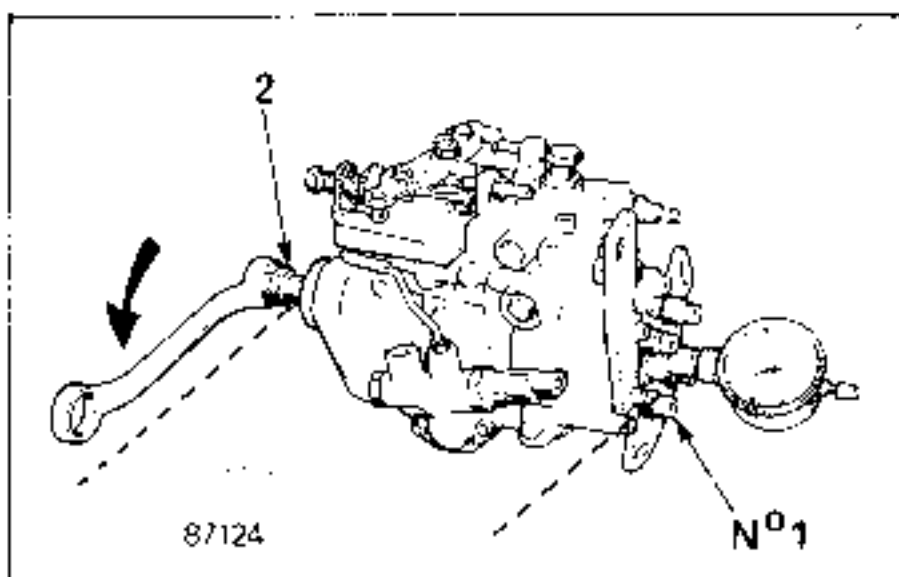


Turn the pump in its normal direction of rotation (arrow) to find the piston BDC.

In this position, adjust the dial half-way along its travel and zero the dial.

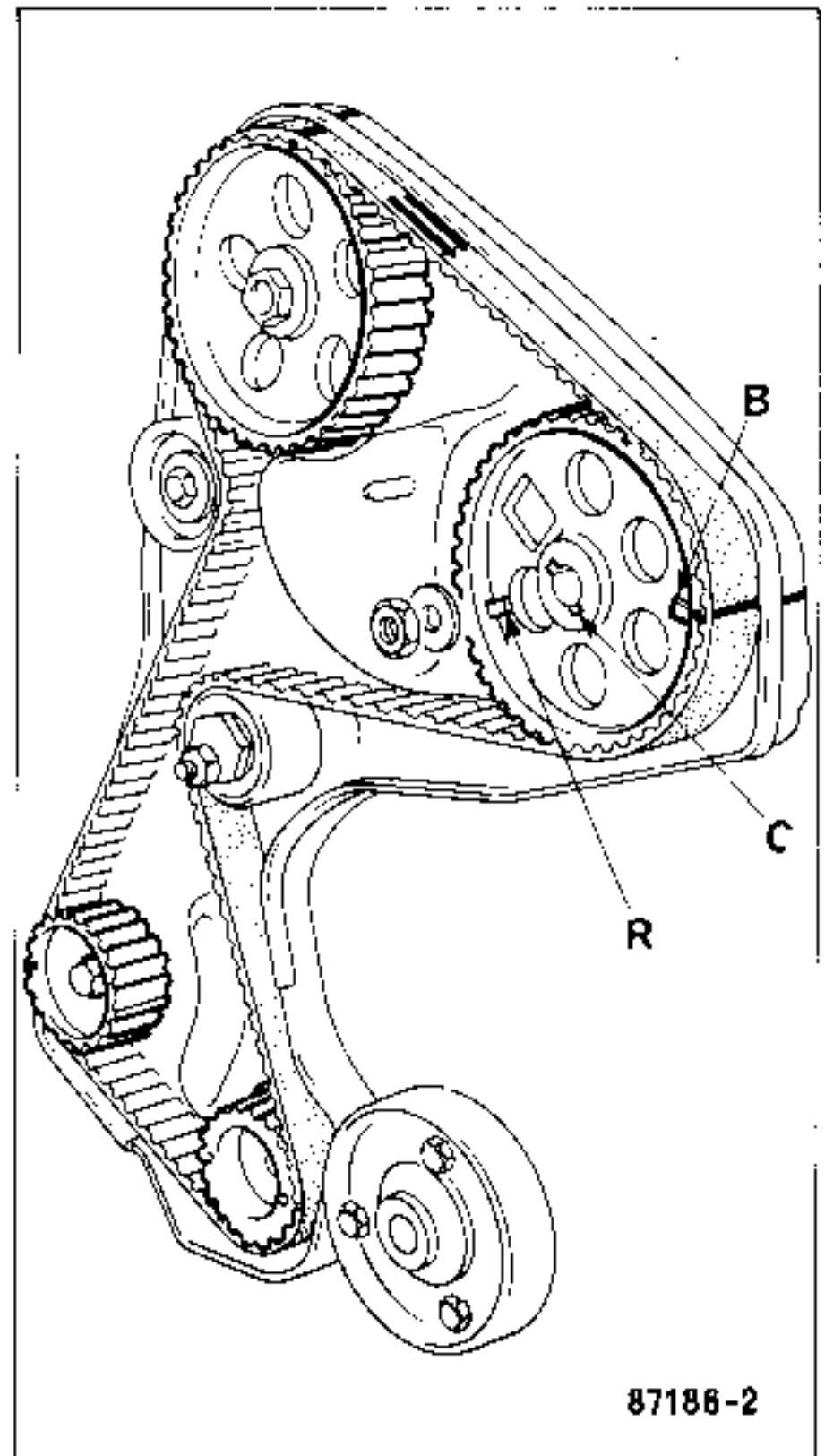
Turn the pump shaft (direction of rotation) to bring the key just in front of the centre of the No.1 outlet, at piston BDC.

Remove the nut and locknut (2).



The position of the pump sprocket differs according to the type of injection equipment. It has two timing marks (B - BOSCH pump, R - ROTO DIESEL pump) and two differently positioned keyways.

B : BOSCH pump timing mark
R : ROTO DIESEL pump timing mark
C : Keyway to be used.

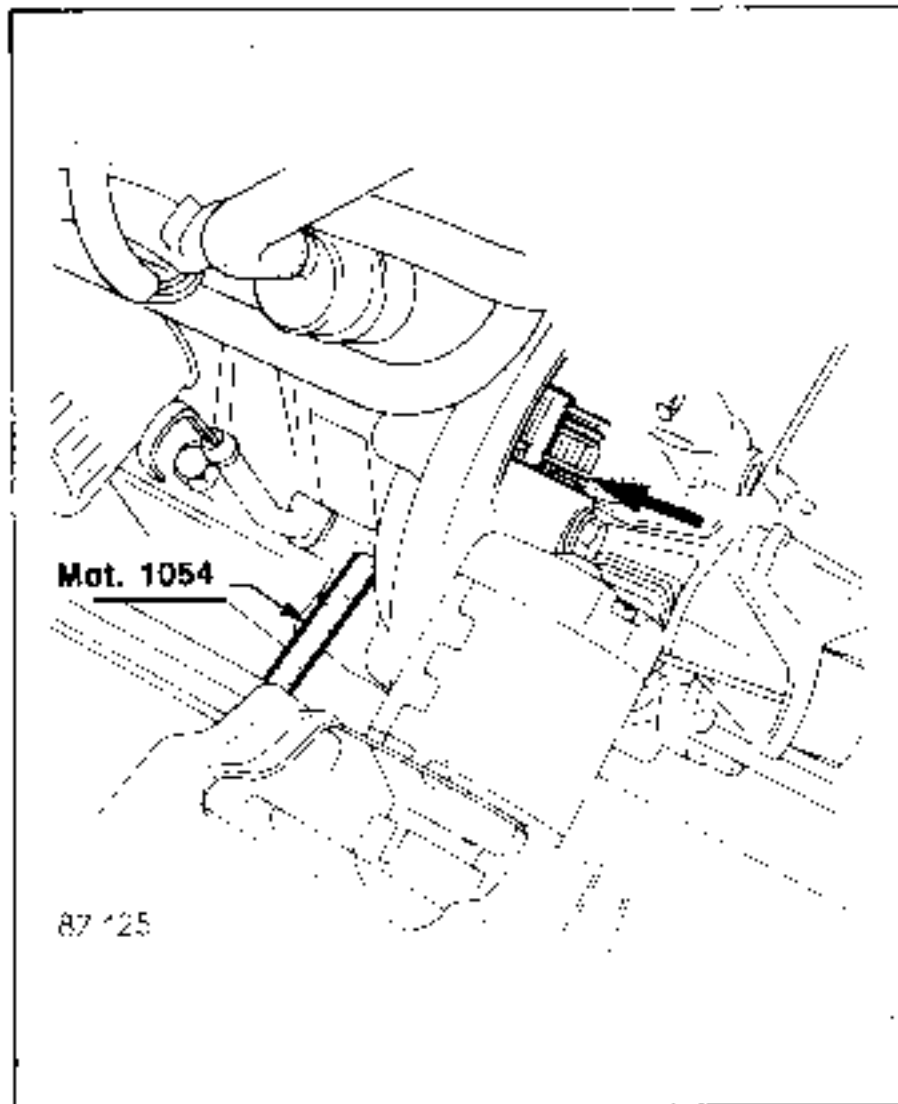


Fit the pump, aligning the key with the keyway in the sprocket (mark C).

Fit the washers and bolts to the securing flange, without tightening them.

Fit the sprocket securing washer and nut and tighten it to 5 daNm.

Turn the crankshaft in its normal direction of rotation, through two turns, and lock it at TDC with gauge pin **Mot. 1054**.



CHECKING THE TIMING

Turn the crankshaft through one and three quarter turns in its normal direction of rotation and check that the dial indicator is on zero at pump piston BDC. Then bring the crankshaft to TDC and lock it (tool **Mot. 1054**). The dial indicator should show a pump piston lift of 0.63 to 0.67 mm.

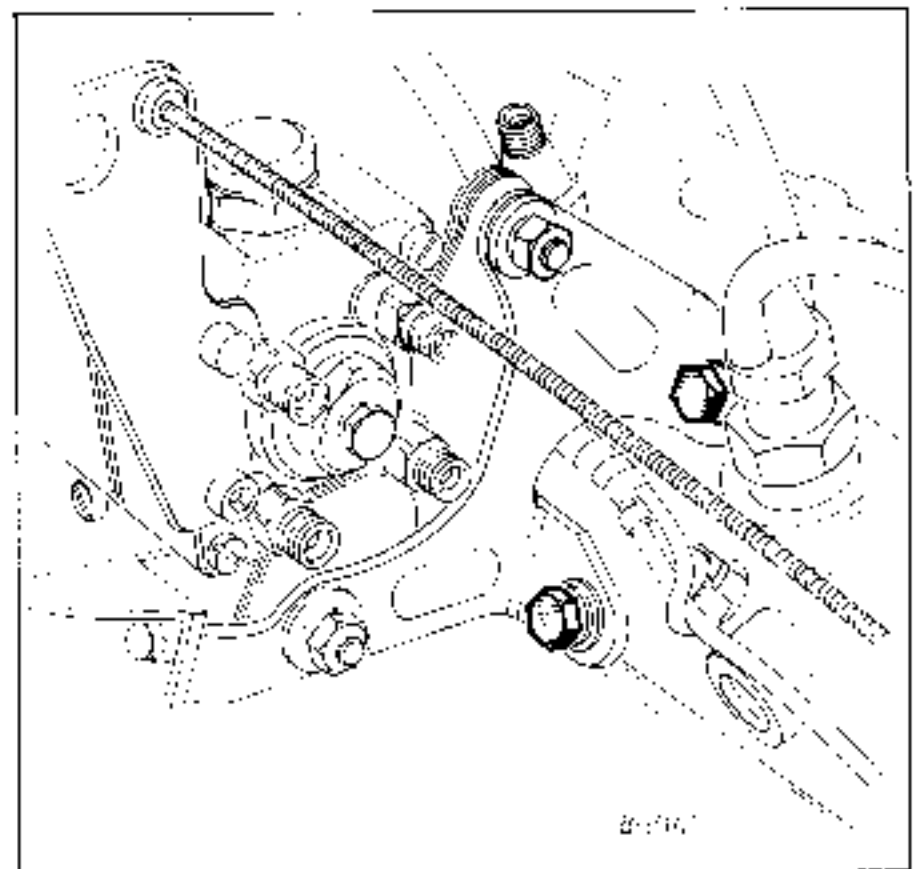
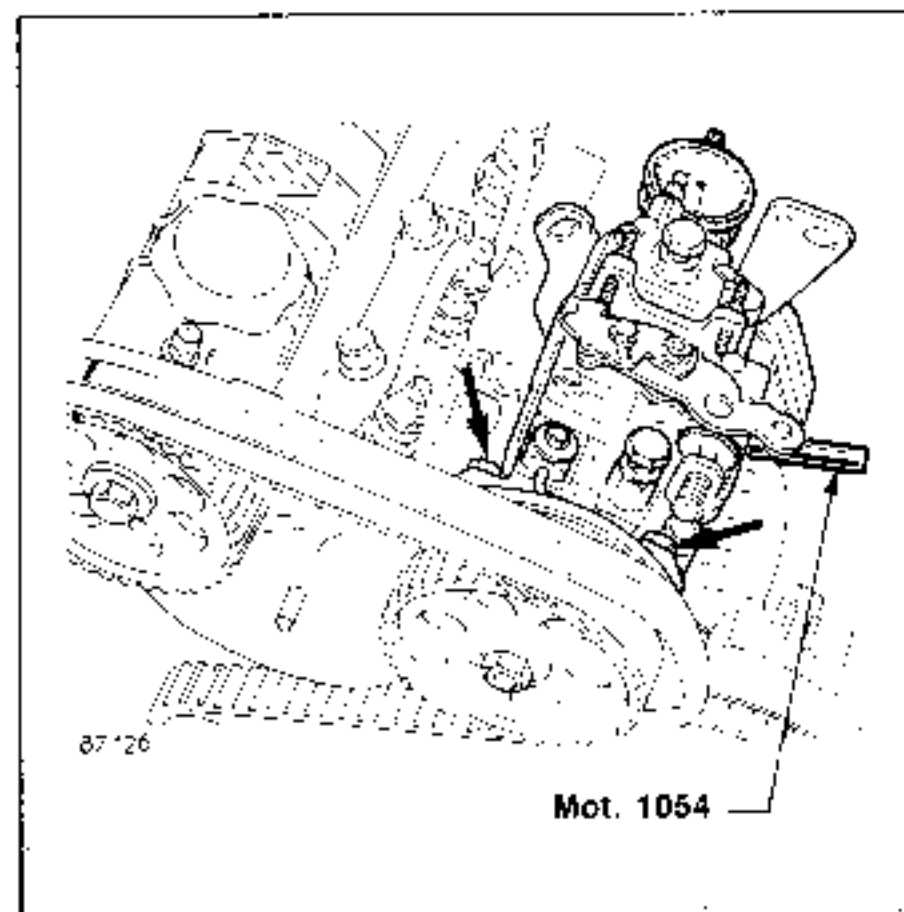
ATTENTION: If the toothed belt tension is incorrect, this will affect the pump timing. The timing is to be checked after retensioning the belt (see Manual **Mot.F (D)**, section "Adjusting the timing belt").

REFITTING THE ADJACENT COMPONENTS

Refit the hydraulic head plug, using a new seal.

Fit the rear support and secure it by screwing up its bolts evenly so as not to subject the pump to stress.

Turn the pump to obtain a piston lift of 0.65 mm and tighten its securing nuts.



Refit the alternator protective casing.

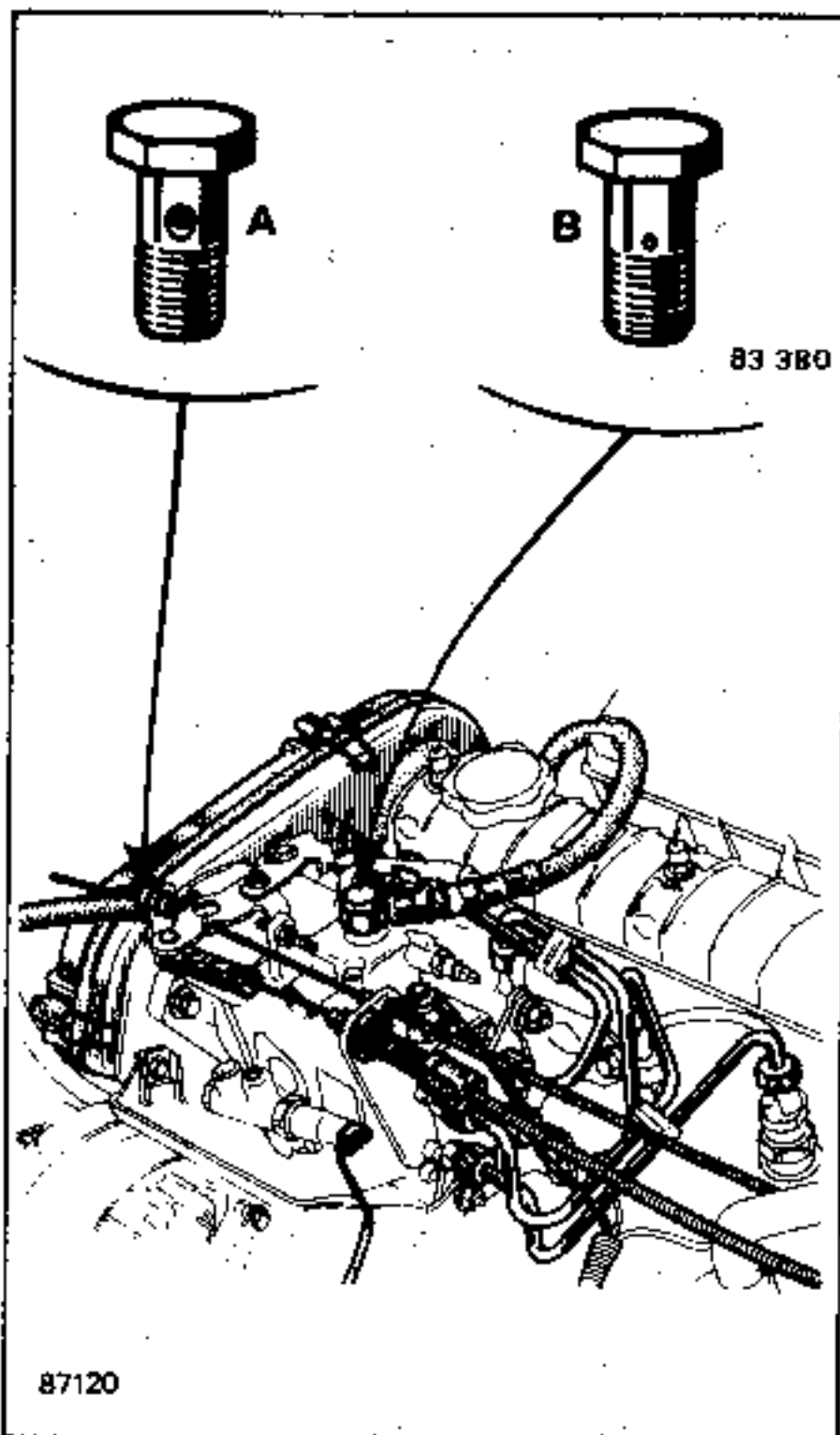
Fit the timing gear casing. It may be necessary to push the engine sideways on its mountings to insert the casing.

Retension the alternator drive belt (see section "Adjusting the belt tension" in manual Mot.F (D)).

Connect up the feed and return pipes.

WARNING:

Do not mix up the banjo bolts:
A - Feed (two 4 mm dia. holes)
B - Return to tank (1 calibrated hole + 1 filter).



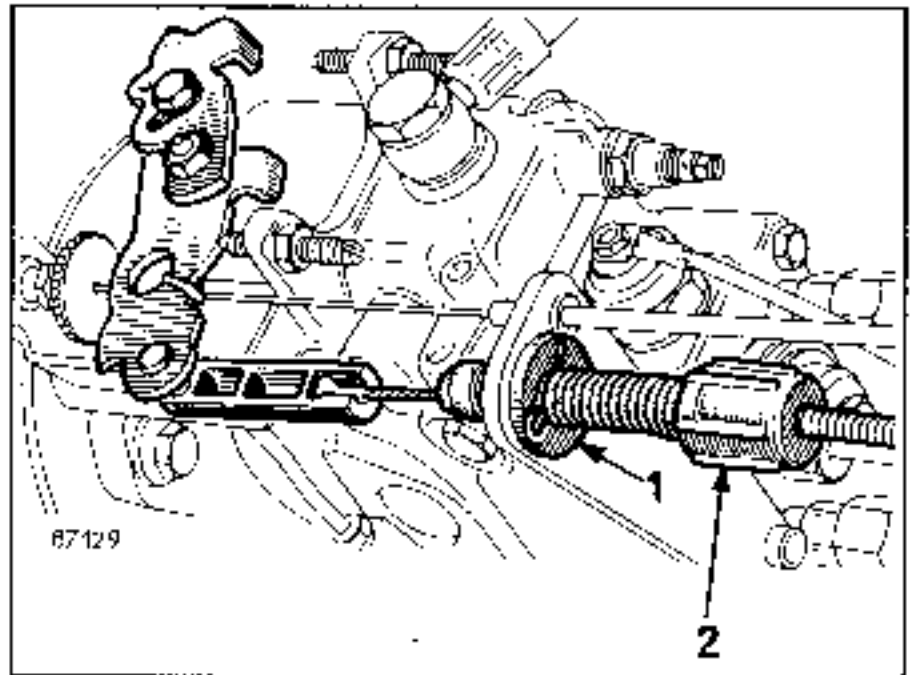
Fit the high pressure pipes.

Reconnect:

- the electric shut-off and cold starting system wiring.

ADJUSTING THE THROTTLE CONTROL

Position clip (1) so that compensator (2) is compressed by approximately 2 mm, with the accelerator pedal at the end of its travel.

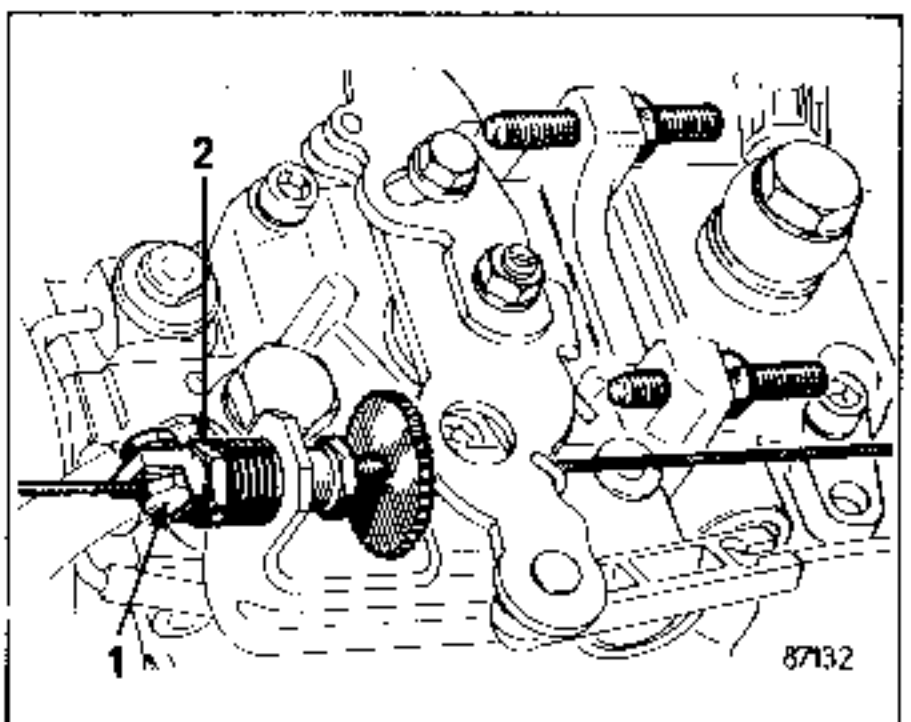


ADJUSTING THE FAST IDLING ON A COLD ENGINE

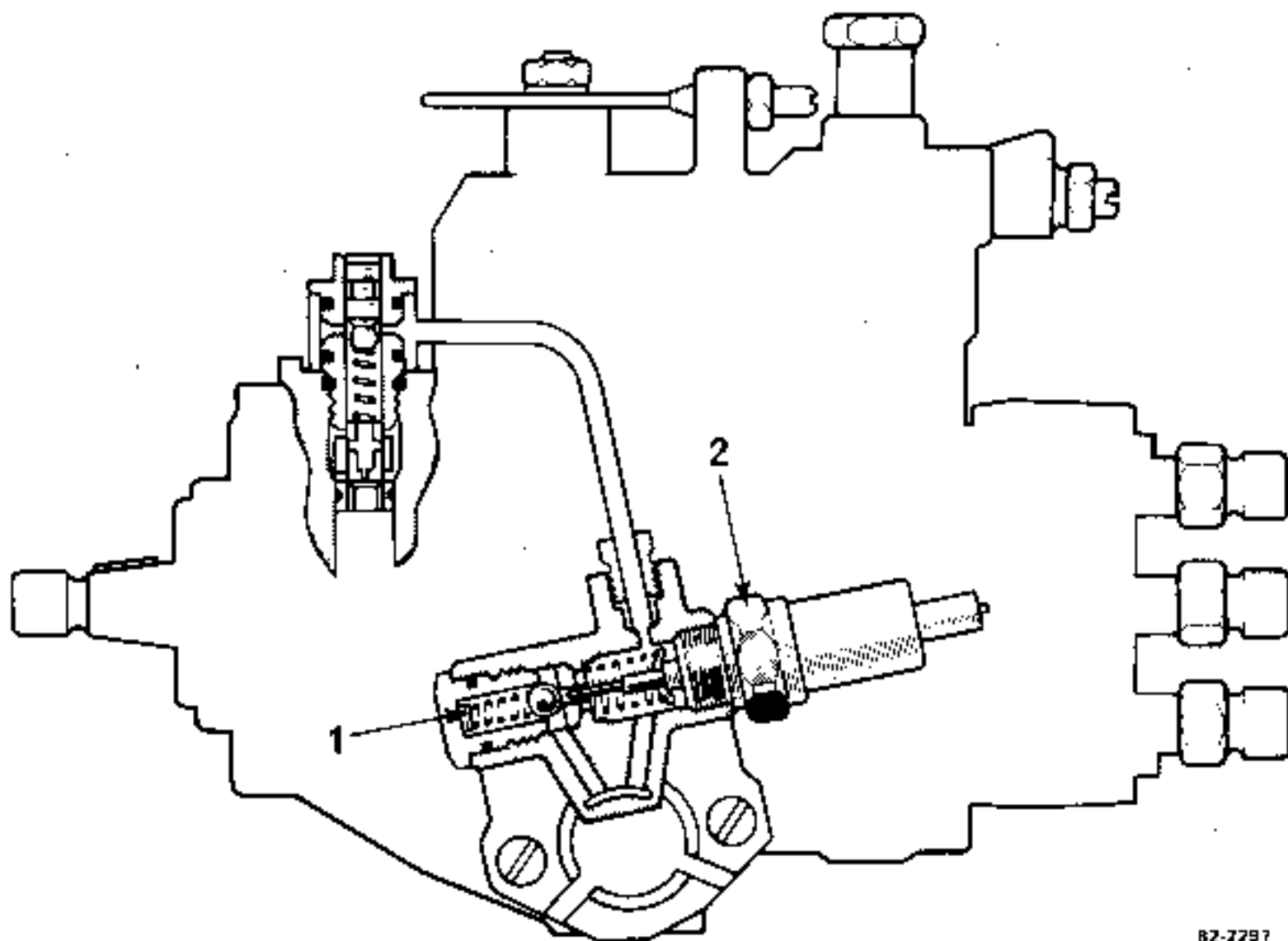
(Water temperature less than 30°C).

Fit the cable, cover end stop and cable clamp (1).

Push stop (2) as far as it will go, tension the cable, place the cable clamp against the stop and tighten it.



Bleed the fuel system.



82-2297

OPERATION

A hydraulic system, comprising a valve (1) and a thermostatic capsule (2), increases the transfer pressure and automatic advance when the engine is running cold.

As it expands, thermostatic capsule (2) opens valve (1) and thus re-establishes the normal transfer pressure and automatic advance.

The normal transfer pressure is re-established by:

- an electrical supply to the capsule (2) which switches on, after the engine is started, as soon as the coolant temperature reaches 50°C or 65°C (depending on the type of thermal switch). Depending on the temperature, the system cuts out after the engine has been running for between 30 seconds and 2 minutes 45 seconds;
- radiation temperature and the fuel temperature (above 35°C the system is overridden);
- the engine speed: above approximately 2 000 rpm the pressure opens valve (1) and thus re-establishes the normal transfer pressure and automatic advance.

CHECKING THE OPERATION

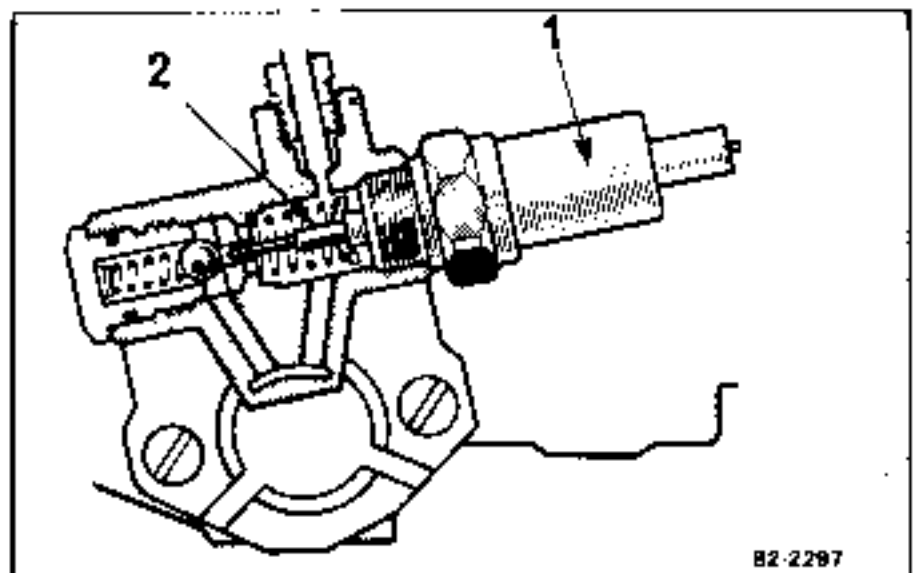
On starting from cold, the engine is noisy at idling and will tend to "knock". After running for several minutes when the engine is almost hot, this knocking will disappear. This is a sign that the system is operating correctly.

REPLACING THE THERMOSTATIC CAPSULE

Disconnect the supply wire and unscrew thermostatic capsule (1). The spring, stop washer and thrust rod (2) will remain in position.

On refitting:

- fit a new seal.



82-2297

The engine speeds are to be adjusted and checked when the engine is **hot**, after the electric fan has cut out.

ADJUSTING THE IDLING SPEED

Idling speed: 850 ± 25 rpm.

If correction is necessary, turn screw (1).

Note: Find the speed at which the engine vibrates the least.

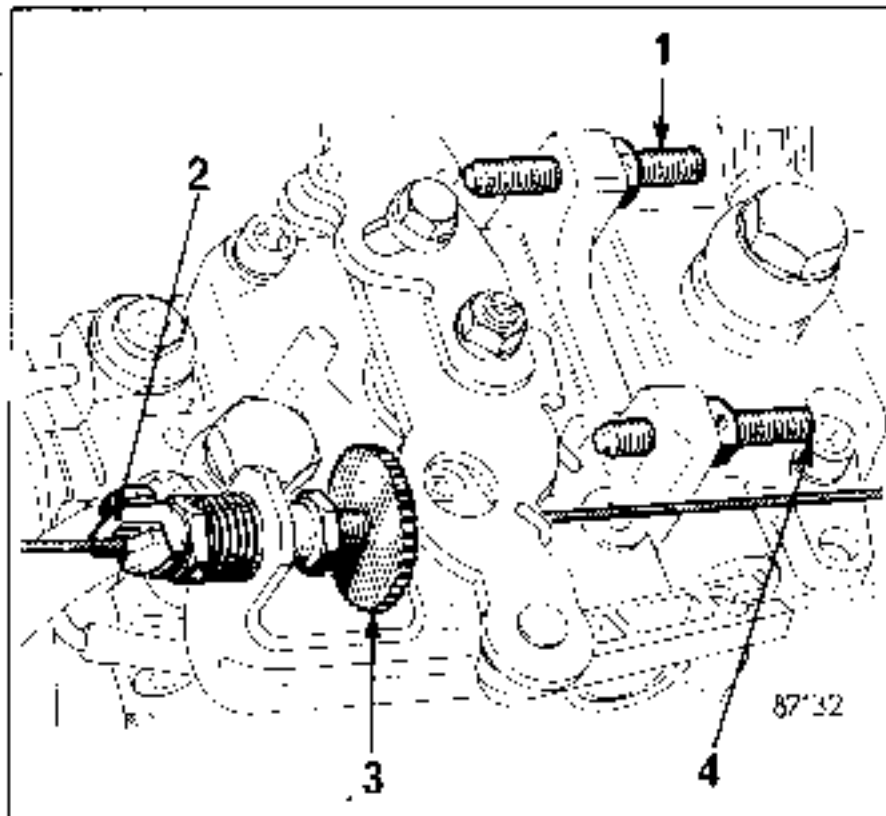
ADJUSTING THE FAST IDLING

On a **hot** engine, slide (2) should be against its min. stop:

- clearance between cable clamp and slide: 1 ± 0.5 mm.

Push slide (2) as far as it will go. The speed should rise to $1\ 150 \pm 50$ rpm.

If correction is necessary, turn milled screw (3).



CHECKING THE MAXIMUM SPEED

Hot engine: fully open the throttle, bringing the lever against screw (4).

The engine speed should be between 5 200 and a maximum of 5 400 rpm

The maximum speed stop screw (4) is sealed during manufacture with a dab of varnish. It should only be adjusted by an injection centre specialist.

Vehicle	Type	Engine
TRAFIC	Pxx4	S8U 720 1
	Pxx4	S8U 722 2
MASTER	Qxx4	(8140) S8U 730 engine N° 1 to 344462 1
	Rxx4	(8140) S8U 731 engine N° 344483 to 512960 2
		Engine N° 512961 → ... 3

Description	Make and type	Special details
Injection pump	BOSCH VE 4/9 F-1950 R 22/3 1 VE 4/9 F-1950 R 22/4 1 VE 4/9 F-2100 R 22/3 2 VE 4/9 F-2100 R 22/5 3	Single piston rotary pump with mechanical centrifugal governor, automatic hydraulic advance and solenoid shut-off.
Injectors	BOSCH KBE - 58 S 4/4	
Pintle and seat assembly	BOSCH DN OSD 193	Setting 125 ± 5 bars
Injector pipes		Outside diameter 6 mm Inside diameter 2.5 mm Length 520 mm
Injection order	1 - 3 - 4 - 2	1 at timing gear end
Timing at T.D.C.		Injection pump piston lift : 1.10 ± 0.05 mm
Fuel filter	PURFLUX or BOSCH or ROTO DIESEL	With integral priming pump

SETTINGS

Idling 700 \pm 50 rpm

Max. speed : **1** 4 300 to 4 400 rpm

2 3 4 600 to 4 700 rpm

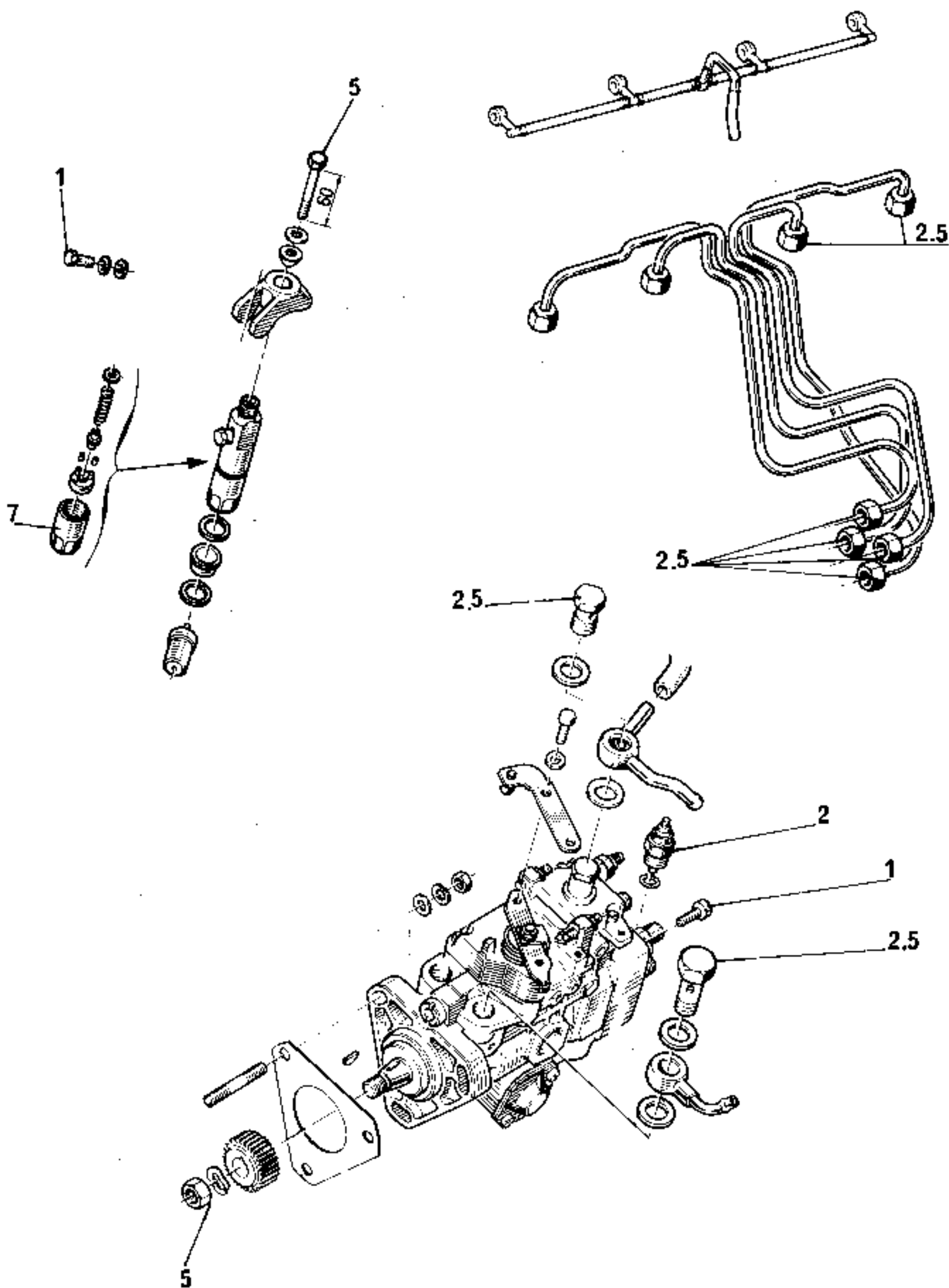
Smoke density :

Approved figure 1.44^{m-1} : 45 %

Maximum legal :

- Goods transport 2.5^{m-1} : 64 %

- Passenger transport 2^{m-1} : 55 %



ESSENTIAL SPECIAL TOOLING

Mot. 49	Sprocket and bearing extractor
Mot. 856	Dial indicator support
Mot. 909	Spanner for injection pump nut
Mot. 910	Set of two T.D.C. gauge rods

REMOVING

Disconnect the battery.

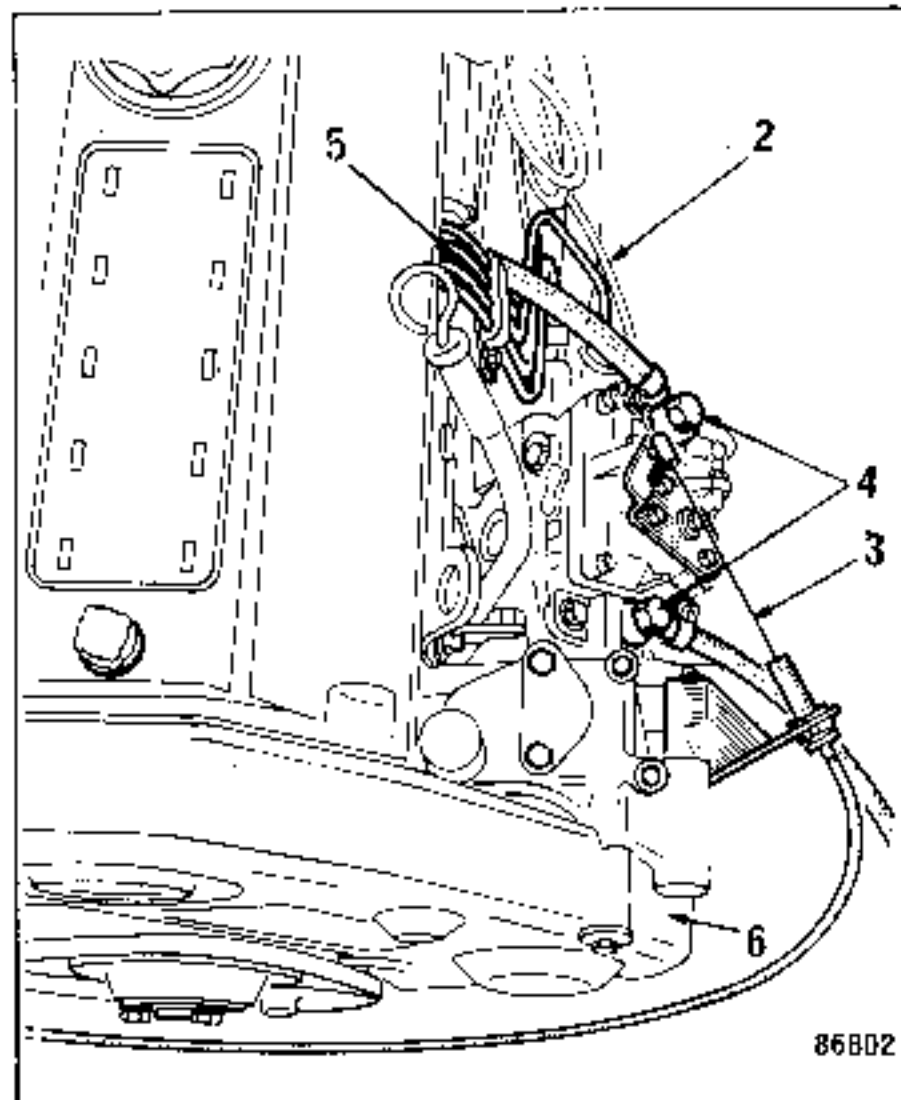
Disconnect shut-off wire (2) and throttle cable (3).

Disconnect the fuel feed and return pipes (4).

Remove the injector pipes (5).

Remove the timing gear casing securing bolts.

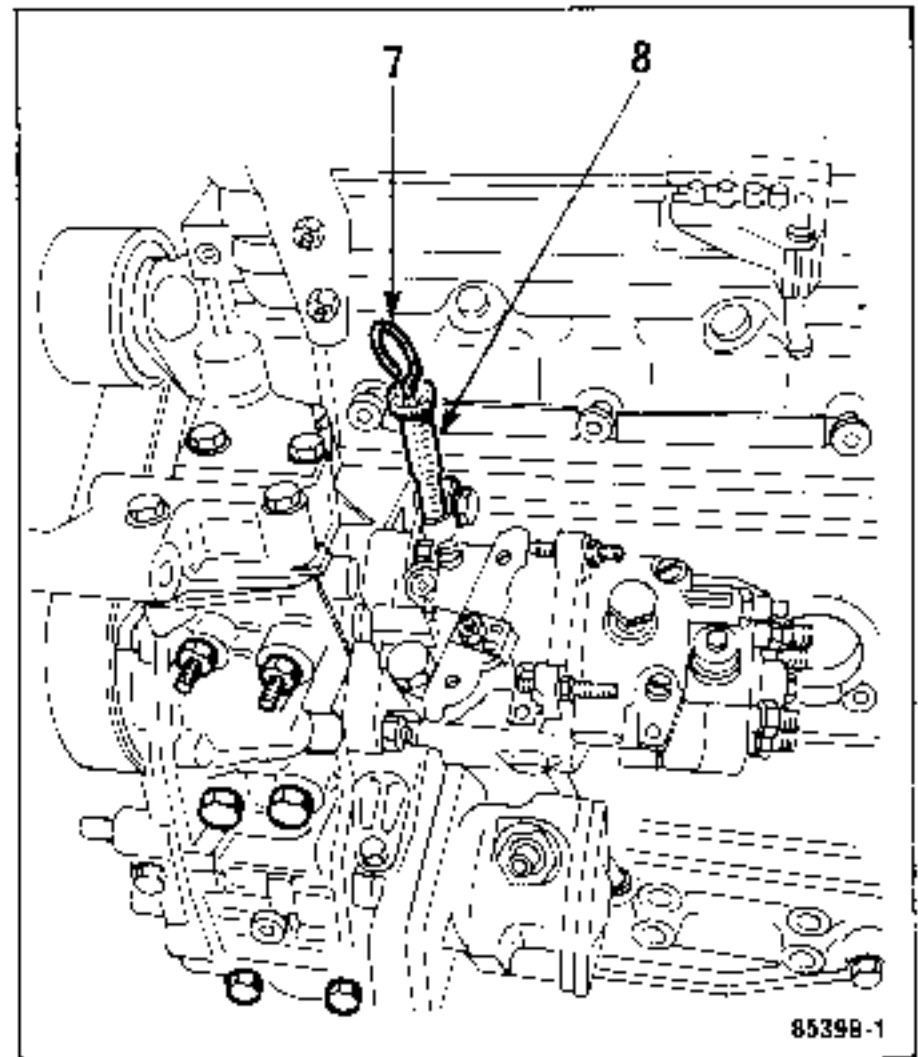
Remove timing gear casing (6).



86802

Note: To gain access to the pump fastenings, it is preferable to remove:

- dipstick (7)
- dipstick guide tube (8)
- the breather
- the protective casing under the engine.



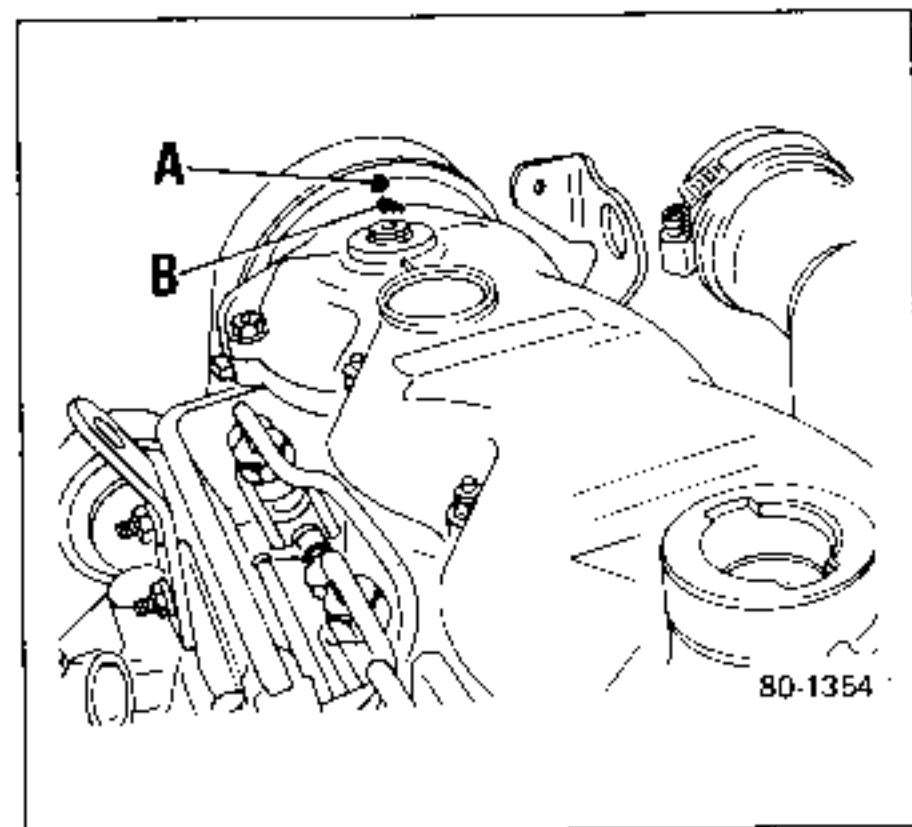
85398-1

Turn the crankshaft by placing a spanner on the pulley bolt or by lifting and turning a drive wheel with the gearbox in 4th.

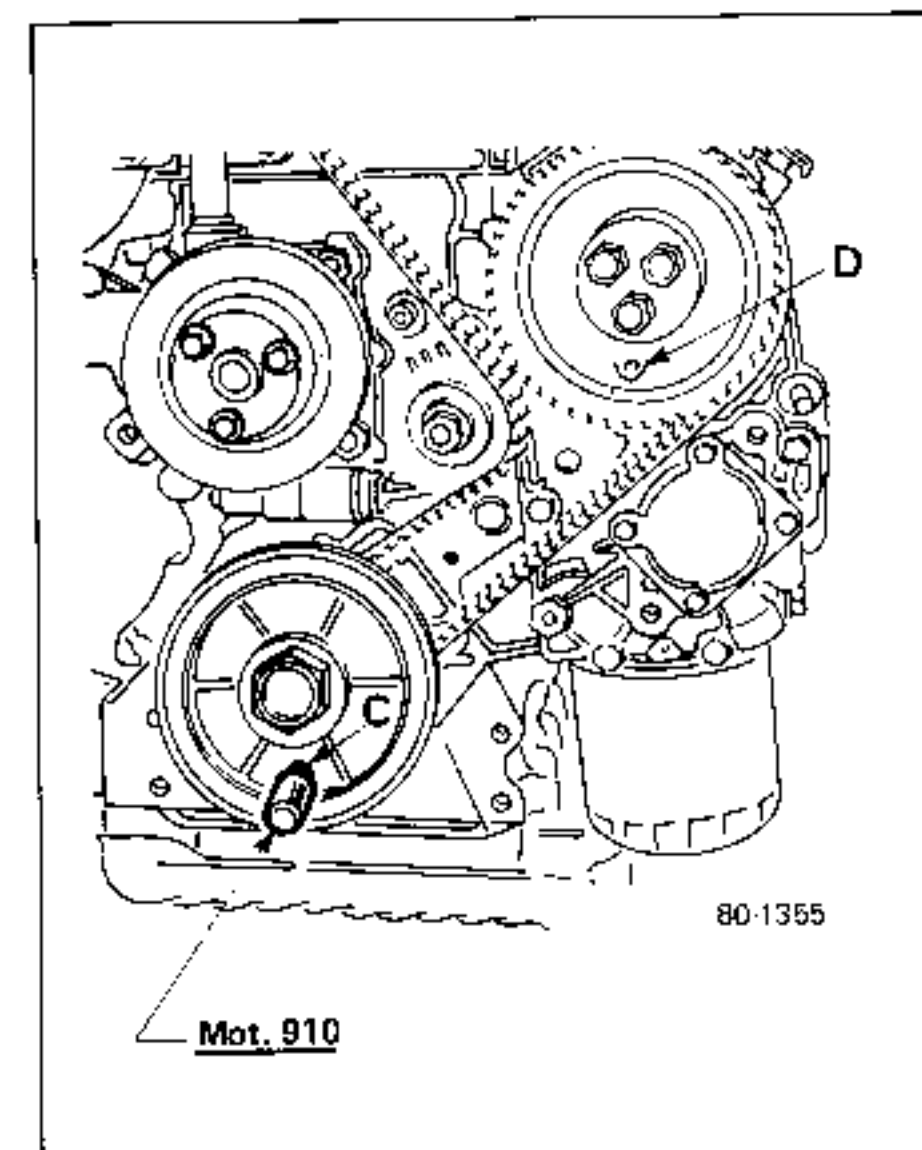
Turn the wheel to bring engine no.1 cylinder (timing gear end) to TDC or turn the engine with the crankshaft pulley bolt.

