

CURSOR SERIES

Vehicle application

C78

C78 ENT C

C10

C10 ENT C

C13

C13 ENT C

Technical and Repair manual

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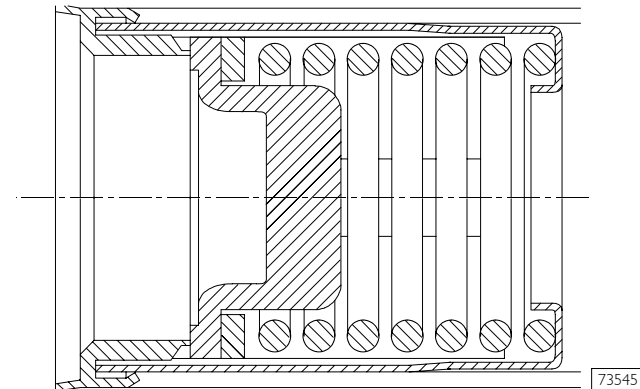
SECTION I

General Specifications

	Page
CORRESPONDENCE BETWEEN TECHNICAL CODE AND COMMERCIAL CODE	3
VIEWS OF ENGINE	5
LUBRICATION	8
<input type="checkbox"/> Oil pump	9
<input type="checkbox"/> Overpressure valve	9
<input type="checkbox"/> Oil pressure control valve (on the base unit) ..	10
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By-pass valve inside the filter support/heat exchanger assembly

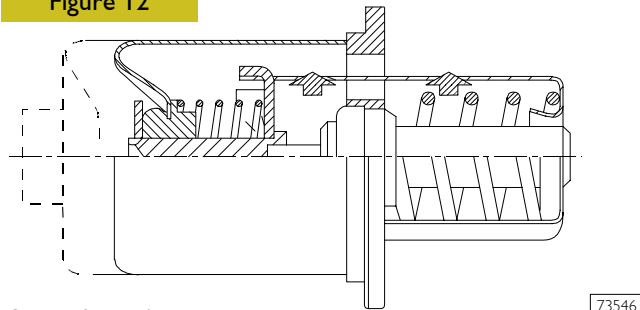
Figure 11



The valve quickly opens at a pressure of: 3 bars.

Thermostatic valve

Figure 12



Start of opening:

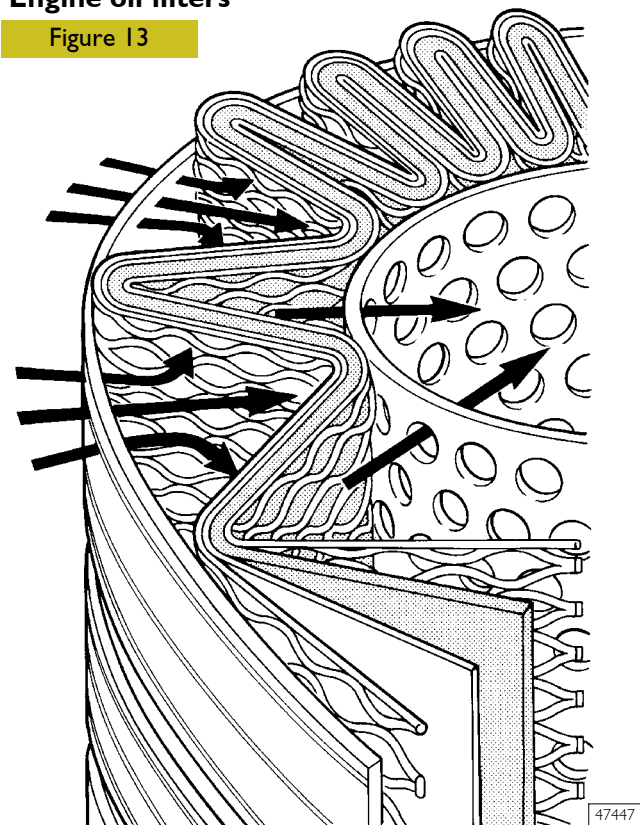
travel 0.1 mm at a temperature of $82 \pm 2^\circ\text{C}$.

End of opening:

travel 8 mm at a temperature of 97°C .

Engine oil filters

Figure 13



This is a new generation of filters that permit much more thorough filtration as they are able to hold back a greater amount of particles of smaller dimensions than those held back by conventional filters with a paper filtering element.

These high-filtration devices, to date used only in industrial processes, make it possible to:

- reduce the wear of engine components over time;
- maintain the performance/specifications of the oil and thereby lengthen the time intervals between changes.

External spiral winding

The filtering elements are closely wound by a spiral so that each fold is firmly anchored to the spiral with respect to the others. This produces a uniform use of the element even in the worst conditions such as cold starting with fluids with a high viscosity and peaks of flow. In addition, it ensures uniform distribution of the flow over the entire length of the filtering element, with consequent optimization of the loss of load and of its working life.

Mount upstream

To optimize flow distribution and the rigidity of the filtering element, this has an exclusive mount composed of a strong mesh made of nylon and an extremely strong synthetic material.

Filtering element

Composed of inert inorganic fibres bound with an exclusive resin to a structure with graded holes, the element is manufactured exclusively to precise procedures and strict quality control.

Mount downstream

A mount for the filtering element and a strong nylon mesh make it even stronger, which is especially helpful during cold starts and long periods of use. The performance of the filter remains constant and reliable throughout its working life and from one element to another, irrespective of the changes in working conditions.

Structural parts

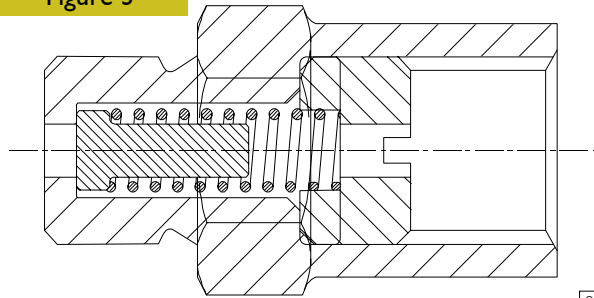
The o-rings equipping the filtering element ensure a perfect seal between it and the container, eliminating by-pass risks and keeping filter performance constant. Strong corrosion-proof bottoms and a sturdy internal metal core complete the structure of the filtering element.

When mounting the filters, keep to the following rules:

- Oil and fit new seals.
- Screw down the filters to bring the seals into contact with the supporting bases.
- Tighten the filter to a torque of $35 \pm 40 \text{ Nm}$.

Overpressure valve

Figure 3

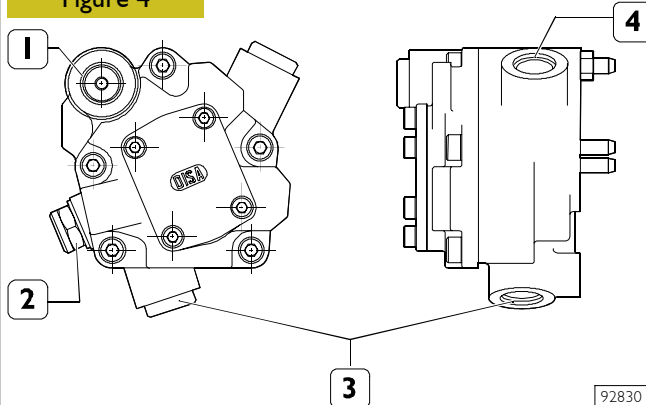


An overpressure valve is a single-acting valve, calibrated to 0.2 ± 0.3 bar, placed on the piping that returns fuel to tank. The overpressure valve prevents fuel duct in cylinder head from emptying with engine stopped.

92829

Feed pump

Figure 4



Feed pump mounted laterally
 1. Overpressure valve - 2. Delivering fuel to injectors -
 3. Sucking in fuel - 4. Pressure control valve

92830

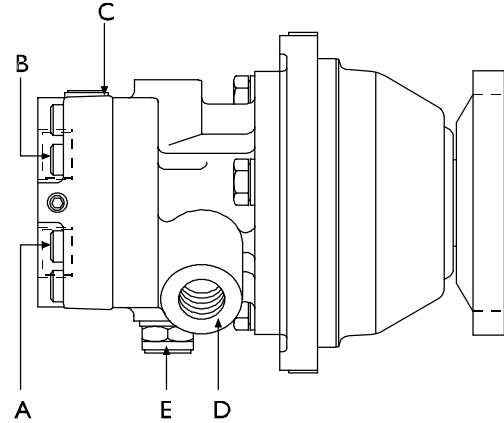
Pump performances					
Pump rotation speed	(rpm)	2600	600	170	100
Minimum flow rate	(l/h)	310	45	12	
Test conditions	Negative pressure on aspiration (bar)	0.5	0.3	0.3	0.3
	Pressure on delivery (bar)	5	3	0,3	0.3
	Test liquid temperature (°C)	30	30	30	30
	Test liquid	ISO 4113			