In this position check that:

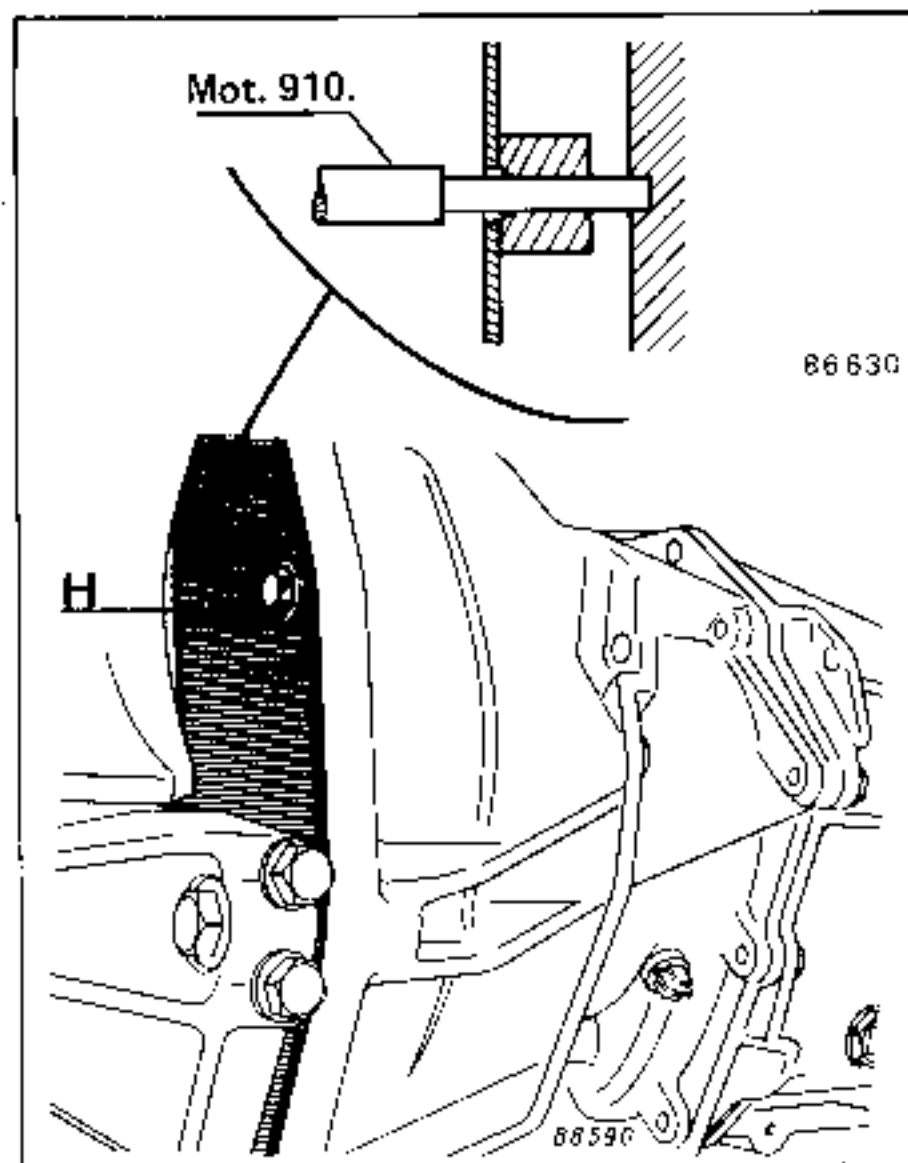
- the mark on the camshaft sprocket (A) is in line with the centre of the boss (B) on the rocker arm cover.



- The marks on crankshaft pulley (C) and injection pump drive sprocket (D) are in line with the timing holes used as locations for the gauge pins (Mot. 910).



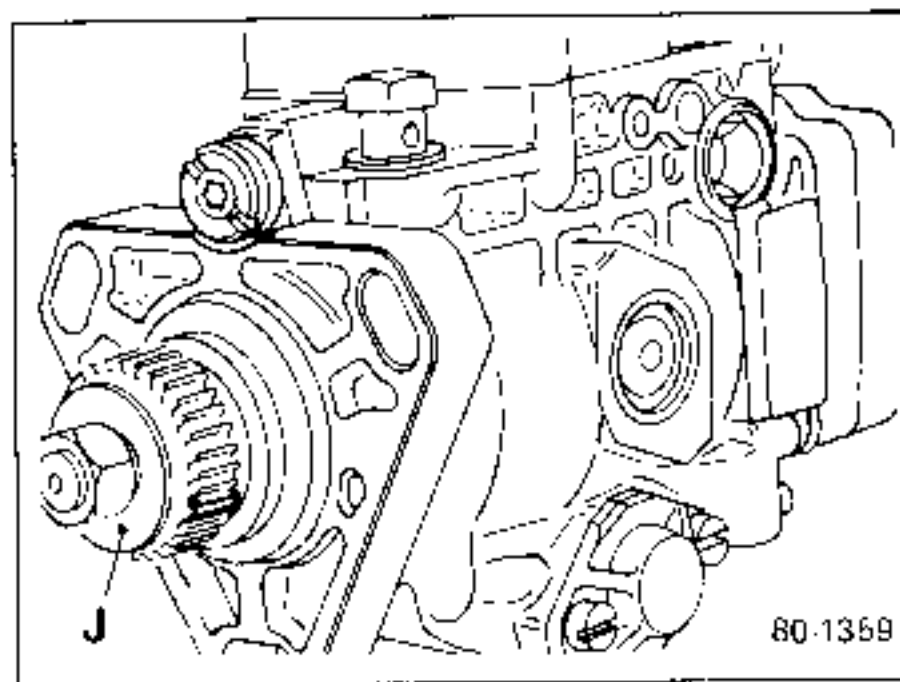
WARNING: Some engines have a TDC index (H) on the flywheel instead of the mark on the crankshaft pulley.



Loosen and remove the injection pump securing nuts using spanner Mot. 909. Remove the washers.

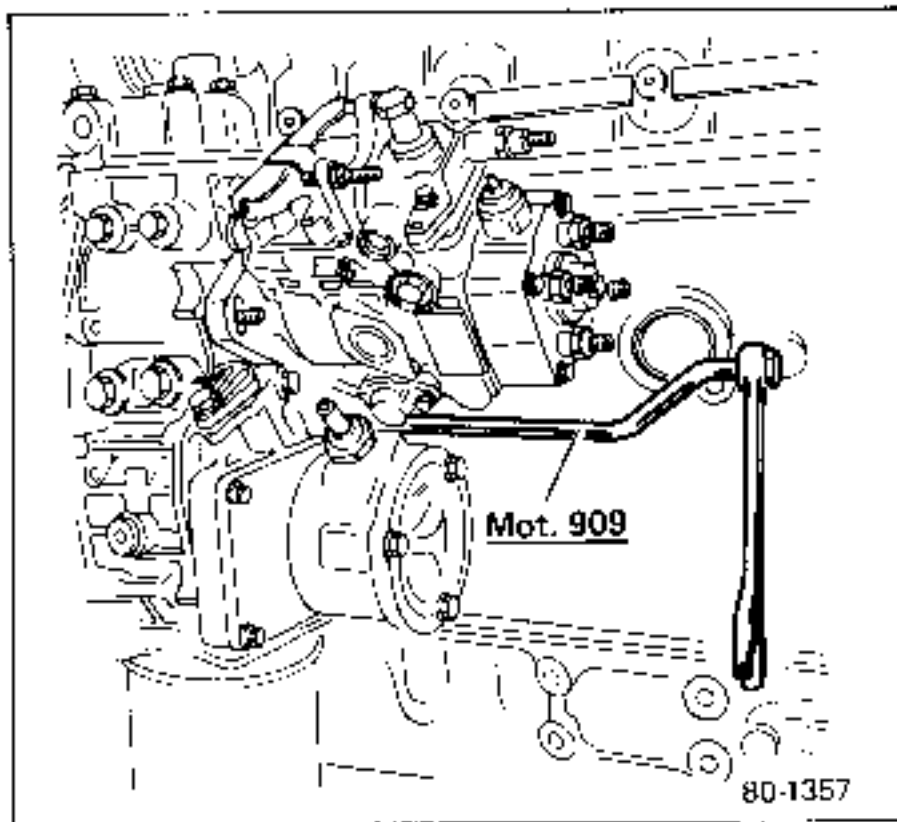
Take out the injection pump.

Note: The pump has a drive hub (J) with a locating tooth on it, which means that the pump can only be fitted in one position.



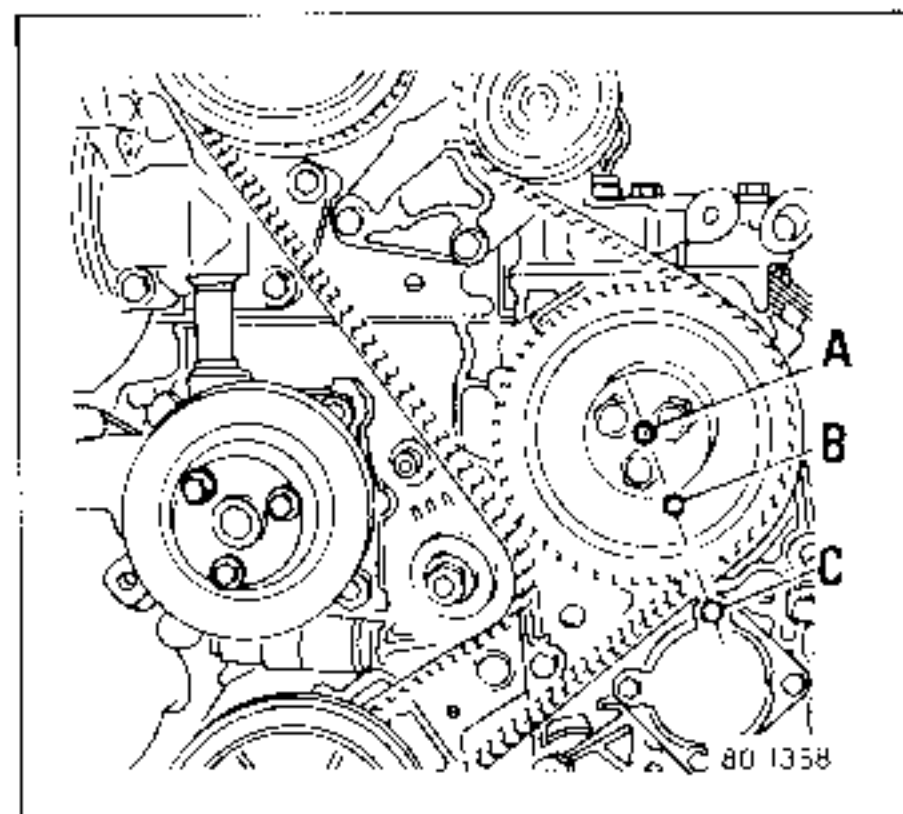
Grip hub (J) in a vice fitted with soft jaws. Loosen the nut and remove the hub with extractor Mot.49.

Do not forget the key when refitting. Tighten the nut to the required torque.

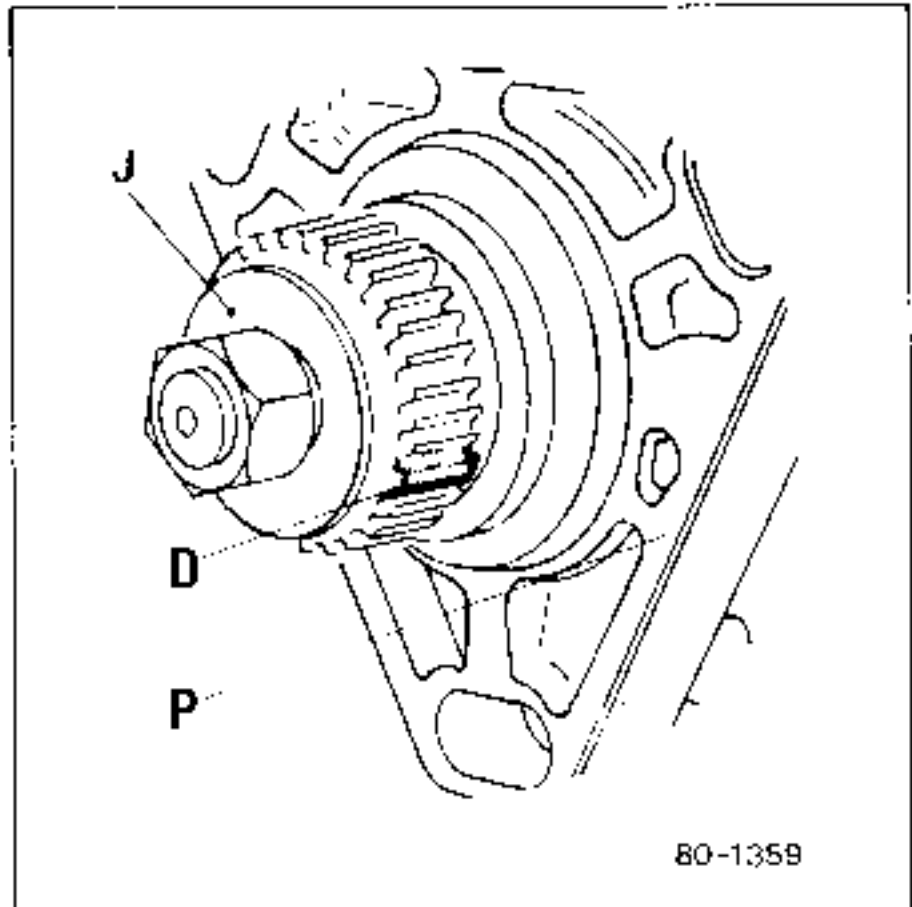


REFITTING

Turn the engine backwards, then return in the normal direction of rotation until the centre of the pump drive sprocket (A), the pump timing pin hole (B) and the power take-off cover upper securing bolt (C) lie on the same line.



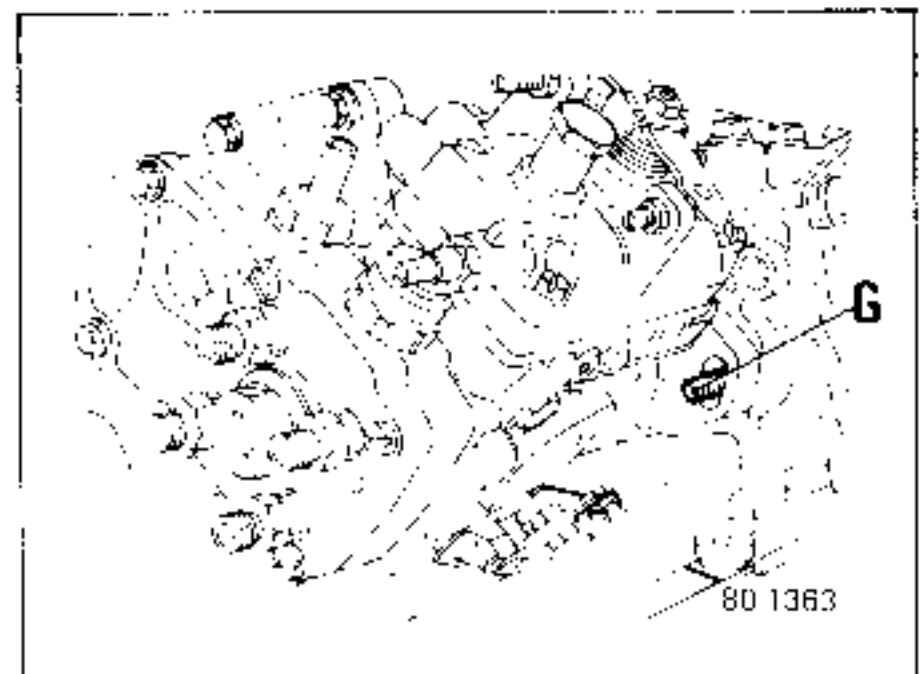
Position the double locating tooth (D) on the injection pump shaft in line with the seal locating area (P).



Note: In this position the injection pump piston will be at BDC and thus make it easier to refit the pump.

Place the injection pump on the engine with the pump upper securing stud (G) in the centre of the slot. It should enter easily.

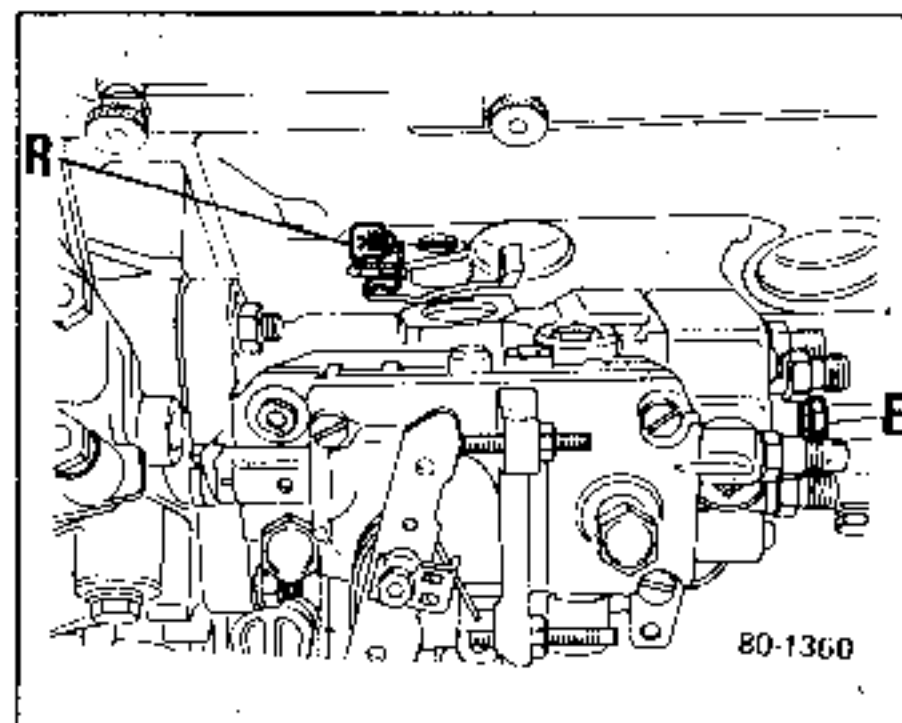
With the injection pump in place, refit the securing nuts and washers without tightening them.



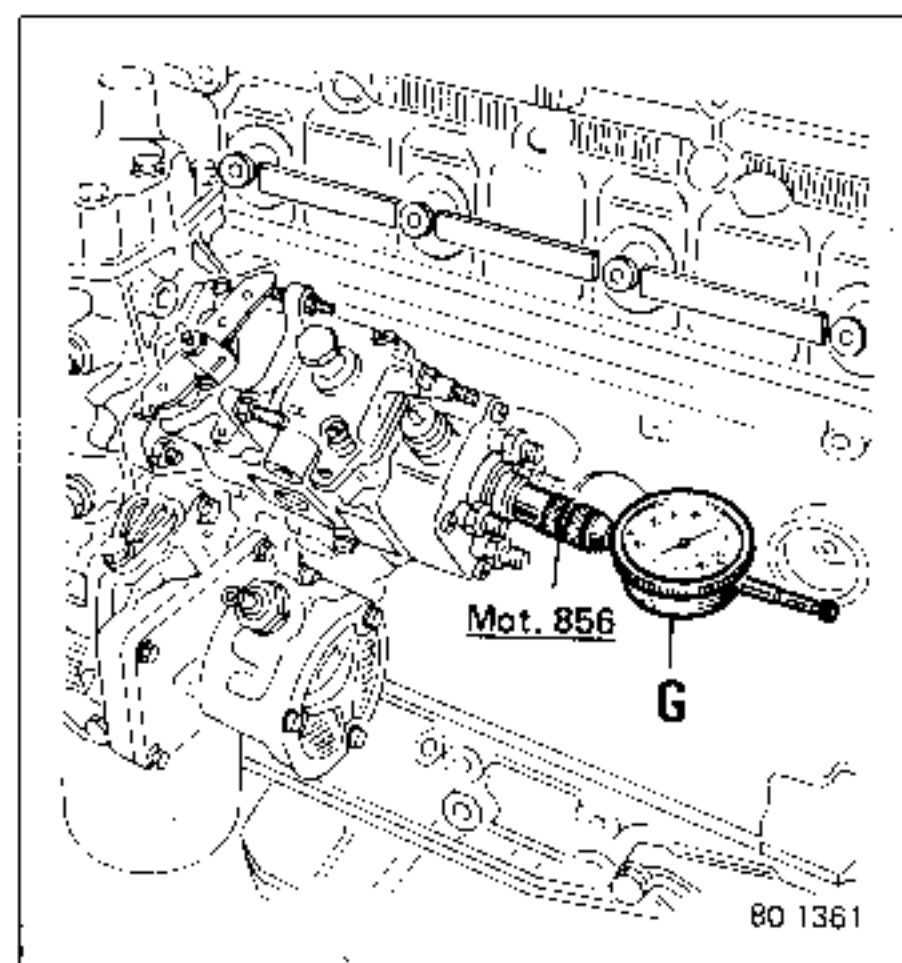
TIMING

If the pump has one, move the manual advance corrector lever to the released position (R).

Remove plug (E) on the injection pump cover.



Screw dial indicator support **Mot.856** into plug tapping (E) and mount a dial indicator (G), fitted with an extension, on it.



Adjust the dial indicator to half-travel and by turning the engine in both directions, find the pump piston BDC and set the dial on zero.

Turn the crankshaft in its normal direction of rotation until gauge rod **Mot.910** engages in the crankshaft pulley or flywheel (A).

In this position, move the injection pump to obtain a pump piston lift of **1.10 mm.**

Tighten the injection pump securing nuts.

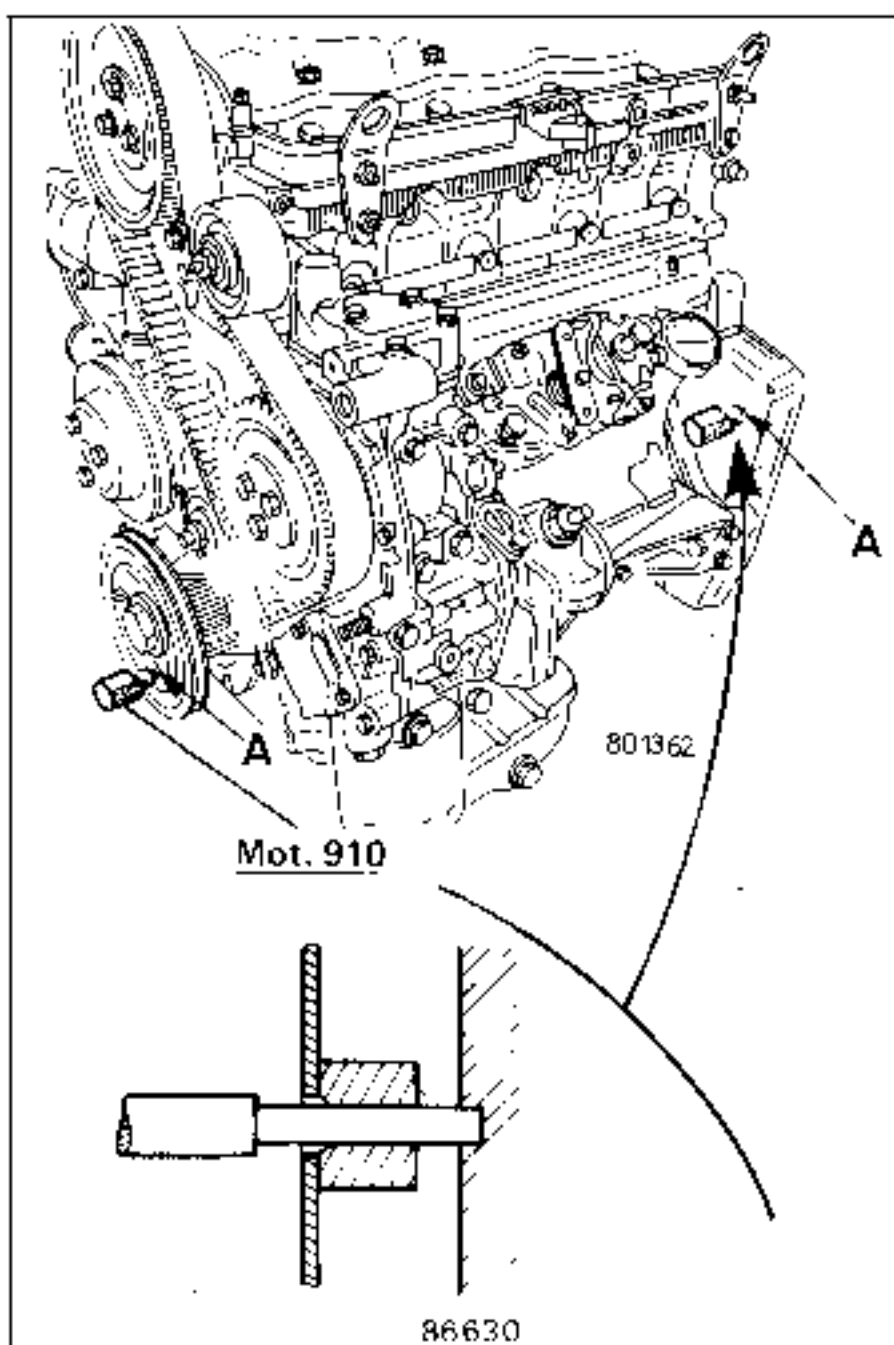
CHECKING

Remove gauge rod **Mot.910**, turn the crankshaft through $1\frac{1}{2}$ turns and then, moving it slowly, check the dial indicator zero point and relock the assembly at TDC with gauge rod **Mot.910**.

Check the pump piston lift which should be between **1.05** and **1.15 mm.**

Remove gauge rod **Mot.910**, support **Mot.856** and the dial indicator.

Refit the hydraulic head plug, using a **new seal.**



REFITTING ADJACENT COMPONENTS

Connect up the fuel feed and return pipes.

WARNING:

Do not mix up the banjo bolts:

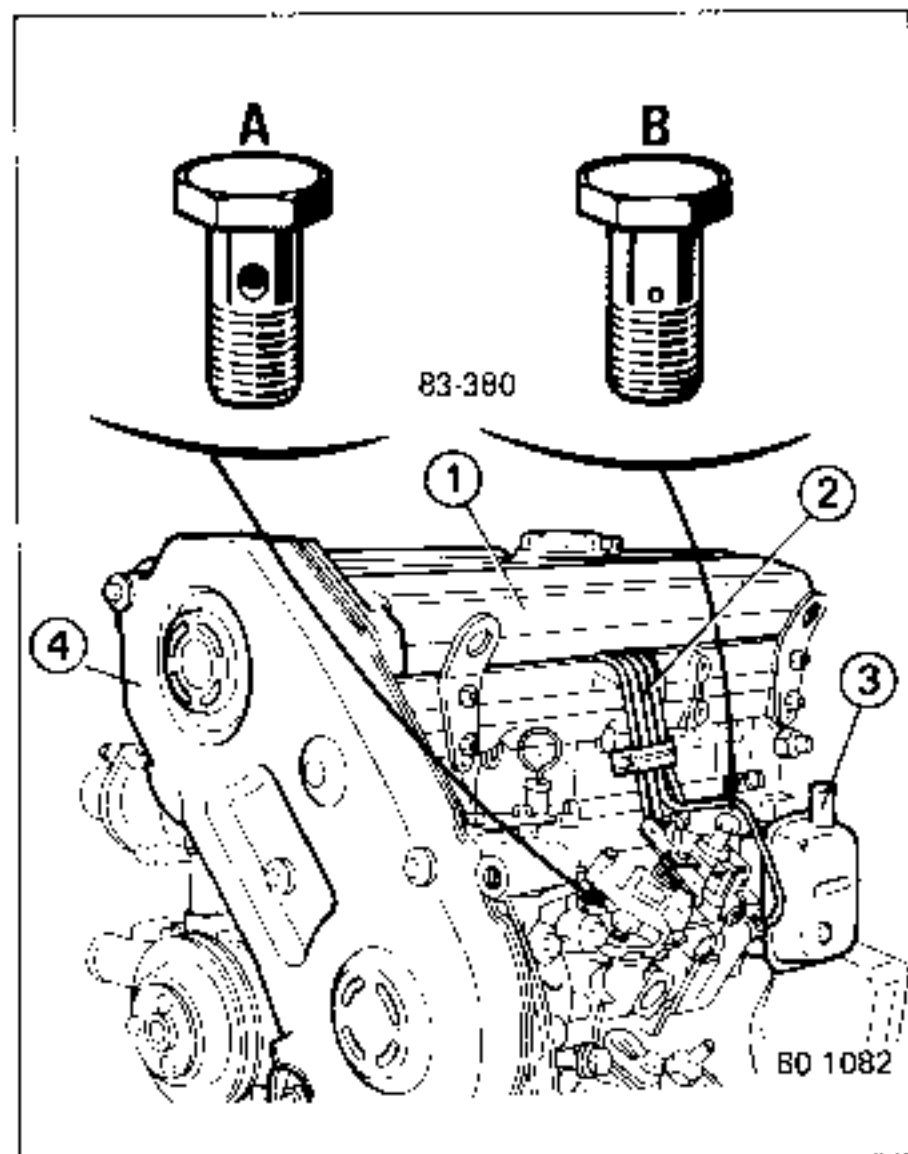
- A - Feed (two 4 mm dia. holes)
- B - Return to tank (one calibrated hole + 1 filter).

Refit:

- the throttle cable and adjust the cable cover clamp bolt on the pump to compress the compensator by approximately 2 mm.;
- injector pipes (2);
- breather casing (3);
- timing gear casing (4);
- soundproofing cover (1).

Reconnect the battery.

Bleed the fuel system.



CHECKING ENGINE SPEEDS

Warm up the engine to its normal operating temperature.

ADJUSTING THE IDLING SPEED

Idling speed: see "Specifications".

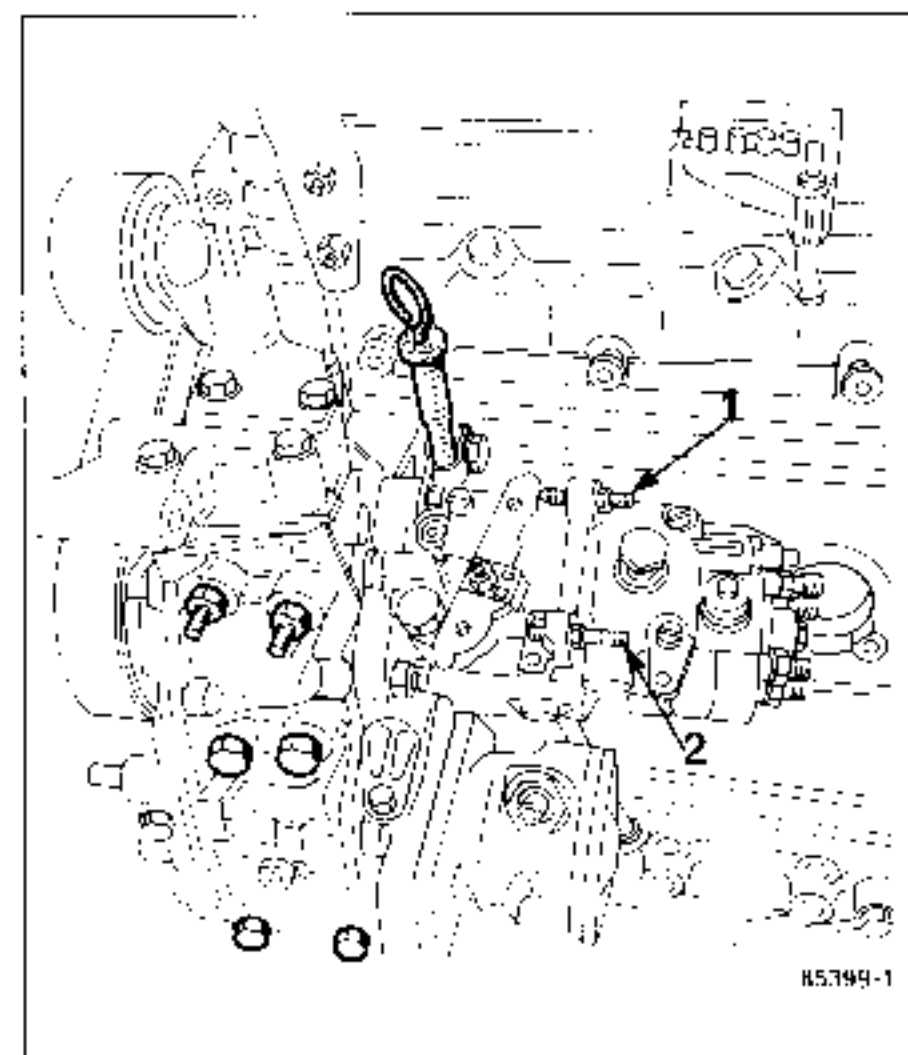
If a correction is necessary, turn adjusting screw (1).

CHECKING THE MAXIMUM SPEED

Warm engine: fully open the throttle with the lever against screw (2).

The speed should be within the specified tolerances.

The maximum speed stop screw (2) is sealed at the factory with a dab of varnish. It should only be adjusted by an injection centre specialist.



Vehicle	Type	Engine
RENAULT 18	1344 - 1354 - 2354	J8S..711
RENAULT 20	1276	852..700
RENAULT 21	L 486 - K 486 - S 486	J8S..704
RENAULT 25	B 296	J8S..706
TRAFIC	Txx3	852..750
	Pxx3	852..720
MASTER	Rxx3	J8S..330
JEEP	CJ7 - CJ8	J8S..800

Description	Make and type	Special details
Injection pump	ROTO DIESEL DPC R 8443... See application chart	Single distributor rotary pump with two pistons, mechanical centrifugal governor, automatic hydraulic advance, cold fast idling system and solenoid shut-off.
Pump T.D.C. timing Locked by a gauge rod		1.40 or 1.80 mm or dimension "X" on pump (see application chart)
Injectors	ROTO DIESEL RKB 45 S 5456	
Pintle and seat assembly	ROTO DIESEL A RDN OSDC 6751 B RDN OSDC 6751 C	Setting 118 ± 7 bars/max. difference 8 bars
Fuel filter	ROTO DIESEL	With integral priming pump. Note: As from 1987 the filter is fitted with a heater for heating the diesel via the engine cooling system.
Injector pipes		Outside diameter 6 mm Inside diameter 2.5 mm Length 330 mm
Fast idling thermostatic unit	CALORSTAT	Travel 7 to 8.5 mm between 30 and 67°C

SETTINGS

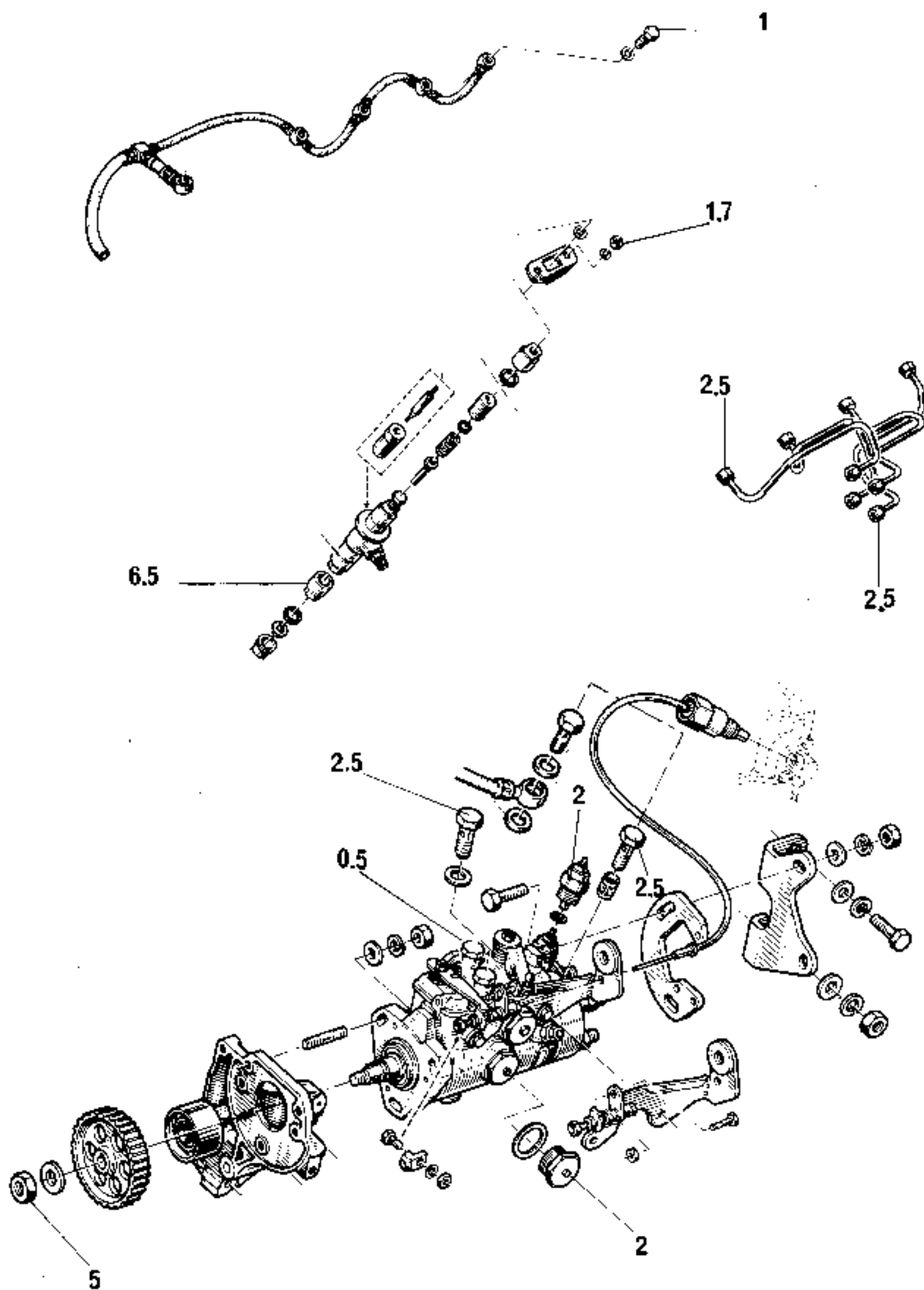
Idling	See chart
Max. speed	See chart
Smoke density :	
Approved figure	1 1.11^{m-1} : 36 % 2 1.31^{m-1} : 41 % 2^{m-1} : 55 %
Maximum legal : (Traffic and Master goods transport)	2.5^{m-1} : 64 %

TIMING CHECK (on diagnostic bay)

Injection pump	Idling speed r.p.m.	Injection commences Before T.D.C.
	750 ± 50	9.5 ± 1°
L, K & S 486	850 ± 50	9.5 ± 1°

Vehicle	Type	Injection pump ROTO DIESEL DPC	Timing setting	Idling speed in r.p.m.	Max. speed in r.p.m.
Renault 18	1344 1354 2354	R 8443 060 B R 8443 061 B R 8443 062 B	1.40	750 ± 50	4 750 to 4 900
		R 8443 130 A R 8443 131 A R 8443 132 B R 8443 A 132 B R 8443 138 A Mod DS* R 8443 139 A Mod DS*	1.80		
Renault 20	1276	R 8443 060 A R 8442 061 A R 8443 062 A	1.40	750 ± 50	4 750 to 4 900
		R 8443 130 A R 8443 131 A R 8443 132 B R 8443 A 132 B R 8443 138 A Mod DS* R 8443 139 A Mod DS*	1.80		
Renault 21	L 486 K 486 S 486	R 8443 A 400 A R 8443 A 401 B	1.80	850 ± 50	4 750 to 4 900
		R 8443 B 402 B	Dimension (X) on pump		
Renault 25	B 296	R 8443 A 400 A R 8443 A 401 B	1.80	750 ± 50	4 750 to 4 900
		R 8443 B 402 B	Dimension (X) on pump		
TRAFIC	Txx3 Pxx3	R 8443 090 A R 8443 091 A R 8443 092 A R 8443 093 A	1.40	800 ± 25	4 250 to 4 400
		R 8443 140 A R 8443 141 A R 8443 142 B R 8443 A 142 B R 8443 148 A Mod DS* R 8443 149 A Mod DS*	Dimension (X) 1.80		
		R 8443 B 143 B	Dimension (X) on pump		
MASTER	Rxx3	R 8443 140 A R 8443 141 A R 8443 142 B R 8443 A 142 B R 8443 148 A Mod DS* R 8443 149 A Mod DS*	1.80	800 ± 25	4 250 to 4 400
		R 8443 B 143 B	Dimension (X) on pump		
JEEP	CJ7 - CJ8	R 8443 190 A R 8443 191 A R 8443 192 B R 8443 A 192 B	1.80	750 ± 50	4 750 to 4 900

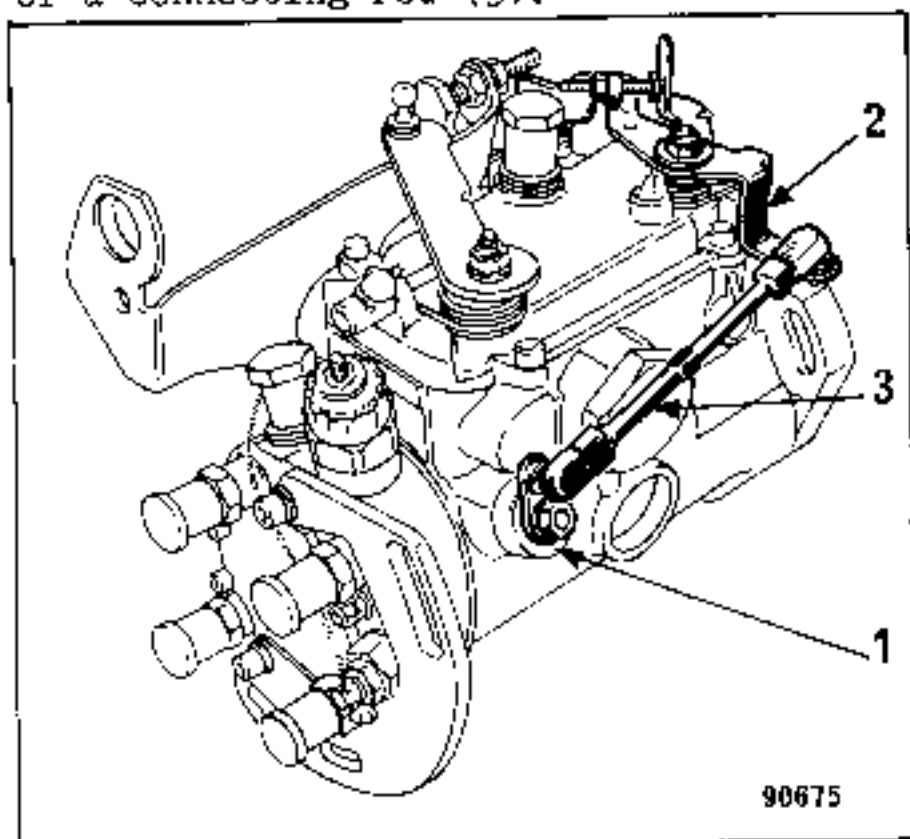
Note : Injection pumps with the plate inscription "Mod DS" identified on the chart by "*" were originally 060 to 062 A or B and 090 to 093 A pumps that have been modified (by the removal of the low load advance system). It is therefore essential to set their timing at 1.80 mm.



HYDRAULIC ADVANCE SYSTEM CONTROLLED BY A SHUT-OFF VALVE

RENAULT 21 and 25 DIESEL vehicles with ROTO DIESEL equipment are fitted with an injection pump which has a hydraulic advance system controlled by a shut-off valve.

The external appearance of this pump differs from the earlier pump in that it has a low load advance shut-off valve (1) connected to the cold start accelerated idling lever (2) by means of a connecting rod (3).



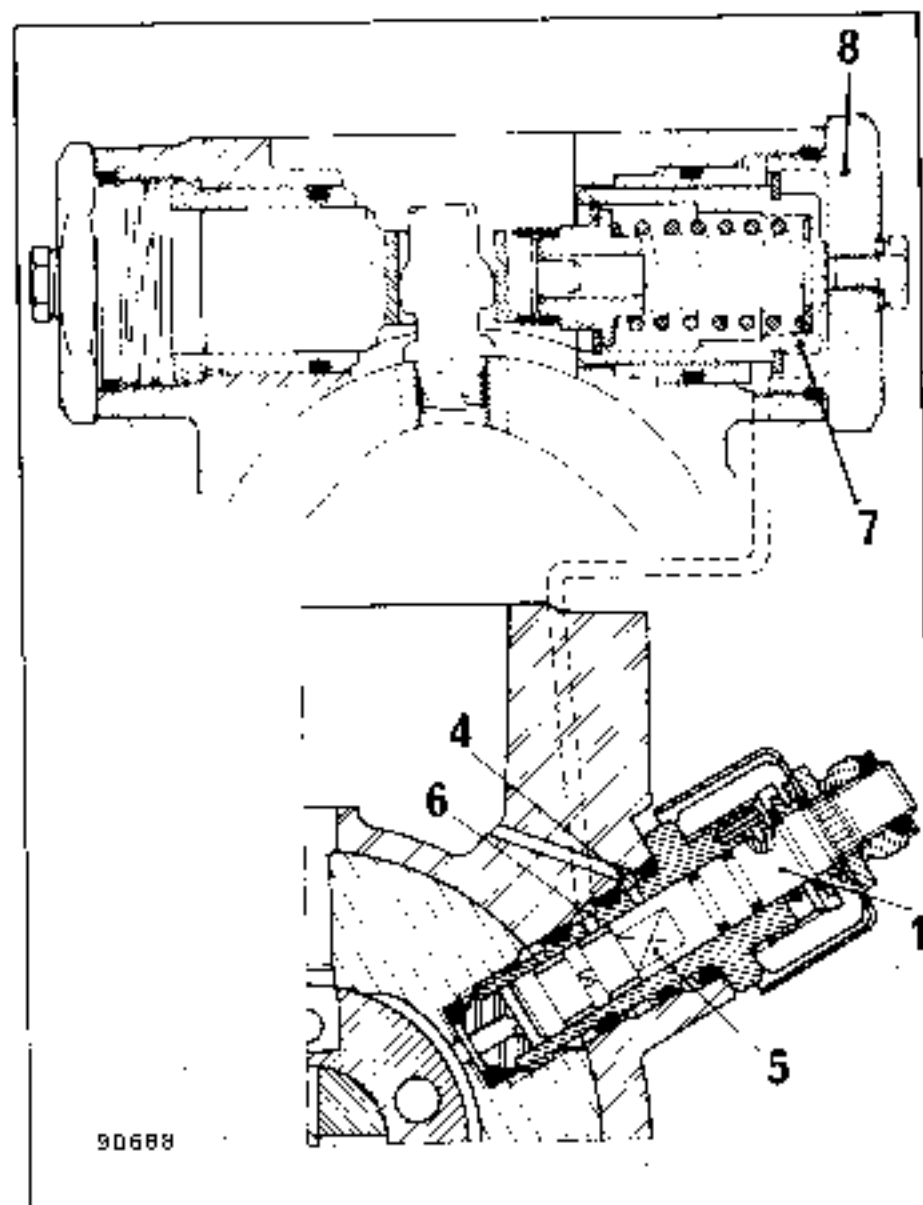
Cold engine

The thermostatic sensor moves lever (2) into the accelerated idling position.

By means of rod (3), shut-off valve (1) is moved into the open circuit position and flat (5) connects ducts (4) and (6).

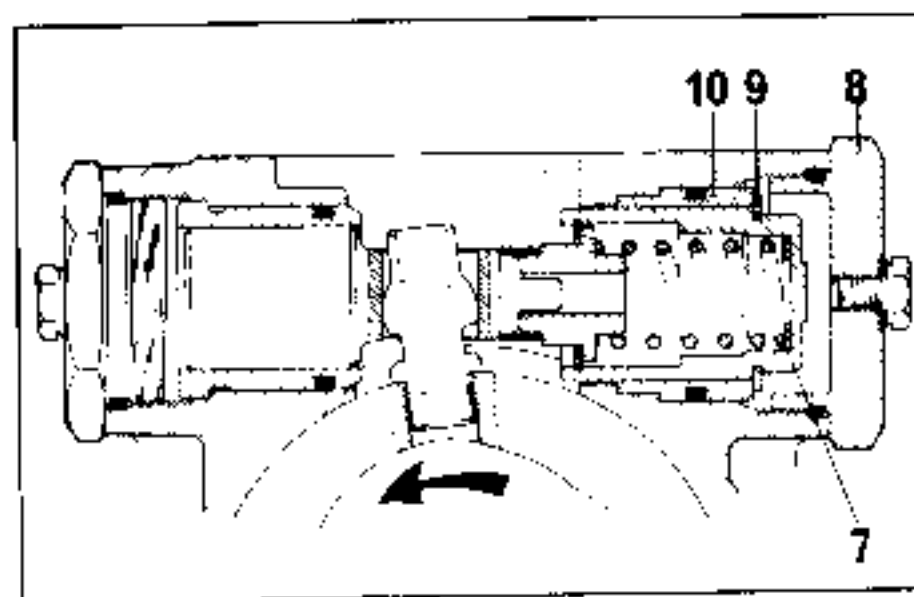
The fuel, under transfer pressure at piston (7) end, is sent directly into the upper housing.

Piston (7) comes into contact with plug (8), producing an additional advance of approximately 1.5° (ie. approximately 3° at crankshaft).



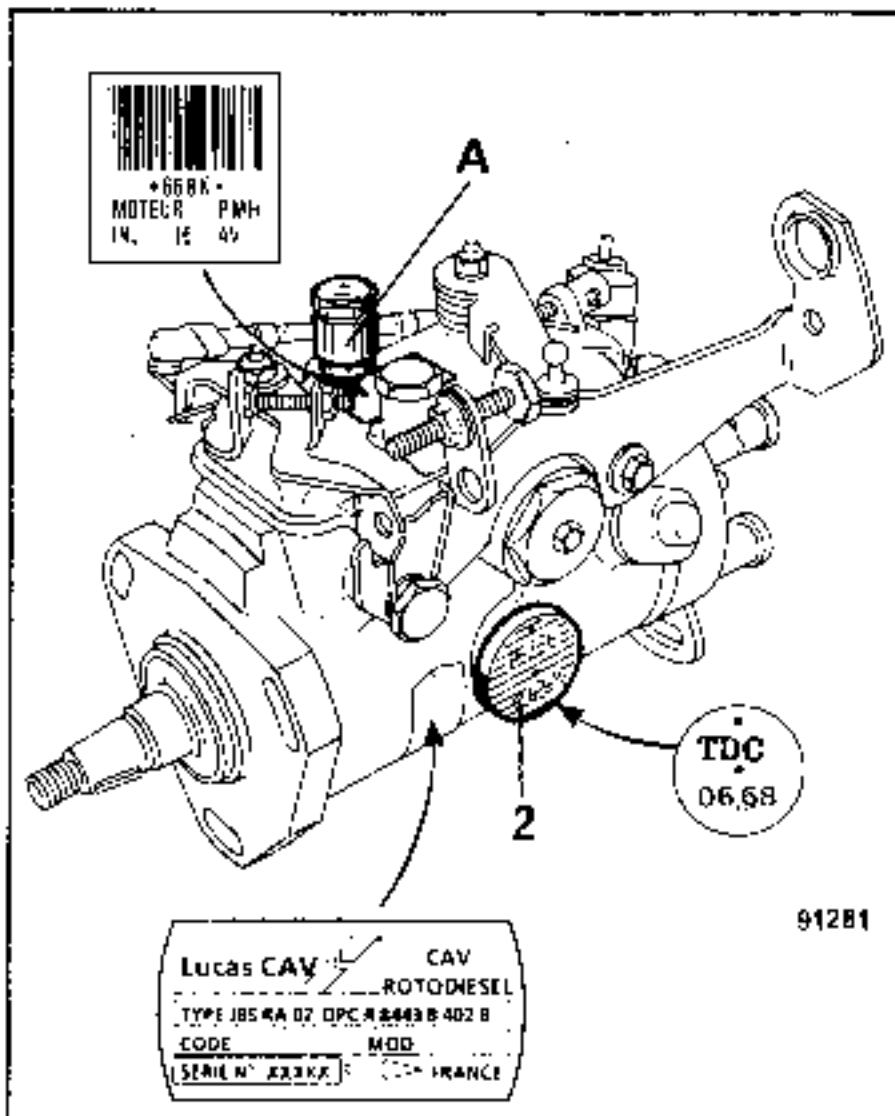
Hot engine

When the engine heats up, the thermostatic sensor frees accelerated idling lever (2). Rod (3) moves the spindle of shut-off valve (1) and flat (5) is no longer opposite ducts (4) and (6). The fuel, under transfer pressure, moves piston (7), the travel of which is limited by circlip (9), which comes to stop on liner (10), thus cancelling the additional advance obtained when the engine was cold.



TIMING THE INJECTION PUMP VIA THE COVER

As from the pumps with suffix B, for example DPC R 8443 B 402 B, the timing method is carried out using a new piece of equipment which is to be placed on the pump cover.