Field of use	
Pump rotation speed (rpm)	2600
Overrunning rotation speed (max 5 min) (rpm)	4100 max
Diesel oil temperature (°C)	-25/+80
Filtering rate on aspiration (micron)	30
Negative pressure on aspiration (bar)	0.5 max

Pressure control valve	
Valve calibration	5 ± 5.8

Injectors return valve	
Valve calibration	3.4 ± 3.8

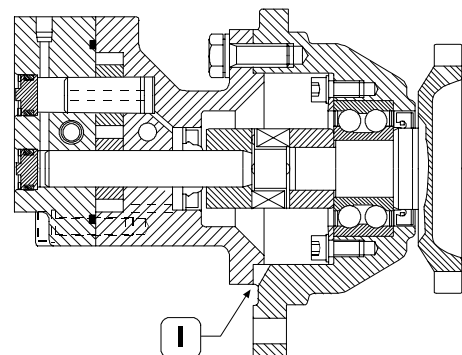
Figure 5



Feed pump mounted frontally
 A. Fuel inlet - B. Fuel delivery - C. By-pass nut -
 D. Fuel return from the pump-injectors -
 E. Pressure relief valve - Opening pressure: 5-8 bars

73547

Figure 6



SECTION ON FEED PUMP
 I. Oil and fuel leaks indicator

98870

Pump performances					
Pump rotation speed	(rpm)	4100	900	250	140
Minimum flow rate	(l/h)	310	45	12	6
Test conditions	Negative pressure on aspiration (bar)	0.5	0.3	0.3	0.3
	Pressure on delivery (bar)	5	3	0.3	0.3
	Test liquid temperature (°C)	50	50	50	20
	Test liquid	ISO 4113			

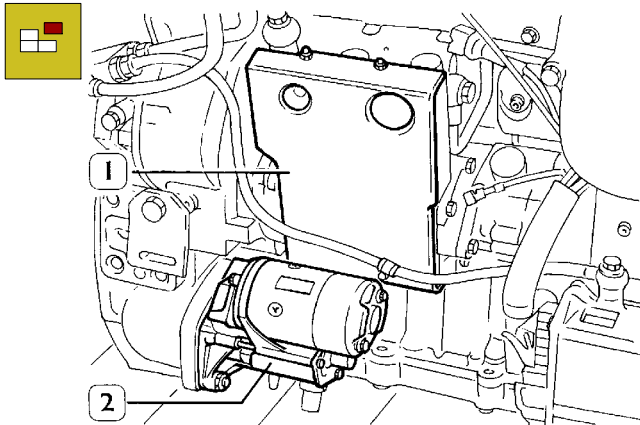
Field of use	
Pump rotation speed (rpm)	4100
Overrunning rotation speed (max 5 min) (rpm)	5800 max
Diesel oil temperature (°C)	-25/+80
Filtering rate on aspiration (micron)	0.5 max
Negative pressure on aspiration (bar)	-25/+120

Pressure control valve	
Valve calibration	5 ± 5.8

Injectors return valve	
Valve calibration	3.4 ± 3.8

DISMANTLING THE ENGINE ON THE BENCH

Figure 1

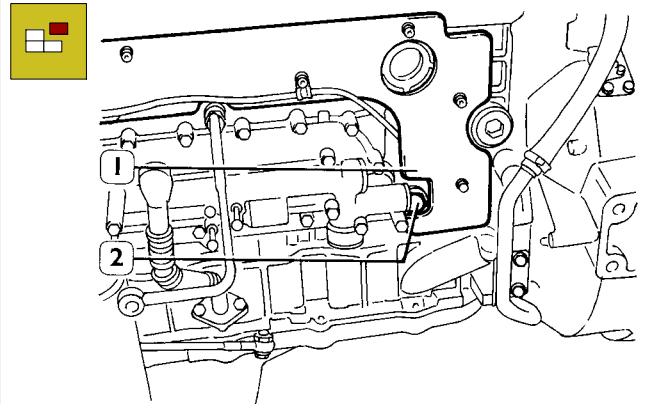


47562

Before dismantling the engine on the rotary stand 99322230, remove the following components:

- starter (2)
- turbocharger soundproofing shield (1)

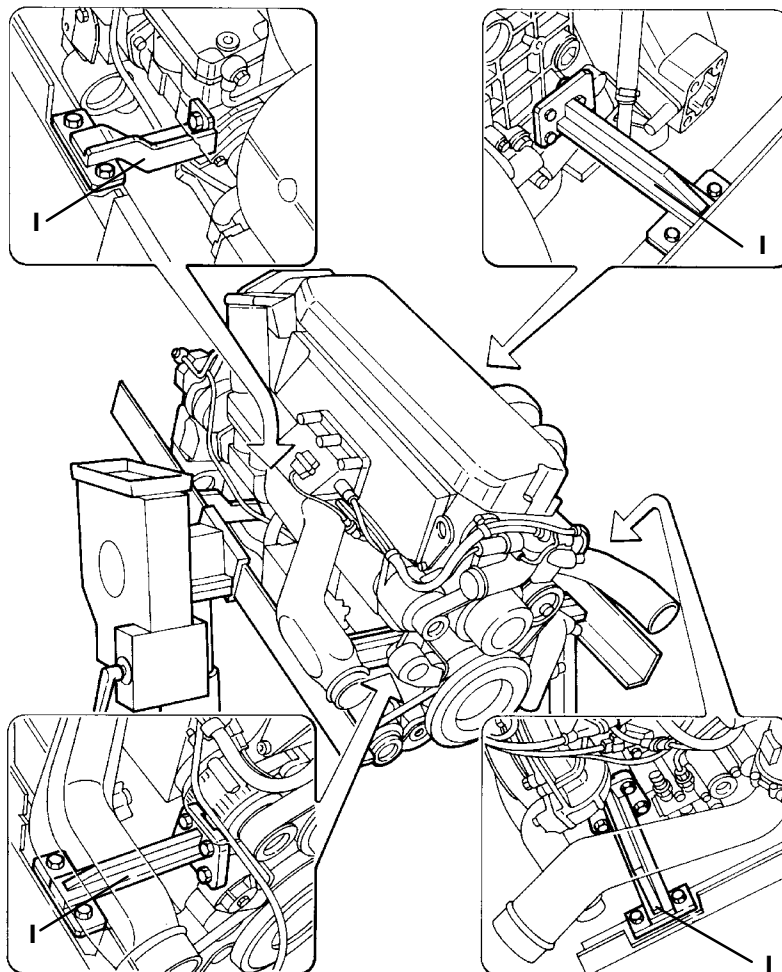
Figure 2



47563

Remove the soundproofing shield (1) and plug (2).

Figure 3

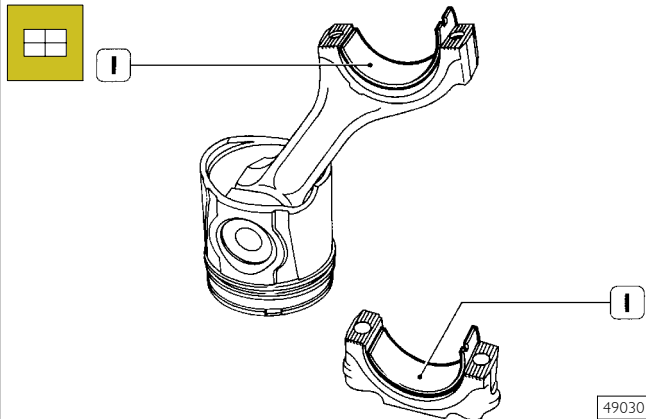


47601

Fix the engine to the rotary stand 99322230, by means of brackets 99361035 (1), remove the fan.

Fitting the connecting rod-piston assembly into the cylinder liners

Figure 44



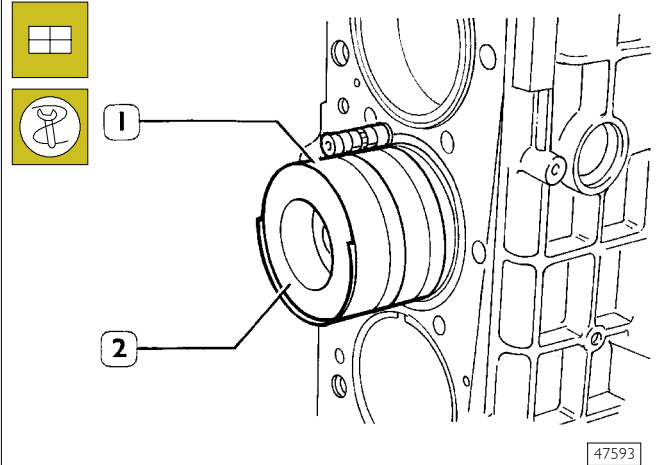
Rotate the cylinder assembly placing it vertically. Lubricate the half-bearings (1) and fit them in the connecting rod and the cap.