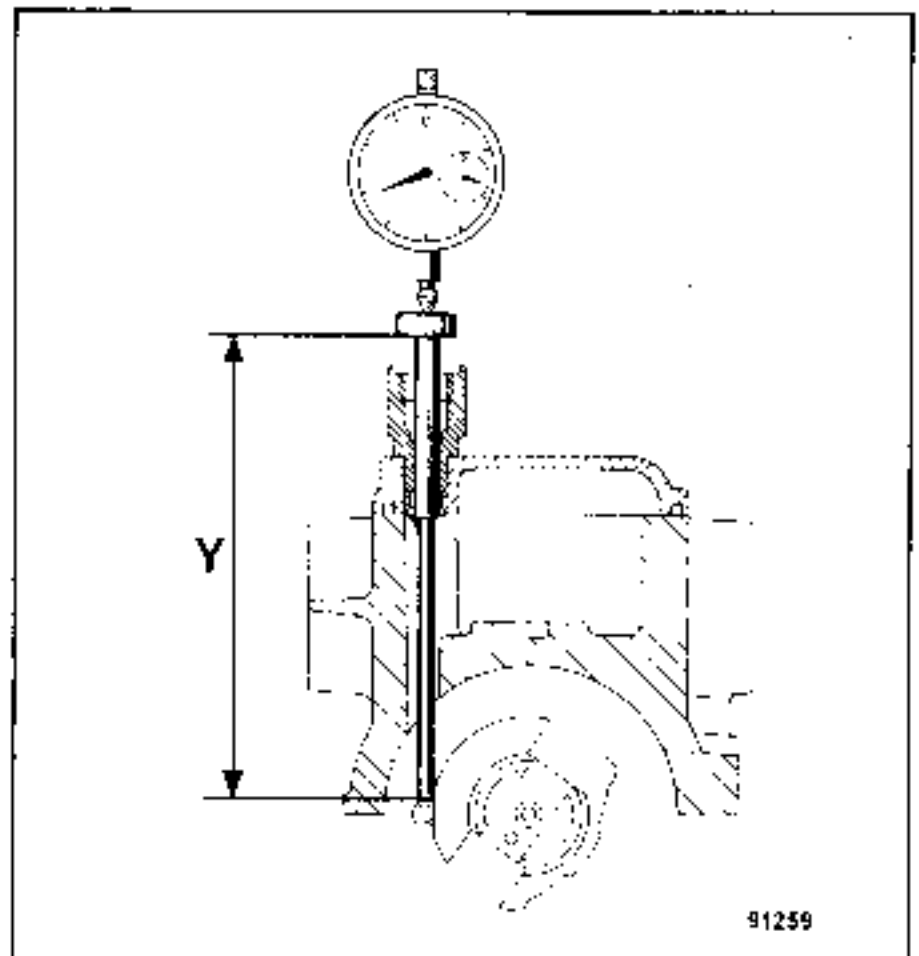
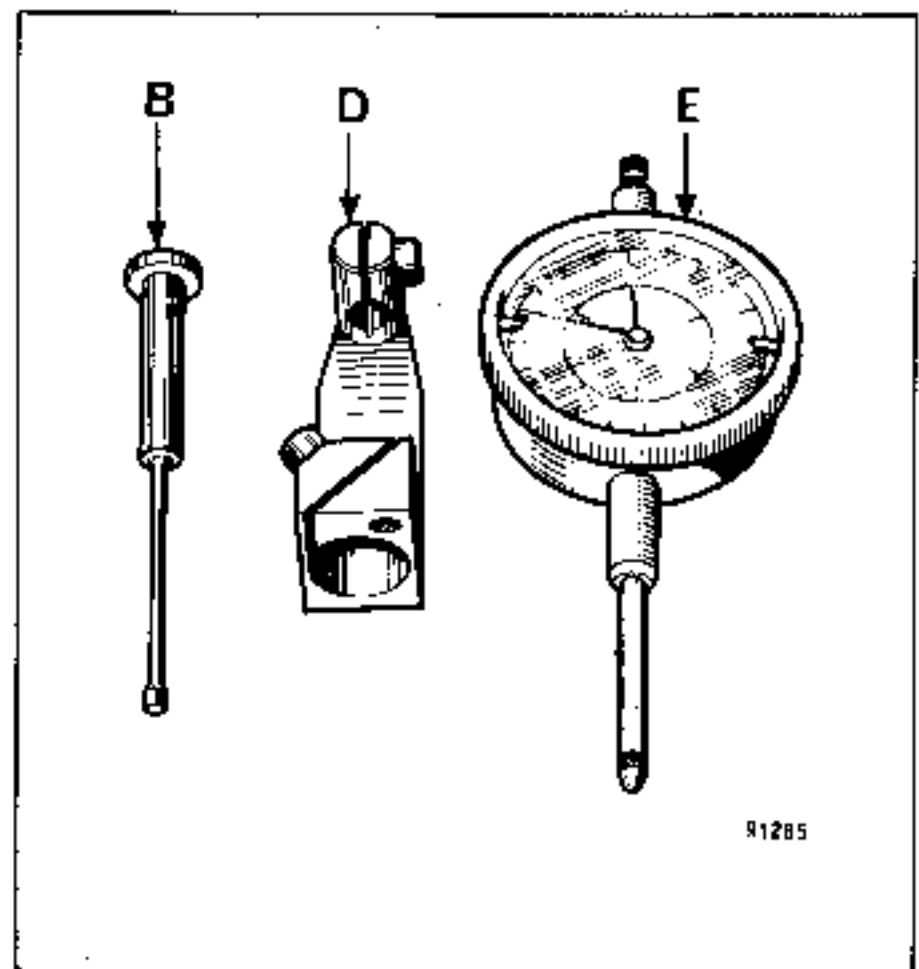
The pump cover has a timing duct (A) fitted with a blanking plug. On these new pumps the gauge lift value (which is peculiar to each pump) is stamped on blanking plug (2). This value corresponds to the timing value on the engine at TDC.

The new system is easier to use for the following reasons:

- angle bracket no longer required;
- the gauge no longer has to have a spring arm;
- the pump body does not have to be drained before the timing can be checked.

Suitable tooling Mot. 1079, comprising the following components, must be used:

- a gauge (B) with very precise dimensions (length $Y = 95.5 \pm 0.01$ mm);
- a dial indicator support (D);
- a dial indicator (E) with a travel of 30 mm.



NOTE: Some pumps may have a bar code label on the cover. This system is only valid for mounting in the factory with suitable tooling.*

The blanking plug showing the timing value is white originally and blue when the pump has been overhauled by a Renault Injection Centre or CAV ROTO DIESEL specialist.

* It should have been removed in the factory and is to be ignored.

ESSENTIAL SPECIAL TOOLING

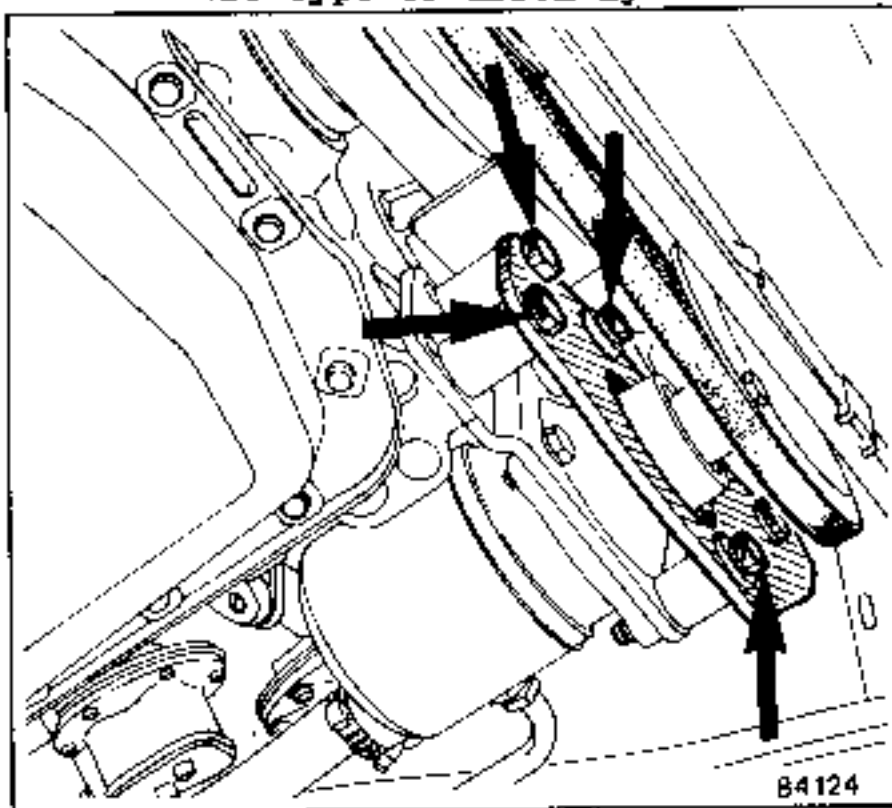
Mot. 854	Injection pump sprocket retainer
Mot. 861	TDC gauge rod
Mot. 877	Tools for setting the Roto Diesel pump timing
Mot. 909-01	Spanner for injection pump nut
Mot. 1053	Injection pump sprocket extractor (replaces B.Vi.28-01, B.Vi.48, B.Vi.859)
Mot. 1079	Tooling for timing Roto Diesel pump (suffix "B") via cover

REMOVING

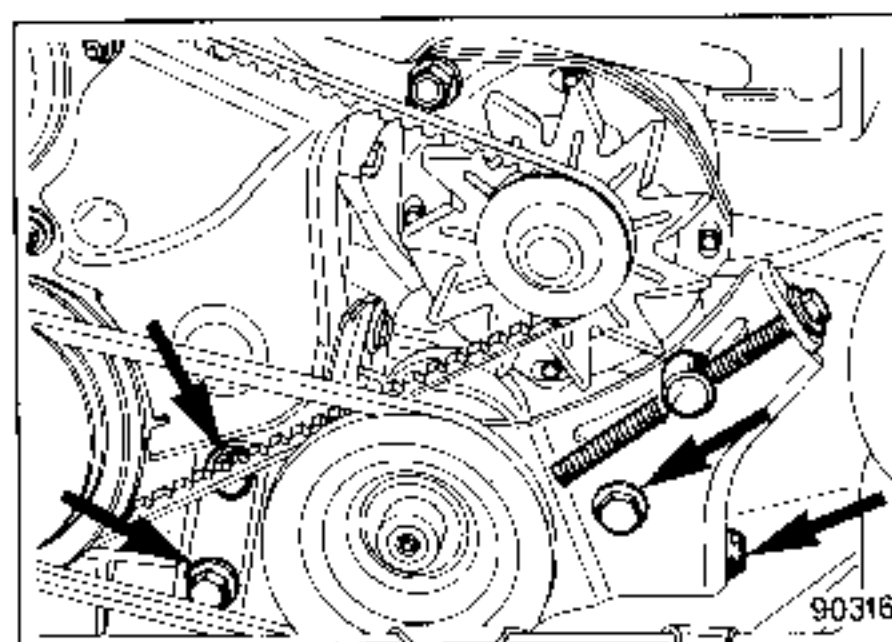
Depending on the version, it may be necessary to remove certain accessories to remove the timing gear casing. See the particular workshop manual for the vehicle in question.

Vehicles with power-assisted steering pump under the alternator

1st type of assembly



2nd type of assembly



Remove the protective panel from under the engine.

Unscrew the hydraulic pump securing bolts (shown by arrows).

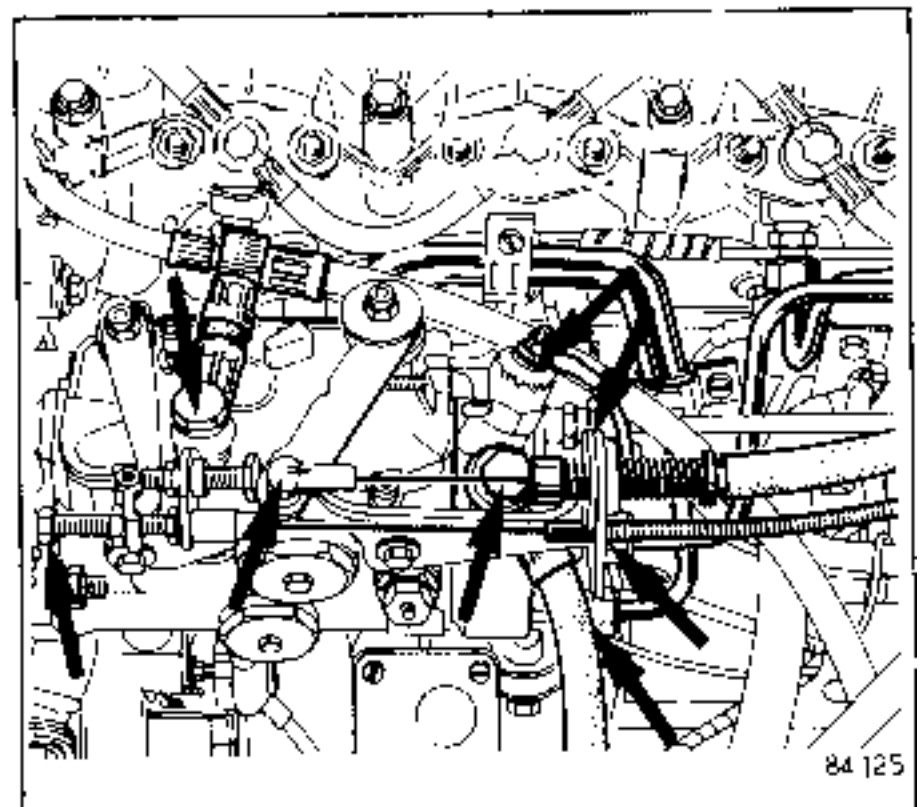
Remove the drive belt and retighten the hydraulic pump securing bolts.

Disconnect the battery.

Disconnect the throttle control, the shut-off solenoid wire and the fast idling cable.

Disconnect the fuel feed and return pipes.

Remove the injector pipes.

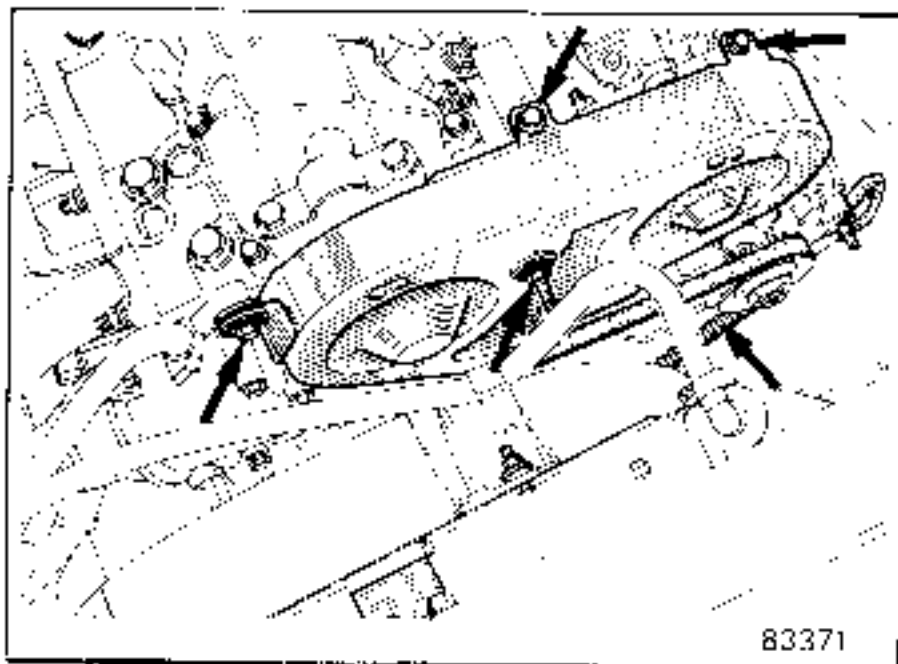


WARNING

Protect the alternator from the fuel which will run out during removal.

Loosen the alternator drive belt and pull back the alternator.

Remove the timing gear casing securing bolts and the casing.



Remove the spacer ring and take off the rear protection plate.

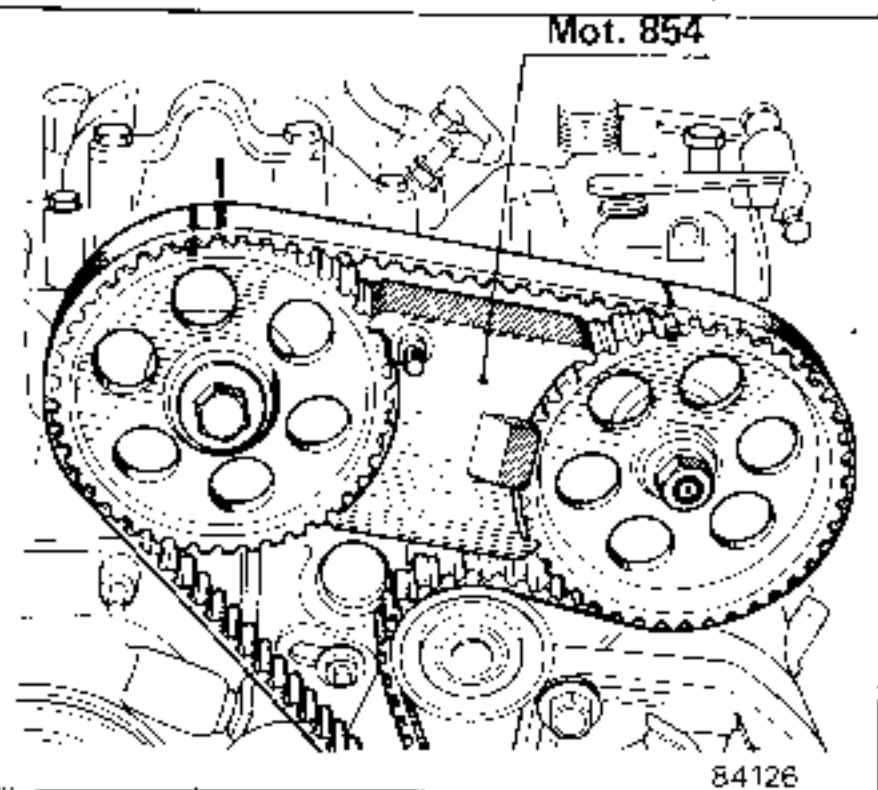
Turn the crankshaft to bring the engine to TDC on No. 1 cylinder (flywheel end).

In this position check that:

- the mark on the camshaft sprocket is in line with the centre of the boss on the rocker arm cover;
- the mark on the injection pump sprocket is in line with the centre of the injection pump boss.

Then move back by one tooth.

Fit locking tool Mot. 854 by turning the crankshaft slightly in both directions until it enters the teeth in the sprockets and then secure it.

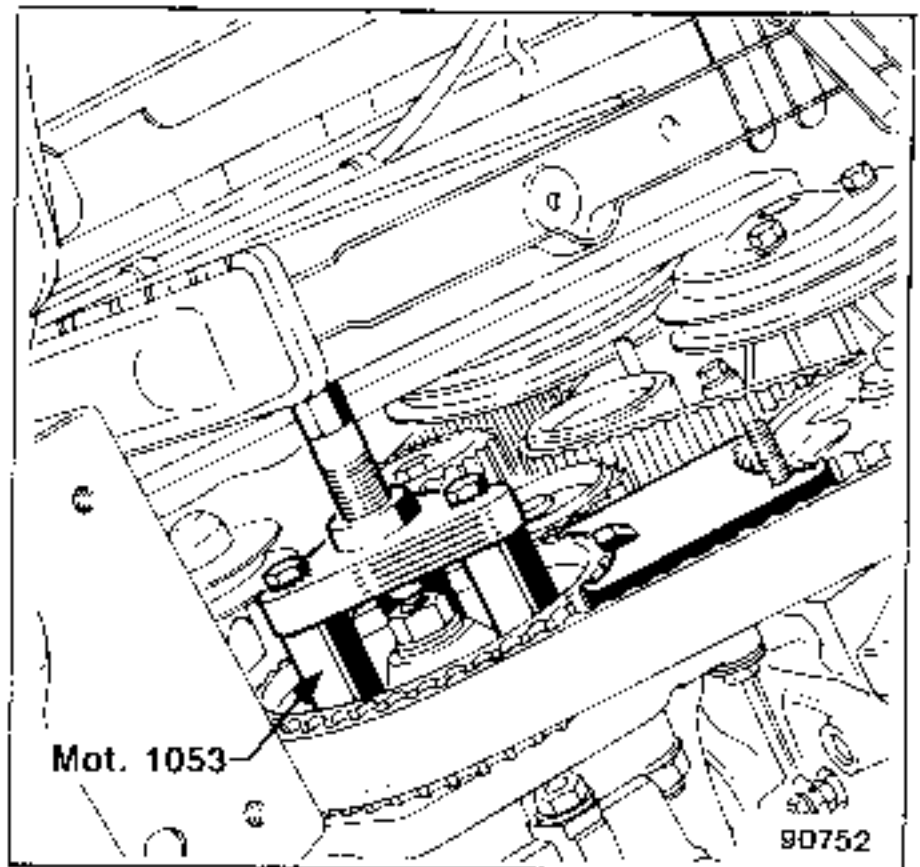


Unscrew the nut on the pump driveshaft until it is flush with the end of the thread.

Fit tool Mot.1053 to the pump sprocket. **Never** locate its claws on the sprocket teeth.

DO NOT STRIKE THE ASSEMBLY WITH A HAMMER TO FREE THE SPROCKET (risk of internal damage to the pump).

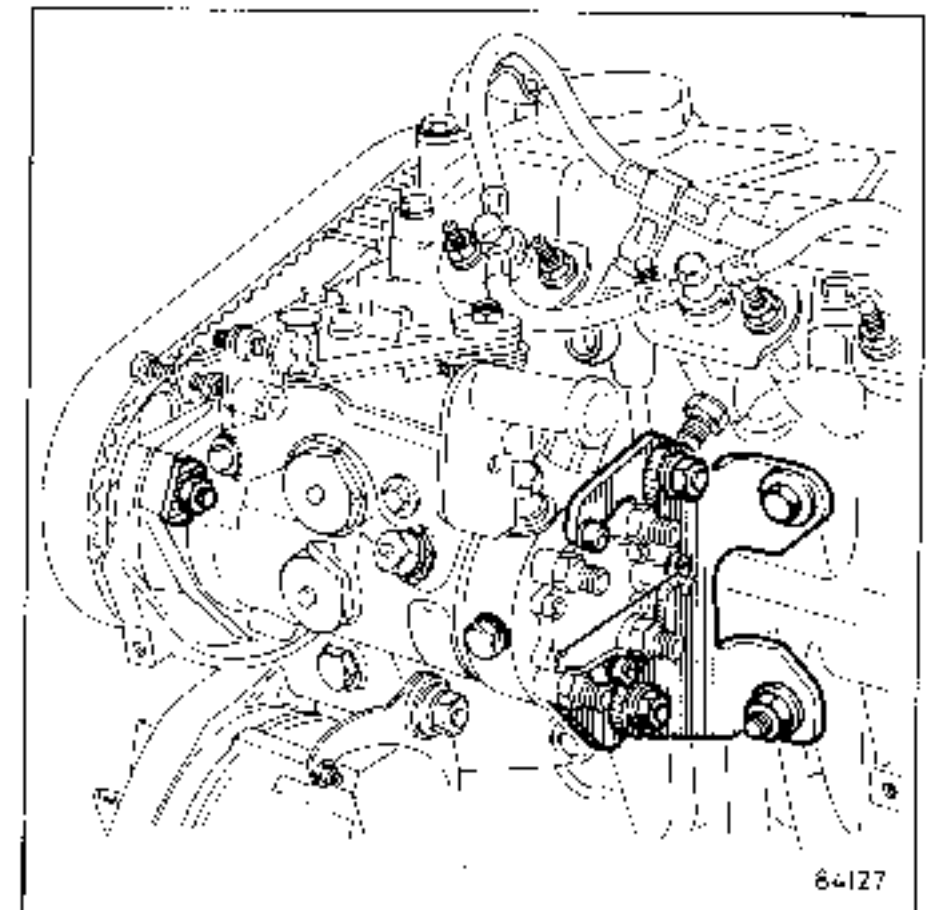
Free the sprocket from its taper and remove extractor Mot.1053 and the sprocket nut and washer.



Remove the protective casing and the pump rear support.

Remove the pump securing nuts and washers.

Take out the injection pump.



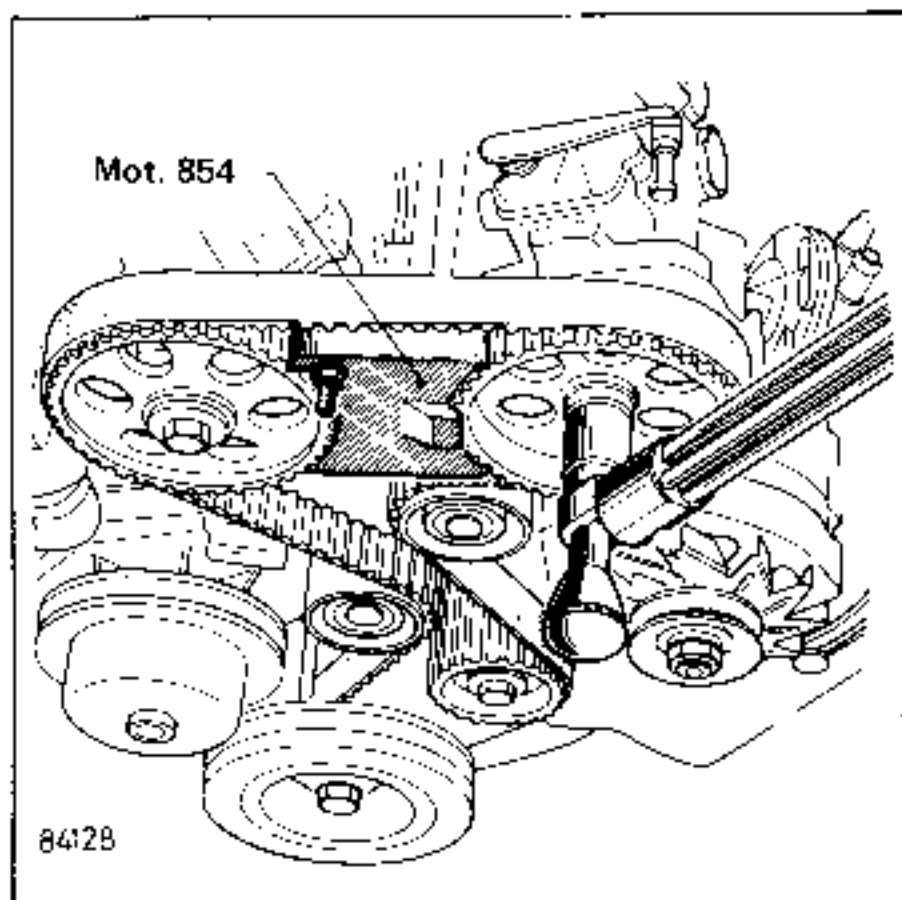
REFITTING

Fit the pump to the engine, aligning the key with the keyway in the sprocket.

With the pump in position, fit the securing nuts, washer and flange, without tightening them.

Fit the sprocket securing nut and washer and tighten it to the specified torque.

Remove locking tool Mot. 854.



TIMING

(PUMP WITH ACCESS TO TIMING AT THE SIDE)

The pump has:

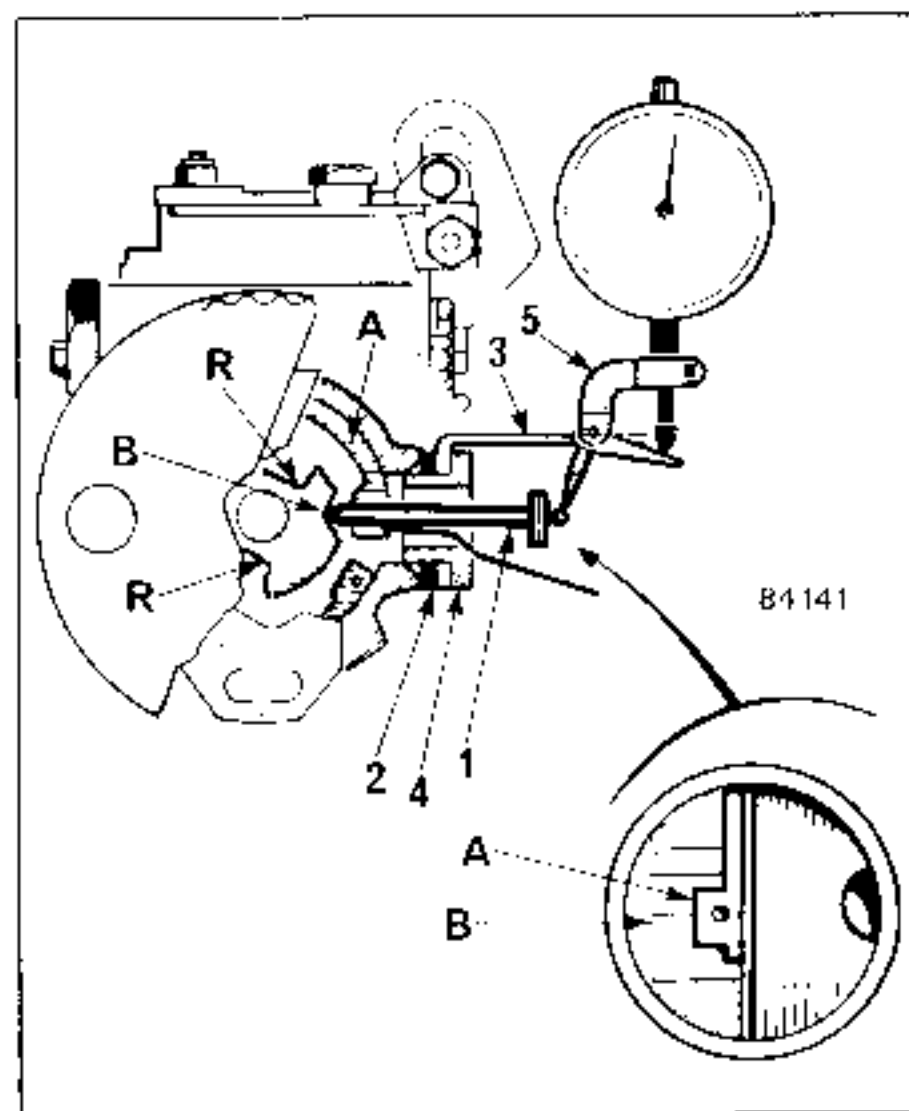
- a timing "V" on the rotating assembly (B);
- a positioning and gauge guide circlip (A), to obtain dial indicator readings on the fixed internal part.

This circlip is positioned at the factory and must never be moved.

Fitting the dial indicator support

Kit Mot.877 consists of :

- a timing gauge rod (1);
- a spacer washer (2) (not to be fitted when the throttle support is mounted on the access plug);
- a dial indicator support (3) with a securing screw and a milled nut to secure the indicator on the support;
- a support securing nut (4);
- an angle bracket secured to the dial indicator (5).



To avoid errors in measurement when timing the pump, a dial indicator corresponding to the following specifications must be used:

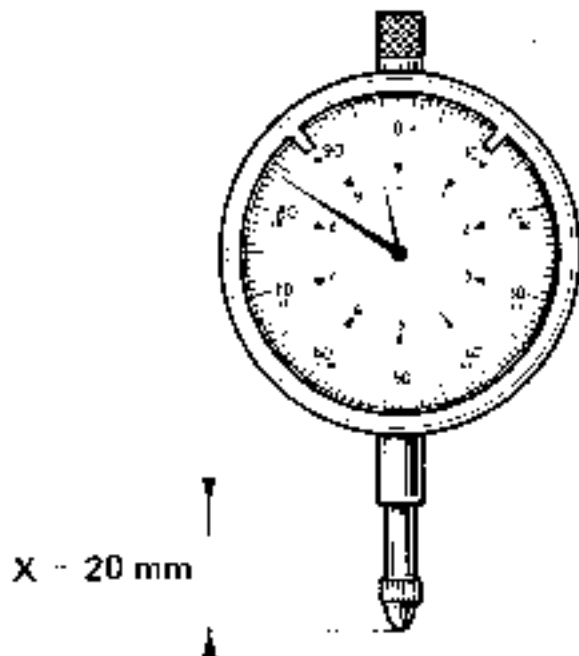
- barrel diameter 8 mm;
- travel 10 mm;
- max. dial diameter 60 mm;

- plunger projection from barrel (dimension X) 20 mm, with securing lug.

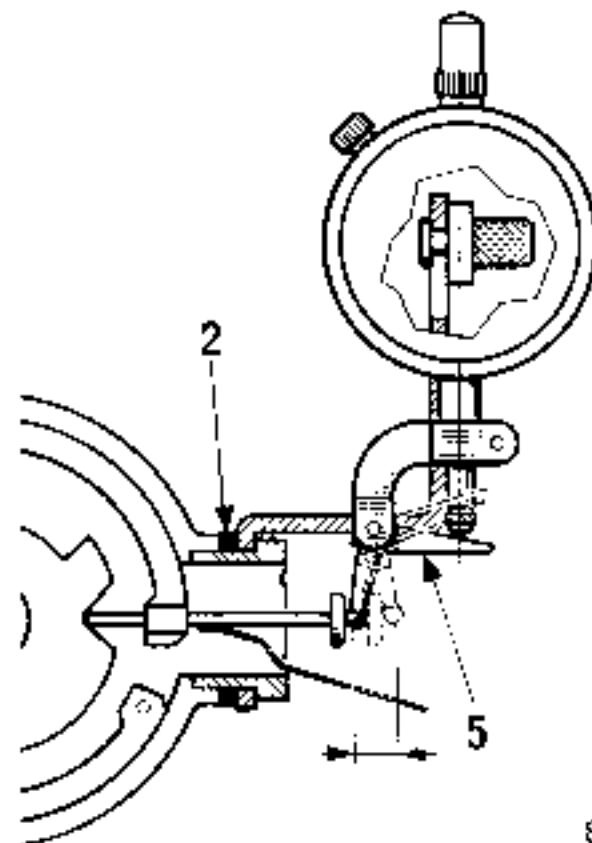
Of the various dial indicators which have been approved, only the **MITUTOYO** and **MICROS SANVOISIN** dial indicators which correspond to these specifications are to be used.

Reminder:

Fitting the dial indicator support

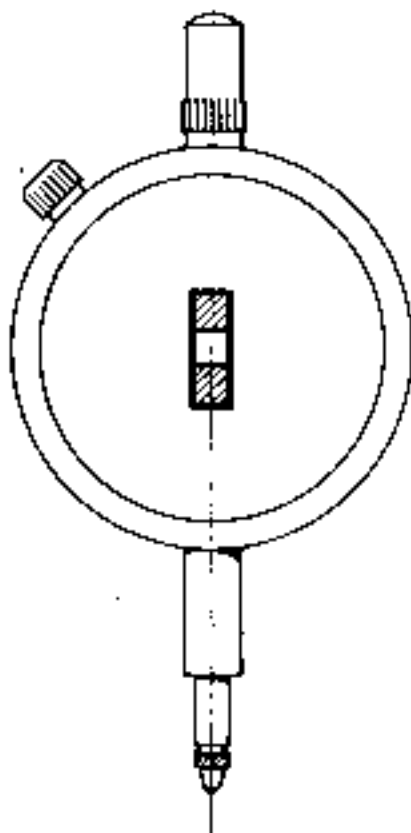


- mounting lug centred on the base of the dial indicator so as to ensure that angle bracket (5) is perpendicular;



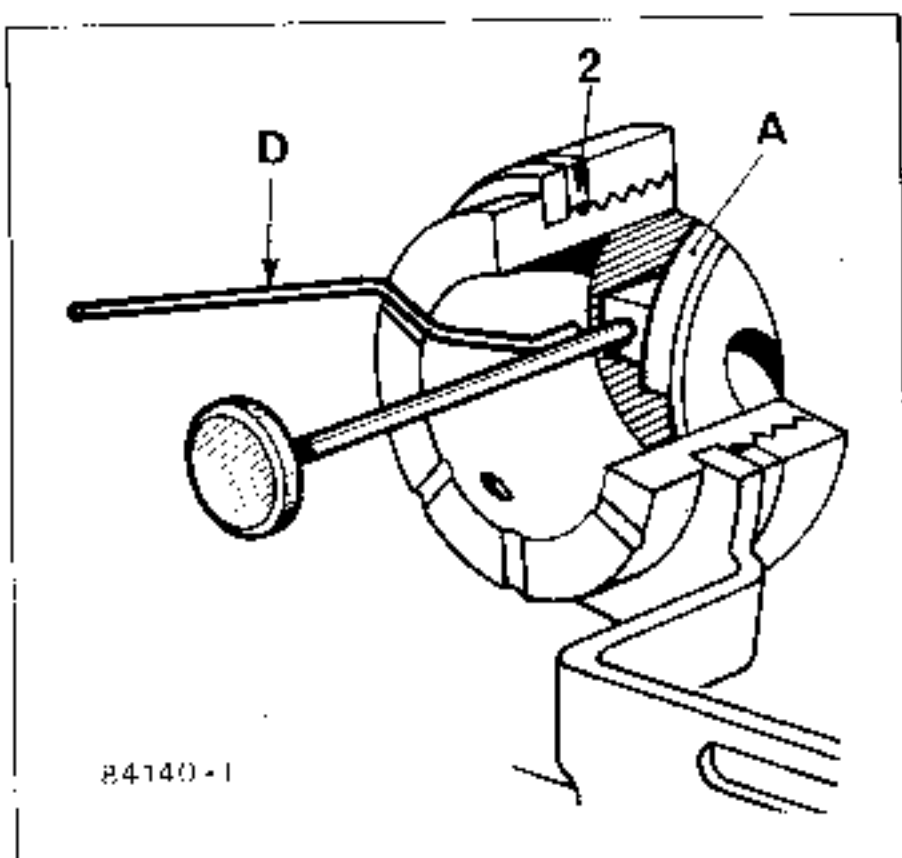
NOTE:

Shim (2) is to be used on all pumps which do not have a throttle support lug on the timing plug.



The gauge rod has a spring arm (D) because the rotating part of the pump has slots (R)* into which it can enter when the engine or the pump is turned outside the timing ramp area.

* See page 47



WARNING

The position of circlip (A), determined at the factory, represents the injection commencement point on the pump. It is therefore essential to take every precaution to avoid moving it.

When mounting the support, the centre of the adjusting "V" (B) should be in line with the gauge rod hole in the circlip (one tooth before TDC, No.1 cylinder compression, flywheel end).

Remove the timing access plug.

Place rod (1) in the hole in the circlip.

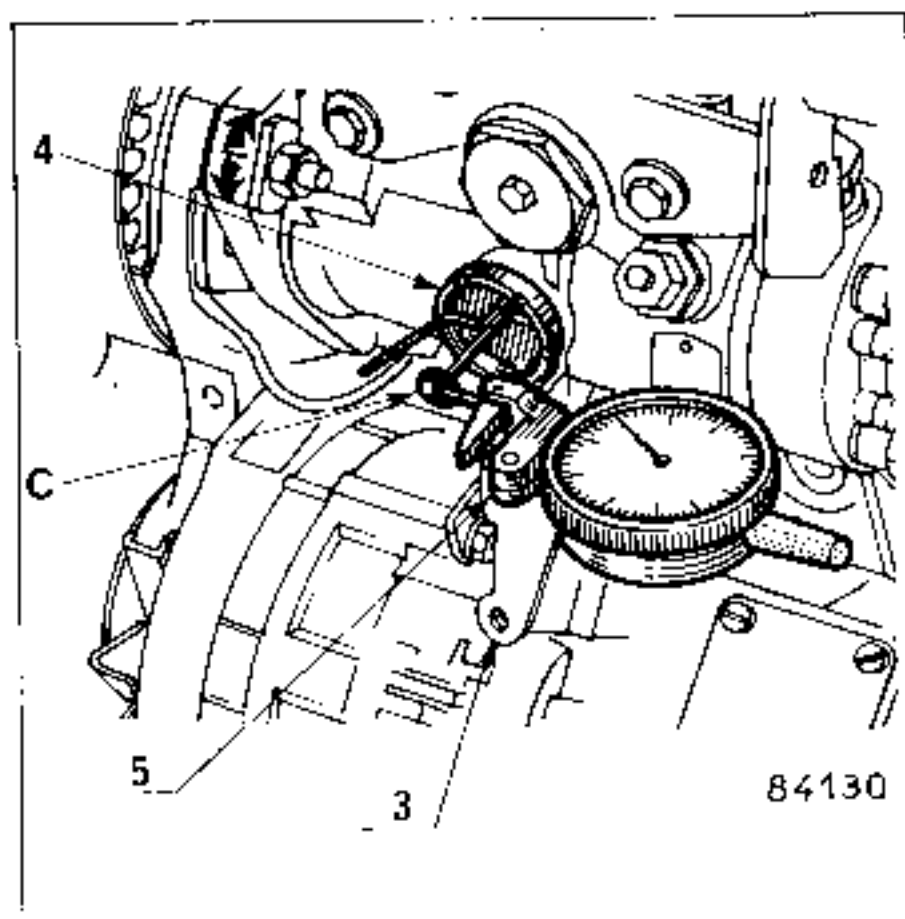
Fit nut (4) with support (3) and washer (2) and screw it in.

Secure angle bracket (5) to the dial indicator and fit the assembly to support (3).

Adjust the assembly so that the dial indicator is at half travel, angle bracket ball (C) is in the centre of the gauge rod and the bracket itself is square with the end of the dial indicator.

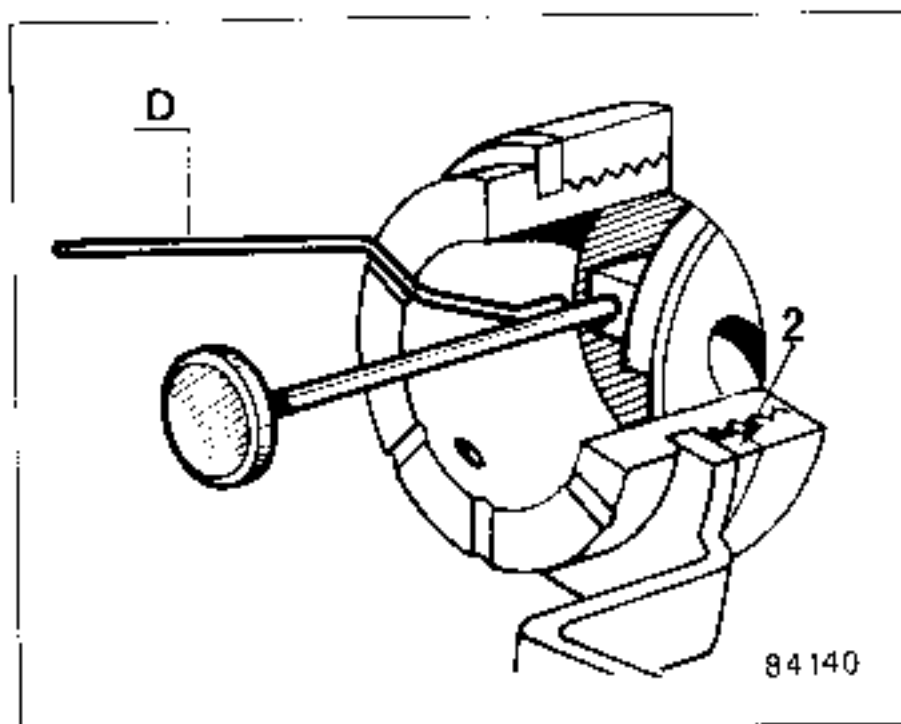
Then, by turning the pump in both directions, determine the centre point of the "V" (B) (smallest reading on the indicator) and zero the dial.

Note the lowest figure obtained, for example 4 mm.



WARNING

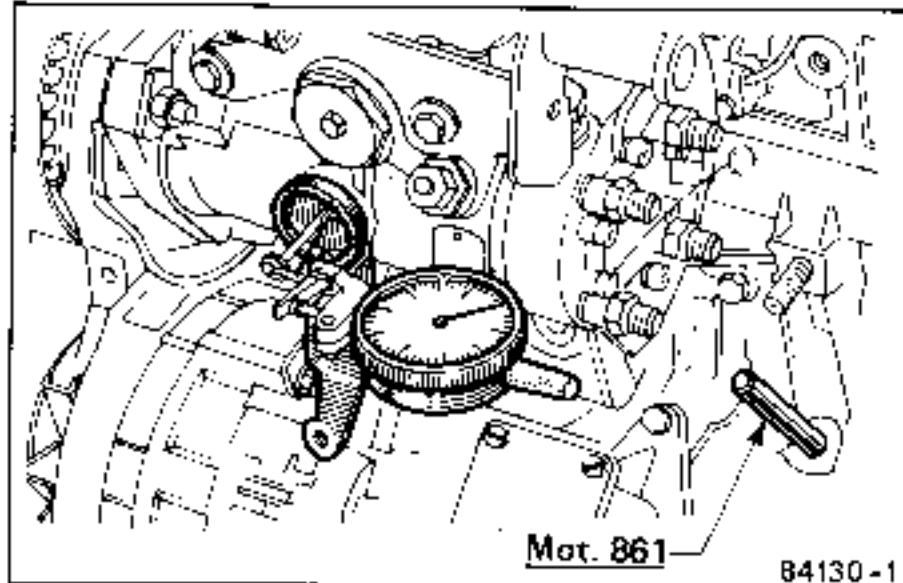
REMEMBER TO TAKE OUT THE GAUGE ROD BEFORE TURNING THE CRANKSHAFT, OTHERWISE THE CIRCLIP MAY MOVE AND BREAK THE GAUGE ROD.



TIMING

Disengage the gauge rod. To do this, pull the rod and engage its spring arm in one of the slots provided on the securing nut.

Turn the crankshaft in its normal direction of rotation through two turns and stop approximately two teeth before TDC, No.1 cylinder compression. Bring the gauge rod into contact with the "V" in the pump rotor.



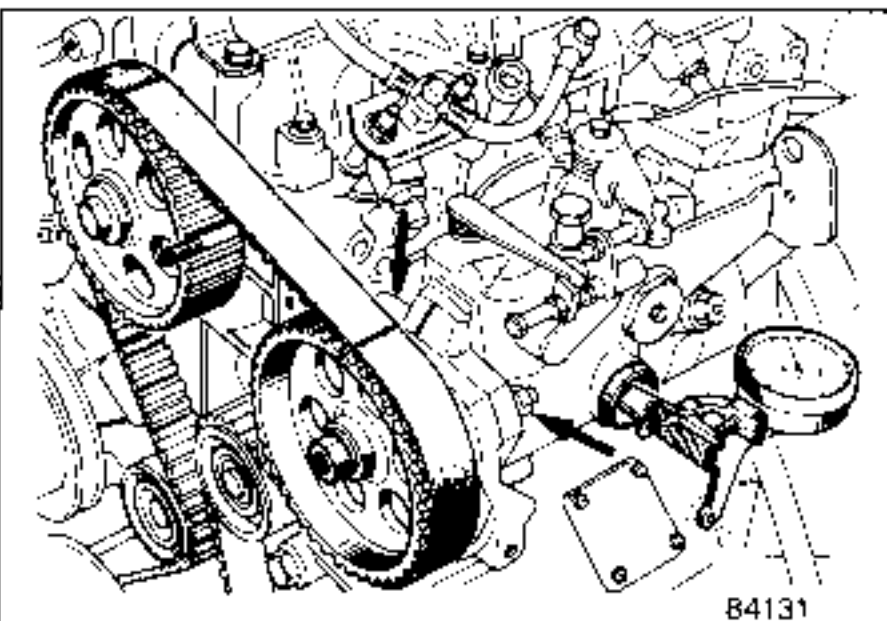
Slowly turn the crankshaft in its normal direction of rotation, check the lowest point (dial indicator zero, for example 4mm) and lock the crankshaft at TDC with pin Mot.861.

Example of timing at 1.80 mm

Turn the pump to lift the gauge rod by 1.80 mm, that is:

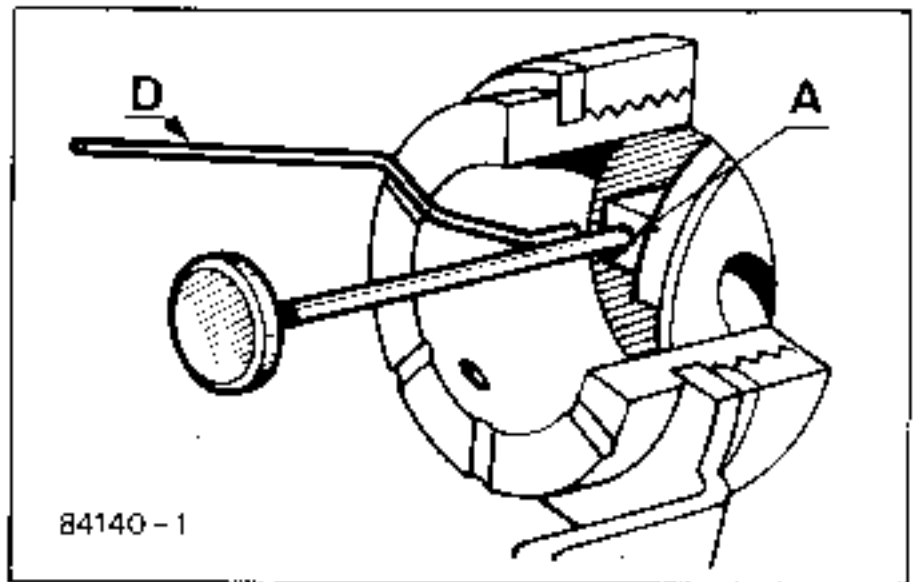
for example: $4 \text{ mm} + 1.80 \text{ mm} = 5.80 \text{ mm}$ at the dial indicator.

Tighten the pump securing nuts.



CHECKING

Pull out crankshaft pin Mot.861 and the timing gauge rod.



TAKE GREAT CARE TO ENSURE THAT THE SPRING ARM IS SECURE IN ONE OF THE SLOTS IN THE NUT.

Turn the engine through two turns. Stop two teeth before TDC.

Unlock the dial indicator gauge rod.

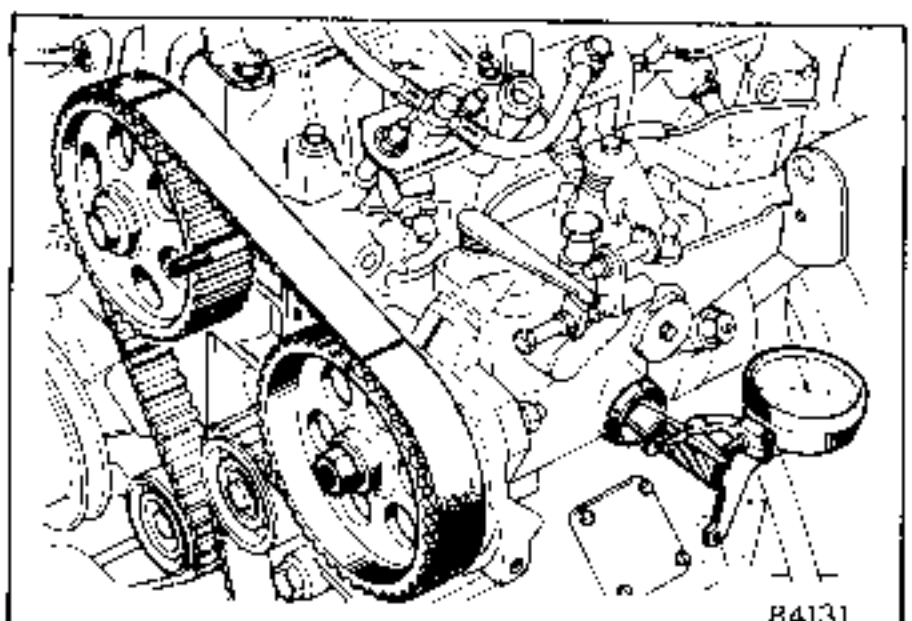
Slowly turn the engine back to check the zero point and then until rod Mot.861 engages in the crankshaft.

The figure should be between 1.78 and 1.82 mm.

Correct it if necessary.

Check the timing marks in this position:

- camshaft: (mark on sprocket in line with centre of boss on rocker arm cover);
- injection pump: (mark on sprocket roughly on centre of injection pump boss).



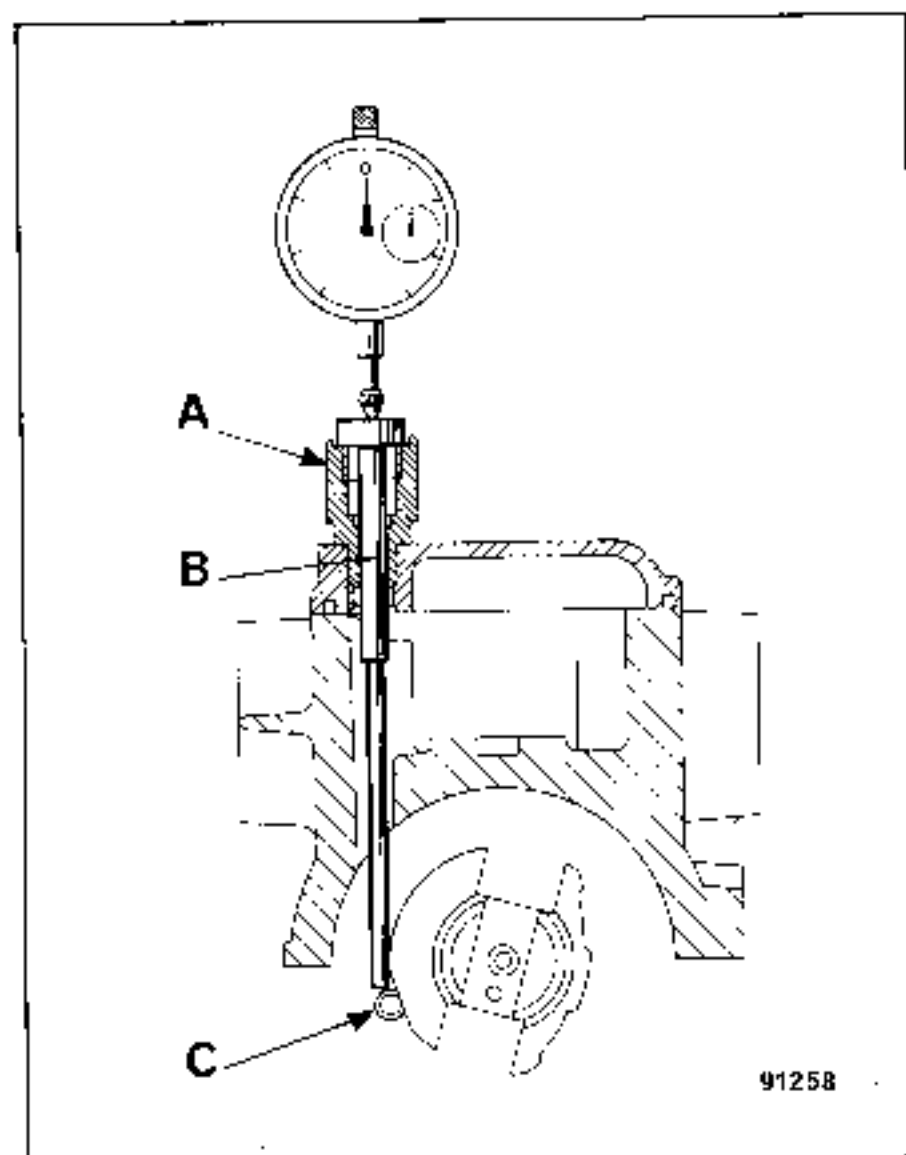
Note: Between the two marks on the sprockets there should be twenty recesses between the teeth on the toothed belt.

TIMING (PUMP WITH ACCESS VIA COVER)

The pump comprises:

- a timing duct (A) located on the pump cover, on which timing gauge rod (B) rests;
- a dowel (C) which is welded to the hydraulic head rotor.

The gauge lift value corresponding to the pump timing when the engine is on TDC is stamped on the side access plug of the pump.



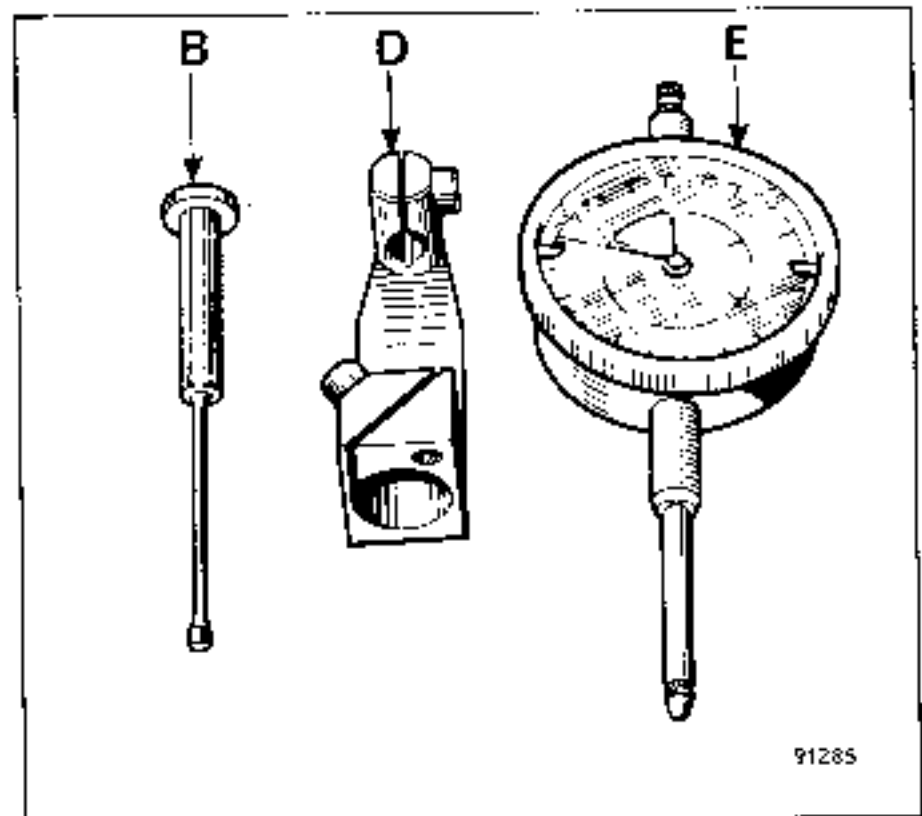
NOTE: By turning the pump driveshaft in the normal direction of rotation, the dowel drives the timing gauge for a travel of approximately 18 mm.

Fitting tooling Mot.1079

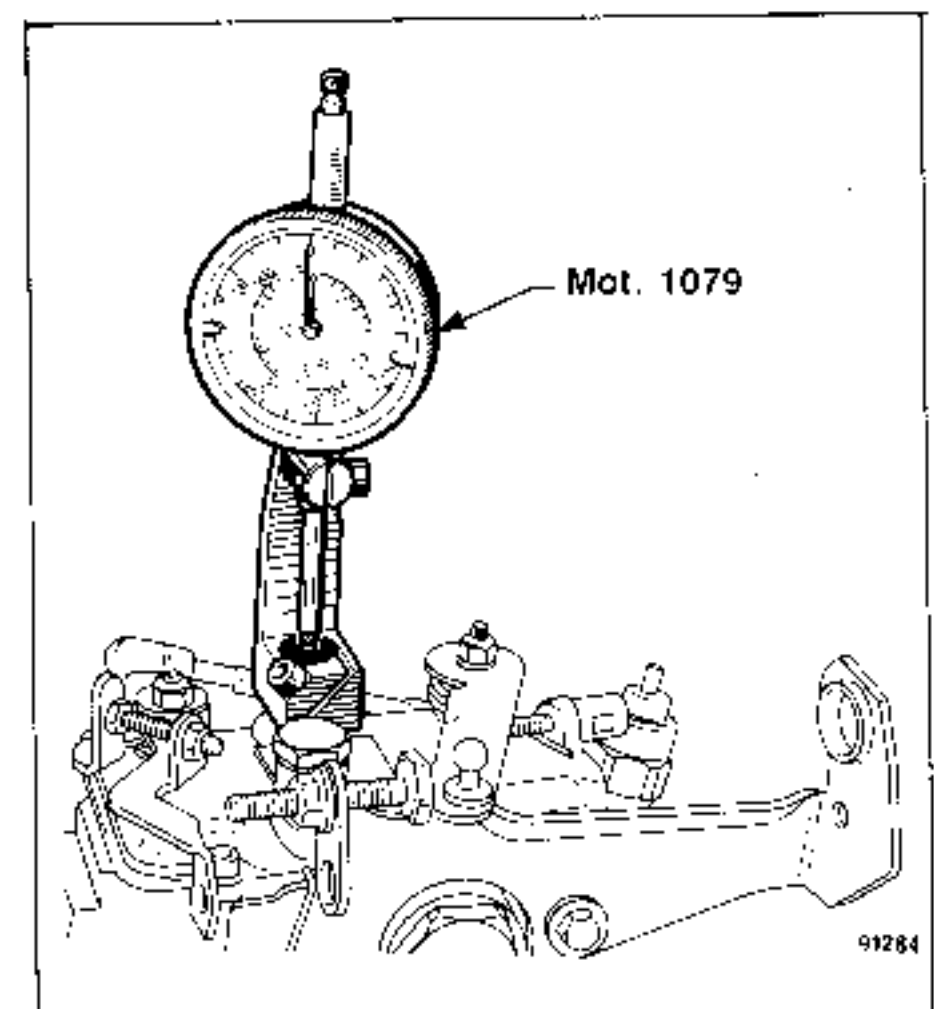
Kit Mot.1079:

- a timing gauge rod (B) which has a reduced diameter in the centre enabling it to move sideways when the pump turns backwards;

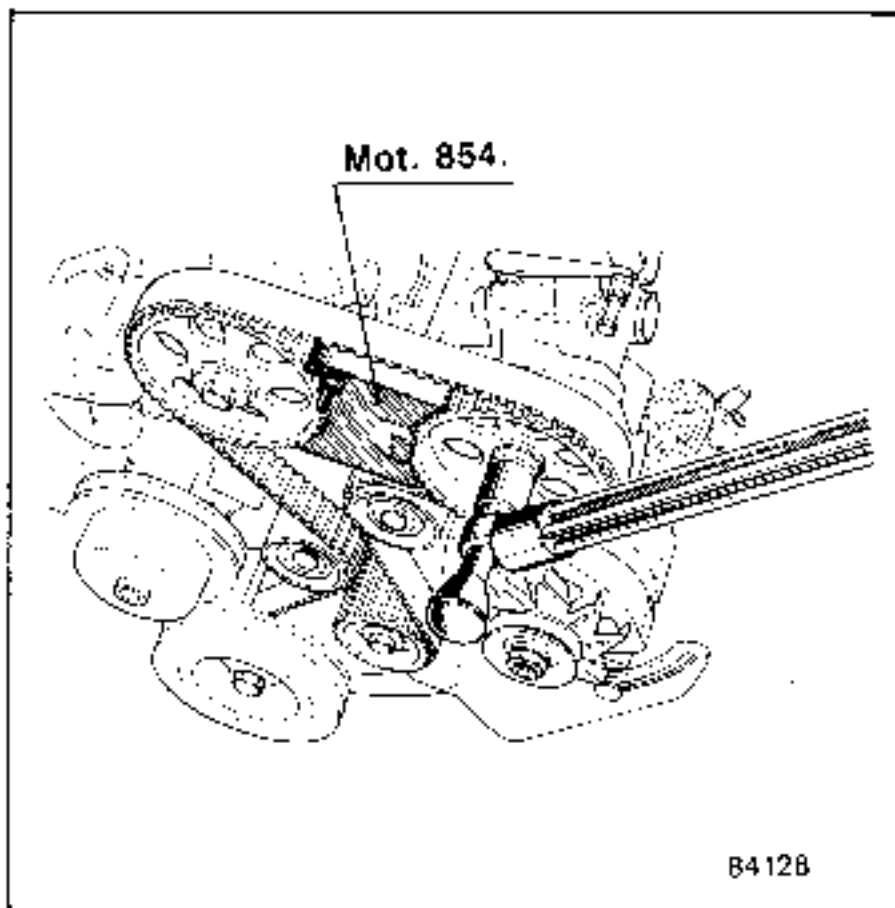
- a dial indicator support (D);
- a dial indicator with a travel of 30 mm (E).



- Remove the access plug and its seal.
- Place gauge rod (B) in timing duct (A) and ensure that it is not in contact with dowel (C).
- Fit in place dial indicator support (D) on duct (A) and secure it.
- Offer up dial indicator (E) to the support and tighten it at a travel of 0.2 mm.
- Zero the dial indicator.



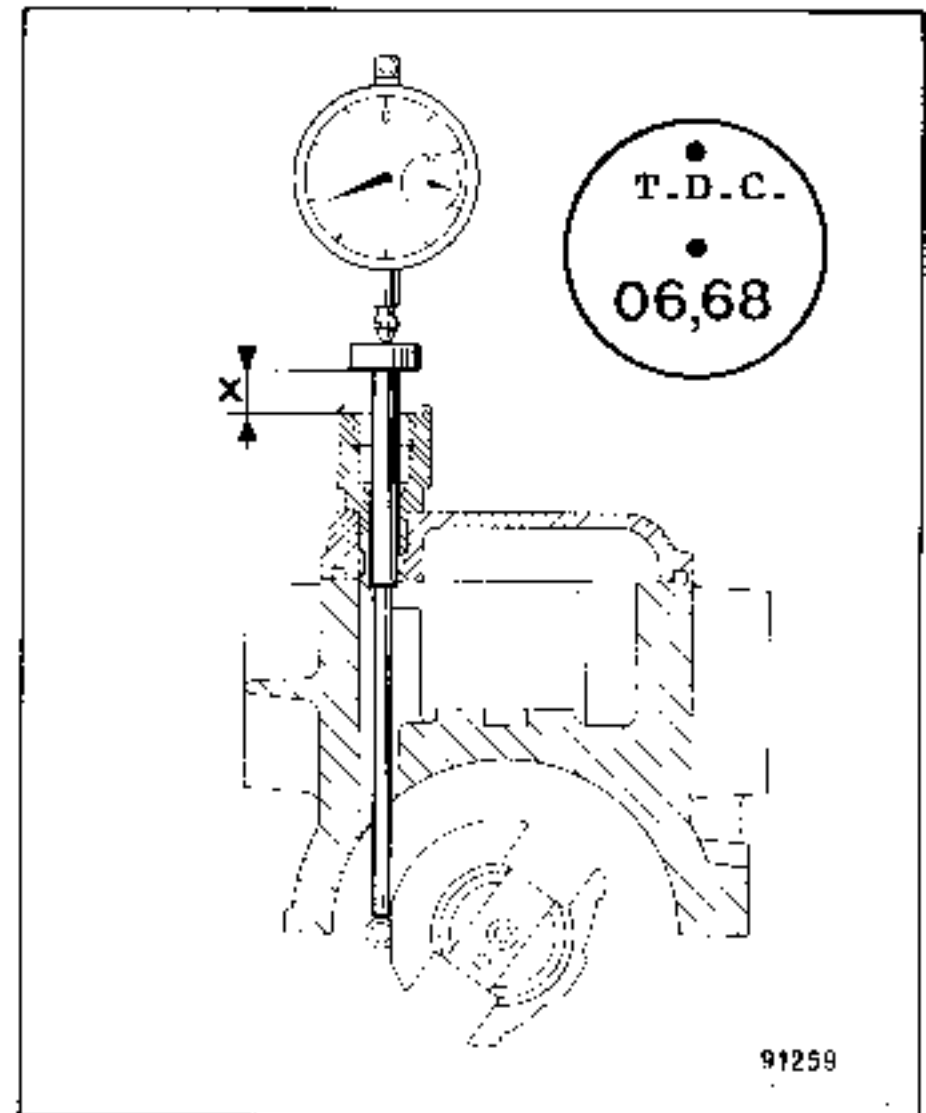
Turn the driveshaft in the normal direction of rotation and check that the gauge rod lift is approximately 18 mm and that, after moving, the gauge rod and the dial indicator return to zero. Turn the driveshaft in the normal direction of rotation until the dial indicator starts to lift. Offer up the pump to the engine and fit it in place, aligning the key with its keyway in the sprocket. When the pump is in position, fit the washers and nuts for the securing flange, without tightening them. Fit the sprocket washer and securing nut and tighten to the recommended torque. Remove retaining tool **Mot.854**.



Slowly turn the crankshaft in the normal direction of rotation and lock it at TDC using gauge rod **Mot.861**.

Turn the pump so as to lift the gauge rod by the value corresponding to the value on the side access plug.

Timing example: dimension X = 6.68 mm.



Tighten the pump securing nuts.

CHECKING

Release gauge rod **Mot.861** and, turning the crankshaft in the normal direction of rotation, turn it through one and three quarter turns.

Check that the dial indicator is at zero.

Slowly turn the crankshaft until gauge rod **Mot.861** engages in the crankshaft.

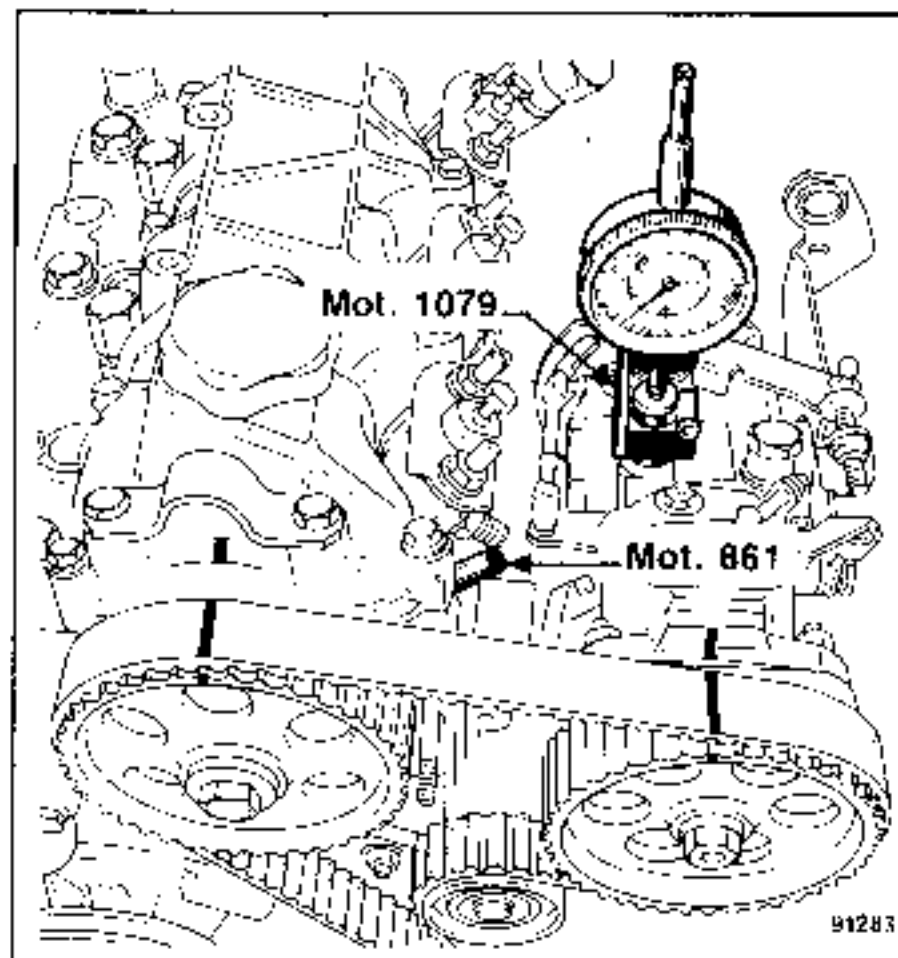
The lift should be
for example: 6.68 ± 0.04 mm.

Correct it if necessary.

NOTE: After any adjustments, the timing must be re-checked.

In this position check that:

- the mark on the camshaft sprocket is in line with the centre of the boss on the rocker arm cover;
- the mark on the injection pump sprocket is in line with the centre of the injection pump boss.



NOTE: Between the two marks on the sprockets there should be twenty recesses between the teeth on the toothed belt.

REFITTING ADJACENT COMPONENTS

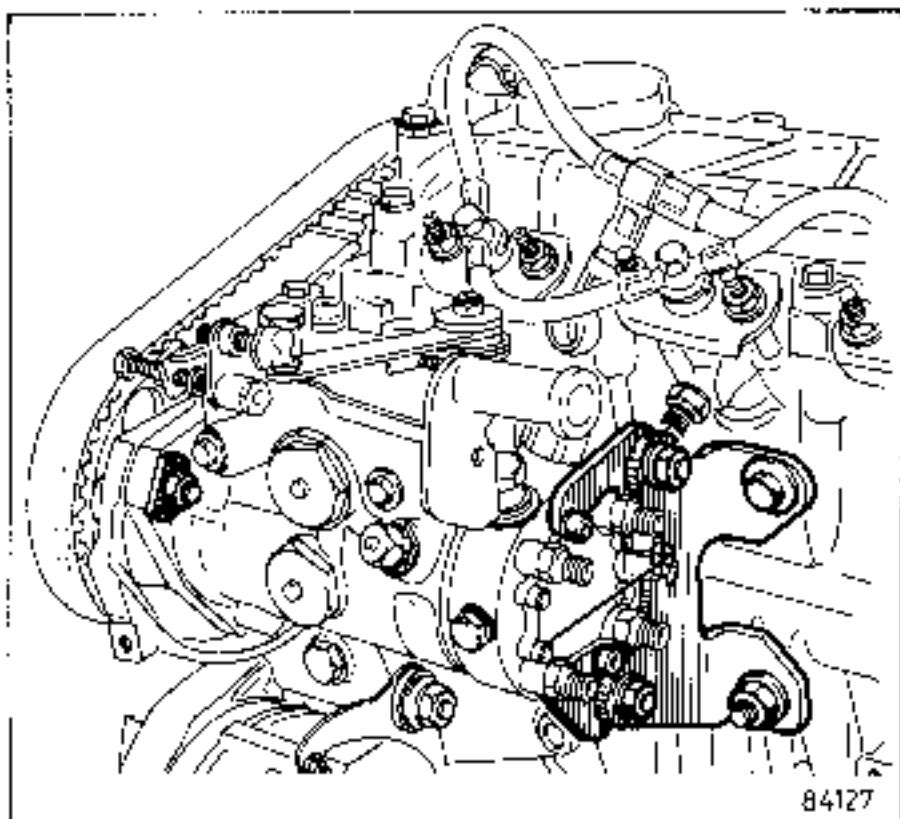
Remove the timing tooling.

Refit the pump plug using a **new seal**.

Remove rod **Mot.861** and refit the access plug to the housing.

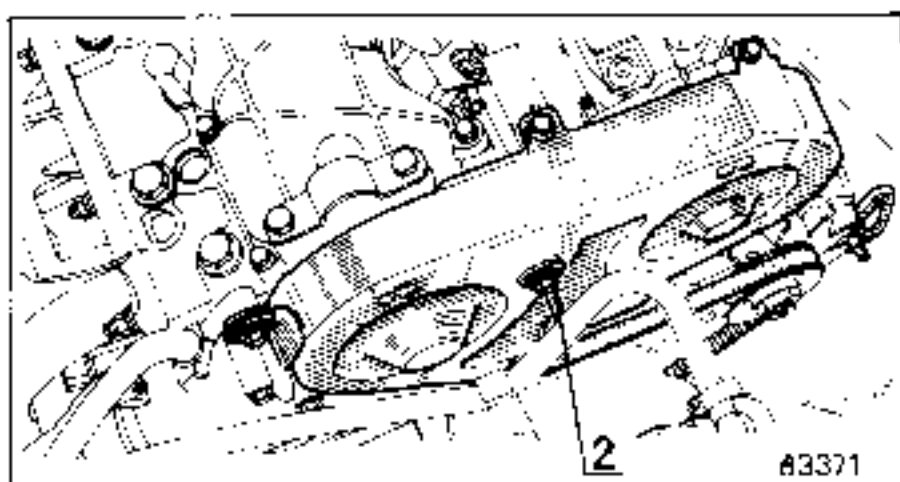
Fit the rear support and secure it, screwing up its bolts evenly so as not to subject the pump to stress.

Refit the alternator protective casing.



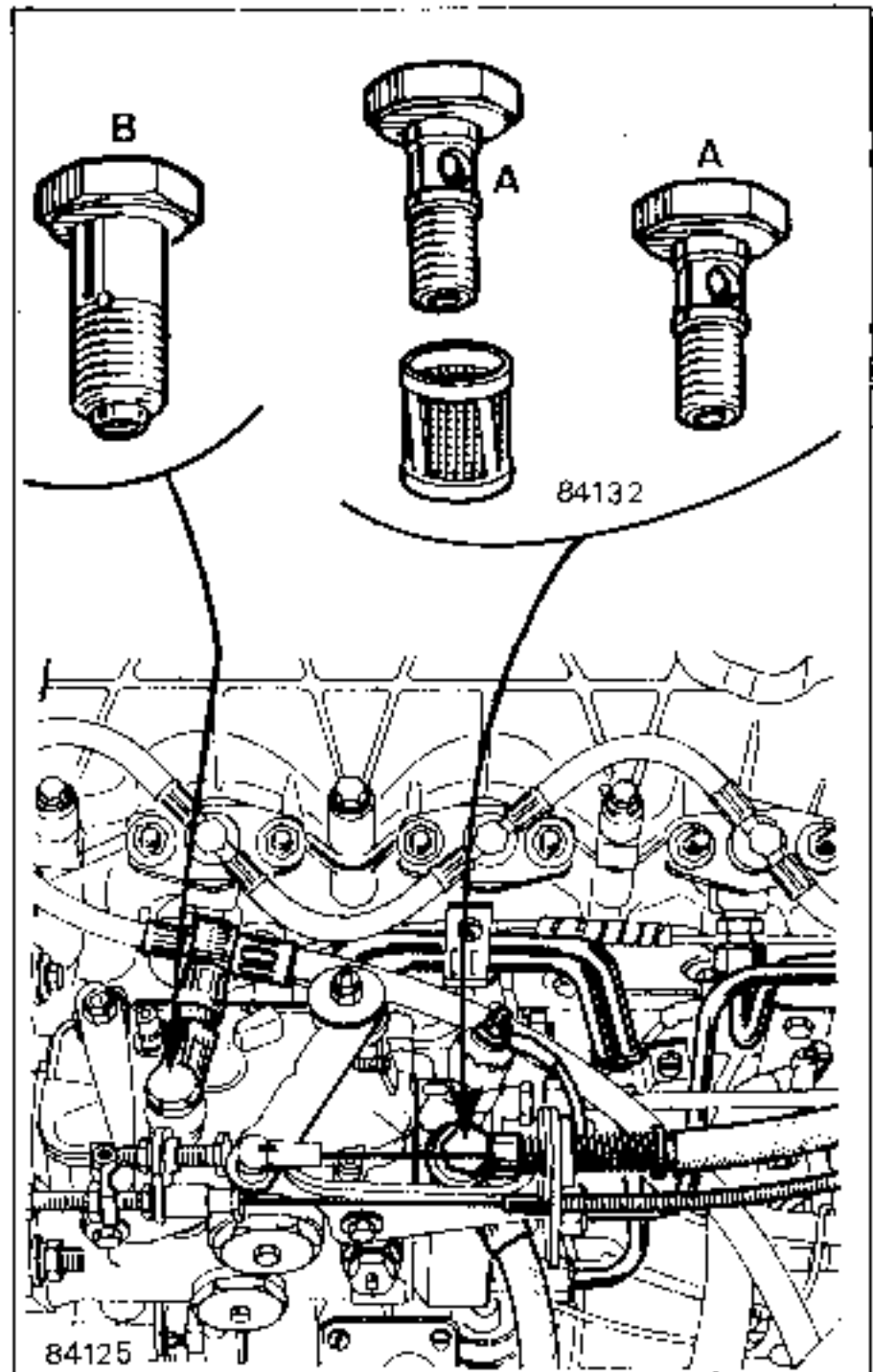
Fit in the following order:

- the spacer ring to bolt (2);
- the timing gear casing and secure it;
- the alternator drive belt and adjust its tension.



Clean the feed pipes and operate the priming pump a few times to remove any dirt.

Connect the feed and return pipes.



WARNING:

A - Feed banjo bolt which may incorporate a pump protection filter.

B - Return to tank banjo bolt with a valve and calibrated jet.

Fit the injector pipes without tightening the unions at the injector ends.

Connect the shut-off solenoid wire.

ADJUSTING THE THROTTLE CONTROL

Adjust the cable cover end clamp to compress the compensator by approximately 2 mm.

ADJUSTING THE FAST IDLING WHEN COLD

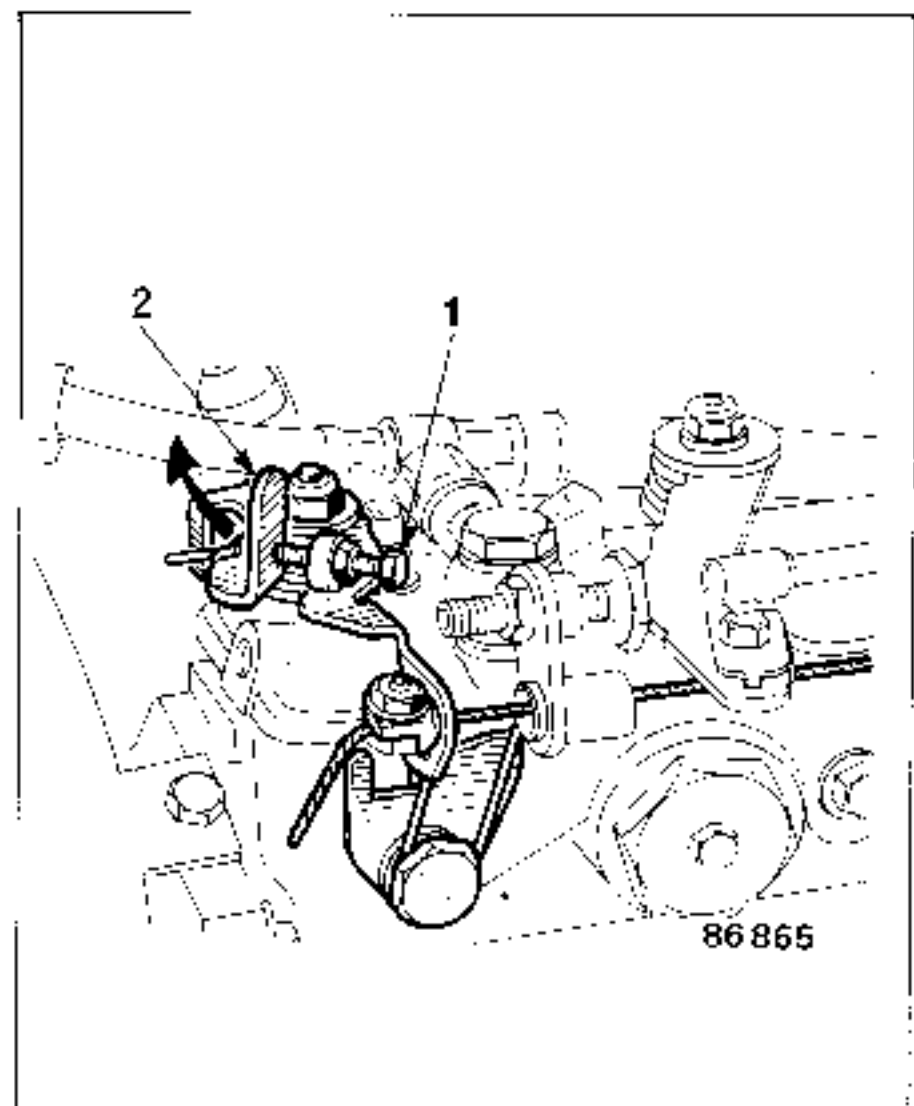
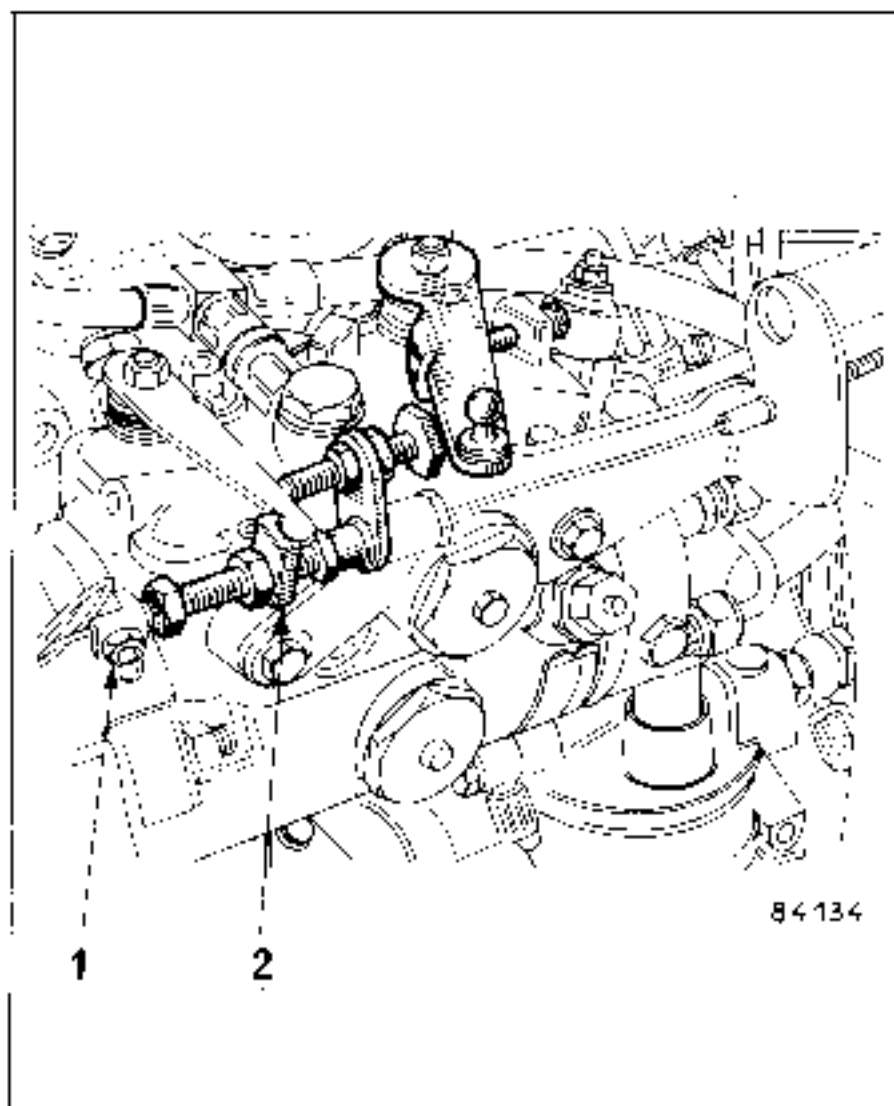
Fit the cable, the cover end stop and cable clamp (1).

Cold engine (coolant temperature less than 30°C).

Push idling stop (2) as far as it will go, tension the cable, bring the cable clamp against the stop and tighten it.

Early type

Later type



Vehicles with a power-assisted steering pump mounted under the alternator.

Fit the drive belt, adjust its tension and tighten the hydraulic pump securing bolts.

Bleed the fuel system.

CHECKING THE ANTI-STALL STOP

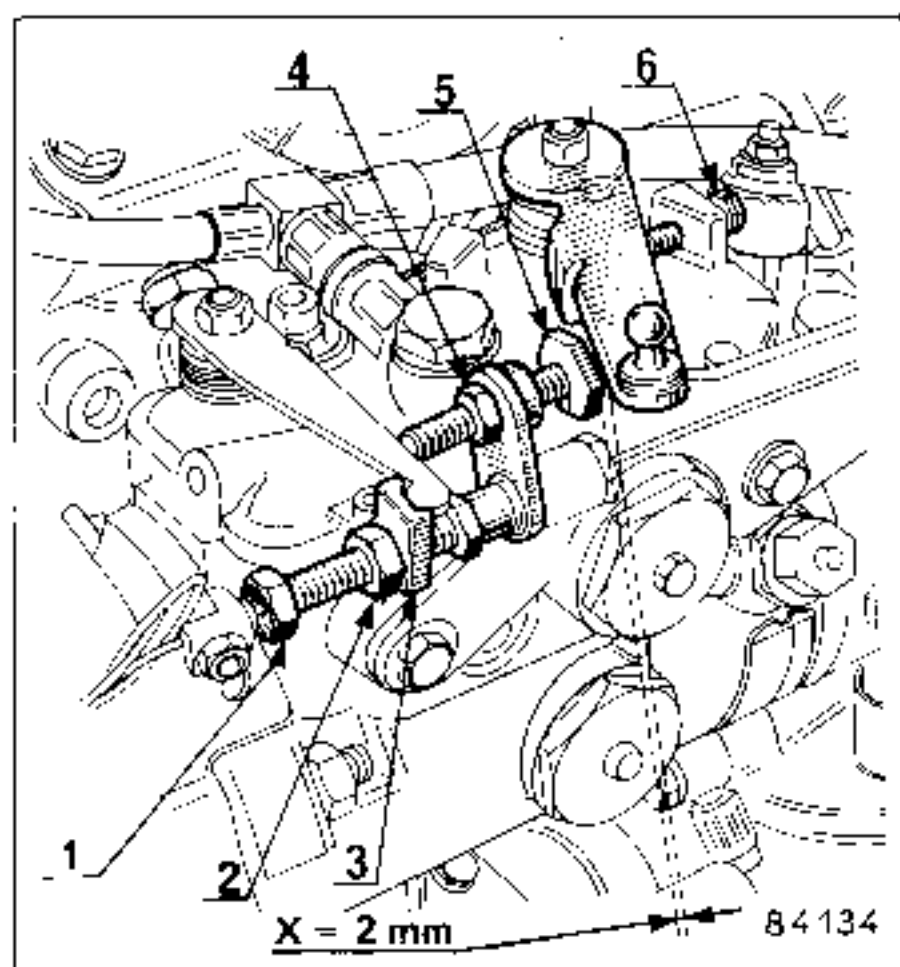
Engine warm, idling speed 750 rpm.

Place a 2 mm spacer (dimension X) between stop (5) and the throttle lever. The speed should not increase by more than 100 rpm.

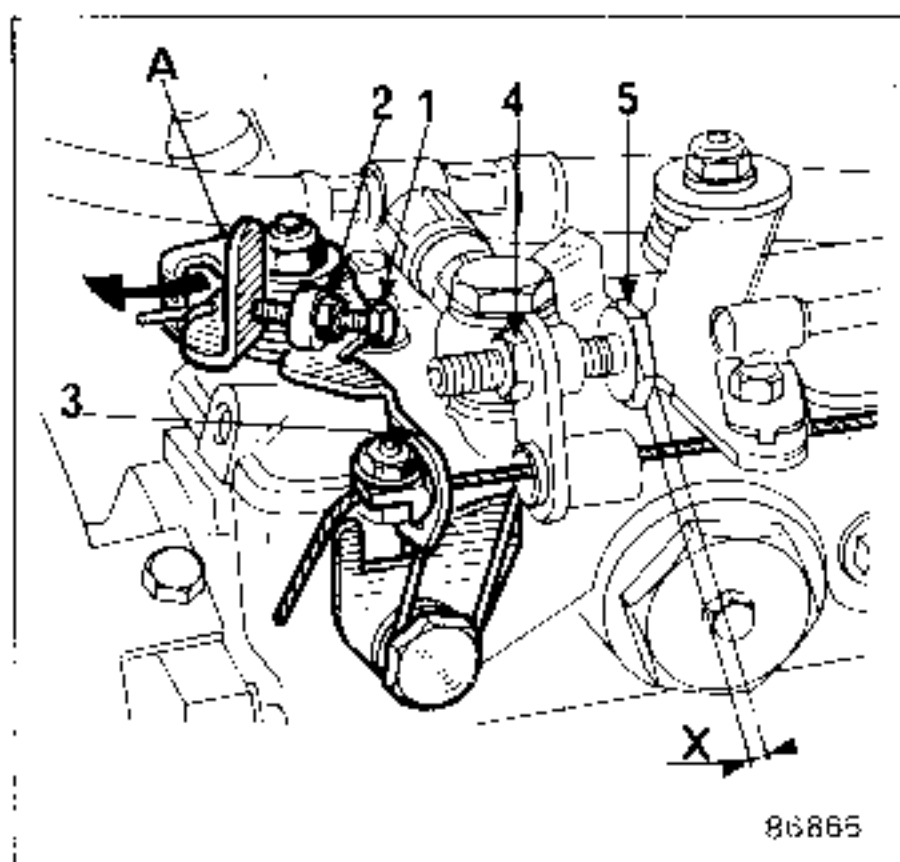
ADJUSTING THE IDLING (warm engine).

1) Pre-adjust the idling to 700 rpm, loosen locknut (2) and turn screw (1) to obtain a speed of 700 rpm.

Early type



Later type



On injection pumps of the later type, the idling lever has been modified and has a new adjusting stop (1). When lever (A), which is held against the idling stop by a spring, is moved in the direction shown by the arrow, it allows the engine to be stopped.

2) Place a 2 mm spacer (dimension X) between stop (5) and the throttle lever. Loosen locknut (4) and turn stop (5) to obtain a speed of 850 ± 50 rpm (then remove the 2 mm spacer) and tighten locknut (4).

3) Adjust the idling speed to the specified figure by turning screw (1) and tightening nut (2).

Note: Find the speed at which the engine vibrates the least, within the tolerance range.

4) Accelerate sharply and allow the engine to return to idling, several times in succession:

a) if the engine returns to too slow an idling speed and tends to stall, unscrew anti-stall stop (5) by $\frac{1}{4}$ of a turn.

b) If the engine loses speed slowly, screw in anti-stall stop (5) by $\frac{1}{4}$ of a turn.

CHECKING THE MAXIMUM SPEED

With the engine warm, open the throttle fully, with the lever against screw (6).

The engine speed should be as specified.

The maximum speed stop screw (6) is sealed at the factory and should only be adjusted by an injection specialist who must then reseal the screw.

Vehicle	Type	Engine
RENAULT 5 2 3 A B	B - C - S 404	F8M..720
EXPRESS 2 3 A B	F 404	F8M..720
RENAULT 9 1 2 3 A	L 424	F8M..700
RENAULT 11 1 2 3 A	B 374 - C 374 - S 374	F8M..700

Description	Make and type	Special details
Injection pump	ROTO DIESEL DPC R 8443 210 A 1 DPC R 8443 A 210 A 1 DPC R 8443 A 370 A 2 DPC R 8443 A 371 A 2 DPC R 8443 B 372 A 3	Single distributor rotary pump with two pistons, centrifugal mechanical governor, automatic hydraulic advance, automatic fast idling when cold and solenoid shut-off.
Pump timing T.D.C. locked by a pin		1.60 ± 0.02 mm 1 & 2 Dimension "X" on 3 pump.
Injectors	ROTO DIESEL LCR 67320	
Pintle and seat assembly	ROTO DIESEL RDN OSDC 6843 1 RDN OSDC 6843 C 2 3	Setting 118 ^{+ 7} / _{- 5} bars/max. difference 8 bars
Fuel filter	BOSCH or A ROTO DIESEL A PURFLUX B	With incorporated priming pump. With incorporated priming pump and diesel fuel heater. With incorporated priming pump and diesel fuel heater. Note: As from 1987 vehicles are equipped with filters with a diesel fuel heater which heats the fuel via the engine cooling system.
Injector pipes		Outside Ø 6 mm Inside Ø 2.5 mm Length 290 mm
Fast idling thermostatic unit	CALORSTAT	Travel 7 to 8.5 mm between 30 and 67°C

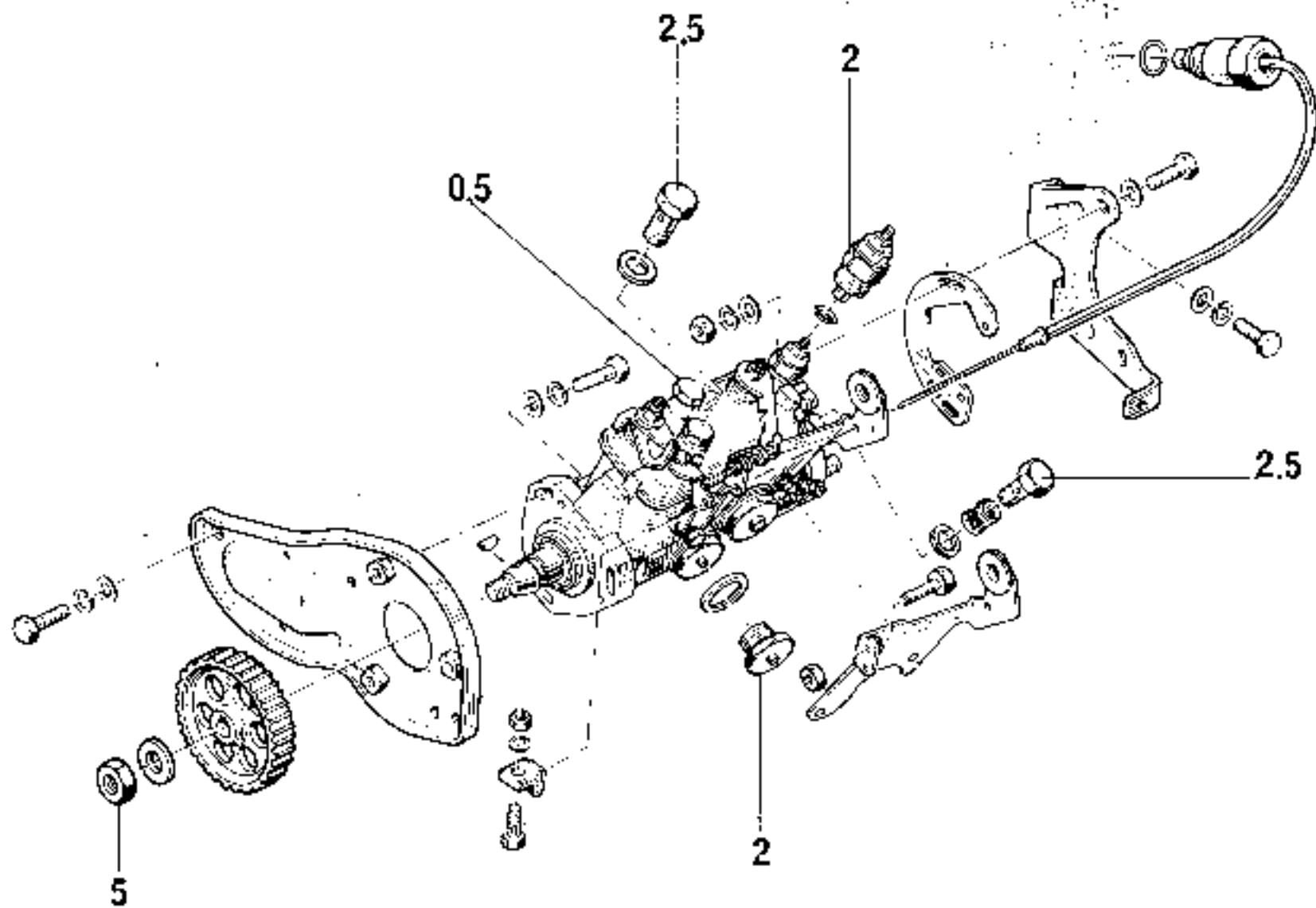
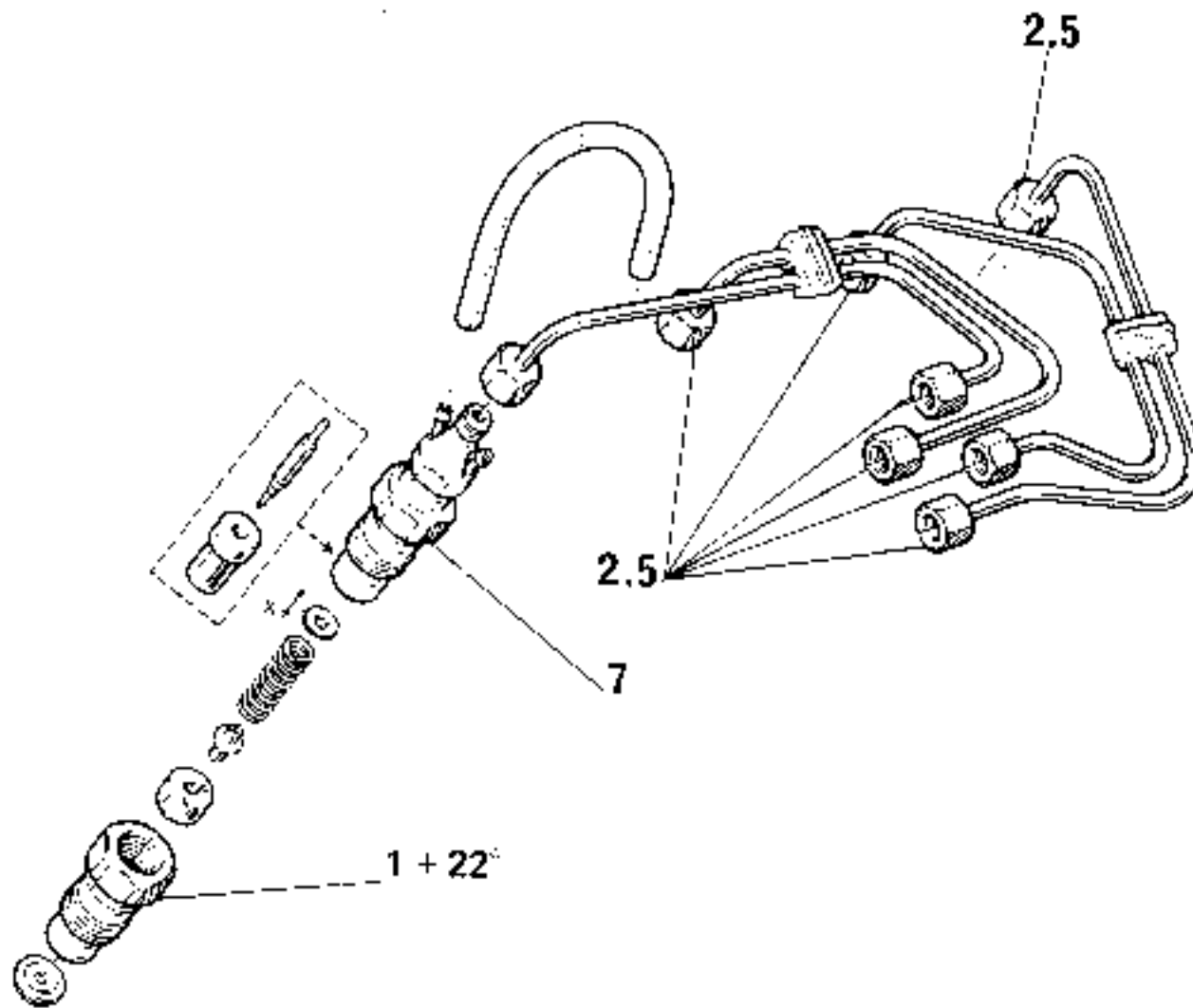
SETTINGS

Idling	850 ± 25 rpm
Max. speed	5 300 ± 100 rpm
Smoke density	
Approved figure	1.11 ^{m-1} : 36 %
Maximum legal	2 ^{m-1} : 55 %

TIMING TEST (on diagnostic bay)

Injection Pump	Idling speed r.p.m.	Injection commences Before T.D.C.
ROTO DIESEL DPC R 8443	850 ± 25	9° ± 1°

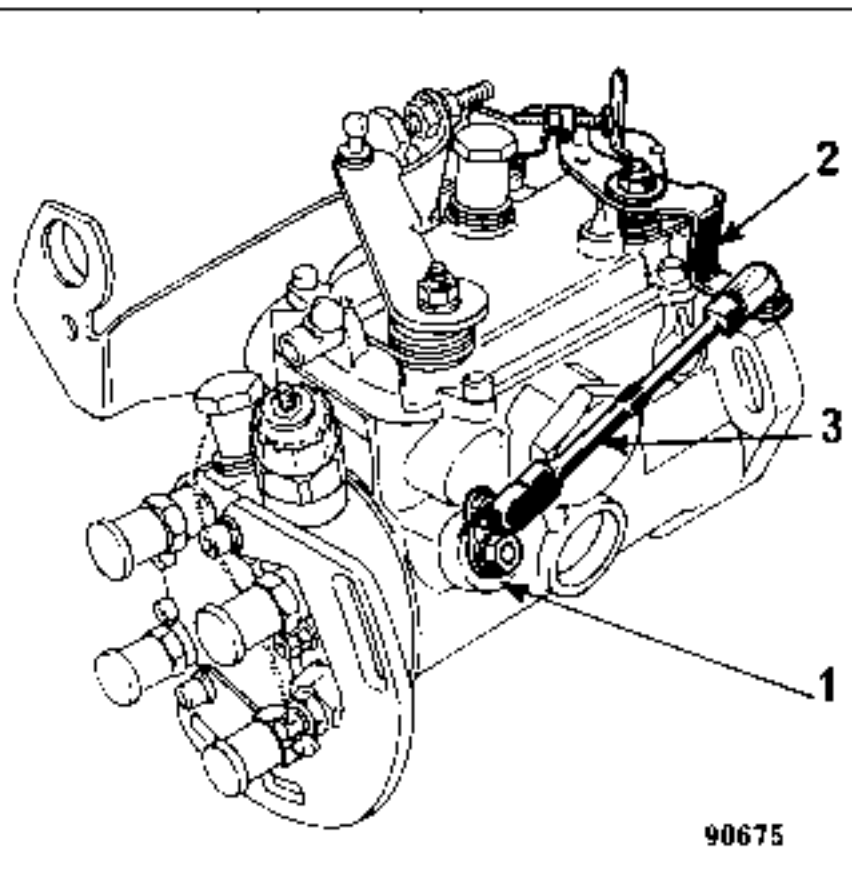
Readings taken with a strobe light across the flywheel/clutch housing timing marks.



HYDRAULIC ADVANCE SYSTEM CONTROLLED BY A SHUT-OFF VALVE

RENAULT 5, 9 and 11 diesel vehicles with ROTO DIESEL equipment may be fitted with an injection pump which has a hydraulic advance system controlled by a shut-off valve.

The external appearance of this pump differs from the earlier pump in that it has a low load advance shut-off valve (1) connected to the cold start accelerated idling lever (2) by means of a connecting rod (3).



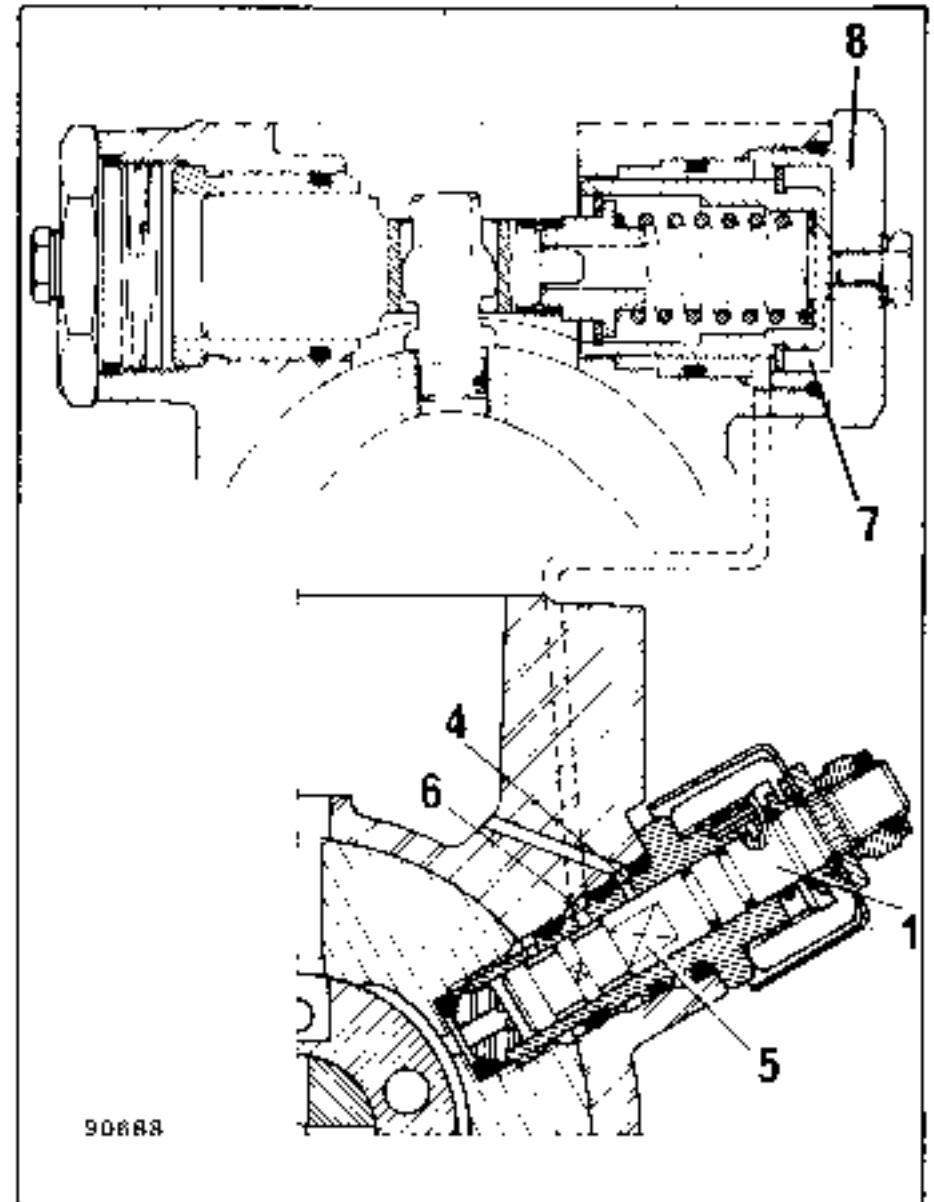
Cold engine

The thermostatic sensor moves lever (2) into the accelerated idling position.