NOTE Not finding it necessary to replace the connecting rod bearings, you need to fit them back in exactly the same sequence and position as in removal. If they are to be replaced, choose connecting rod bearings based on selection described in Section 4.

Lubricate the half-bearings (1) and fit them in the connecting rod and the cap.

NOTE Do not make any adjustment on the bearing shells.

Figure 46

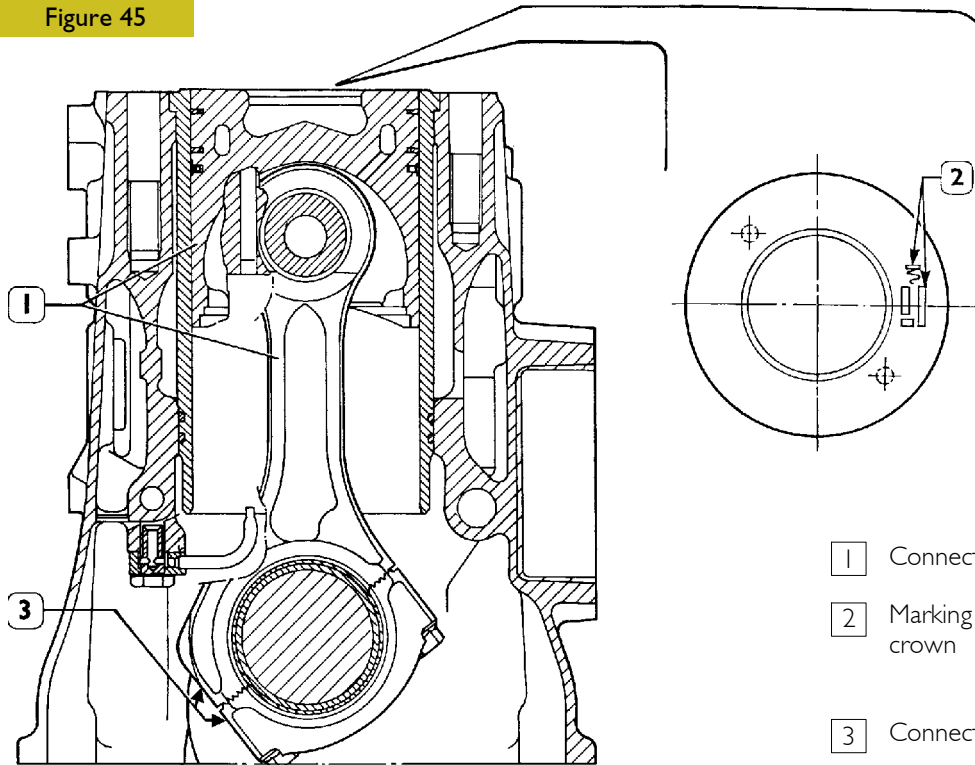


Fit the connecting rod-piston assemblies (2) into the piston liners, using the band 99360605 (1). Check the following:

- the openings of the split rings are offset by 120°;
- all pistons belong to the same class, A or B;
- ideogram (2, Figure 45), stamped on the piston crown, is placed toward the engine flywheel, or the cavity, on the piston skirt, corresponds to the position of the oil spray nozzles

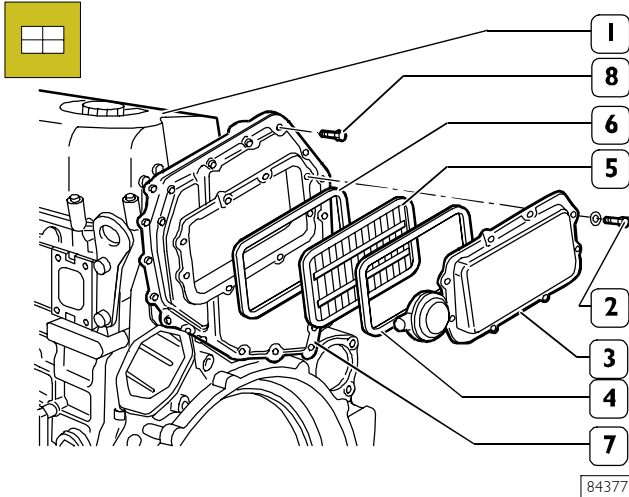
NOTE The pistons are supplied as spares in class A and can also be fitted in class B cylinder liners.