By means of rod (3), shut-off valve (1) is moved into the open circuit position and flat (5) connects ducts (4) and (6).

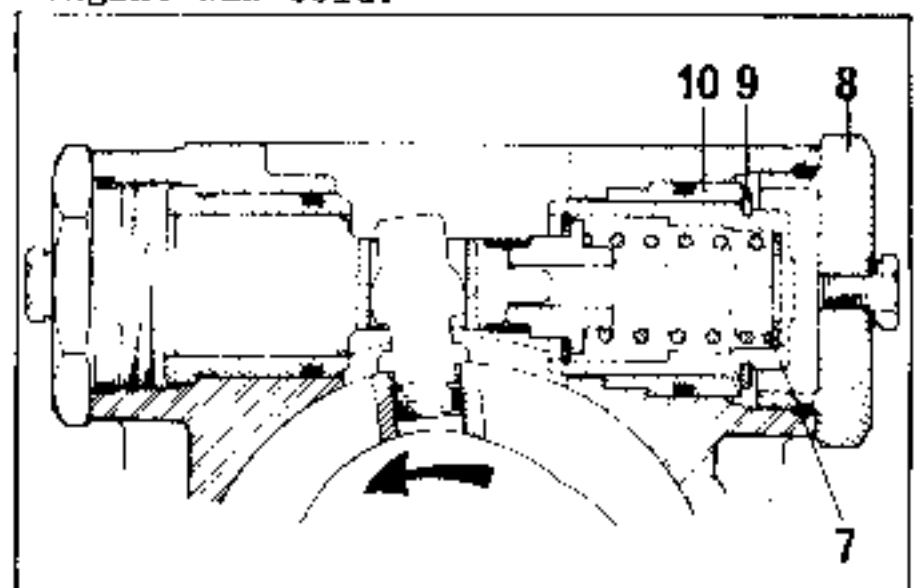
The fuel, under transfer pressure at piston (7) end, is sent directly into the upper housing.

Piston (7) comes into contact with plug (8), producing an additional advance of approximately 2° (ie. approximately 4° at crankshaft).



Hot engine

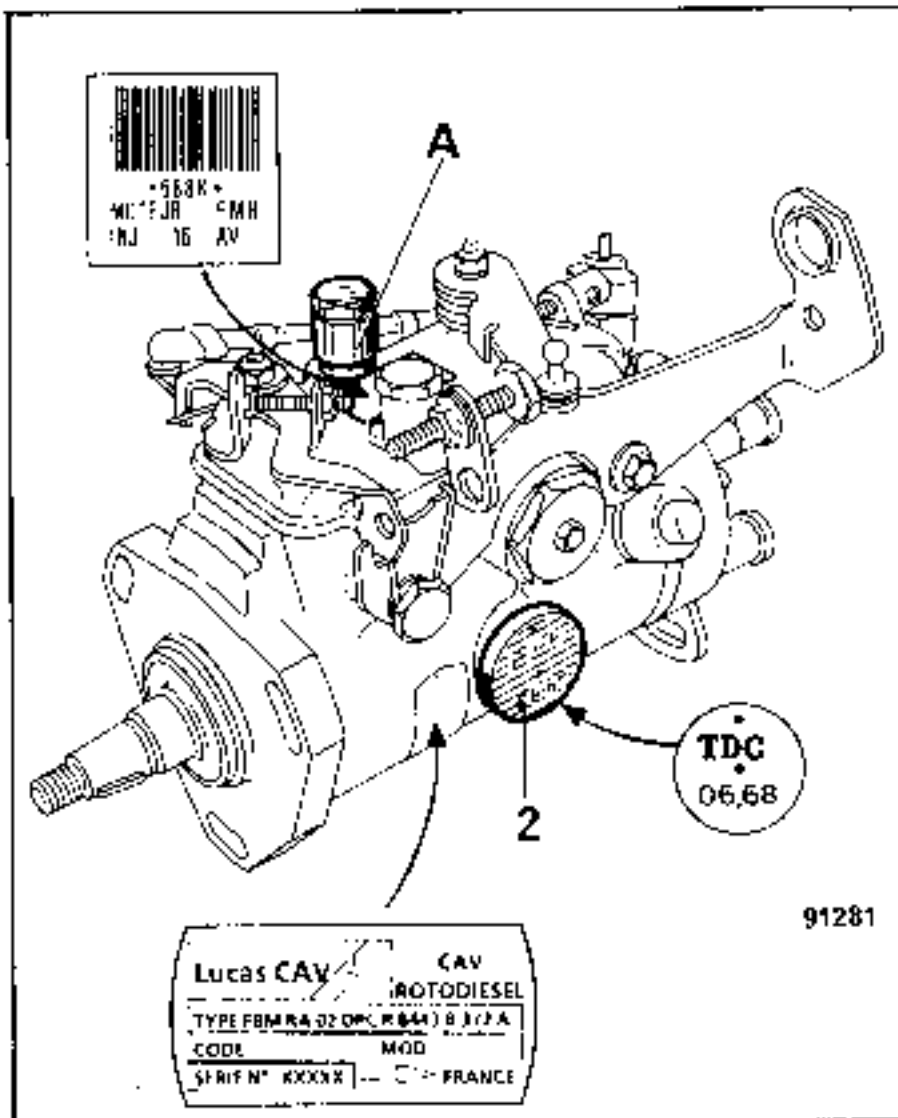
When the engine heats up, the thermostatic sensor frees accelerated idling lever (2). Rod (3) moves the spindle of shut-off valve (1) and flat (5) is no longer opposite ducts (4) and (6). The fuel, under transfer pressure, moves piston (7), the travel of which is limited by circlip (9), which comes to stop on liner (10), thus cancelling the additional advance obtained when the engine was cold.



TIMING THE INJECTION PUMP VIA THE COVER

As from the pumps with suffix B, for example DPC R 8443 B 372 A, the timing method is carried out using a new piece of equipment which is to be placed on the pump cover.

The pump cover has a timing duct (A) fitted with a blanking plug.



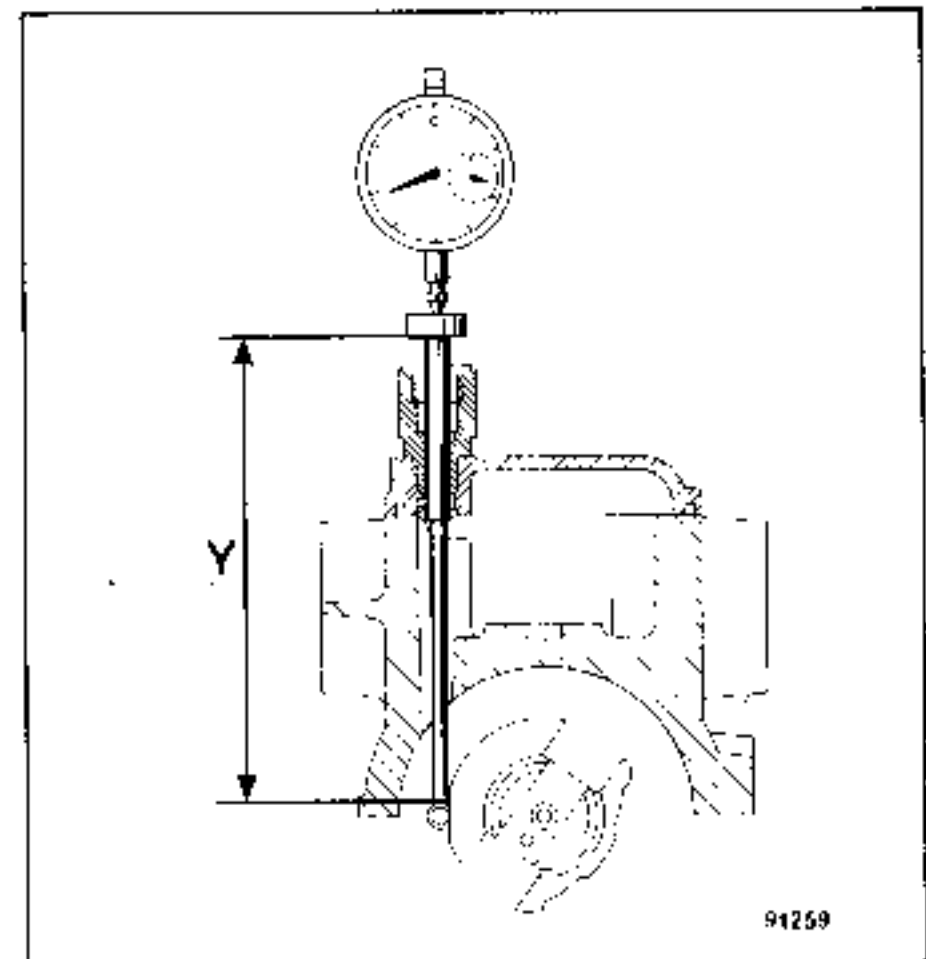
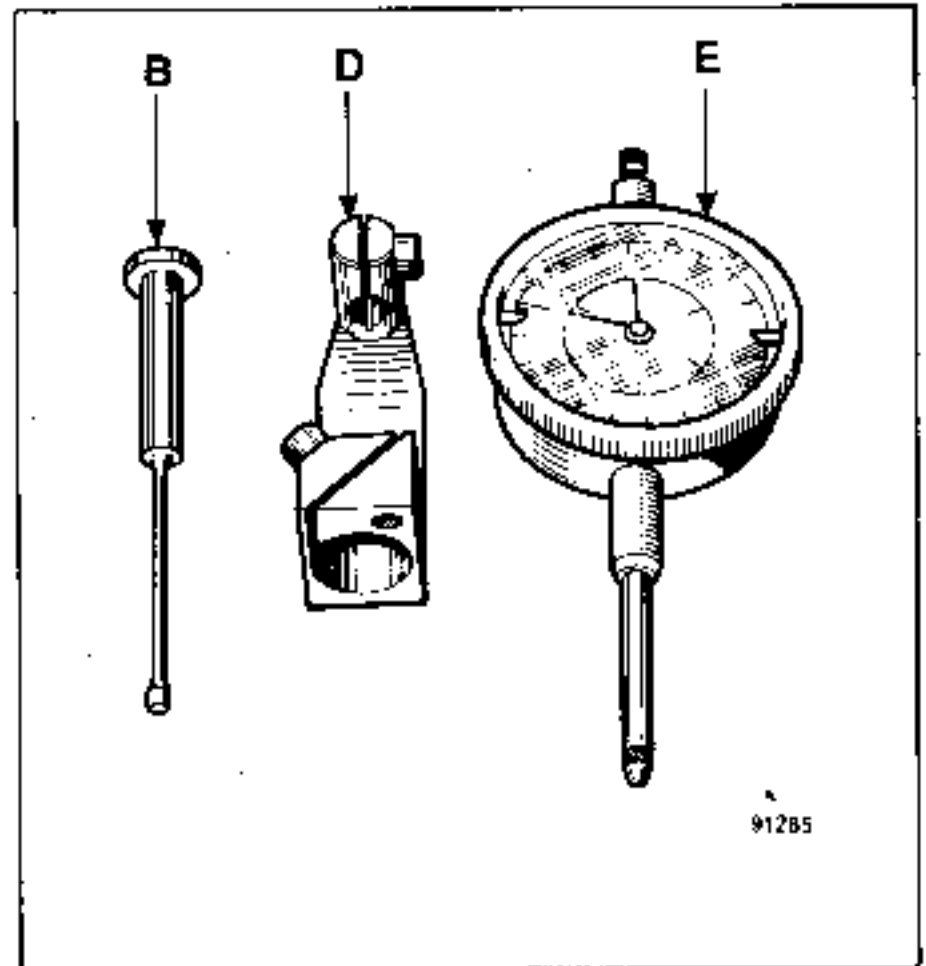
On these new pumps the gauge lift value (which is peculiar to each pump) is stamped on blanking plug (2). This value corresponds to the timing value on the engine at TDC.

The new system is easier to use for the following reasons:

- angle bracket no longer required;
- the gauge no longer requires a spring arm;
- the pump body does not have to be drained before the timing can be checked.

Suitable tooling **Not.1079**, comprising the following components, must be used:

- a gauge (B) with very precise dimensions (length $Y = 95.5 \pm 0.01$ mm);
- a dial indicator support (D);
- a dial indicator (E) with a travel of 30 mm.



NOTE: Some pumps may have a bar code label on the cover. This system is only valid for mounting in the factory with suitable tooling.*

The blanking plug showing the timing value is **white** originally and **blue** when the pump has been overhauled by a Renault Injection Centre or CAV ROTO DIESEL specialist.

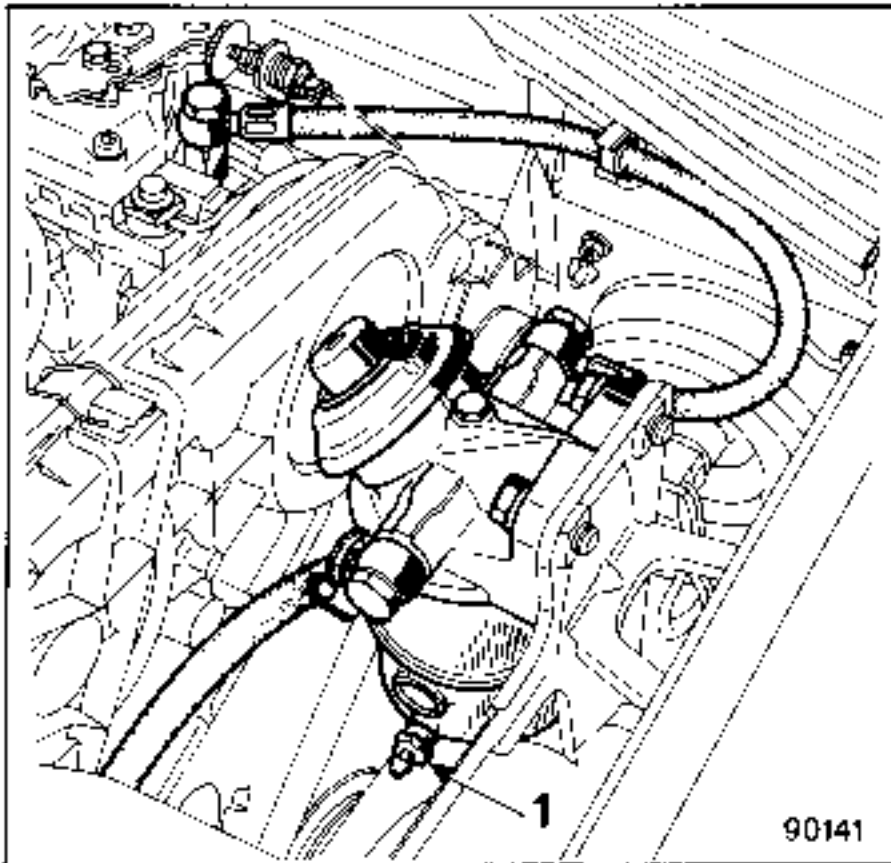
* It should have been removed in the factory and is to be ignored.

ESSENTIAL SPECIAL TOOLING

Mot. 877	Dial indicator support
Mot. 861	Top dead centre gauge pin (40 mm shorter for B-C-F-S 404)
Mot. 996	Injection pump sprocket retainer
Mot. 1053	Injection pump sprocket extractor (replaces B.Vi.28.01, B.Vi.48, B.Vi.859)
Mot. 1079	Tooling for timing ROTO DIESEL pump (suffix "B") via the cover

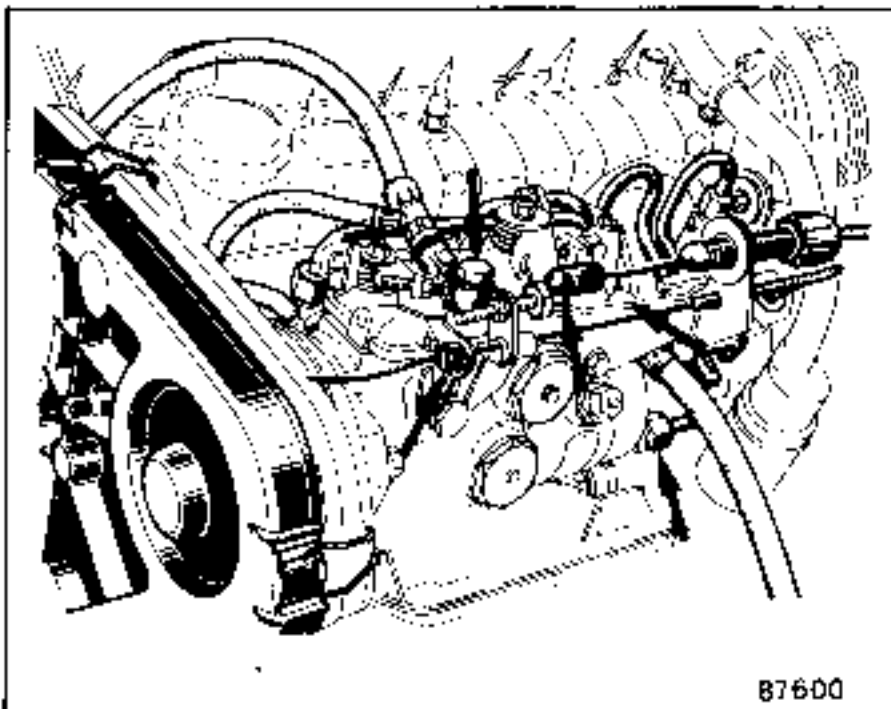
Removing:

NOTE: On B, C, F and S 404 type vehicles the fuel filter must be disconnected and removed in order to remove the injection pump.

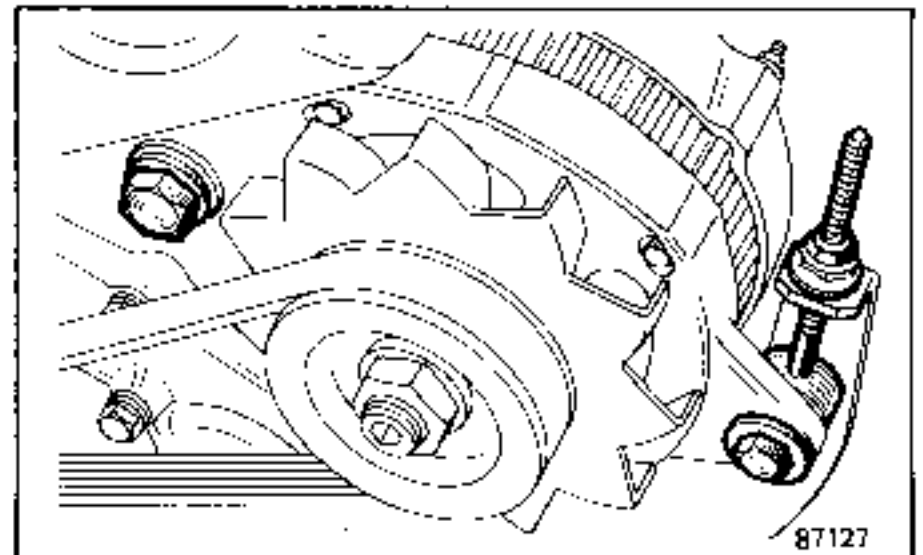


Disconnect the battery.

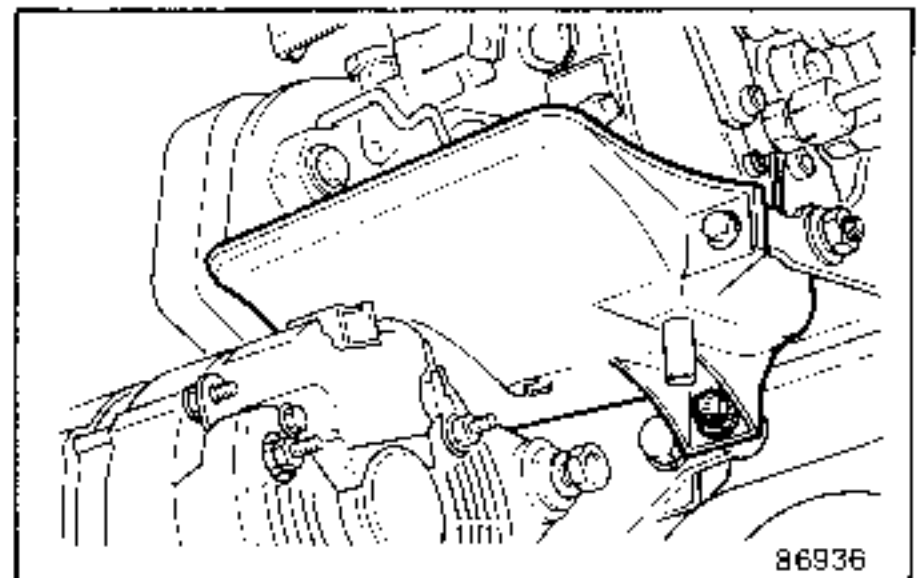
Disconnect or remove the cables, wires and pipes from the pump.



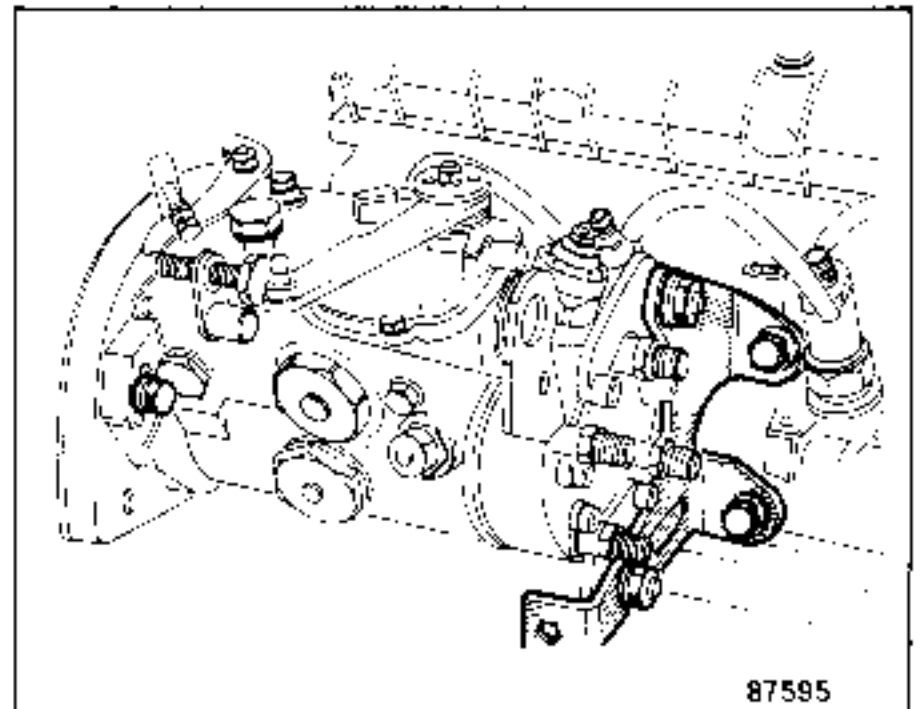
Loosen the alternator drive belt.



Remove the alternator protective casing.

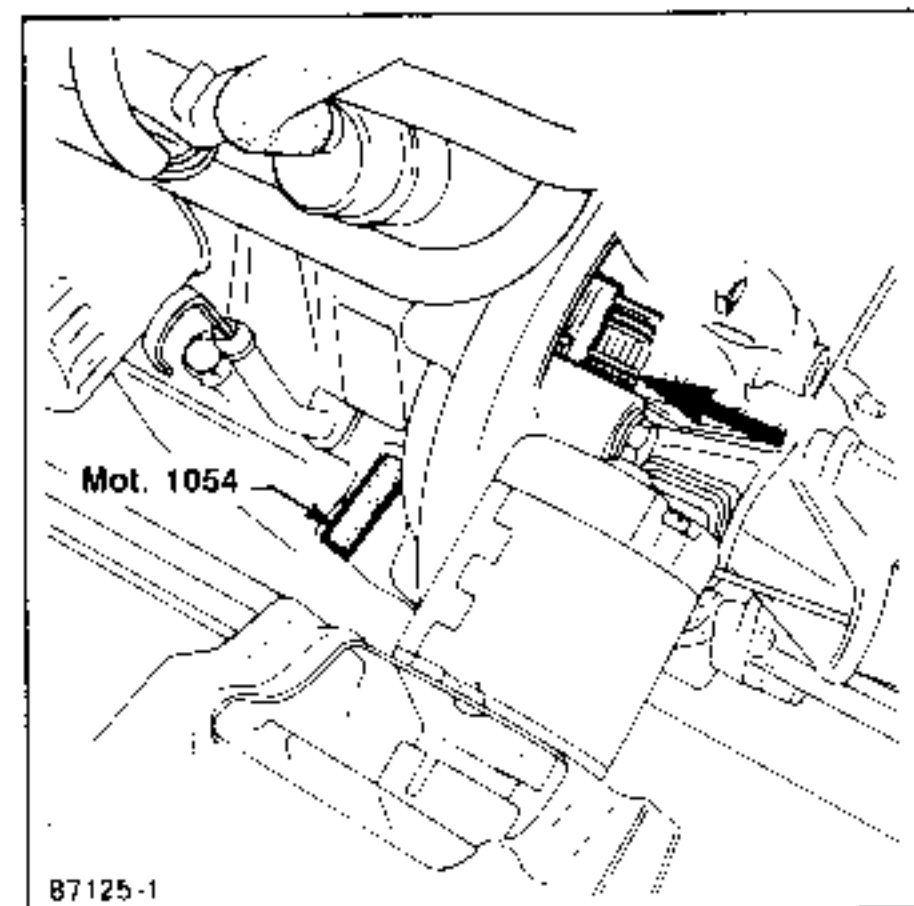


Remove the pump rear support.

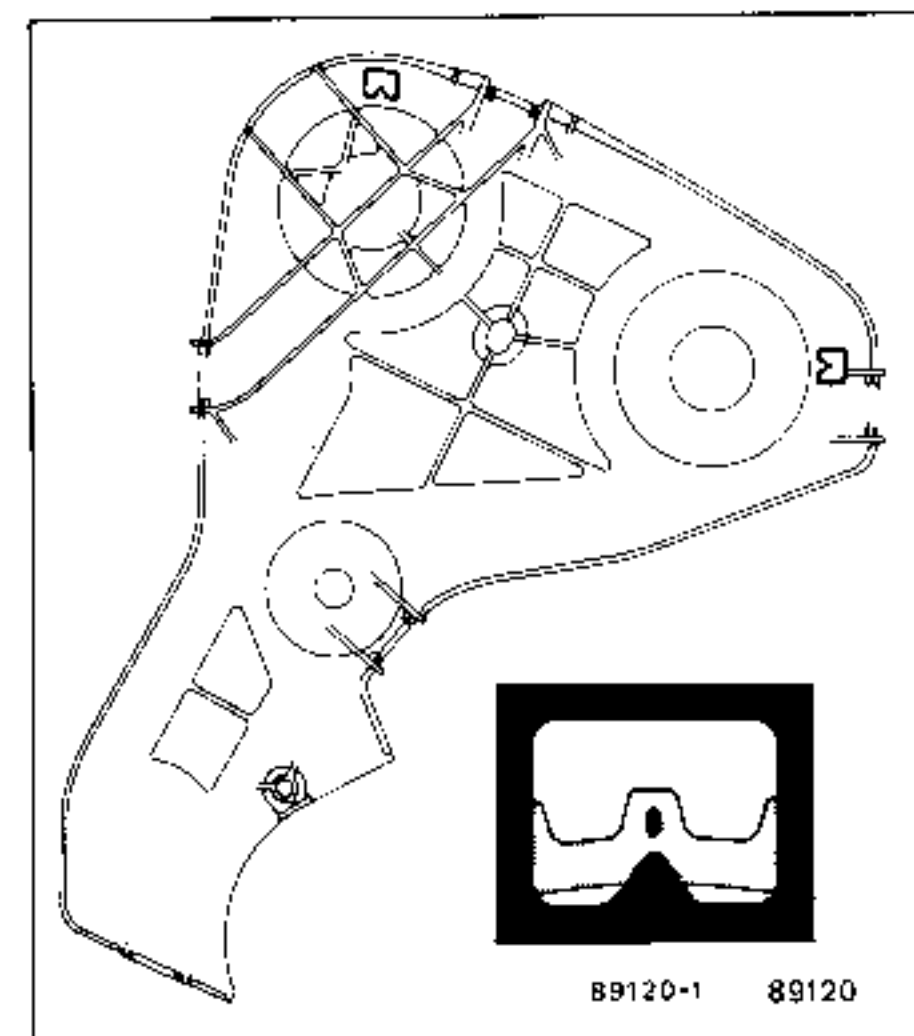


With the gearbox in 5th, lift the front righthand wheel.

Turn the wheel to bring the engine to TDC on No. 1 cylinder (flywheel end) (check with gauge pin **Mot.1054**).

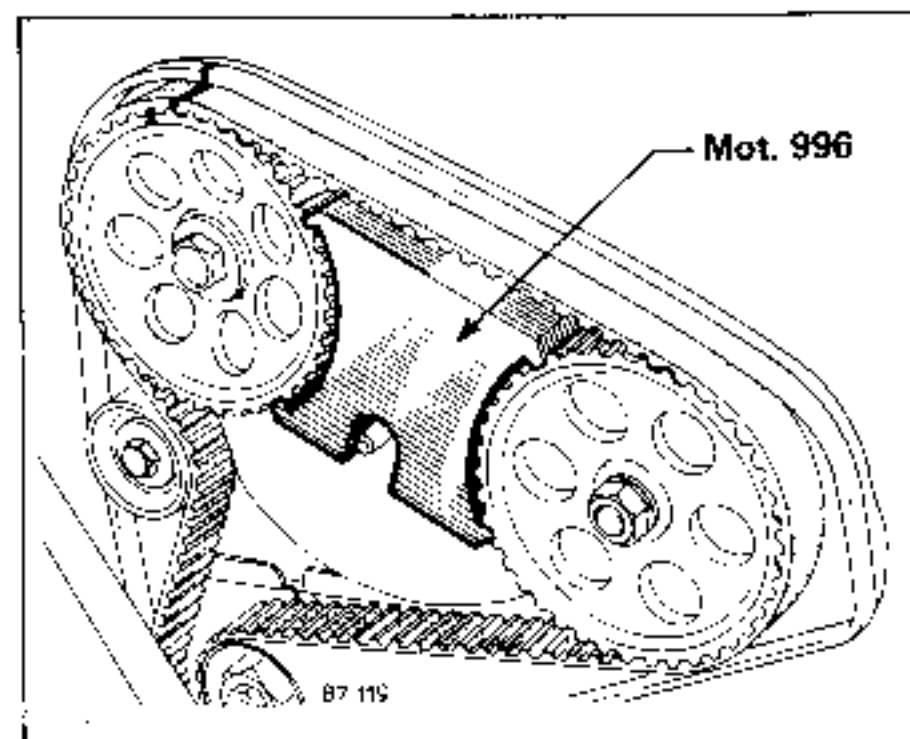


Then move back by 1 tooth.



Remove the timing gear casing.

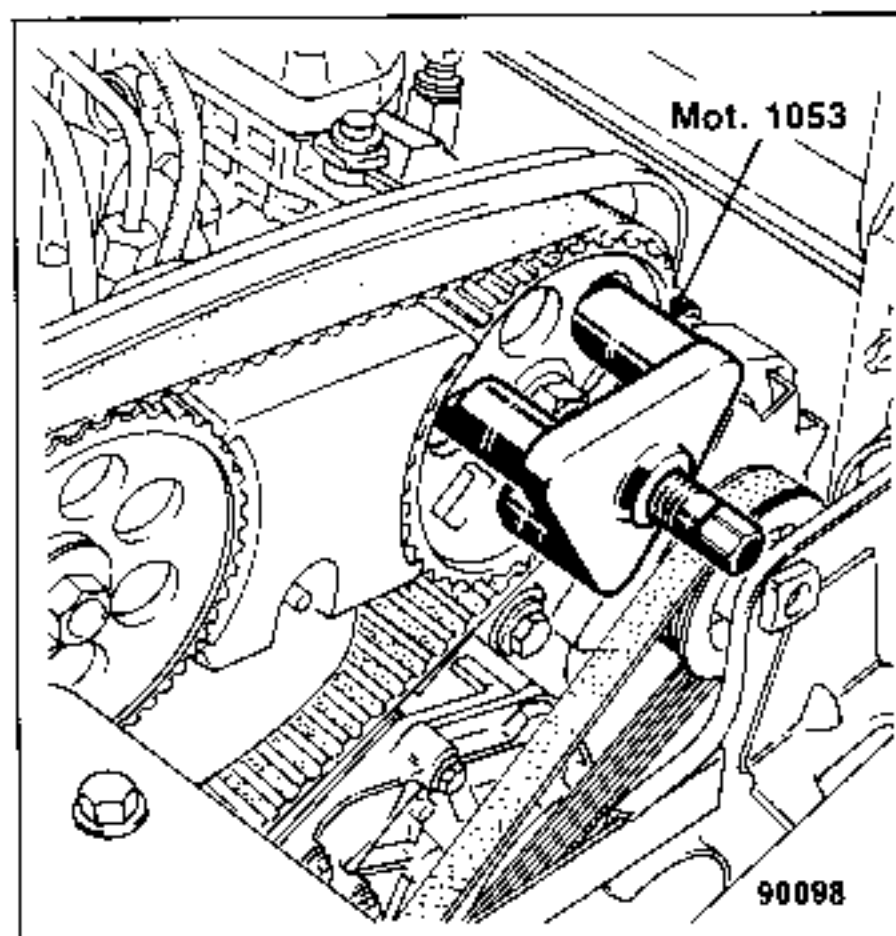
Fit locking tool **Mot.996**.



Unscrew the nut on the pump driveshaft until it is flush with the end of the thread.

Fit tool **Mot.1053** to the pump sprocket and separate the sprocket from the cone. **Never locate its claws on the sprocket teeth.**

Do not strike the assembly with a hammer to free the sprocket (risk of internal damage to the pump).



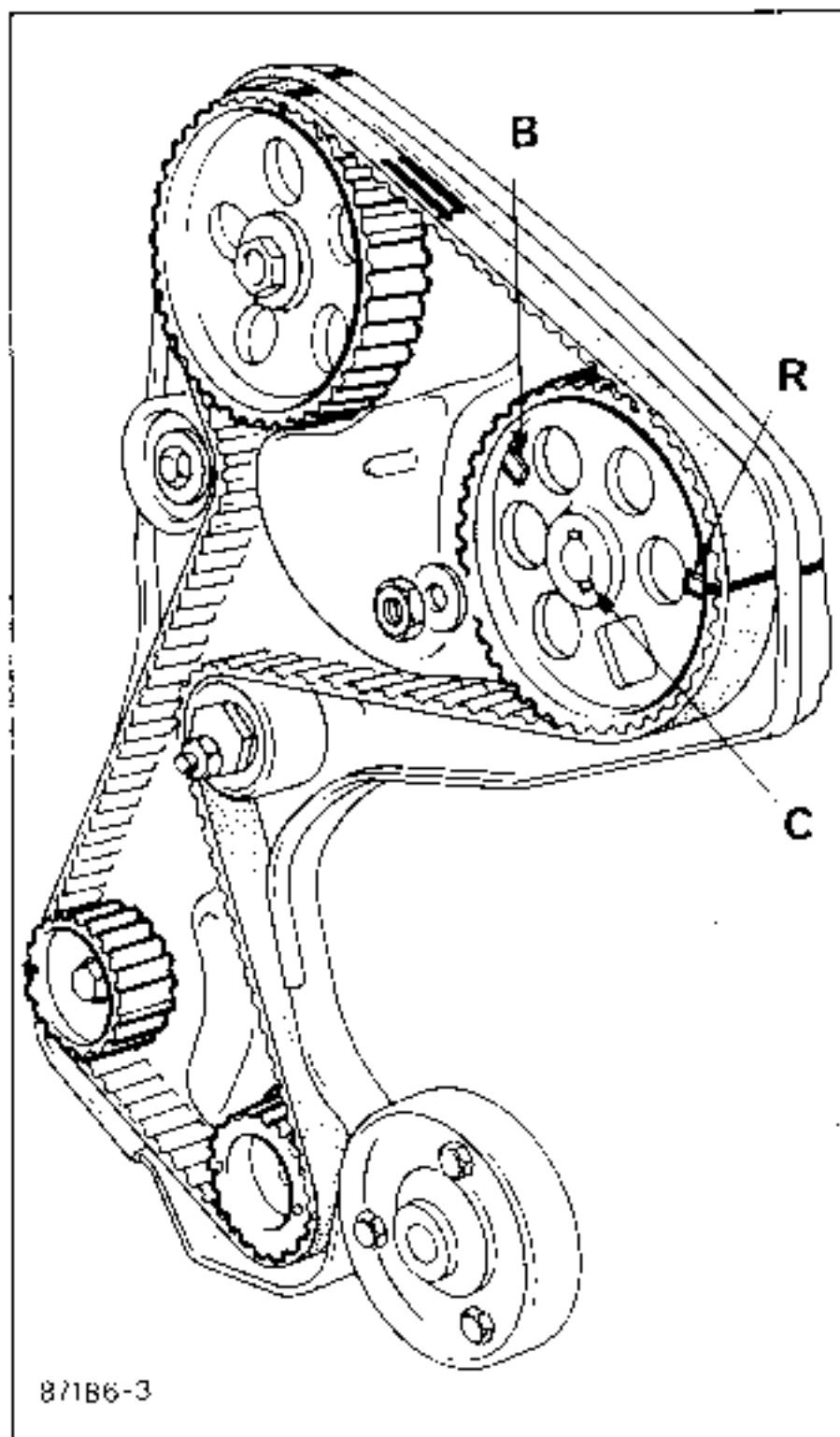
Remove the nut and the washer.

Remove the securing bolts and take off the pump.

REFITTING

The position of the pump sprocket varies according to the injection equipment. It has two position marks on it (B BOSCH pump; R ROTO DIESEL pump) and two keyways, in different positions.

B : mark for BOSCH pump
R : mark for ROTO DIESEL pump
C : keyway to be used.



Position the pump on the engine and fit it, aligning its key with the keyway in the sprocket (mark C).

With the pump in position, fit the washers and nuts to the securing flange, without tightening them.

Fit the sprocket nut and washer (1) and tighten it to the specified torque.

Remove locking tool Mot. 996.

WARNING

If the timing belt tension is incorrect, it will affect the timing, so the tension must be checked and, if necessary, adjusted before setting the timing (see workshop manual MOT.F (D) - "Timing gear" section).

TIMING

(PUMP WITH ACCESS TO TIMING GEAR AT THE SIDE)

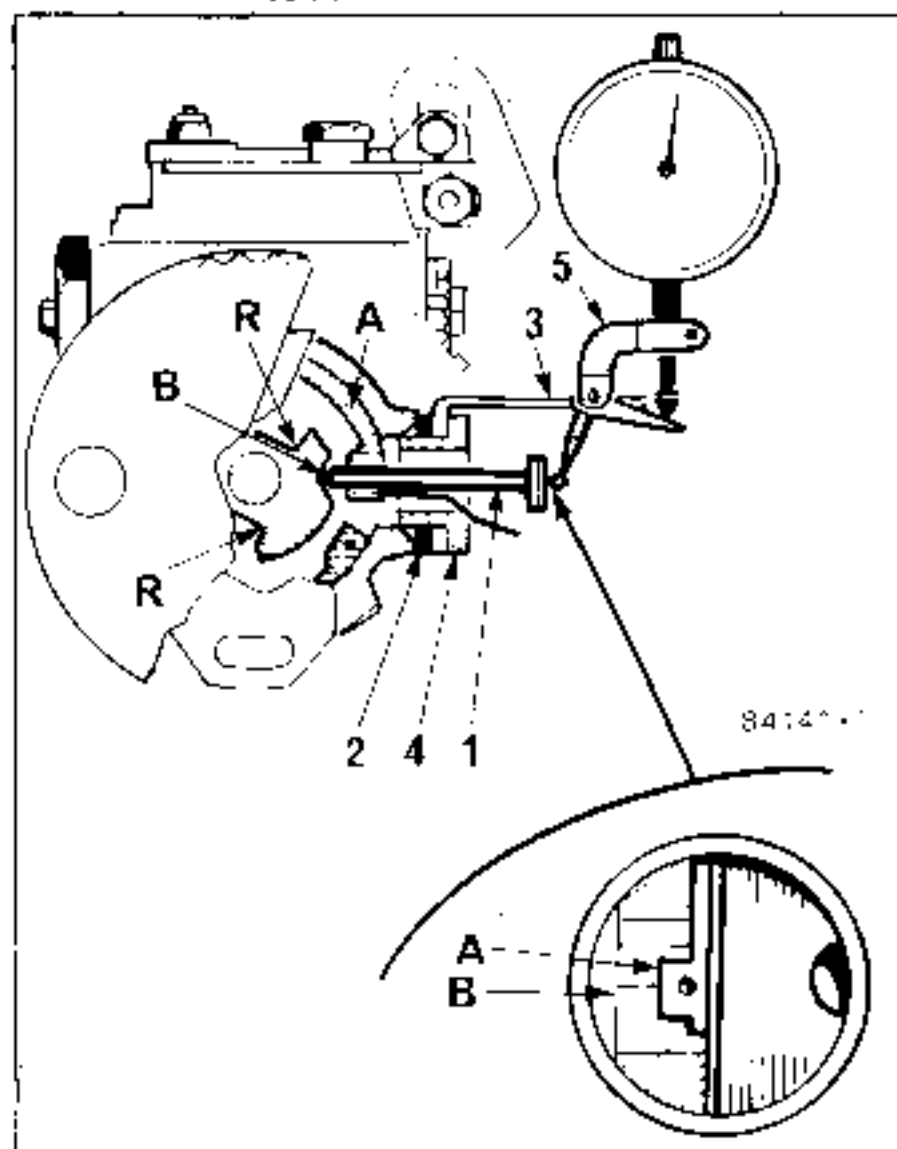
The pump has:

- a timing "V" on the rotating assembly (B);
- on the fixed internal section, a circlip (A) for positioning and guiding the dial indicator gauge rod.

This circlip is positioned at the factory and is not to be moved.

Fitting the dial indicator support
Contents of kit Mot. 877

- a gauge rod (1);
- a spacer washer (2) (not to be fitted when the throttle support is mounted on the access plug);
- a dial indicator support (3) with a securing screw and a milled nut for fixing the indicator to the support;
- a support securing nut (4);
- an angle bracket fixed to the dial indicator (5).



To avoid errors in measurement when timing the pump, a dial indicator corresponding to the following specifications must be used:

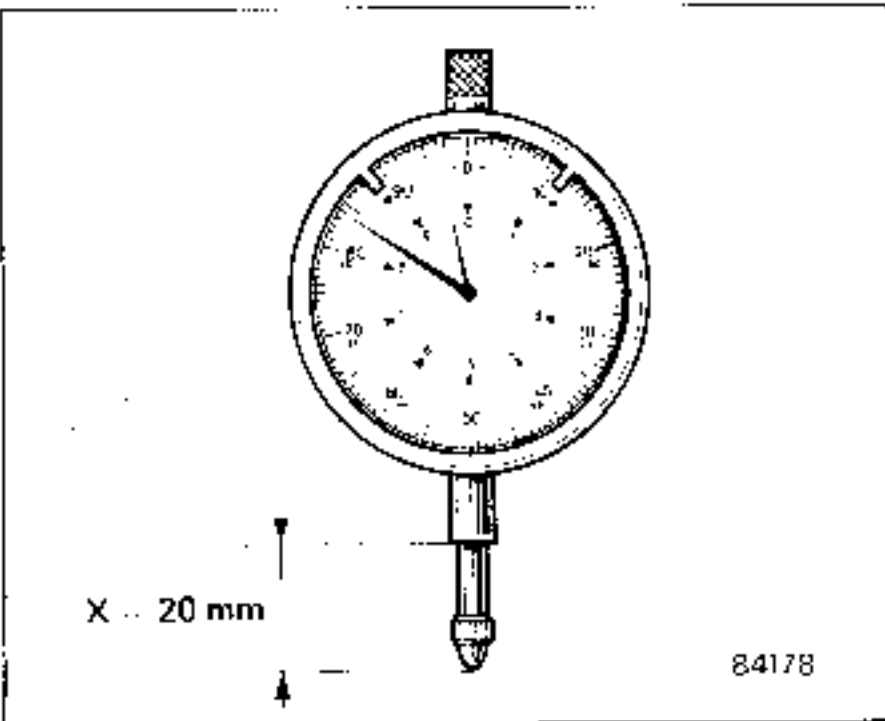
- barrel diameter 8 mm;
- travel 10 mm;
- max. dial diameter 60 mm;

- plunger projection from barrel (dimension X) 20 mm, with securing lug.

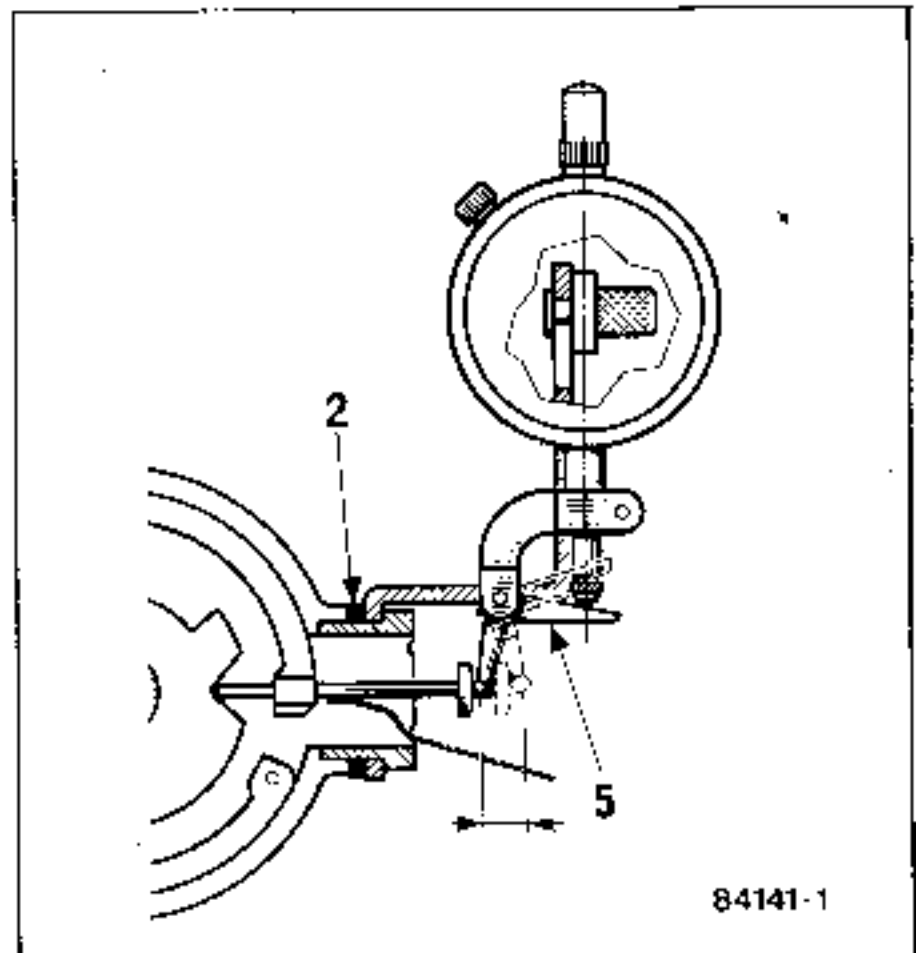
Of the various dial indicators which have been approved, only the **MITUTOYO** and **MICROS. SANVOISIN** dial indicators which correspond to these specifications are to be used.

Reminder:

Fitting the dial indicator support

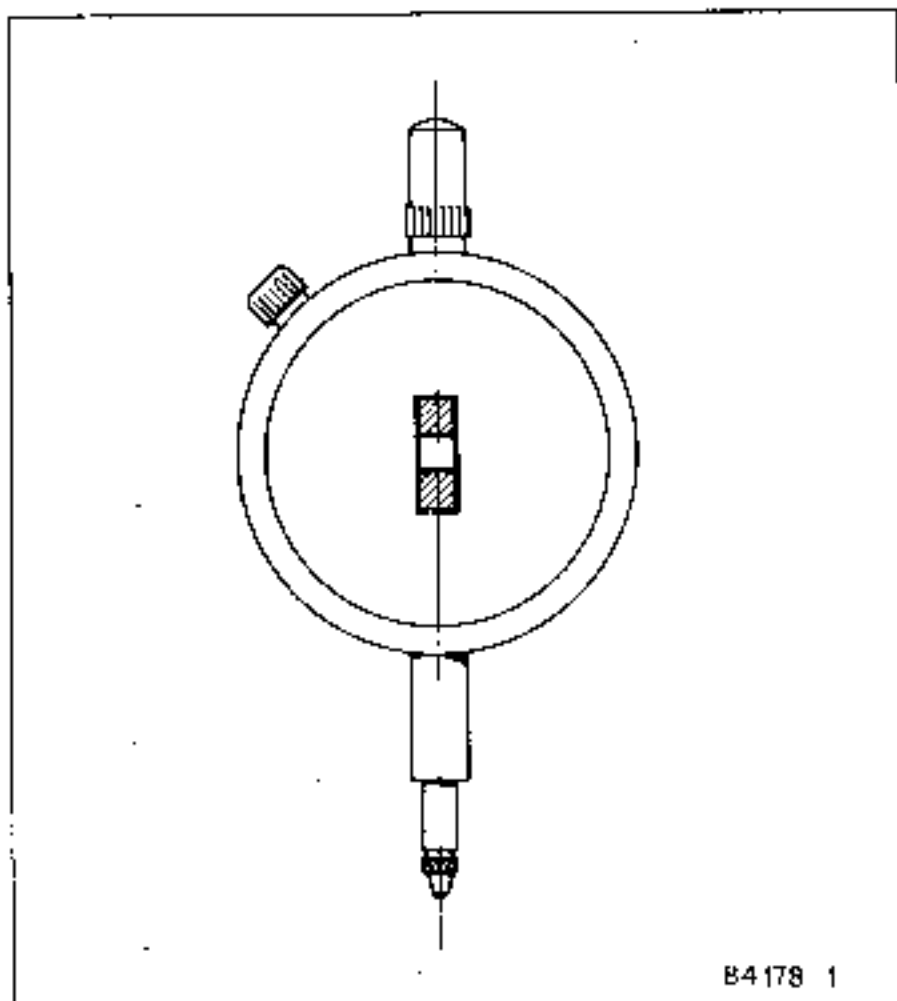


- mounting lug centred on the base of the dial indicator so as to ensure that angle bracket (5) is perpendicular;



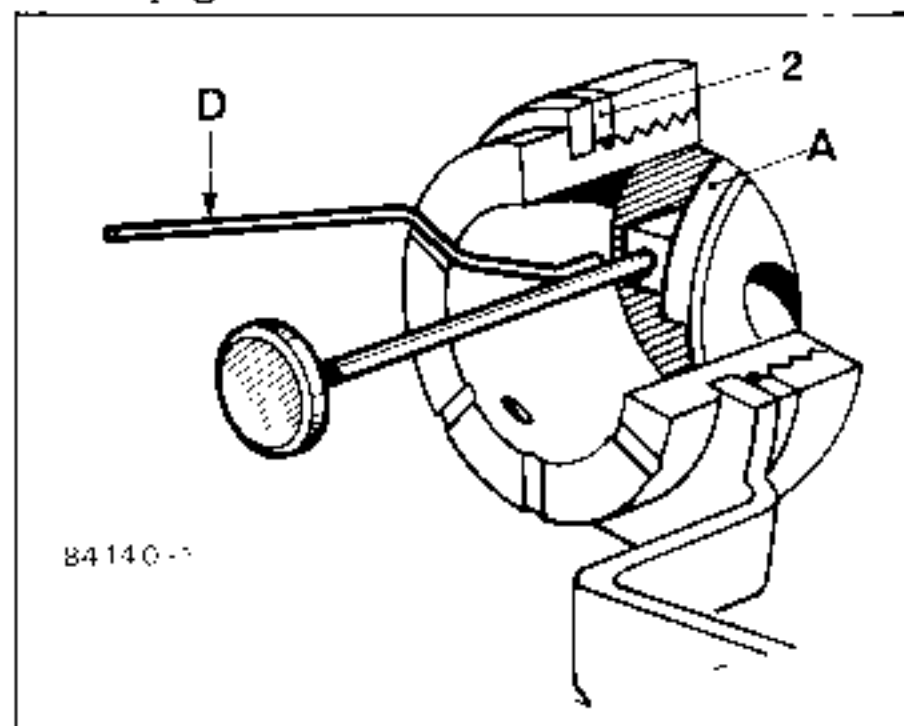
NOTE:

Washer (2) is to be used on all pumps which do not have a throttle support lug on the timing plug.



The gauge rod has a spring arm (D) because the rotating part of the pump has slots (R)* into which it can enter when the engine or the pump is turned outside the timing ramp area.

* See page 64.



WARNING

The position of circlip (A), determined at the factory, represents the injection commencement point on the pump. It is therefore essential to take every precaution to avoid moving it.

When mounting the support, the centre of the adjusting "V" (B) should be in line with the gauge rod hole in the circlip (one tooth before TDC, No.1 cylinder compression, flywheel end).

Remove the timing access plug.

Place rod (1) in the hole in the circlip.

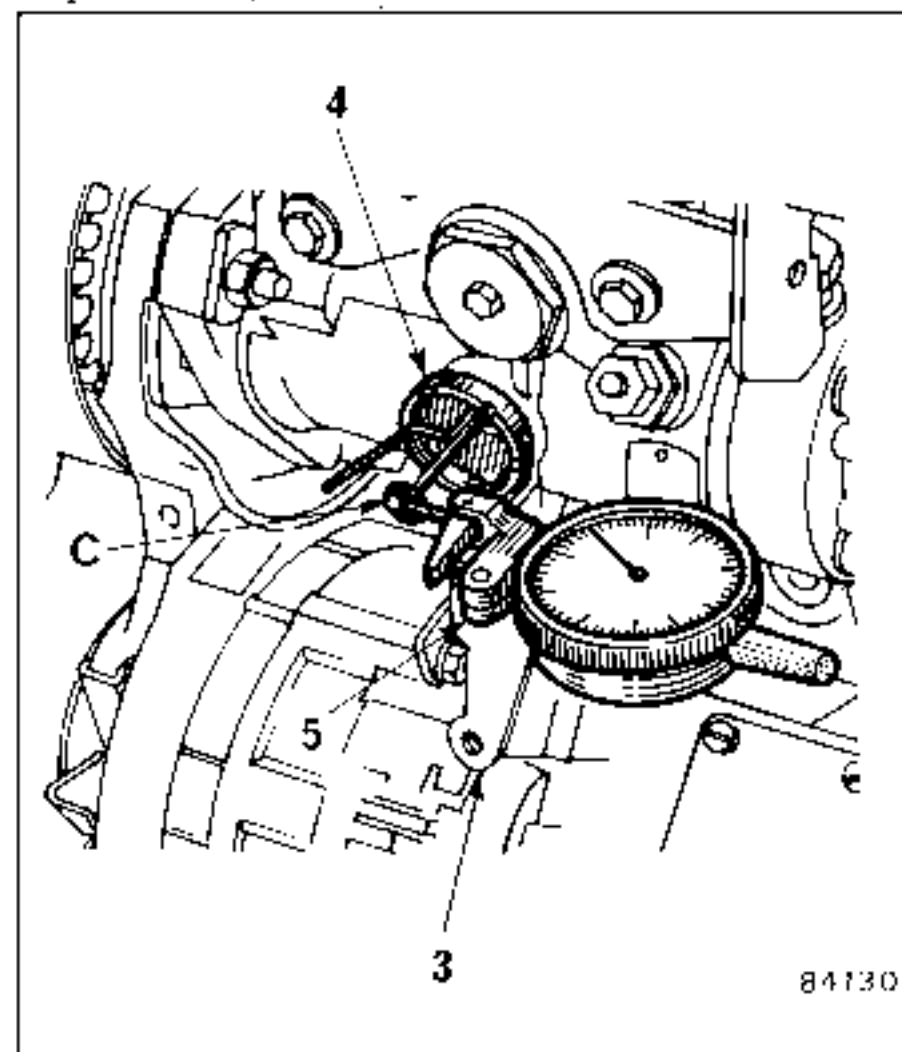
Fit nut (4) with support (3) and washer (2) and screw it in.

Secure angle bracket (5) to the dial indicator and fit the assembly to support (3).

Adjust the assembly so that the dial indicator is at half travel, angle bracket ball (C) is in the centre of the gauge rod and the bracket itself is square with the end of the dial indicator.

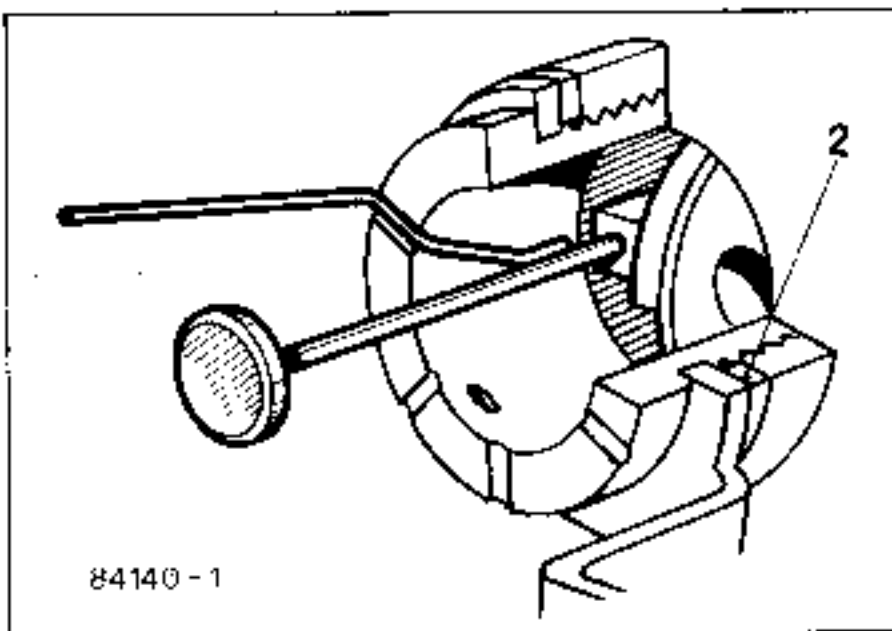
Then, by turning the pump in both directions, determine the centre point of the "V" (B) (smallest reading on the indicator) and zero the dial.

Note the lowest figure obtained, for example 4 mm.



TIMING

REMEMBER TO TAKE OUT THE GAUGE ROD BEFORE TURNING THE CRANKSHAFT, OTHERWISE THE CIRCLIP MAY MOVE AND BREAK THE GAUGE ROD.



Disengage the gauge rod. To do this, pull the rod and engage its spring arm in one of the slots provided on the securing nut.

Turn the crankshaft in its normal direction of rotation through two turns and stop approximately two teeth before TDC, No.1 cylinder compression.

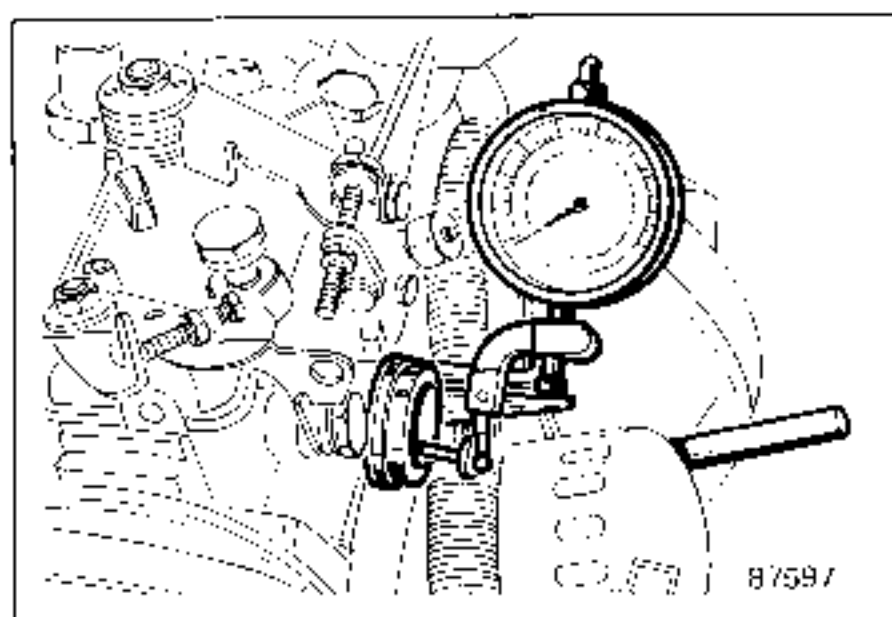
Bring the gauge rod into contact with the "V" in the pump rotor.

Slowly turn the crankshaft in its normal direction of rotation, check the lowest point (dial indicator zero, for example 4mm) and lock the crankshaft at TDC with pin **Mot.1054**.

Turn the pump to lift the gauge rod by 1.60 mm, that is:

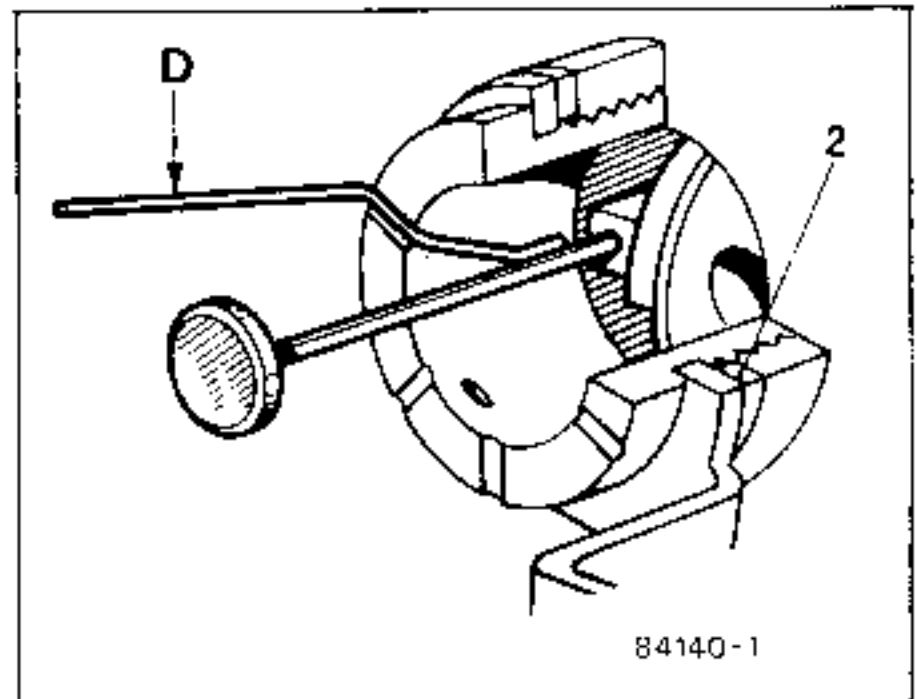
for example: $4 \text{ mm} + 1.60 \text{ mm} = 5.60 \text{ mm}$ at the dial indicator.

Tighten the pump securing nuts.



CHECKING

Pull out crankshaft pin **Mot.1054** and the timing gauge rod.



TAKE GREAT CARE TO ENSURE THAT THE SPRING ARM (D) IS SECURE IN ONE OF THE SLOTS IN THE NUT.

Turn the engine through two turns.

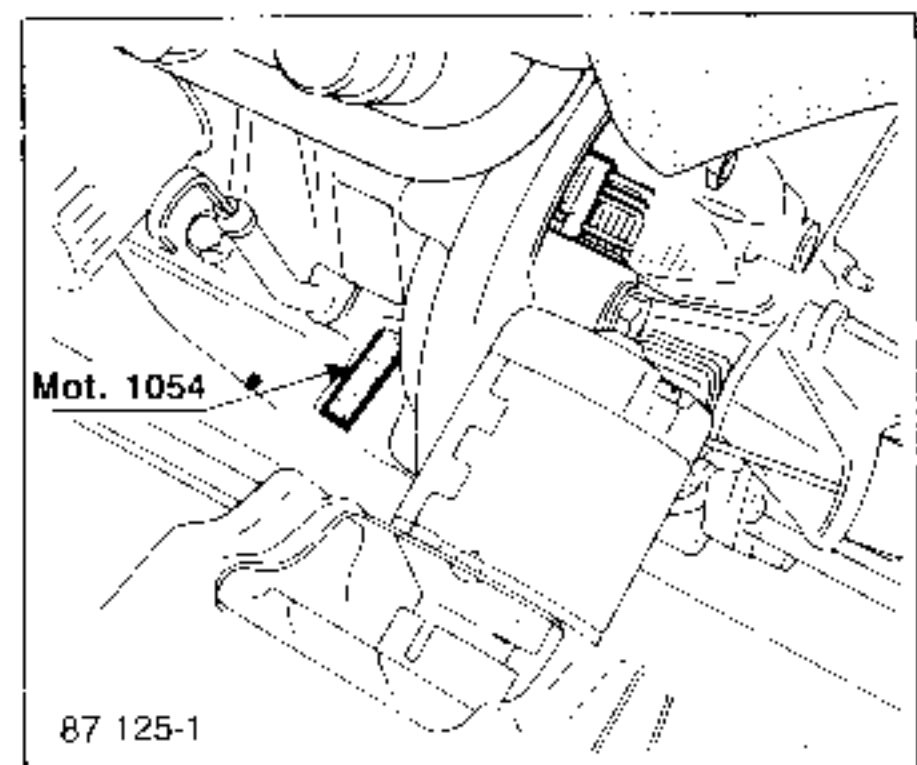
Stop two teeth before TDC.

Unlock the dial indicator gauge rod.

Slowly turn the engine back to check the zero point and then until rod **Mot.1054** engages in the crankshaft.

The figure should be between 1.58 and 1.62 mm.

Correct it if necessary.

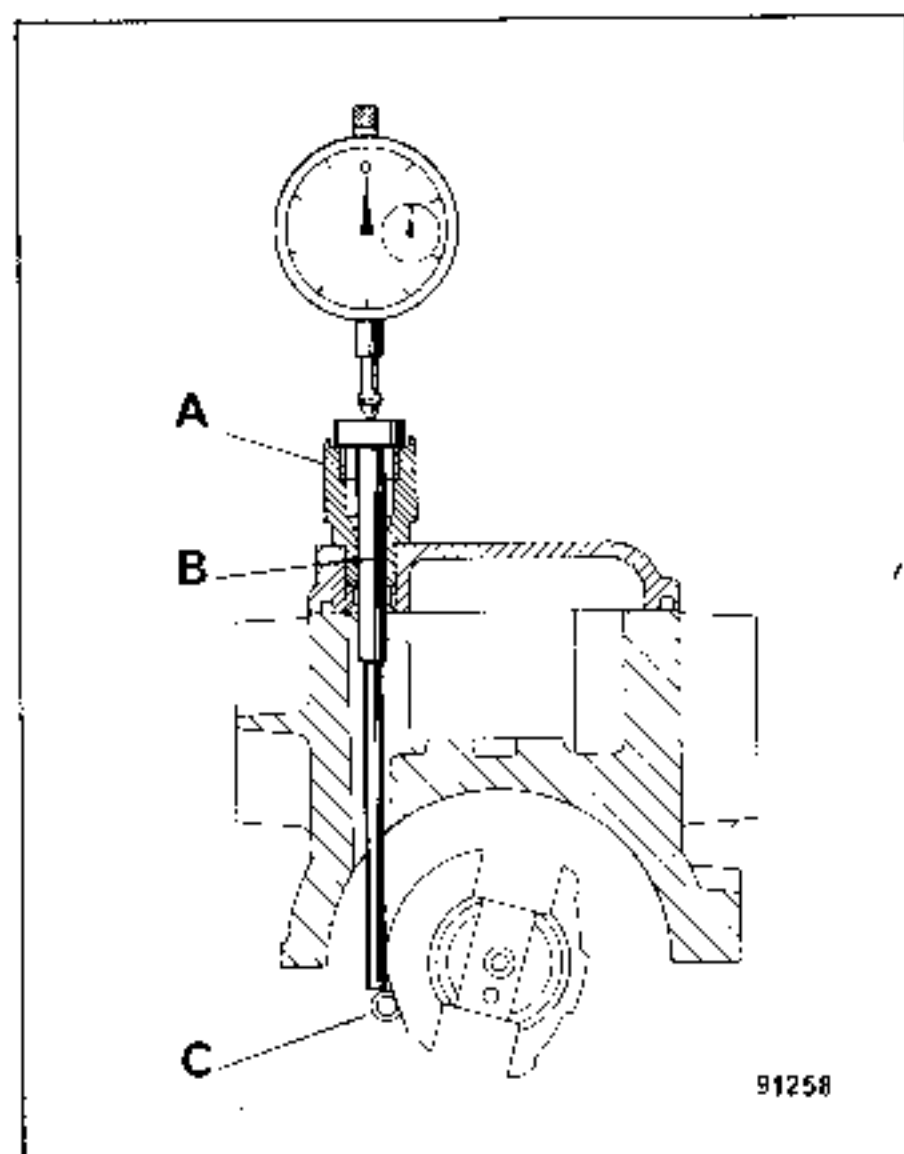


TIMING (PUMP WITH ACCESS VIA COVER)

The pump comprises:

- a timing duct (A) located on the pump cover, on which timing gauge (B) rests;
- a dowel (C) which is welded to the hydraulic head rotor.

The gauge lift value corresponding to the pump timing when the engine is on TDC is stamped on the side access plug of the pump.



NOTE: By turning the pump driveshaft in the normal direction of rotation, the dowel drives the timing gauge for a travel of approximately 18 mm.

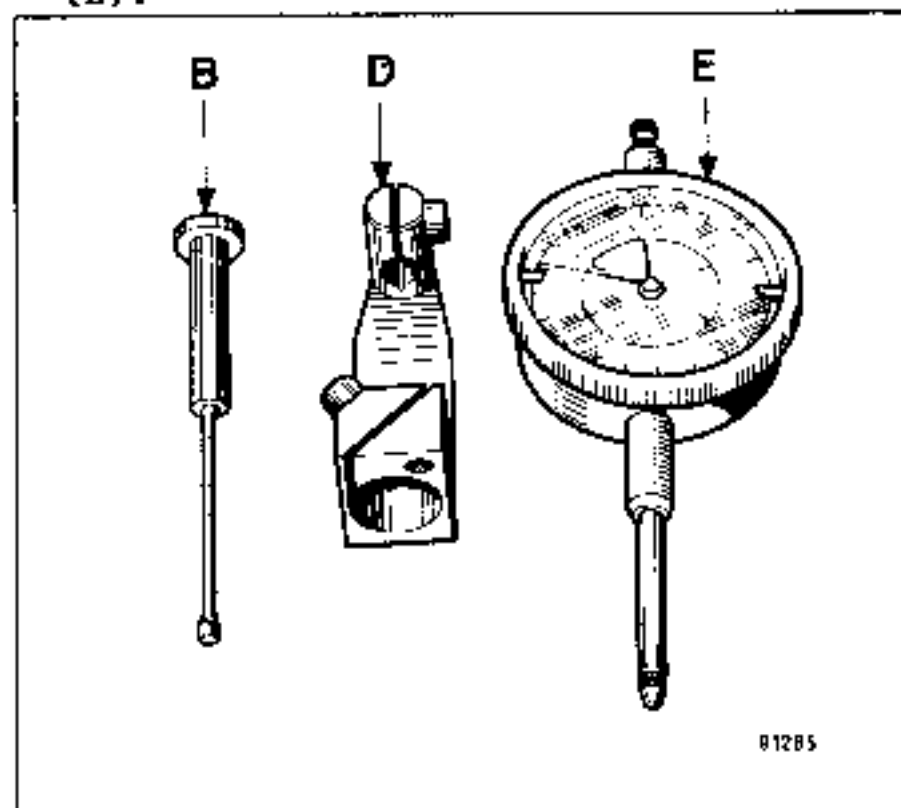
Fitting tooling Mot.1079

Kit Mot.1079: ,

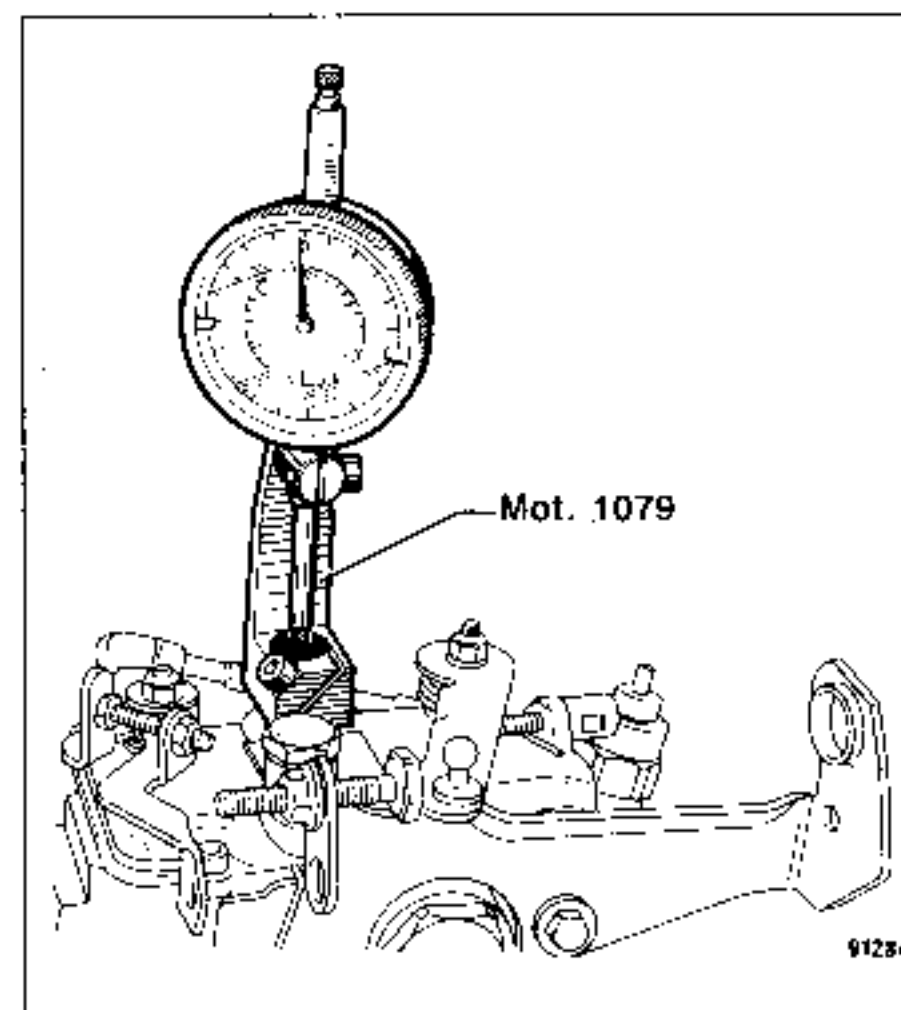
- a timing gauge rod (B) which has a reduced diameter in the centre enabling it to move sideways when the pump turns in reverse;

- a dial indicator support (D);

- a dial indicator with a travel of 30 mm (E).



- Remove the access plug and its seal.
- Place gauge rod (B) in timing duct (A) and ensure that it is not in contact with dowel (C).
- Fit in place dial indicator support (D) on duct (A) and secure it.
- Offer up dial indicator (E) to the support and tighten it at a travel of 0.2 mm.
- Set the dial on zero.



Turn the driveshaft in the normal direction of rotation and check that the gauge rod lift is approximately 18 mm and that after moving the gauge rod and the dial indicator return to zero.

Turn the driveshaft in the normal direction of rotation until the dial indicator starts to lift.

Depending on the type of injection equipment, the pump sprocket has a different position: it has two position markings (B BOSCH pump, R ROTO DIESEL pump) and two keyways in different positions:

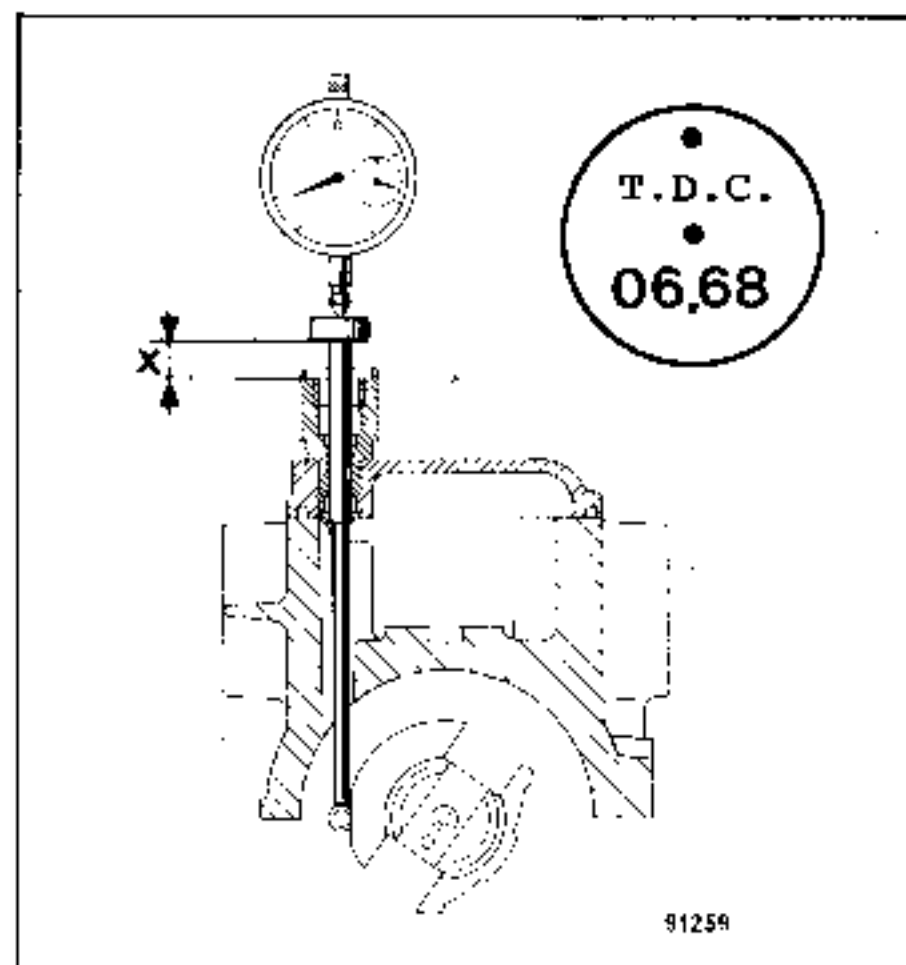
Offer up the pump to the engine and fit it in place, aligning the key with its keyway in the sprocket (mark C). When the pump is in position, fit the washers and nuts for the securing flange, without tightening them. Fit the sprocket washer and securing nut (1) and tighten to the recommended torque.

Remove locking tool **Mot. 996**.

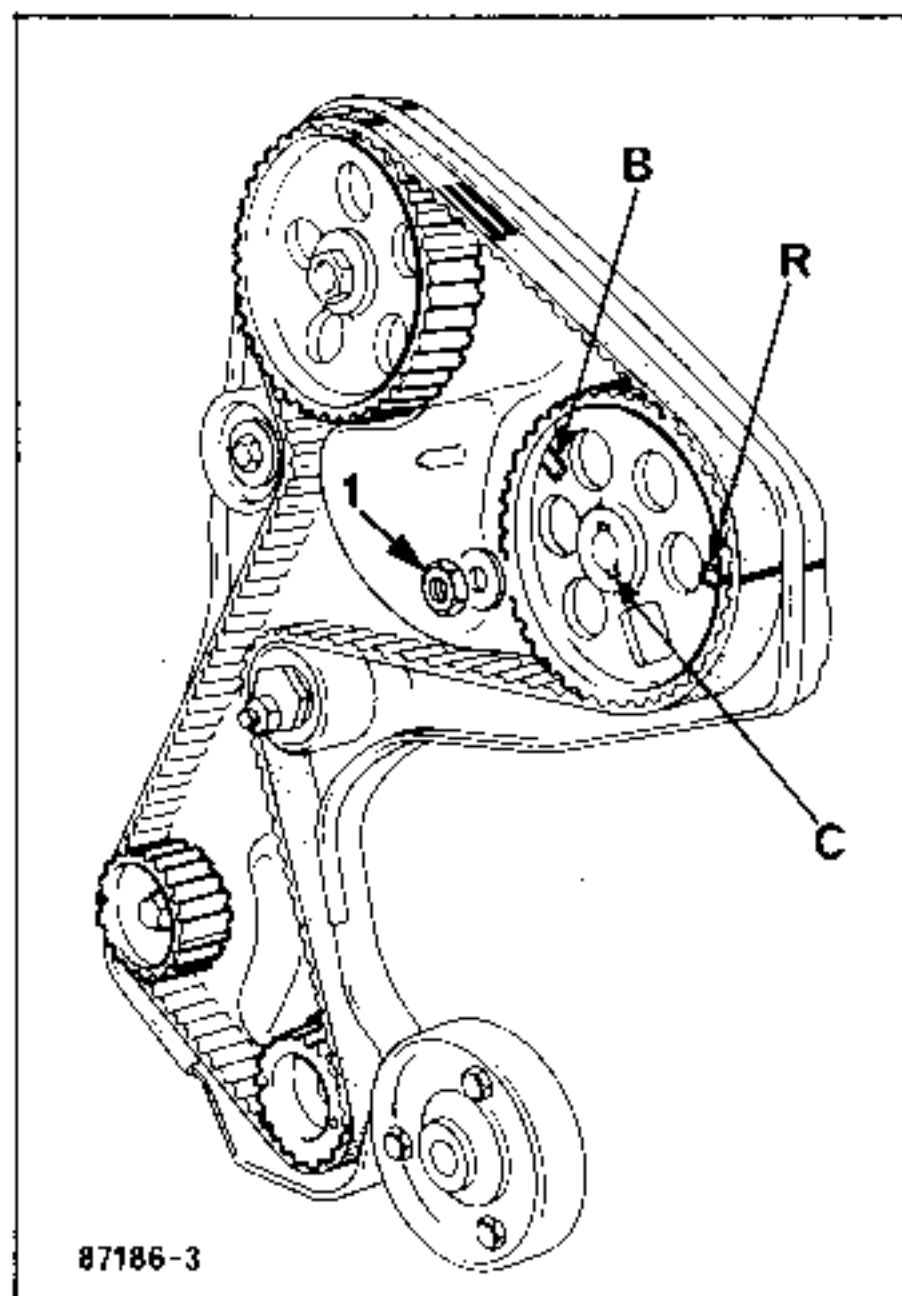
Slowly turn the crankshaft in the normal direction of rotation and lock it at TDC using gauge rod **Mot. 1054**.

Turn the pump so as to lift the gauge rod by the value corresponding to the value on the side access plug.

Timing example: dimension X = 6.68 mm.



Tighten the pump securing nuts.



B : mark for BOSCH pump
R : mark for ROTO DIESEL Pump
C : keyway to be used.

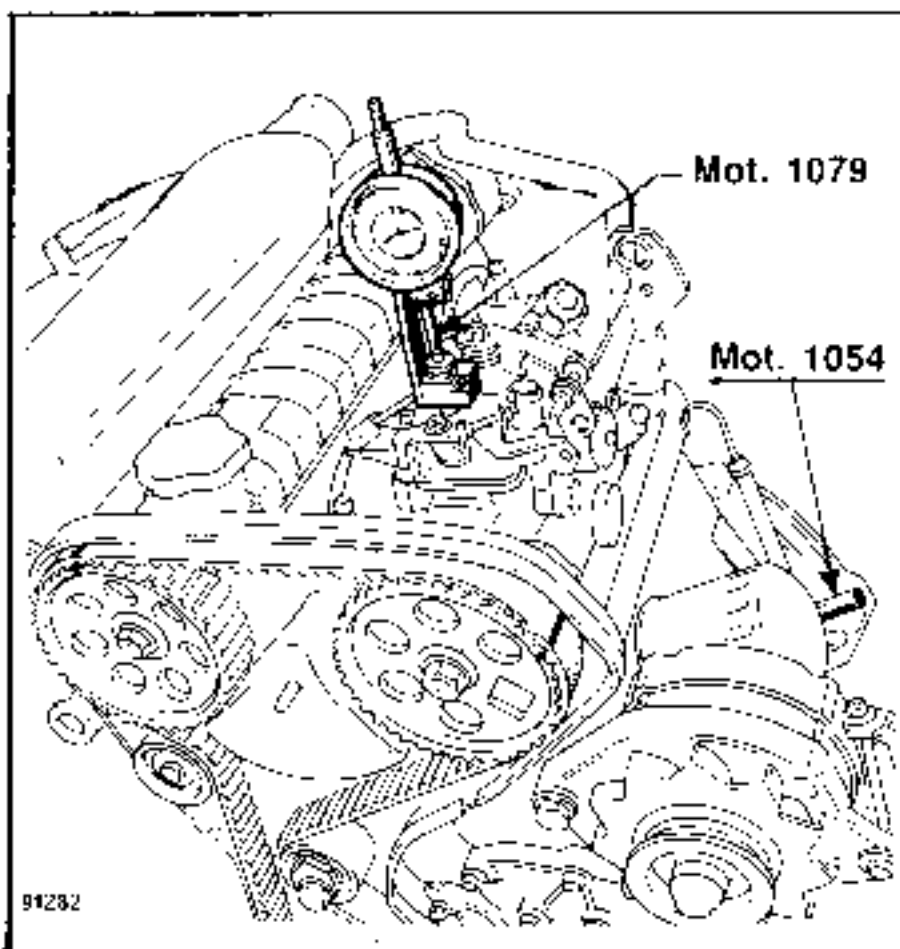
CHECKING

Release gauge rod **Mot.1054** and turning the crankshaft in the normal direction of rotation turn it through one and three quarter turns. Check that the dial indicator is at zero.

Slowly turn the crankshaft until gauge rod **Mot.1054** engages in the crankshaft.

The lift should be for example: 6.68 ± 0.04 mm. Correct it if necessary.

NOTE: After any adjustments, the timing must be re-checked.

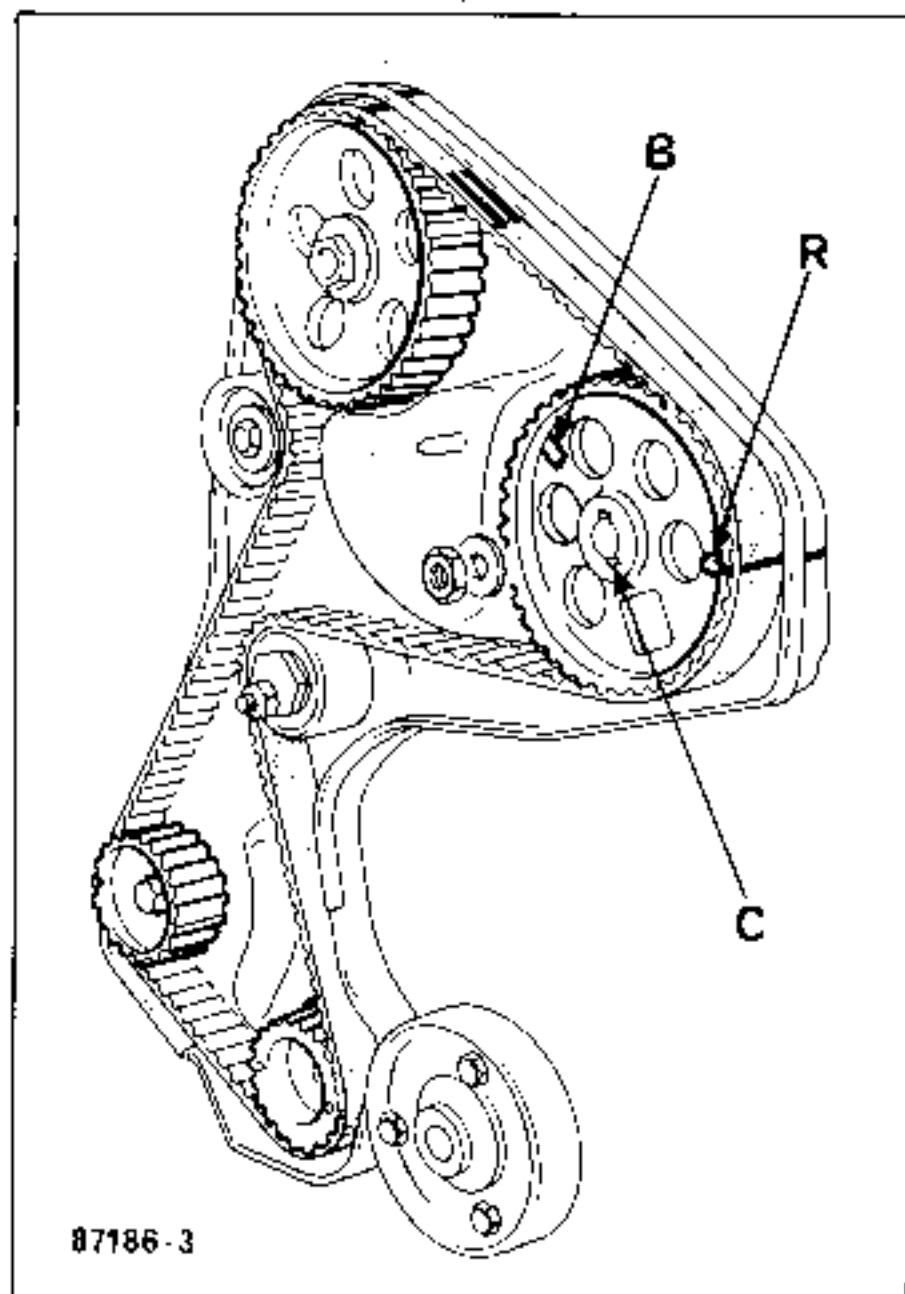


In this position check the timing marks:

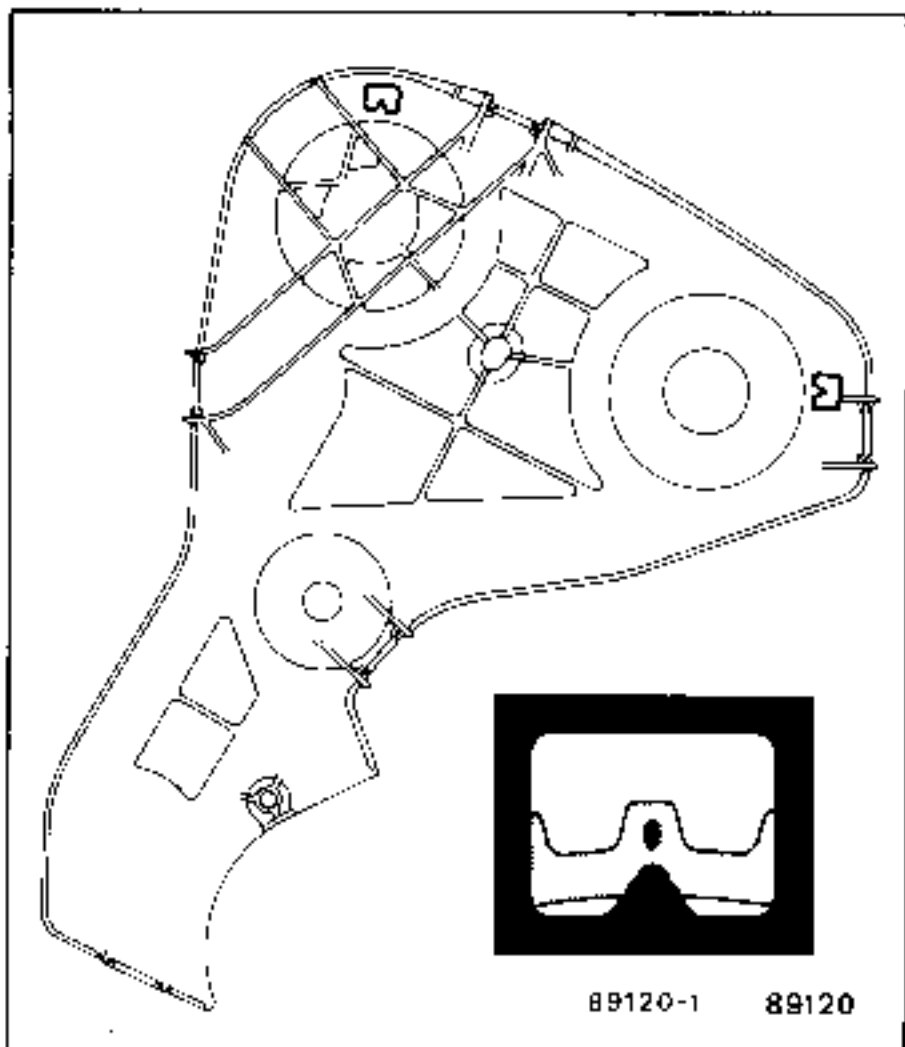
Depending on the type of injection equipment, the pump sprocket has a different position: it has two position markings (B BOSCH pump, R ROTO DIESEL pump) and two keyways in different positions:

B : mark for BOSCH pump
R : mark for ROTO DIESEL Pump
C : keyway to be used.

NOTE: Between the two marks on the sprockets there should be thirty recesses between the teeth on the toothed belt.



If the casing has marking slots, fit it in place and ensure that the toothed wheel marks are in line with the markings on the casing.

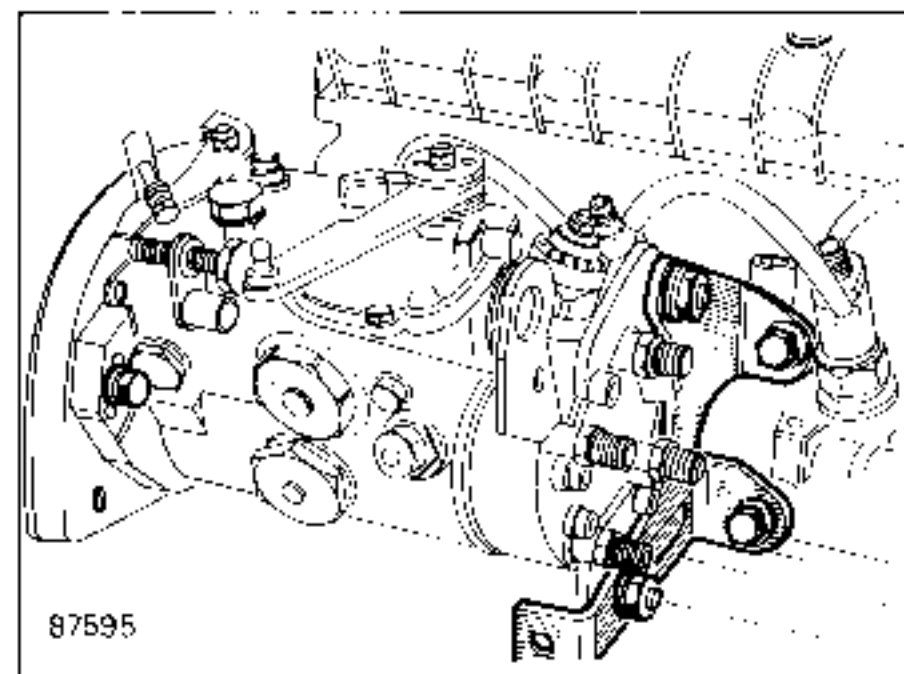


REFITTING ADJACENT COMPONENTS

Remove the timing tooling.

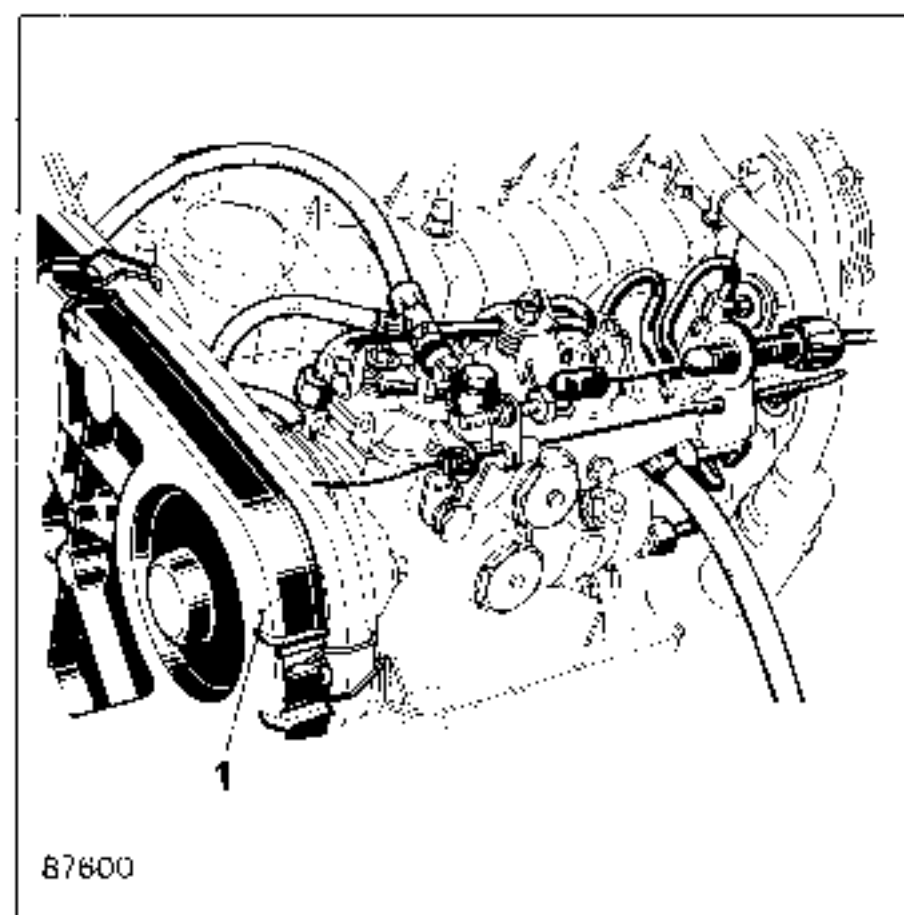
Refit the pump plug using a **new seal**.

Fit the rear support and secure it, screwing up its bolts evenly so as not to subject the pump to stress.



Refit the alternator protective casing.

Fit the timing gear casing; it may be necessary to push the engine sideways on its mountings to insert the casing.



Retension the alternator drive belt (see "Adjusting the drive belt tension").

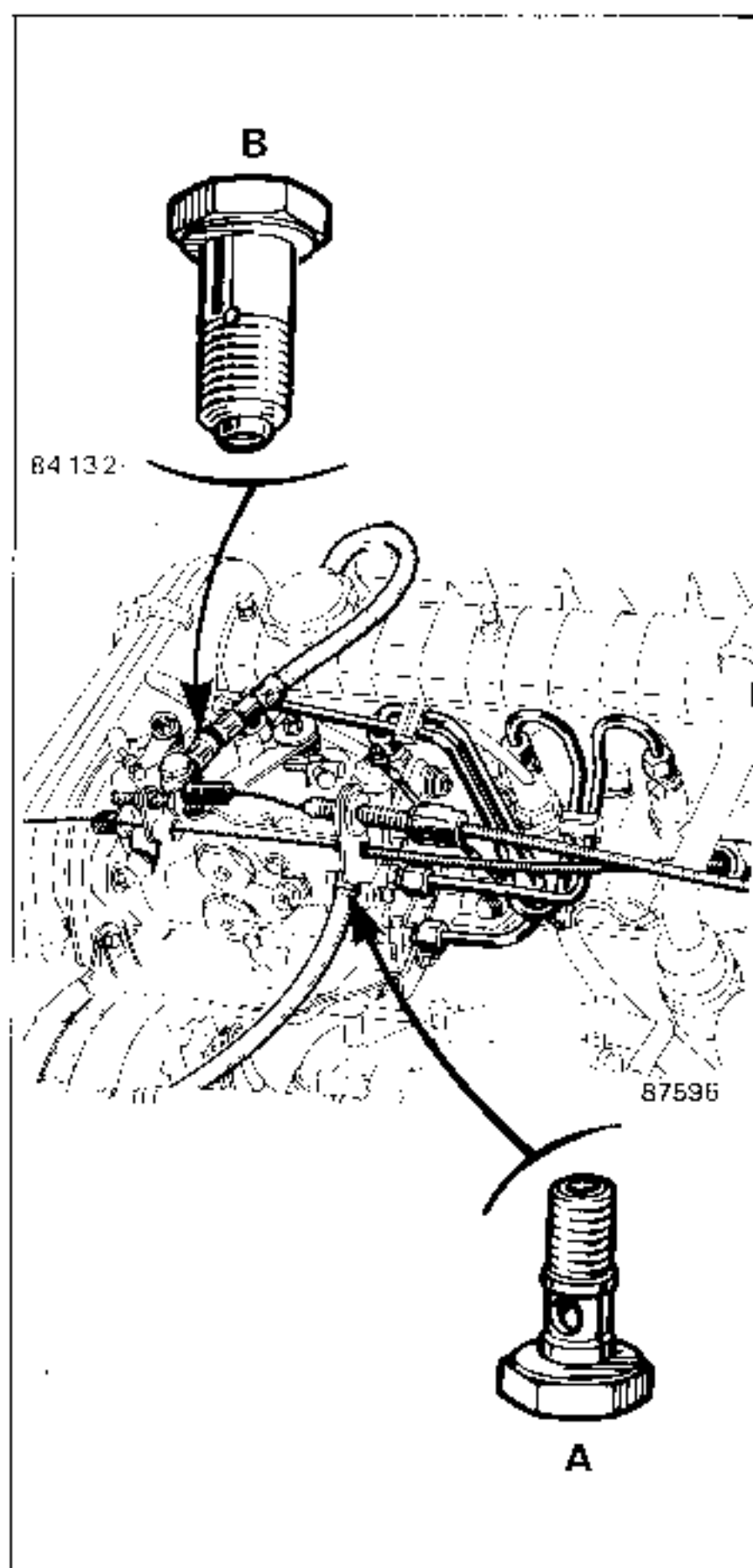
Clean the feed pipes and activate the priming pump several times to remove any impurities present.

Connect the feed and return pipes.

WARNING

A - The feed banjo bolt has a pump protection filter.

B - The return to tank banjo bolt has a valve and a calibrated jet.



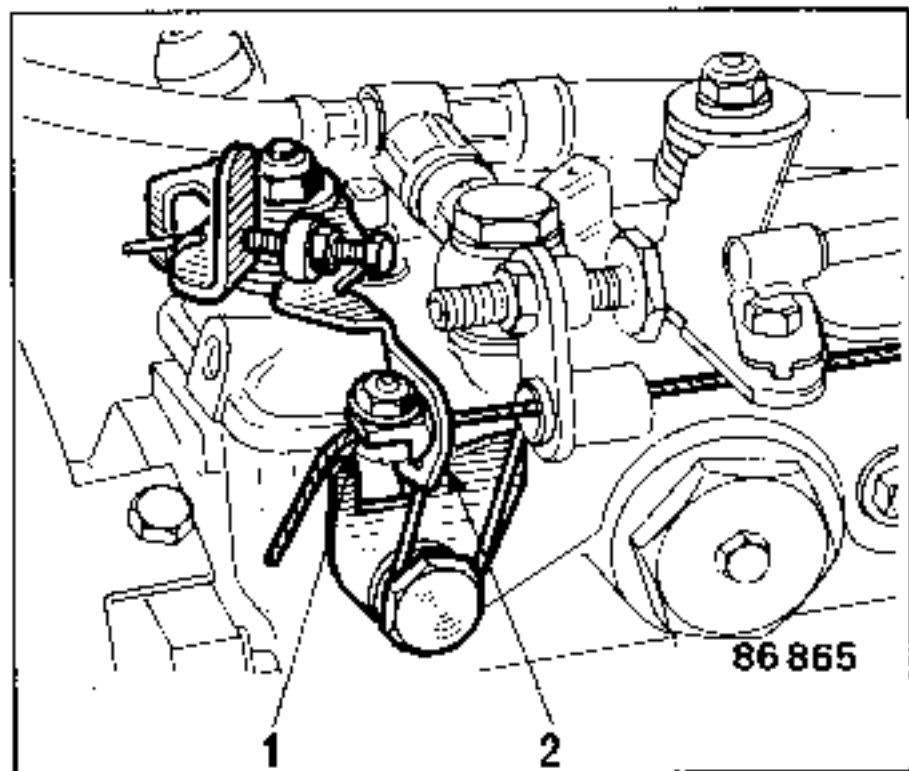
Fit the injector pipes without tightening the unions at the injector ends. Connect the shut-off solenoid wire. Refit the throttle control & adjust it:

- with the accelerator pedal fully depressed;
- with the throttle control on the pump at the end of its travel.

Adjust the cable cover end clamp to compress the compensator by approximately 2 mm.

ADJUSTING THE FAST IDLING WHEN COLD

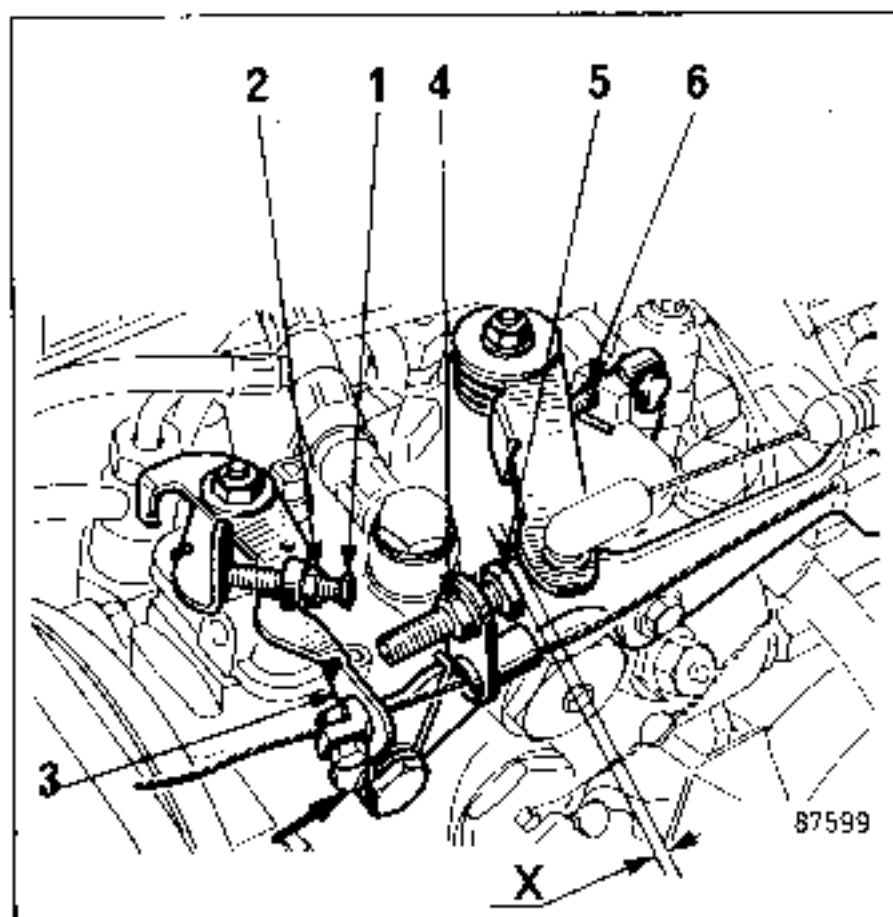
Fit the cable, the cover end stop and cable clamp (1). Cold engine (coolant temperature less than 30°C). Push idling stop (2) as far as it will go, tension the cable, bring the cable clamp against the stop and tighten it.



Bleed the fuel system.

CHECKING ENGINE SPEEDS

CHECKING THE ANTI-STALL STOP



Engine warm, idling speed 850 ± 25 rpm.

Place a 2 mm spacer (dimension X) between stop (5) and the throttle lever. The speed should not increase by more than 100 rpm, that is, 950 ± 25 rpm.

Note: When the engine is warm, lever (3) must return against the minimum stop (shown by arrow).

ADJUSTING THE IDLING (warm engine)

- 1) Pre-adjust the idling speed to 750 rpm. Loosen locknut (2) and turn screw (1) to obtain a speed of 750 rpm.
- 2) Place a 2 mm spacer (dimension X) between stop (5) and the throttle lever. Loosen locknut (4) and move stop (5) to obtain a speed of 900 ± 50 rpm (then remove the 2 mm spacer) and tighten locknut (4).
- 3) Adjust the idling speed to 850 ± 25 rpm by turning screw (1) and tighten locknut (2).
- 4) Accelerate sharply and allow the engine to return to idling speed several times in succession:
 - a) if the engine returns to a speed lower than idling and tends to stall: unscrew anti-stall screw (5) by $\frac{1}{4}$ of a turn;
 - b) if the engine speed falls slowly: screw in anti-stall stop (5) by $\frac{1}{4}$ of a turn.

CHECKING THE MAXIMUM SPEED

Warm engine: open the throttle lever fully, against its stop. The engine speed should be between 5200 and 5400 rpm.

As the max. speed stop screw (6) is sealed at the factory it should only be adjusted by an injection specialist who should then reseal it.

As this operation can have serious consequences for the injection pump, it is essential that it should only be carried out under conditions of absolute cleanliness.

1) Clean off the area round the solenoid and blow it with compressed air.

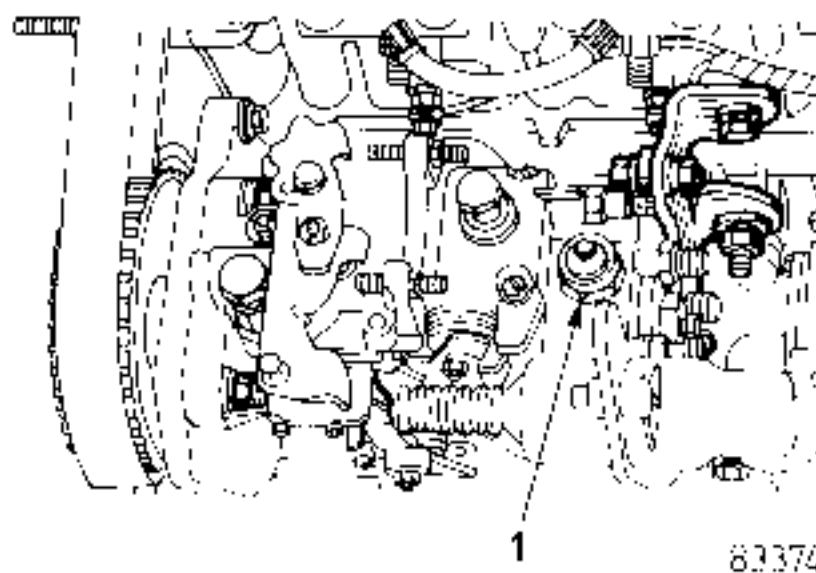
2) When dismantling and reassembling the solenoid, operate the plunger button on the priming pump so that the fuel carries any dirt in the solenoid tapping with it when it flows out.

Note:

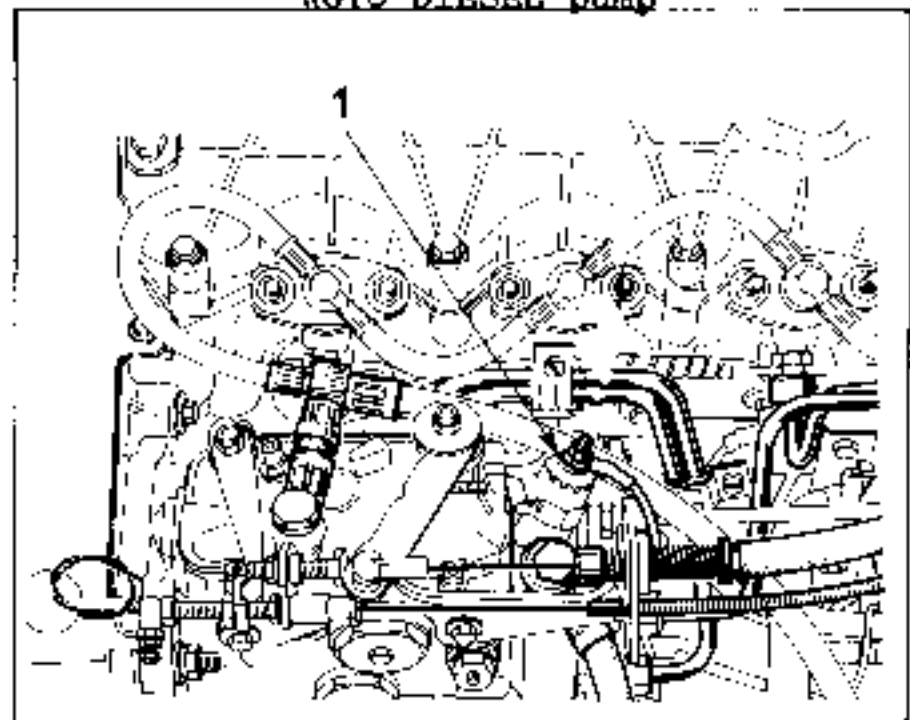
Given the close proximity of the alternator, protect it during this operation.

Disconnect the shut-off supply wire. Loosen solenoid (1) and unscrew it whilst operating the priming pump. Recover the valve and its spring.

BOSCH pump



ROTO DIESEL pump

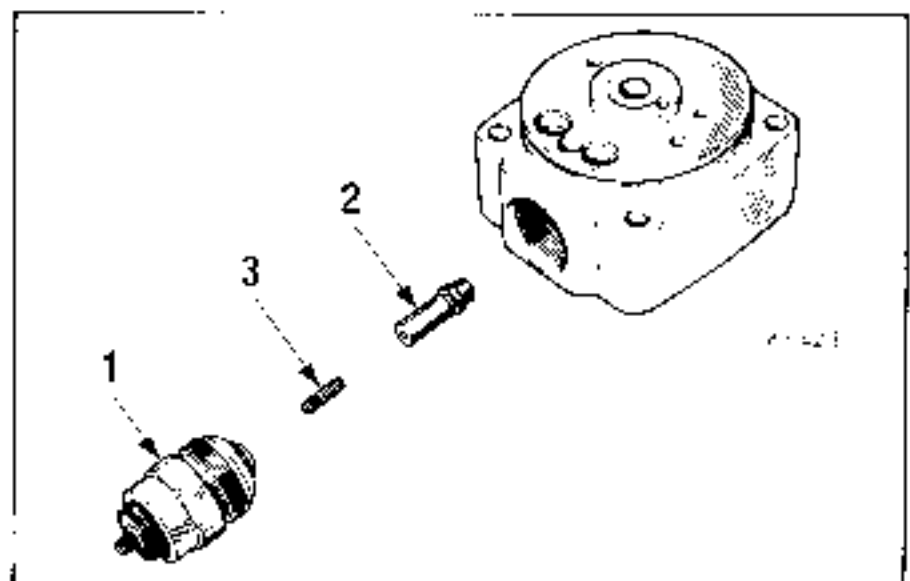


On refitting:

place a new seal on the solenoid body.

Place the valve and its spring, coated with grease, in its location on the hydraulic head and the housing.

Fit the solenoid and screw it in whilst operating the priming pump. Tighten it to the specified torque.



THERMOSTATIC CAPSULE

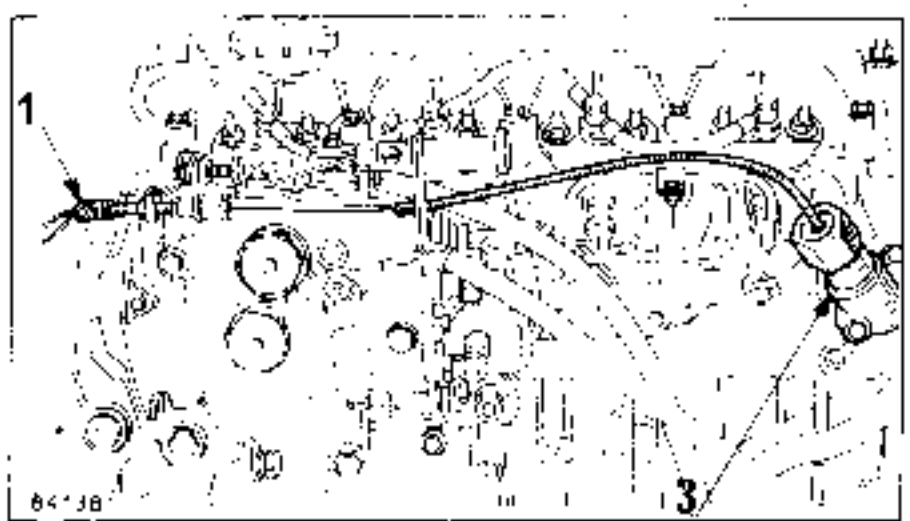
Removing - Refitting

Loosen and remove cable clamp (1). Free the cable and its cover from the pump support.

Remove the thermostatic element and plug the tapping to avoid losing coolant.

On refitting:

- fit a **new seal** (3), check and top up the coolant, if necessary.



ESSENTIAL SPECIAL TOOLING

Mot.869	Injector nut tightening socket
Ele.721	Limited torque plug spanner

REMOVING

Remove in the following order:

- the leak-back banjo bolt;
- the union nut on the injector pipe from the pump;
- the two clamp securing nuts;
- the flat washers;
- the securing clamp;
- the injector;
- the seal and flame baffle washer.

REFITTING

Place the following in the cylinder head:

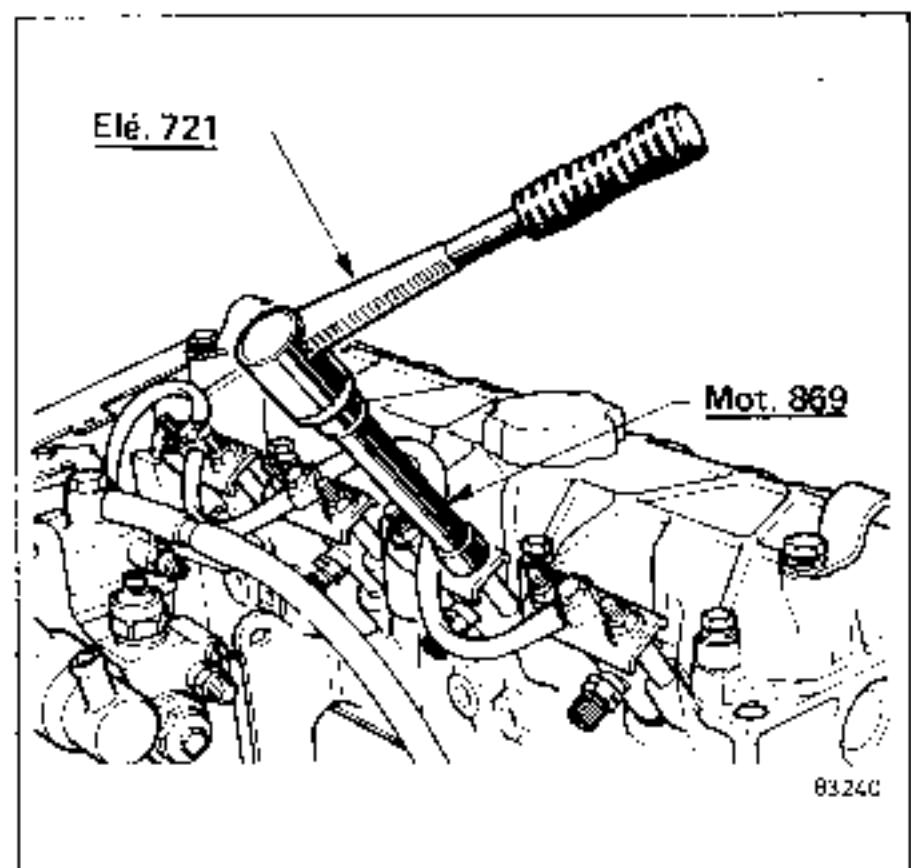
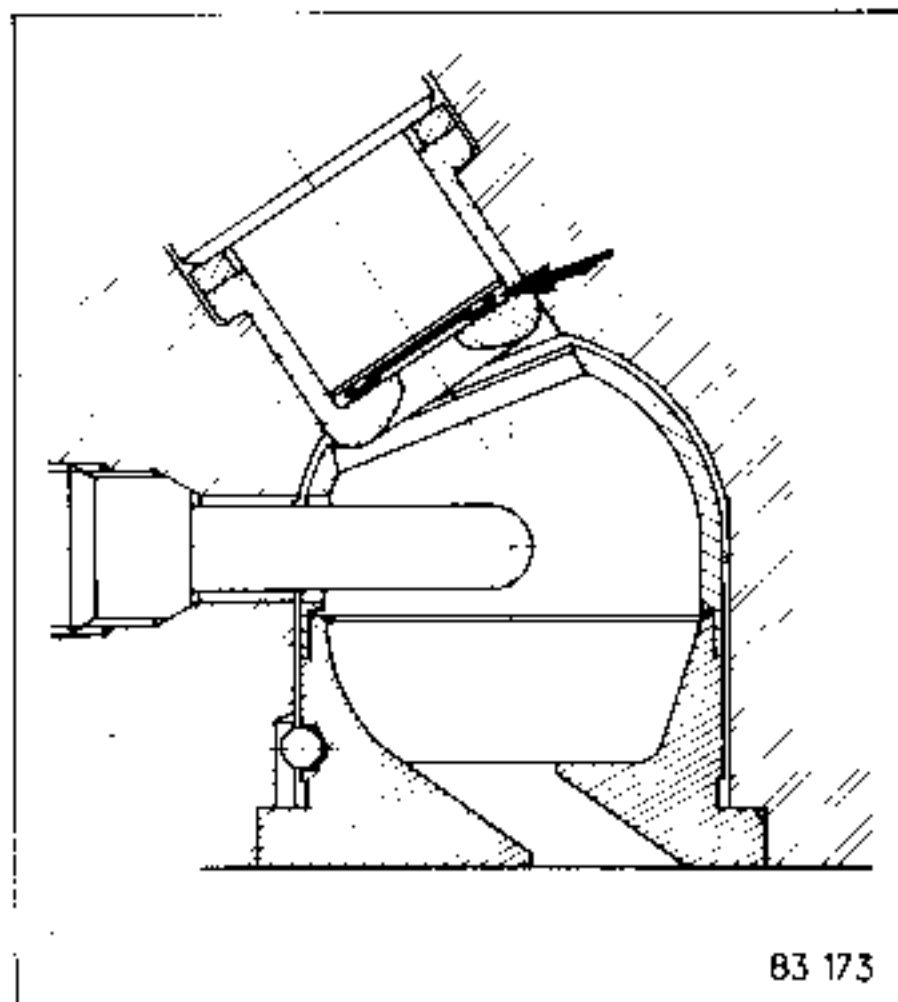
- a new seal and a flame baffle washer (positioned as shown by the arrow);

- the injector, ensuring that it is square against its seal.

Fit the clamp, the washers and the nuts.

Tighten the two nuts evenly using spanner **Ele.721** and socket **Mot.869**.

Refit the leak-back banjo bolt using **new** seals.



Injectors are to be overhauled under conditions of absolute cleanliness.

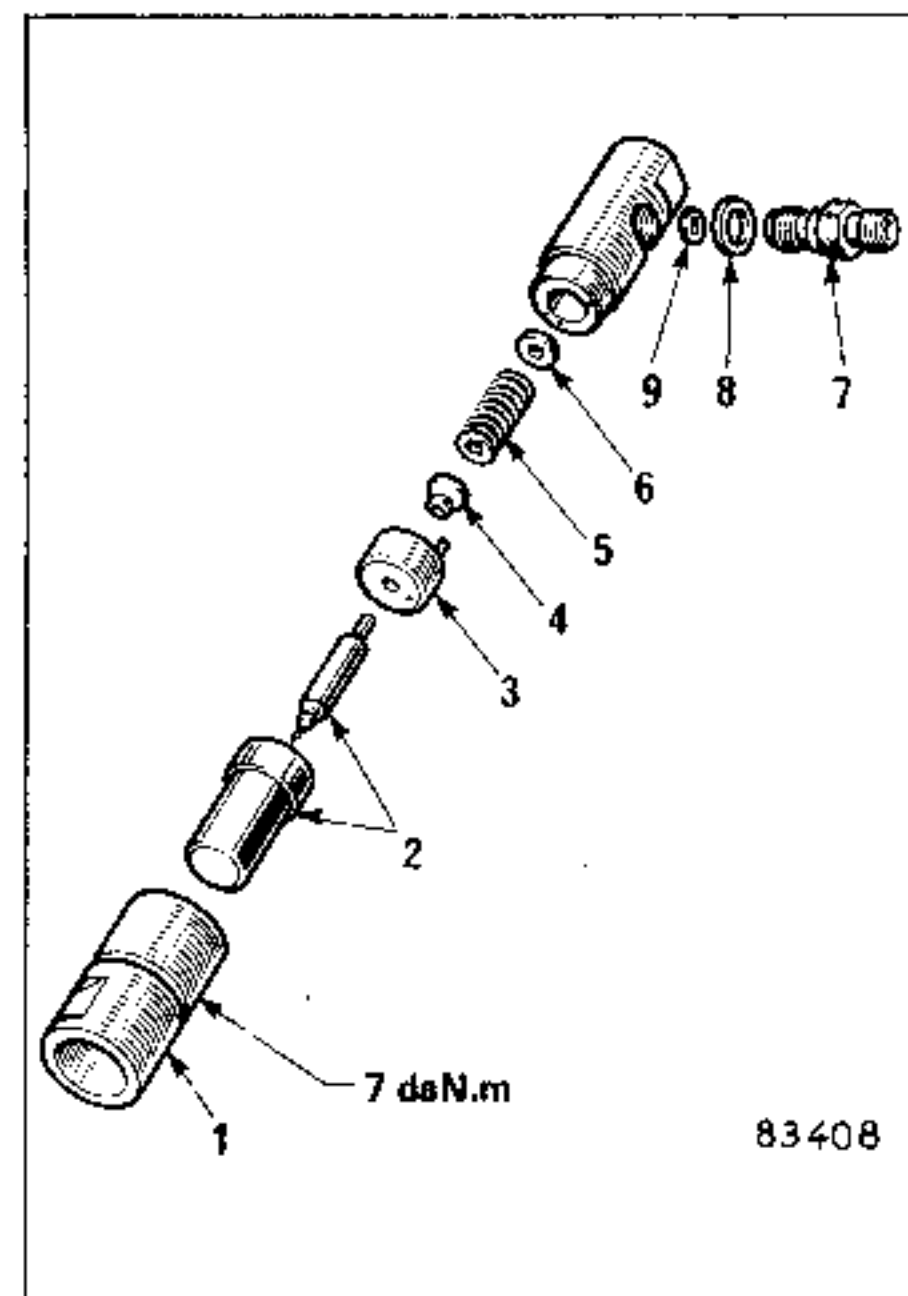
Rinse the parts in clean fluid before reassembly.

*Use injector test fluid **INJECTELF.E.D.**, (supplied in 5 litre cans) for rinsing off the parts and testing the injector on a test pump.*

Grip the injector across its flats in a vice fitted with soft jaws.

BOSCH injectors

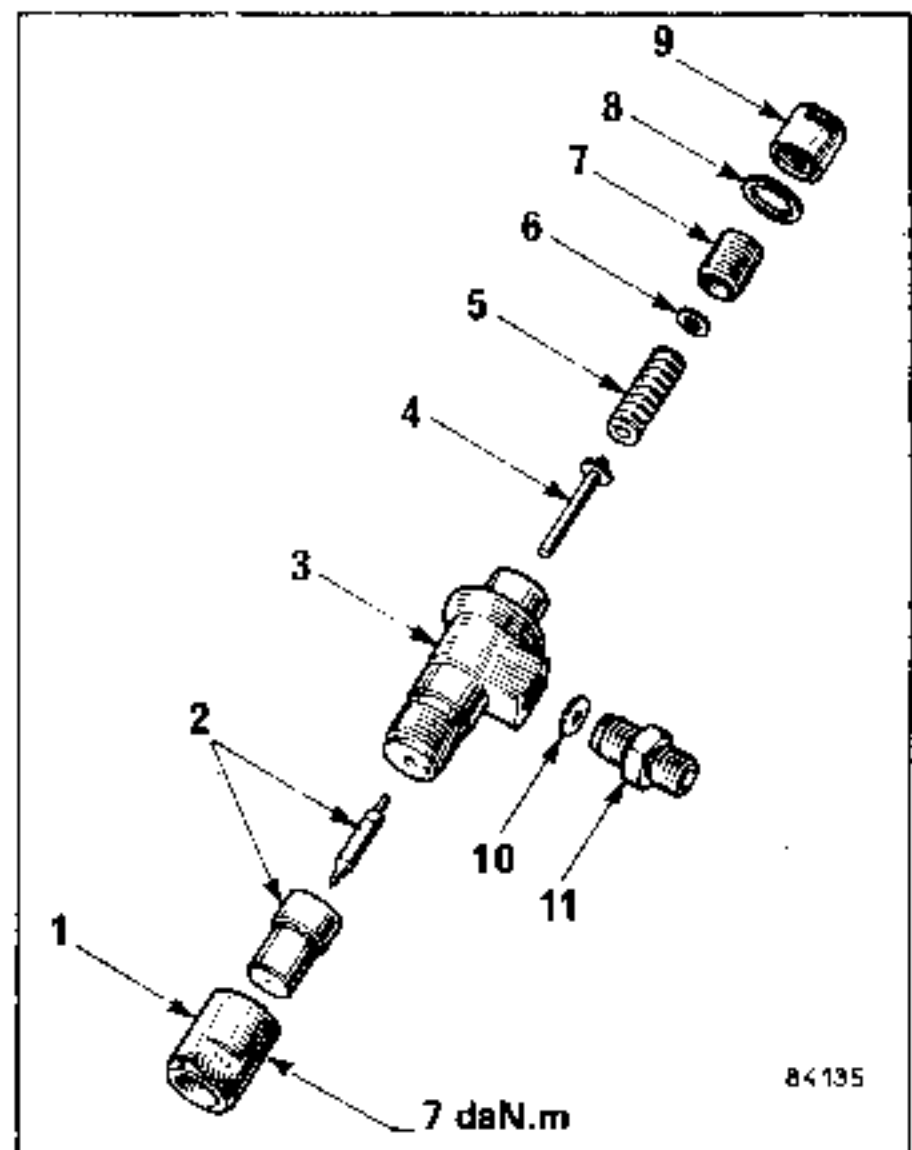
Loosen the nozzle securing nut (1).



ROTO DIESEL injectors

Unscrew one after the other:

- cap (9);
- body (3).



Note:

These injectors are equipped with an opening pressure adjusting screw (7).

To adjust the injector opening pressure, loosen cap (9) and turn screw (7) with a screwdriver.

After adjustment, retighten cap (9).

ESSENTIAL SPECIAL TOOLING

Mot.997

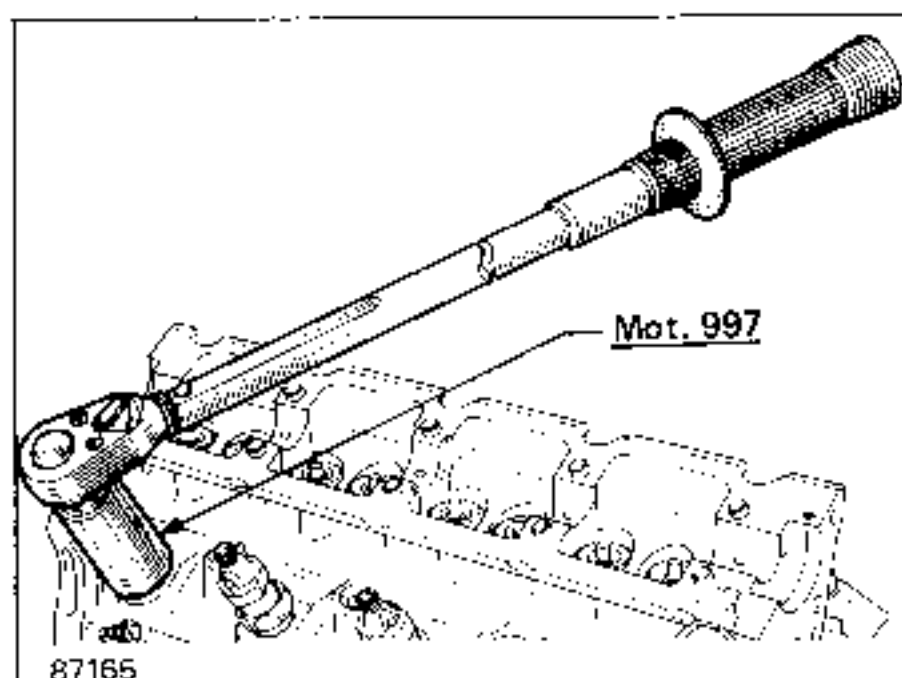
Spanner for injector fastenings

REMOVING

Remove the leak-back pipe.

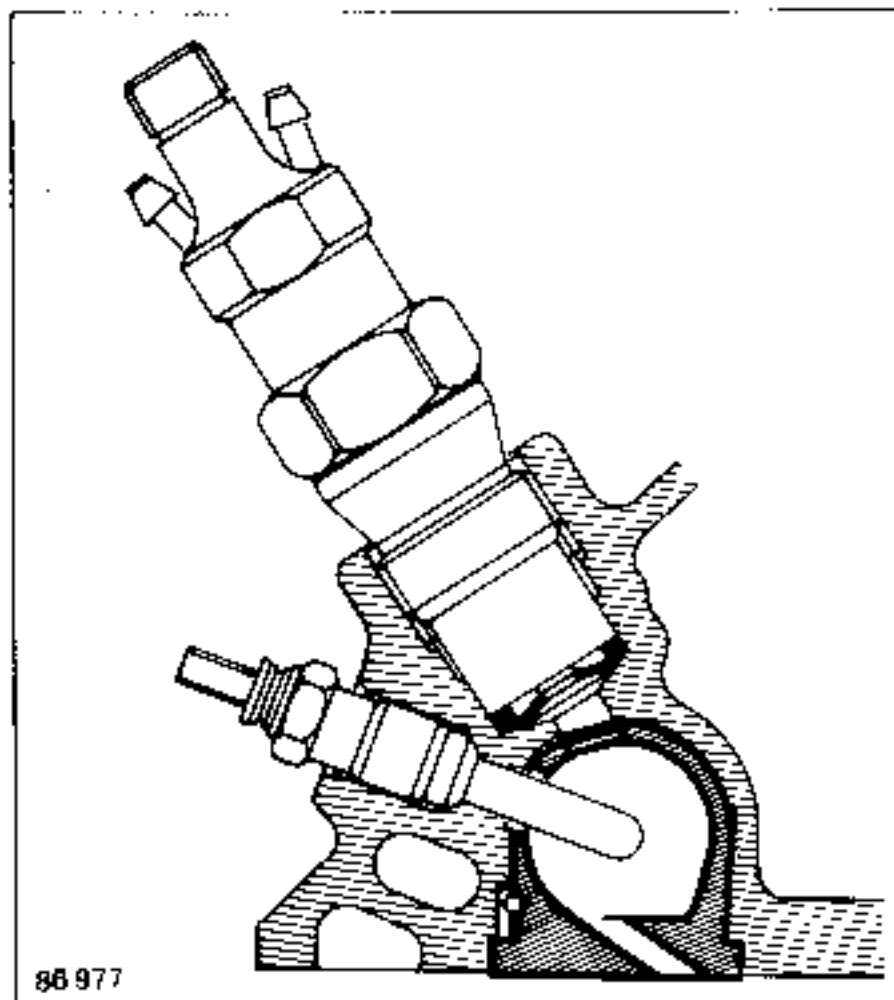
Remove the injector pipe.

Unscrew the injector using tool **Mot.997**.



REFITTING (Special points)

It is essential to fit a new flame baffle washer and to tighten the injector to **7 daNm**.



F8M engine - Dismantling - reassembly

BOSCH injectors

Injectors are to be overhauled under conditions of absolute cleanliness.

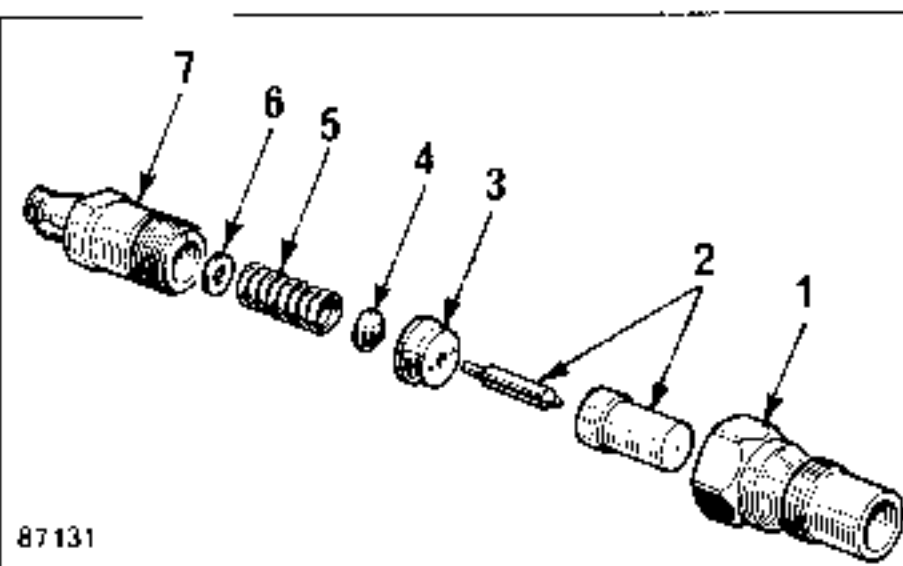
Rinse the parts in clean fluid before reassembly.

Use injector test fluid **INJECTELF E.D.** (supplied in 5 litre cans) for rinsing off the parts and for testing the injectors on a test pump.

Dismantling - reassembly

Grip the injector across its flats in a vice fitted with soft jaws.

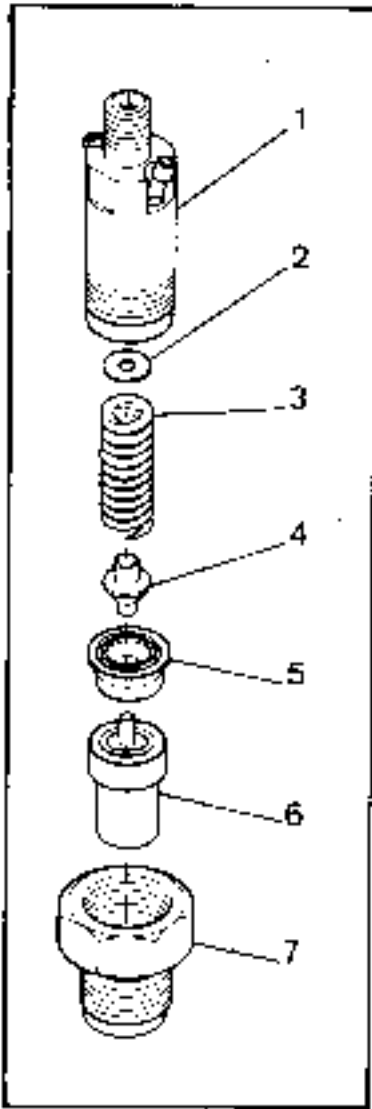
Loosen the nozzle securing nut (1).



- 1 - Securing nut
(tightening torque = 7 daNm)
- 2 - Pintle and seat
- 3 - Intermediate plate
- 4 - Pressure pad
- 5 - Pressure adjusting spring
- 6 - Adjusting washer
- 7 - Injector body

ROTO DIESEL INJECTORS

ESSENTIAL SPECIAL TOOLS	
Mot. 591-01	Spanner for tightening by angular method
Mot. 591-02	Magnetised flexible arm
Mot. 997	Spanner for injector fastenings
Mot. 1011	Injector support



- 1 - Body
- 2 - Setting shim
- 3 - Pressure setting spring
- 4 - Thrust pad
- 5 - Two faced spacer
- 6 - Pintle and seat
- 7 - Nozzle retaining nut

NOTE

The pressure at which the injector opens is adjusted by fitting shims (2) of varying thicknesses.

(0.10 mm provides on average a pressure change of 10 bars).

Dismantling

Place the injector on support Mot. 1001, grip the support in a vice and loosen the nut with socket Mot. 997.

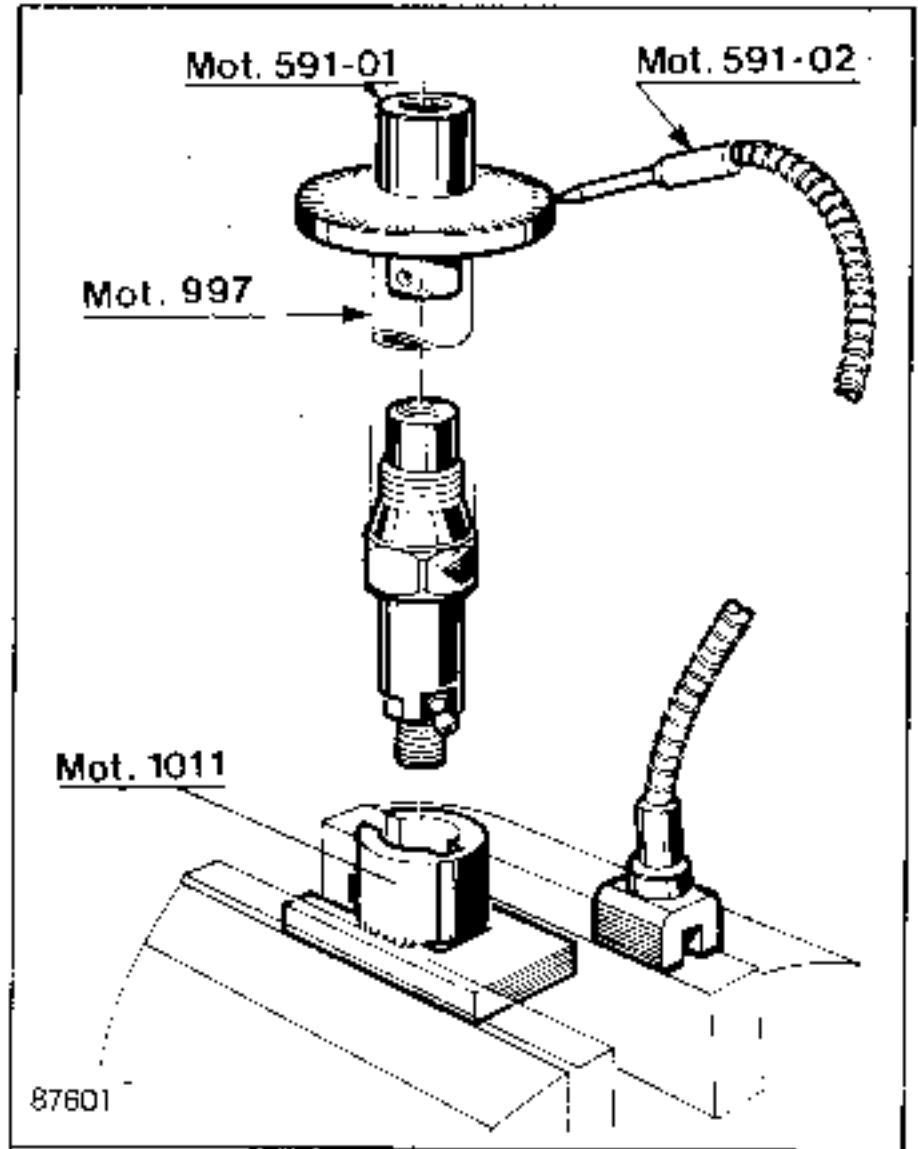
Reassembly

Overhaul injectors under conditions of absolute cleanliness.

Rinse the parts in clean fluid before reassembly.

The nozzle retaining nut is tightened by the **angular method**.

- With a torque wrench apply a torque of **1 daNm** to the injector holder nut. Fit the angle tightening tooling Mot. 591-01 and Mot. 591-02 and mark the 0° position.
Tighten the nut through $22^\circ \pm 1^\circ$.



NOTE: A pre-tightening torque of 2 daNm and an angle of $19^\circ \pm 1^\circ$ may be applied. On parts which have been heat-treated (resulting in a black appearance) a torque of 13 daNm may be applied. However, this method is not recommended since it does not guarantee perfect leaktightness.

REMOVING

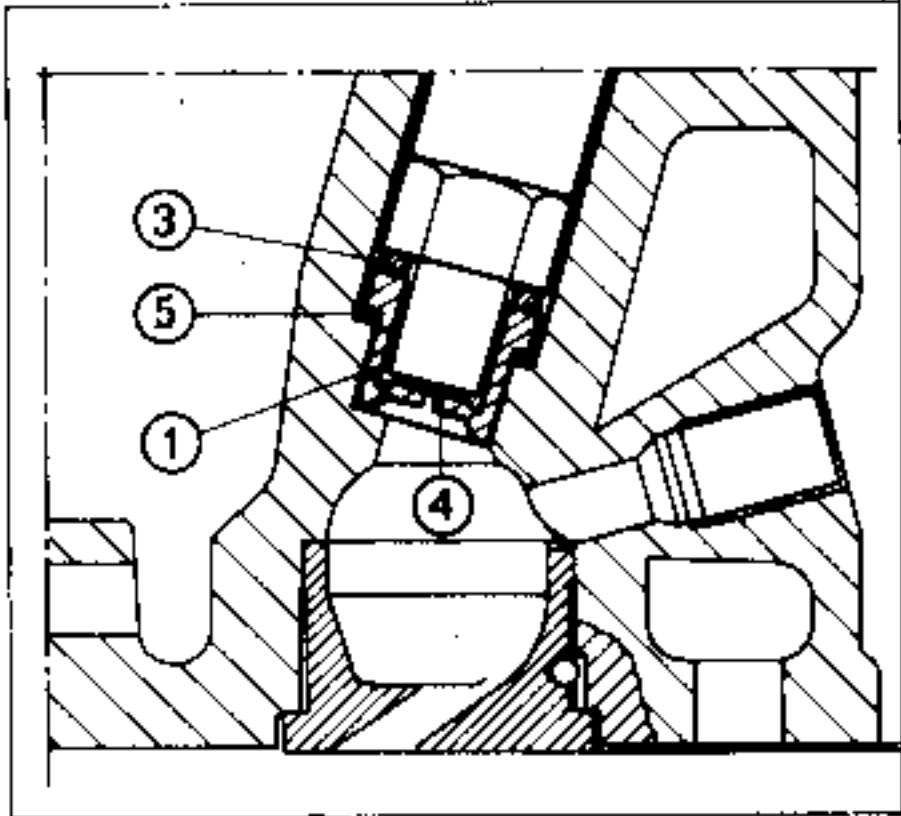
Remove:

- the soundproofing cover;
 - the injector and leak-back pipes.
- Remove the nut and clamp and take out the injector holder.

REFITTING

If the heat baffle (1) is replaced, replace seal (5) before refitting it. The load is to be taken on the face of seal (3) and not on the nozzle sealing face (4).

For example, use a mandrel of the same diameter as nozzle retaining nut (8) and an old injector seal (3).



Fit the injector and clamp and tighten the nut to the specified torque.

S8U engine Dismantling - reassembly

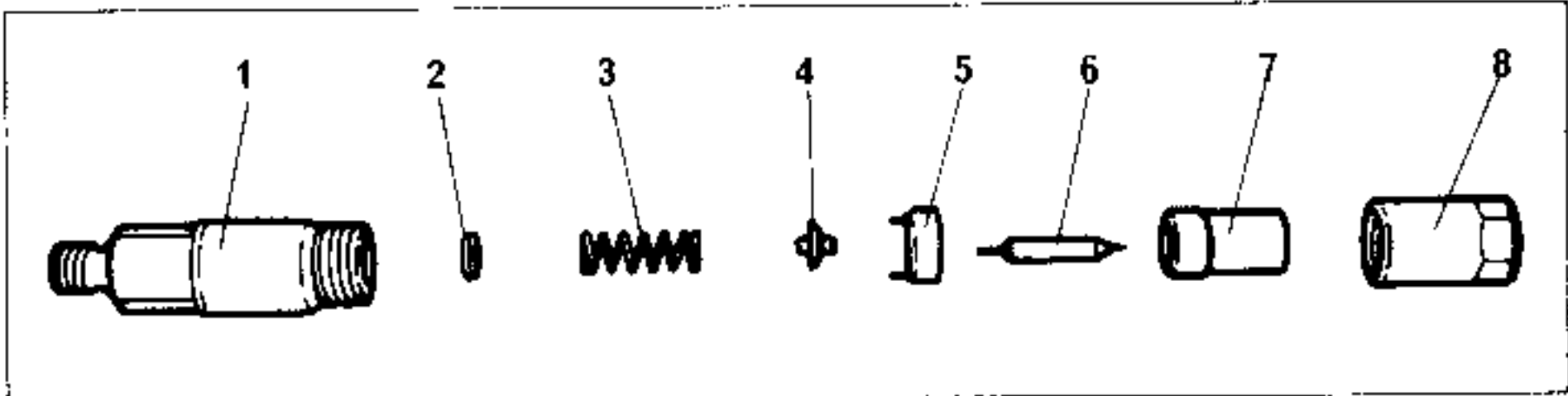
Grip injector (1) across the flats on its body in a vice fitted with soft jaws.

Unscrew nut (8) and remove:

- seat (7) and its pintle (6), taking care not to allow the needle to fall;

- intermediate plate (5);
- pressure pad (4);
- spring (3) and pressure adjusting washer (2).

Refit these parts in reverse order and tighten the nut to the specified torque.



CLEANING THE INJECTORS

Use a cleaning product selected by **RENAULT** to decarbonise the parts.

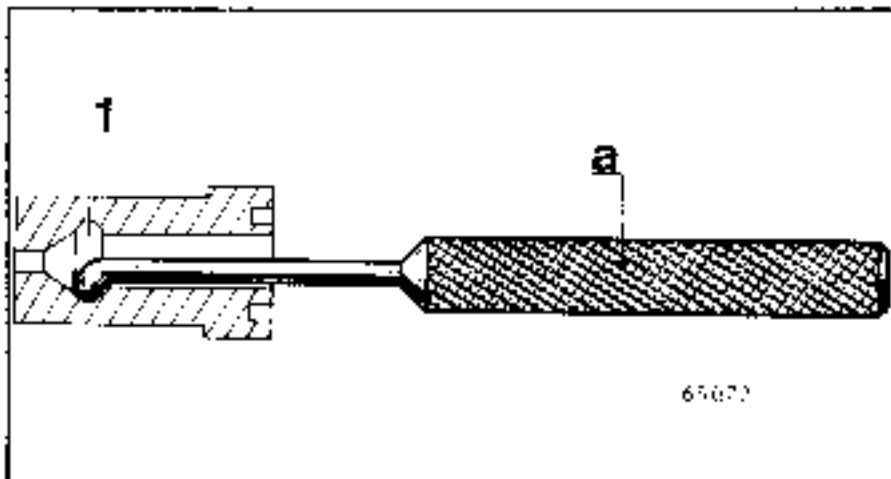
The injector seat and pintle are to be cleaned very carefully to avoid any risk of distortion, impact or scoring.

The tools required for cleaning are part of the **BOSCH** injector cleaning kit **KDEP 2900**.

a) Clean the pintle and injector seat with clean fluid. Decarbonise the outside of these parts with a brass wire or nylon brush (never a steel wire brush).

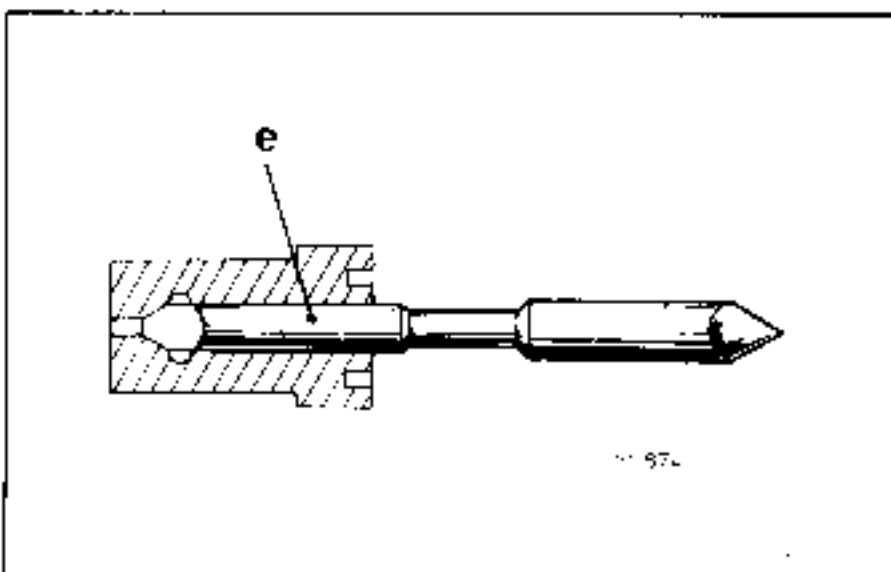
b) Decarbonising the injector seat undercut.

Insert scraper (a) into the needle location and scrape out undercut (1) as shown in the illustration.



c) Decarbonising the seat

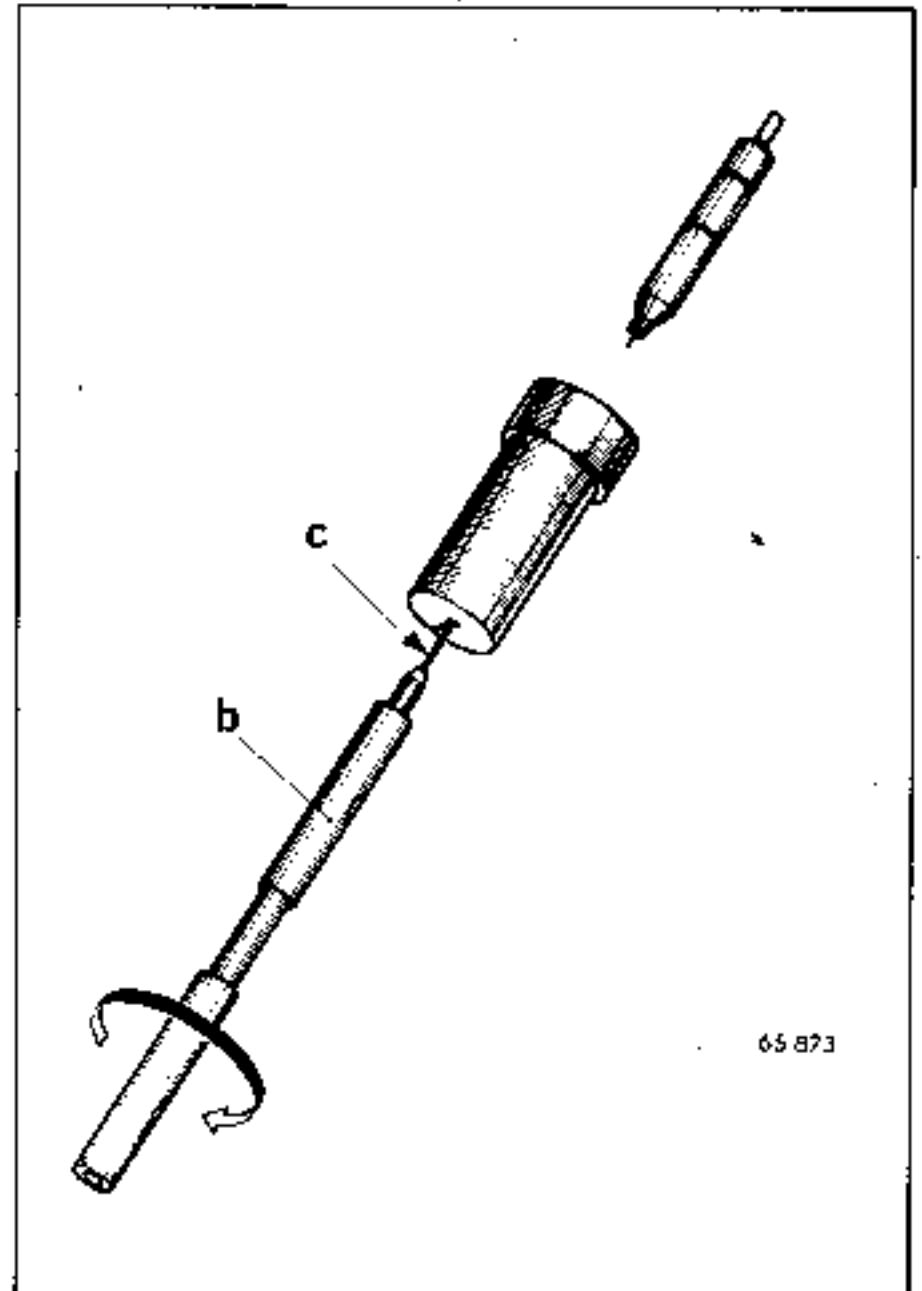
Insert the special cutter (e) which is the same diameter as the needle, into the injector body and clean the seat by turning it.



d) Cleaning the pintle hole

- Fit brass scraper (c) which corresponds to the hole diameter to the tool holder (b).

- Insert the scraper into the hole and decarbonise by turning it.



VISUAL INSPECTION

Thoroughly rinse off and inspect the body and the needle.

Check:

1) On the pintle
- whether the seat is pitted or distorted;
- whether the injection pintle is worn or damaged.

2) On the body
- whether the seat is distorted
- on pintle injectors, whether the injector hole is distorted (ovality).

3) Operating check

Dip the pintle in clean fluid and introduce 2/3 of its length into the injector seat.

When held almost vertical, it should fall on to its seat under its own weight.

IMPORTANT NOTE:

Under no circumstances are any rectification operations other than cleaning to be carried out on an injector. Using abrasive products for lapping or regrinding the injector seat or pintle seats is **strictly forbidden**.

These operations change the specifications of the injectors and result in **poor combustion, smoke, low power and overheating**.

TESTING

The test pump is to be mounted on a bench reserved exclusively for reconditioning injectors. It must always be clean and protected against dust.

When setting up the pump select a complete injector holder, measure its opening pressure and put it aside as a master sample.

It can be used from time to time to check that the pump pressure gauge is in good condition.

The following tests can be carried out on an injector test pump:

- a) the opening pressure, known as the "injector setting pressure";
- b) leak test
- c) the injector operating noise and jet pattern.

IMPORTANT: The jet from an injector can cause very serious injury. Ensure that it cannot make contact with anybody.

Connect the test pump to the injector holder.

Ensure that the unions are in good condition and clean. Any dust which enters can have a detrimental effect on the operation of the injector.

OPENING PRESSURE

Isolate the pressure gauge and give a few quick strokes of the pump to bleed the system thoroughly.

Open the connection to the pressure gauge and move the pump lever very slowly.

Note the pressure reading at the moment the injector opens (the setting pressure) which should be the figure specified.

The opening pressure can be adjusted by altering the thickness of the washer (or by turning a screw).

As an indication, 0.1 mm represents a pressure change of 10 to 12 bars.

On any one engine, the maximum setting pressure difference of the injectors must not exceed 8 bars.

Note: When fitting new parts such as a pintle and seat assembly and pressure spring, set the opening pressure near the maximum tolerance level.

LEAK TEST

Maintain the pressure of 10 to 20 bars below the opening pressure, by holding the pump lever.

Seat leak test

No drops should form on the injector nose for a period of up to 10 seconds.

Note: A slight dampness on the nozzle is not cause for rejection.

Leak test on pintle and seat - injector and leak-back.

No fuel should weep from the nozzle nut or the leak-back circuit.

- Weeping from around the nozzle securing nut shows that there is a defect at the injector holder plate (3) or the nozzle.

- Leakage from the leak-back circuit shows that there is a defect at the injector plate, the pintle and seat assembly or the injector.

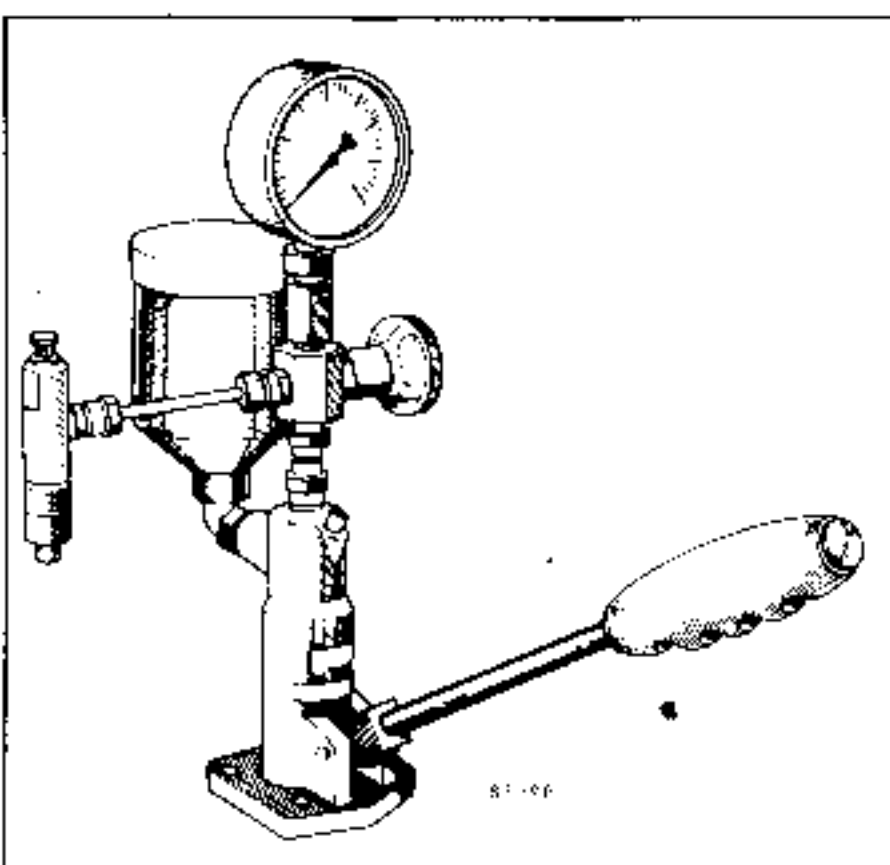
Note: If the test pump or test bench is in perfect condition (pressure circuit and pump valve absolutely leakproof) the leak test can consist of measuring the time taken for the pressure to drop from 30 to 80 bars below the opening pressure.

EXAMPLE

- If the opening pressure is 130 bars, note the time taken for the pressure to drop from 100 to 50 bars.

If the time taken for the pressure to drop is more than 6 seconds, the pintle and seat assembly and the injector are in good condition.

WARNING: In view of the effect of the test pump a pressure drop time of less



than 6 seconds cannot be considered as cause for rejecting the injector.

INJECTOR NOISE AND SPRAY PATTERN CHARACTERISTICS

Injectors produce a low "snorting" noise which is only perceptible at a rate of 1 to 2 pump strokes per second.

At higher pump rates, this noise disappears and is replaced by a whistling noise, perceptible at rates of between 4 and 6 strokes per second.

Up to the point where the injector whistles, its pattern is poorly atomised, sometimes unevenly distributed and frayed at the edges.

When the pump is operated quickly, it should be neat, finely atomised and at the required angle.

Note: These characteristics are obtained with test fluid INJECTELF E.D..

Using any other fluid which does not have the same properties will result in extensive differences in the injector noise and in the spray pattern.

INTRODUCTION

The fuel system for a diesel engine has one or more filters to clean the fuel and thus avoid damage to the injection system.

If poorly filtered fuel were to be used, precision component such as:

- hydraulic heads;
- pump components;
- pressure valves;
- injector pintles and seats

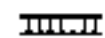

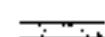
would be subject to wear and would deteriorate very quickly. The result would be:

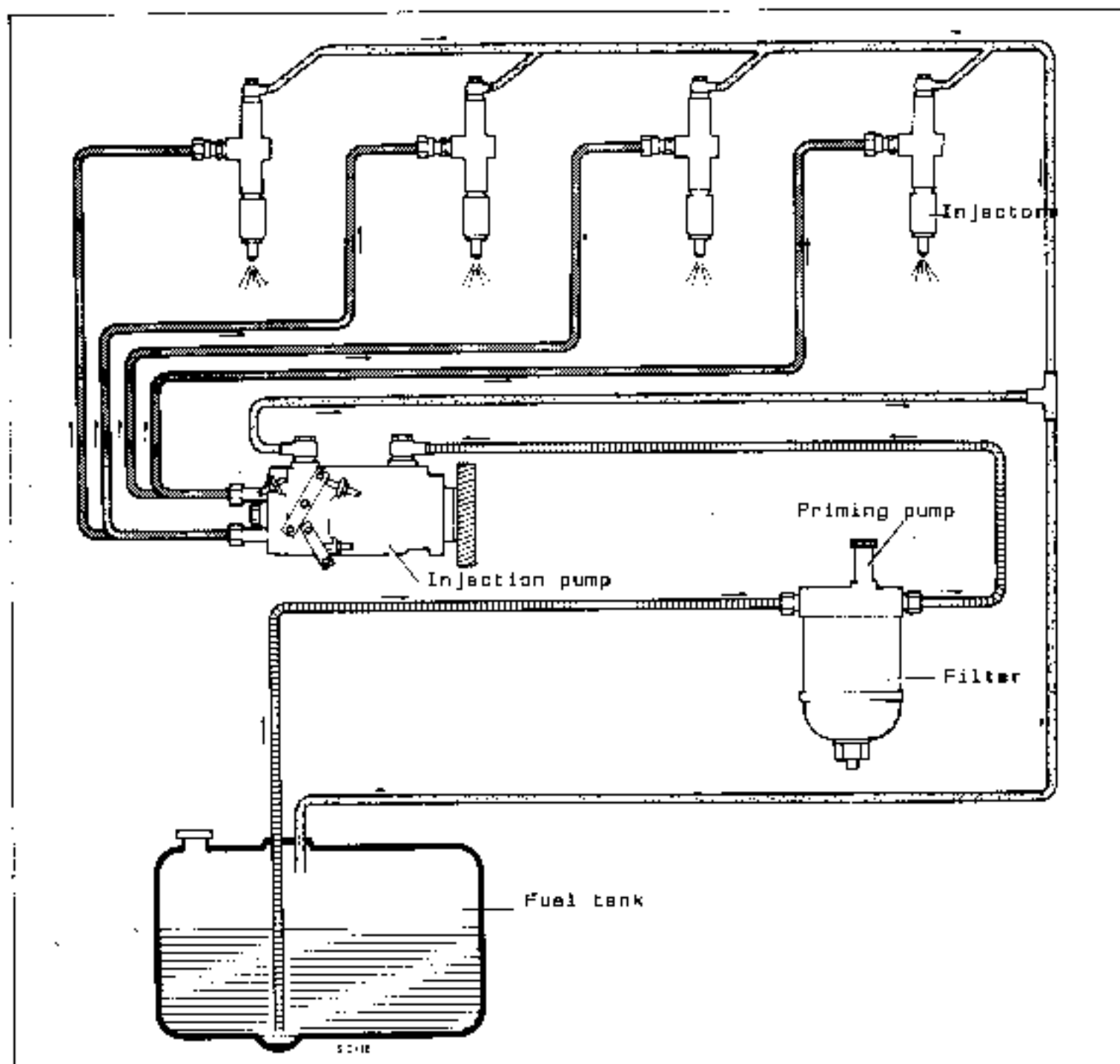
- poor engine running;
- breakdown in a very short time;
- very expensive injection equipment reconditioning operations.

Only a few hours running without a filter would be enough to put the injection equipment out of action.

The fuel system must always be in perfect operating condition and, if the injection equipment is to have a long useful life, we strongly advise against running the engine, however briefly, without one or more of the filters.

Note: It is essential that only genuine replacement cartridges of the type specified for the system in question should be used.

-  Feed circuit (suction)
-  Pressure circuit (injection)
-  Return circuit



USING DIESEL FUEL IN WINTER

Winter precautions

To avoid incidents in frosty weather:

- ensure that your vehicle's battery is always well-charged;
- never allow the level of diesel fuel in the tank to drop too far so as to avoid condensation of water vapour which would build up at the bottom of the tank.

Vehicles without a diesel fuel heater

At temperatures below 0°C it is advisable to put an additive in the diesel fuel.

Vehicles with a diesel fuel heater

This equipment enables the diesel fuel to be used without additives down to -18°C or, if the vehicle is used regularly for short trips (cold engine) down to -5°C.

These temperatures can be lowered by a further ten degrees by mixing one of the following products with the fuel in the proportions stated below and before very cold periods:

ADDITIVE	MAX. PROPORTION ADDED	RENAULT PART NUMBER
SODICAM	0.2 %	0.5 L 7701 403 600 1 L 7701 506 776
BARDAHL	0.3 %	1 L 7701 404 189
ELF ACCEL	0.2 %	(1-litre can)
ELF STOPOGEL ACCEL	0.2 %	(1-litre can)
DOMESTIC PARAFFIN*	30 % MAX.	
LOW GRADE PETROL*	15 % MAX.	

* - These additives are only to be used in exceptional circumstances for a limited period.

* - The addition of high grade petrol is absolutely forbidden because of the anti-pre-ignition products it contains.

* - It is preferable to pour the petrol into the tank before the diesel fuel (to ensure a complete mix).

If the above precautions have not been taken and the vehicle refuses to start or stops soon after starting, change the filter element.

Fuel heaters are available for fitting to fuel systems(see RENAULT approved accessories).

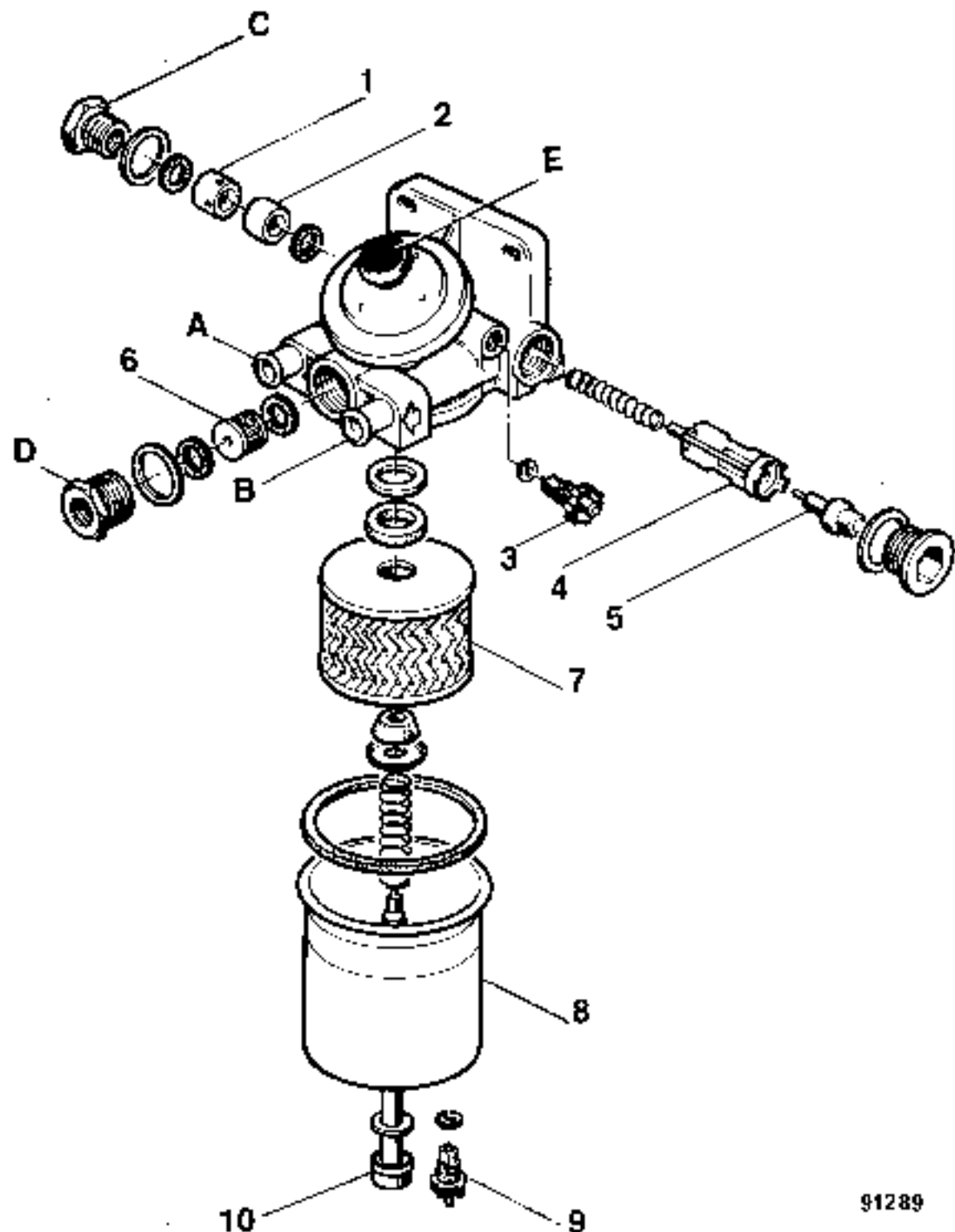
MAINTENANCE

	Single element filter, BOSCH and ROTO DIESEL	Two-element filter BOSCH
Every 5000 miles (7500 km) (or more frequently if there is a large quantity of water in the filters)	Drain the water from the filter	Drain the water from both filters
Every 10 000 miles (15 000 km)	Replace the filter element	Replace the fuel input filter element
Every 30 000 miles (45 000 km)		Replace the fuel output filter element

PURFLUX FILTER

The PURFLUX filter is of the type with an internal cartridge which is housed inside the filter chamber.

A hot water circuit, branching off from the engine cooling system, is housed in the filter cover. A valve (4) controlled by a thermostatic capsule (5) shuts off the water circuit and limits the diesel fuel temperature.



- A - water circuit inlet
- B - water circuit outlet
- C - fuel inlet
- D - fuel outlet
- E - priming pump

- 1 - inlet valve
- 2 - delivery valve
- 3 - bleed screw
- 4 - water circuit valve
- 5 - thermostatic capsule
- 6 - defuming unit
- 7 - filter cartridge
- 8 - chamber
- 9 - drain plug
- 10 - mounting screw

91289

REPLACING THE FILTER ELEMENT

Loosen bleed screws (3) and (9) and drain the filter.

Unscrew screw (10), take out chamber (8) and filter element (7).

On reassembly:

Use new seals and ensure that they are correctly positioned; tighten screw (10) to between 0.7 and 0.9 daNm.

NOTE: To make the operation easier, the filter mounting screws may have to be removed and the filter taken out of its housing without disconnecting the water circuit.

ROTO DIESEL FILTER
(with crimped diaphragm priming pump which cannot be dismantled).

The hot water system, branched off from the engine cooling system, is guided into the drain casing chamber.

A temperature regulator (B) closes the water circuit and limits the diesel fuel temperature.

A : water circuit inlet
B : water circuit outlet

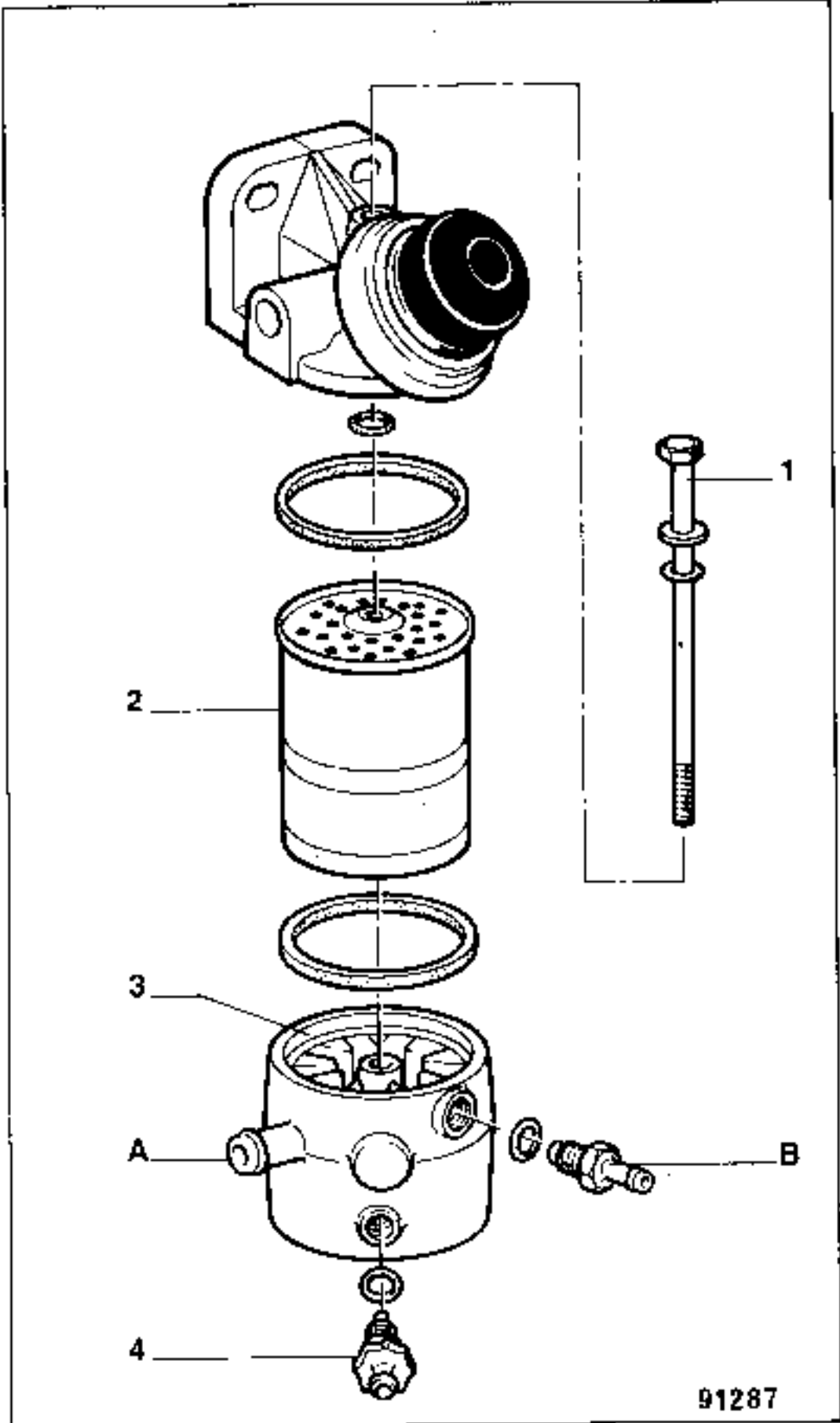
REPLACING THE FILTER ELEMENT

Unscrew the bleed screw and drain plug (4) to drain the filter.

Loosen screw (1), move the drain casing chamber (3) to the side without disconnecting the water circuit and take out the filter element (2).

On reassembly:

Use new seals, ensure that they are correctly positioned and position drain box (3) correctly. Torque tighten screw (1) to between 0.8 and 1 daNm.



BOSCH FILTER

BOSCH filters are of the "quick release cartridge" type.

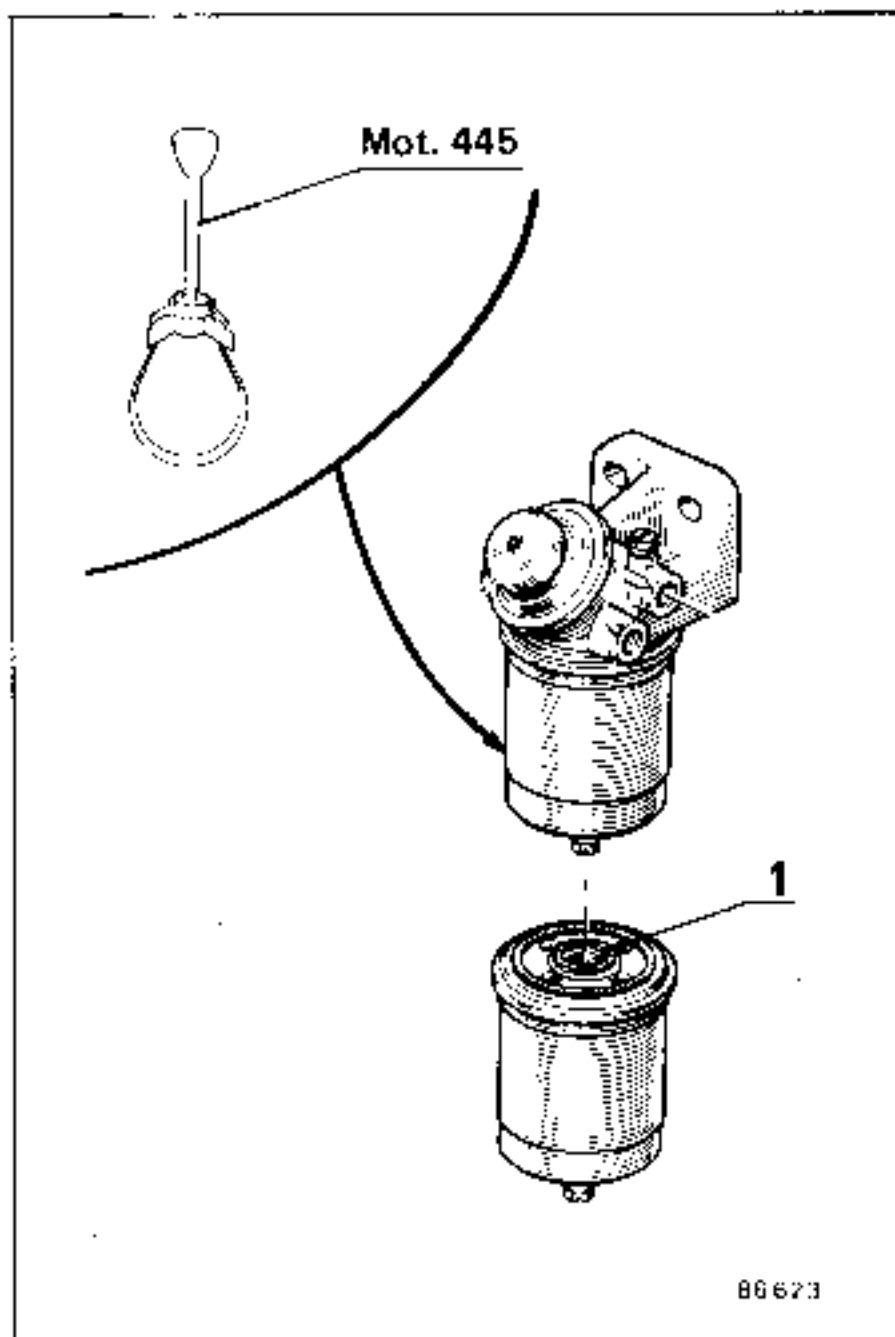
Depending on the application the cartridge may be:

- large filtration area, small drain;
- small filtration area, large drain.

Ensure that the correct type for the vehicle is used (see Parts Catalogue).

CHANGING THE FILTER ELEMENT

Initially, the screw thread is sealed with jointing compound. Replacement cartridges are supplied with a seal (1).



Unscrew the filter element using tool Mot. 445.

When fitting:

- screw in the new element by hand then tighten it a further $\frac{1}{4}$ turn with tool Mot. 445.

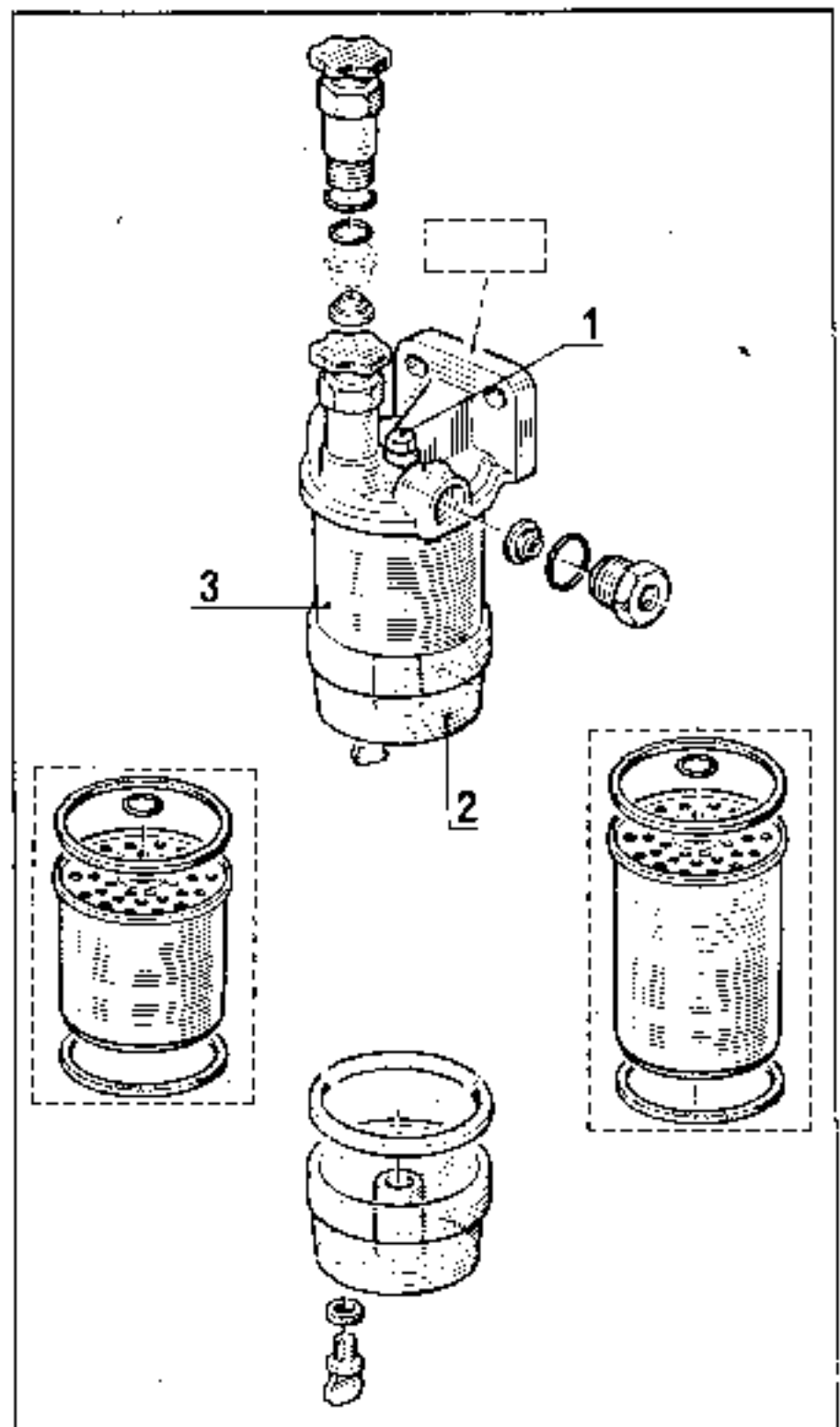
ROTO DIESEL FILTERS

On ROTO DIESEL filters, the filter cartridge comes between the drain bowl and the cover.

Depending on the application, the filter may be equipped with:

- a small or large cartridge;
- a small or large drain bowl.

Fit the correct type for the vehicle (see Parts Catalogue).



CHANGING THE FILTER ELEMENT

Unscrew screw (1) and remove drain bowl (2) and filter element (3).

When refitting:

- ensure that the seals are correctly positioned and tighten screw (1) to between 0.8 and 1 daNm.

SYSTEMS WITHOUT A PRIMING PUMP

After carrying out work on injection equipment, it is essential to tighten correctly all the feed and return unions.

Reprime the system by operating the starter a number of times:

- 10 seconds running the starter
- 5 seconds stopped

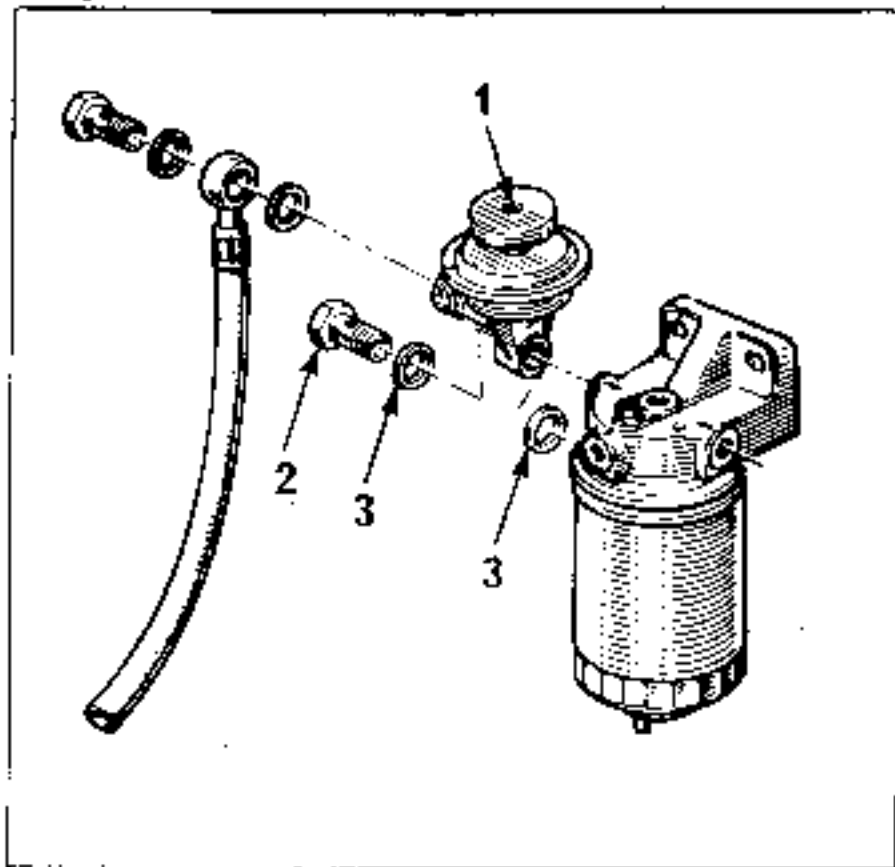
until the engine starts.

Note: A priming pump can be fitted to the filter.

For those vehicles not so equipped, the priming pump can be fitted temporarily to facilitate filling the system after work on the injection equipment or can be left in place if the vehicle operator requests it.

Parts required:

- 1 - Priming pump part no. 77 00 698 994
- 2 - Banjo bolt part no. 77 00 667 526
- 3 - Copper seal (2)
part no. 77 00 667 527.



SYSTEMS WITH A PRIMING PUMP

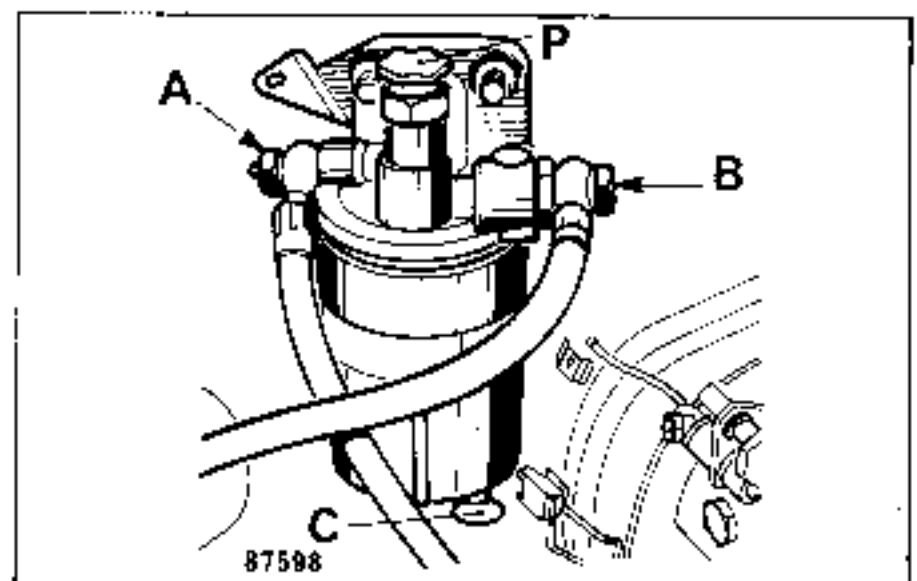
BLEEDING THE FUEL SYSTEM

Owing to the close proximity of the alternator and the starter, protect them when bleeding.

This operation must be carried out:
a) after disconnecting a fuel pipe (for example, following removal of the engine);
b) after air has entered the injection pump feed circuit;
c) if the engine has been run until there is no fuel in the tank, or after replacement of the fuel filter, it may be necessary to bleed the system and reprime it.

Proceed as follows:

- loosen union (B) on the fuel filter;
- unscrew plunger knob (P);



- operate priming pump knob (P) until fuel flows from union (B) (without any air bubbles) then retighten it.

ROTO DIESEL PUMP

Switch on the ignition (energising the shut-off solenoid enables the hydraulic head circuits to be bled).

- Continue to operate the priming pump knob until resistance is felt, give a few extra strokes then screw down knob (P).

After removing one of the injector pipes (injector input unions loose), operate the starter and fully depress the accelerator until fuel starts to spurt from the injector pipe unions. Tighten the injector pipe unions.

Preheat and start the engine.

Check the various fuel system and injection system pipes for leaks.

DRAINING WATER FROM THE FILTER

For the filter to be properly emptied, bleed screw (A) must be opened at the same time as drain screw (C).

ESSENTIAL SPECIAL TOOLS

Mot. 867

Pressure testing kit

PRELIMINARY CHECKS

For the engine to operate efficiently, the fuel system must always be in perfect condition.

In the event of a defect, before touching the injection pump check:

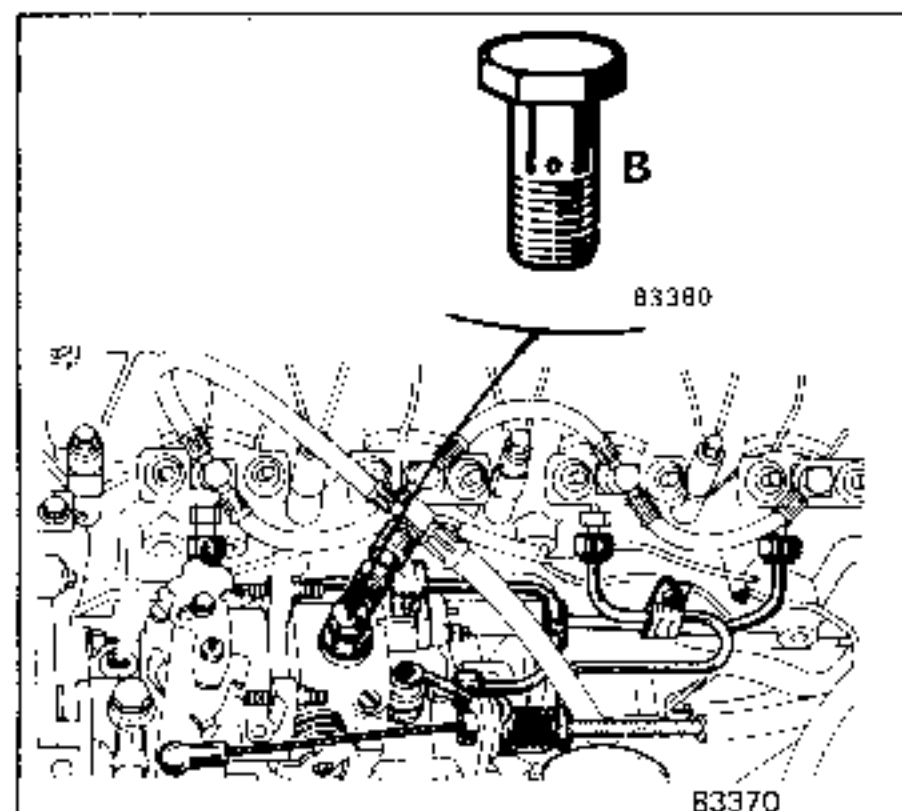
- the feed and return pipes which must be leak-free and unkinked;
- the fuel tank air vent; the filler cap must incorporate a vent;
- the amount of fuel returning to tank.

To measure it, disconnect the return hose from the rigid pipe on the chassis and suspend it in a flask graduated in ml or cc. Run the engine at idling speed for **one minute**. The amount in the flask should be:

- between 0.3 and 0.7 litres (300 to 700 cc).

If this figure is not correct, check that the calibrated jet in the return banjo bolt (B) on the pump is correct.

Clean the filter and jet with compressed air.



CHECKING THE PRESSURE PUMP

Use tool Mot. 867.

1) Measure the system pressure at filter outlet (B) (engine running at maximum off-load speed).

- Normal figure approx. -0.1 bars
- Max. figure -0.2 bars

2) Measure the pressure at filter input (A) (engine running at maximum off-load speed).

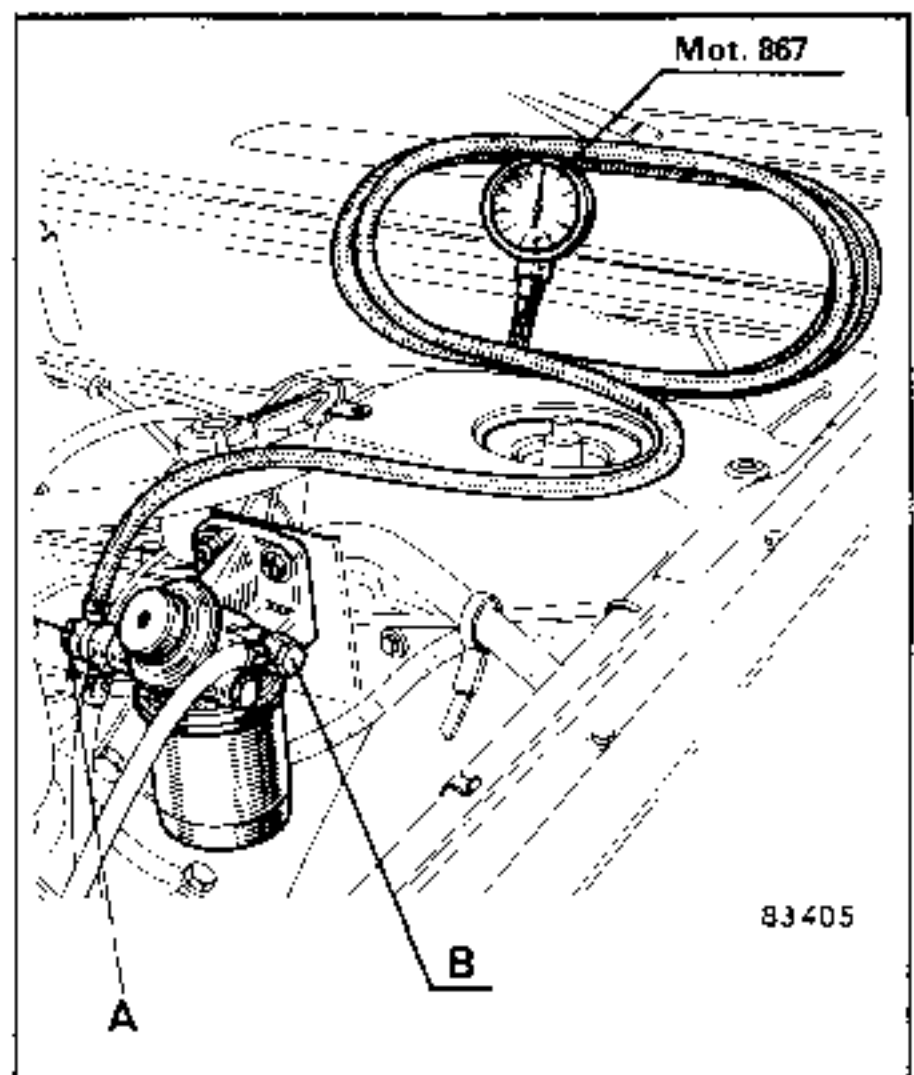
- Normal figure -0.05 bars
- Max. figure -0.1 bars

The pressure loss across the filter cartridge is:

$$B - A = 0.15 \text{ bars max.}$$

Note: If the pressure loss across the cartridge is more than 0.15 bars, replace the cartridge.

If B is more than -0.1 bars, check the pipes, unions and tank air vent.



GENERAL

If a Diesel engine breaks down or operates inefficiently

DO NOT IMMEDIATELY CONSIDER THAT THE INJECTION PUMP IS RESPONSIBLE

In fact, the pump is very reliable both as regards wear of its component parts and the stability of its adjustments.

The injection equipment comprises various components which are to be maintained and checked in case of defect :

- fuel tank;
- feed and return pipes;
- fuel filter;
- injectors,
- preheating system;
- engine shut-off solenoid.

Do not forget, either, the engine itself and the basic Diesel operating principle.

The fuel injected into the injection chamber is ignited by the temperature in this chamber.

This temperature depends on the compression and therefore one must check the valves, the piston rings and, in short, the general condition of the engine.

When starting from cold, the temperature also depends on the speed of rotation of the engine. This is dependent on the condition of the battery, the starter motor, the the oil and the engine itself.

You will find under :

- A : ENGINE NOT STARTING AND PRODUCING BLACK SMOKE
- B : ENGINE NOT STARTING AND PRODUCING WHITE SMOKE
- C : ENGINE NOT STARTING AND NOT PRODUCING ANY SMOKE
(at temperatures below 0°C)
- D : ENGINE STARTING AND THEN STOPPING
- E : AFTER A FEW MINUTES RUNNING, ENGINE REMAINS NOISY AT IDLING
SPEED AND TENDS TO "KNOCK"
- F : ENGINE LACKS POWER
- G : ENGINE LACKS POWER, CONSUMES TOO MUCH FUEL AND SMOKES
- H : ENGINE MISFIRES AND RUNS UNEVENLY
- I : MAX. SPEED TOO LOW
- J : MAX. SPEED TOO HIGH
- K : ENGINE BLOWS AIR
- L : ENGINE KNOCKS

INCIDENTS ASSOCIATED WITH THE TURBOCHARGING SYSTEM

- M : LOW POWER
- N : BLACK SMOKE AT THE EXHAUST

A - NOT STARTING, PRODUCING BLACK SMOKE

DEFECT - PROBABLE CAUSE

1. Dirty air filter.
2. Defective injector.
3. Starter motor too slow.
4. Pump timing.

CHECK - REMEDY

- Change the cartridge.
- Check and adjust the injectors.
- Check battery, electrical circuit and engine oil grade.
- Check pump timing.

B - NOT STARTING, PRODUCING WHITE SMOKE

DEFECT - PROBABLE CAUSE

1. Defective pre-heating.
2. Cold starting system not operating.
3. Pump timing.
4. No excess fuel delivery.
5. Cylinder head gasket defective.

CHECK - REMEDY

- Check electrical circuit, change any defective parts.
- Adjust the system and change any defective parts.
- Check the pump timing.
- Fuel or return circuit defective. Check solenoid shut-off. Pump defective.
- Change cylinder head gasket.

C - NOT STARTING, NOT PRODUCING ANY SMOKE

DEFECT - PROBABLE CAUSE

1. Fuel tank empty.
2. Dirty fuel filter.
3. Fuel supply defective.
4. Engine shut-off solenoid defective.
5. Compression too low.
6. Ice at the low points in the system. Wax forming in the filter (during winter).

CHECK - REMEDY

- Fill tank and bleed system.
- Change cartridge.
- Check fuel pump, system for leaks, bleed system.
Check that filler cap is correct (with vent).
- Check electrical circuit and solenoid operation.
- Check compression pressures and condition of engine.
- Unfreeze and clean the pipes. Change filter element. Treat fuel against the cold.

D - ENGINE STARTING AND THEN STOPPING

DEFECT - PROBABLE CAUSE

1. Dirty fuel filter.
2. Dirty air filter.
3. Air in system.

CHECK - REMEDY

- Change filter element.
- Change cartridge.
- Check system for leaks and bleed it.

**E - AFTER A FEW MINUTES RUNNING, ENGINE REMAINS NOISY AT IDLING SPEED
AND TENDS TO "KNOCK"**

DEFECT - PROBABLE CAUSE

1. Cold starting system not cutting out.

CHECK - REMEDY

- Check operation of thermostatic capsule.
- FSM engine BOSCH equipment**
- No current supply to thermostatic capsule.
Check electrical circuit.
- Capsule resistance burned out (resistance approximately 23 ohms). Change thermostatic capsule.
- The thermal switch on the coolant system is disconnected or no longer works, check the electrical circuit, change the thermal switch.

F - ENGINE LACKS POWER

DEFECT - PROBABLE CAUSE

1. Dirty fuel filter.
2. Throttle control incorrectly adjusted.
3. Fuel system defective.
4. Injector pipes crushed near unions.
5. Pump timing.
6. Injectors defective.
7. Injection pump incorrectly adjusted.

CHECK - REMEDY

- Change filter element.
- Adjust accelerator cable.
- Check feed and return pipes, filler cap (air vent). Feed and return banjo bolts on pump. Fuel pump.
- Check inside diameter of injector pipes.
- Check pump timing.
- Check injector condition, setting and type.
- Have pump adjusted by an injection centre.

G — ENGINE LACKS POWER, CONSUMES TOO MUCH FUEL AND SMOKES

DEFECT - PROBABLE CAUSE

1. Air filter dirty.
2. Injectors defective.
3. Valve clearances incorrect.
4. Pump timing.
5. Timing diagram incorrect.
6. Compression too low.
7. Exhaust partially blocked.
8. Running temperature too low.
9. Injection pump incorrectly adjusted.

CHECK - REMEDY

- Change cartridge.
- Check injector condition, setting and type
- Check valve clearances.
- Check pump timing.
- Readjust timing.
- Check compression pressures and condition of engine.
- Check exhaust system.
- Check cooling system (thermostat).
- Have pump adjusted by injection centre.

H — ENGINE MISFIRES AND RUNS UNEVENLY

DEFECT - PROBABLE CAUSE

1. Idling too slow (hunting).
2. Leakage between pump and injector.
3. Dirty fuel filter.
4. Air entering system.
5. Injector defective or incorrect type.
6. Incorrect valve clearances.
7. Piston seizing or rings gummed up.
8. Injection pump defective.

CHECK - REMEDY

- Adjust idling speed.
- Check high pressure circuit.
- Change filter element.
- Check fuel system.
- Check condition, setting and type of defective injector.
- Check and adjust the valve clearances.
- Check compression pressures, overhaul engine.
- Have pump reconditioned by injection centre.

I - MAX. SPEED TOO LOW

DEFECT - PROBABLE CAUSE

1. Dirty fuel filter.
2. Throttle control incorrectly adjusted.
3. Injection pump incorrectly adjusted.

CHECK - REMEDY

- Change filter element.
- Adjust accelerator cable.
- Have pump adjusted by injection centre.

J - MAX. SPEED TOO HIGH

DEFECT - PROBABLE CAUSE

1. Injection pump incorrectly adjusted.

CHECK - REMEDY

- Have pump adjusted by injection centre.

K - ENGINE BLOWS AIR

DEFECT - PROBABLE CAUSE

1. Leakage from injector seal.
2. Leakage past preheating plug.
3. Leakage at cylinder head gasket.

CHECK - REMEDY

- Replace defective seal.
- Tighten the plug or change it if defective.
- Change the head gasket.
Check the gasket faces and liner protrusions.

L - ENGINE KNOCKS

DEFECT - PROBABLE CAUSE

1. Injector seized.
2. Air entering system.
3. Incorrect fuel.
4. Incorrect valve clearances.
5. Injector leak-back blocked.
6. Pump timing.
7. Incorrect timing diagram.
8. Valve sticking.
9. Valve spring broken.
10. Pistons worn or sticking.
11. Big-end run.
12. Flywheel loose.

CHECK - REMEDY

- Change defective injector.
- Check fuel system.
- Drain tank and fill with diesel fuel.
- Check valve clearances.
- Check injector holders and leak-back gallery.
- Check pump timing.
- Check timing system.
- Overhaul cylinder head.
- Change defective spring.
- Overhaul engine.
- Overhaul engine.
- Recondition.

Incidents associated with the turbocharging system

M — LOW POWER

DEFECT - PROBABLE CAUSE

CHECK - REMEDY

- | | |
|---|---|
| 1. Pipe between inlet manifold and L.D.A. disconnected. | Reconnect the pipe. |
| 2. Vent pipe under L.D.A. diaphragm blocked. | Unblock pipe. |
| 3. Injection pump delivery too low. | Have injection pump adjusted by injection centre. |

N — BLACK SMOKE AT THE EXHAUST

A - BOOST PRESSURE TOO LOW

DEFECT - PROBABLE CAUSE

CHECK - REMEDY


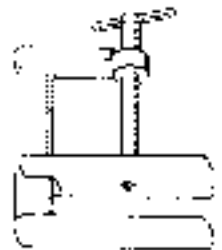
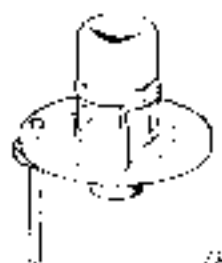





- | | |
|----------------------------|--|
| 1. Intake system leaking. | Check air filter, intake system, pipes and air-air exchanger for leaks. |
| 2. Turbocharger defective. | Replace turbocharger.
Note : Neither the wastegate valve nor the turbocharger can be overhauled. |

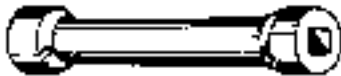

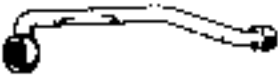
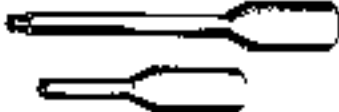

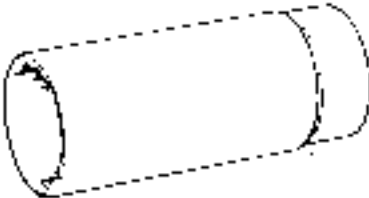
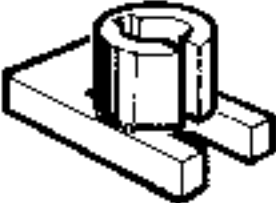

B - BOOST PRESSURE CORRECT


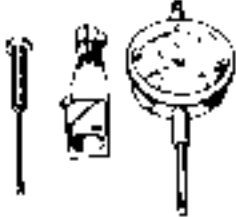
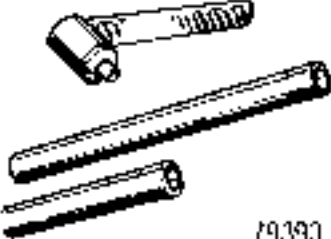
DEFECT - PROBABLE CAUSE

CHECK - REMEDY

- | | |
|--------------------------------------|---|
| 1. Injection pump delivery too high. | Have injection pump adjusted by injection centre. |
|--------------------------------------|---|

	METHODS Ref.	PART NUMBER	DESCRIPTION
 69716	Mot. 445	00 00 044 500	Oil filter strap wrench
 85654	Mot. 453-01	00 00 045 301	Hose clamps
 78184	Mot. 591-01	00 00 059 101	Wrench for tightening cylinder head by angular method 1/2" drive
 77885	Mot. 591-02	00 00 059 102	Magnetised flexible arm for tightening cylinder head by angular method
 83254	Mot. 854	00 00 085 400	Injection pump sprocket retainer
 84375	Mot. 856	00 00 085 600	Dial indicator support. For setting BOSCH injection pump timing
 83394	Mot. 861	00 00 086 100	Top dead centre gauge pin
 83657	Mot. 867	00 00 086 700	Tooling for setting the ROTO DIESEL pump timing

	METHODS Ref.	PART NUMBER	DESCRIPTION
 83867	Mot. 869	00 00 086 900	Socket for tightening the injector nut
 84127	Mot. 877	00 00 087 700	Tooling for setting the ROTO DIESEL pump timing
 84747	Mot. 909-01	00 00 090 901	Wrench for injection pump securing nut
 84918	Mot. 910	00 00 091 000	Set of 2 T.D.C. gauge pins for setting the timing
 87164	Mot. 996	00 00 099 600	Injection pump sprocket retainer
 86890	Mot. 997	00 00 099 700	Wrench for removing and refitting injector
 87602	Mot. 1011	00 00 101 100	Injector support
 90097	Mot. 1053	00 00 105 300	Extractor with interchangeable claws

	METHODS Ref.	PART NUMBER	DESCRIPTION
 90277	Mot. 1054	00 00 105 400	T.D.C. gauge rod (replaces Mot.861 for B.C 404)
 91285	Mot. 1079	00 00 107 900	Tooling for timing ROTO DIESEL pump via the cover (suffix "B")
 79393	Eté. 721	00 00 072 100	Limited torque spark plug wrench