Figure 45



- 1 Connecting rod-piston assembly
- 2 Marking area of ideogram on the piston crown
- 3 Connecting rod marking area

Figure 83



Fit the distribution cover (1).

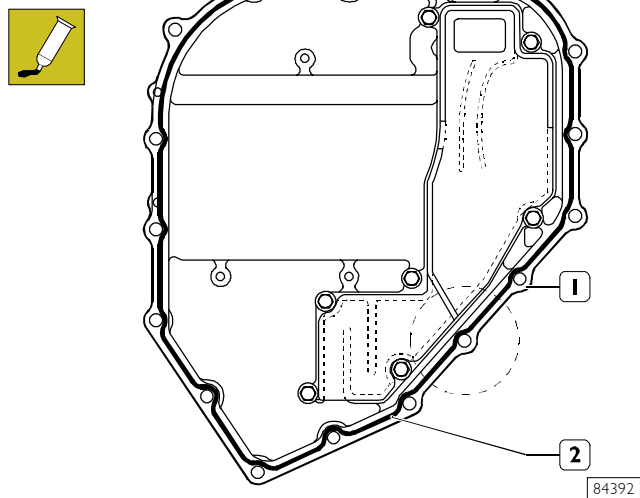
Fit the blow-by case (7) and its gasket and then tighten the screws (8) to the prescribed torque.
Install the filter (5) and the gaskets (4 and 6).

NOTE The filter (5) operation is unidirectional, therefore it must be assembled with the two sight supports as illustrated in the figure.

Fit the cover (3) and tighten the fastening screws (2) to the prescribed torque.

NOTE Apply silicone LOCTITE 5970 (IVECO No. 2995644) on the blow-by case (7) surface of engines fitted with P.T.O. according to the procedure described in the following figure.

Figure 84



Apply silicone LOCTITE 5970 (IVECO No. 2995644) on the blow-by case and form a string (2) of $\varnothing 1.5 \pm_{0.2}^{0.5}$ as shown in the figure.

NOTE Fit the blow-by case (1) within 10' from sealer application.

ENGINE COMPLETION

Complete the engine by installing or connecting the following components:

- thermostatic unit;
- belt tensioner, water pump, alternator;
- control belt;
- belt tensioner, conditioner compressor;
- control belt.

Figure 85

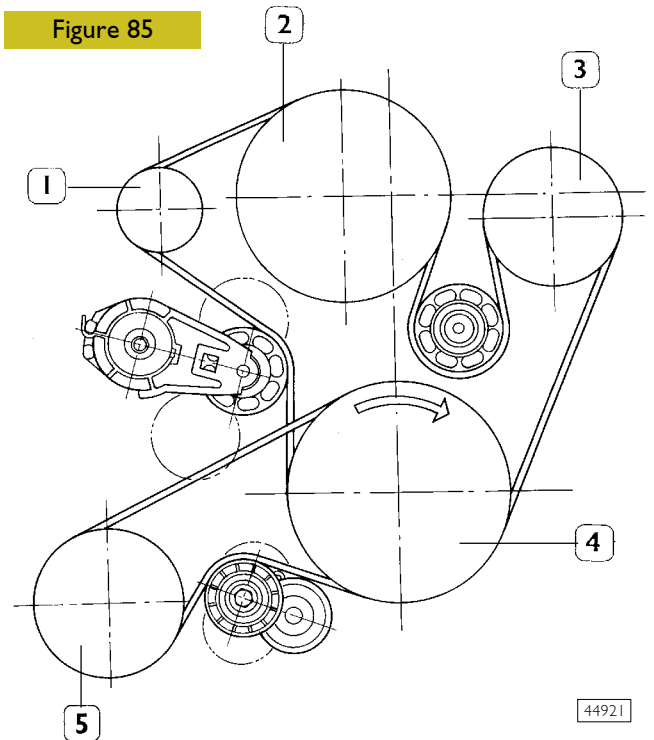
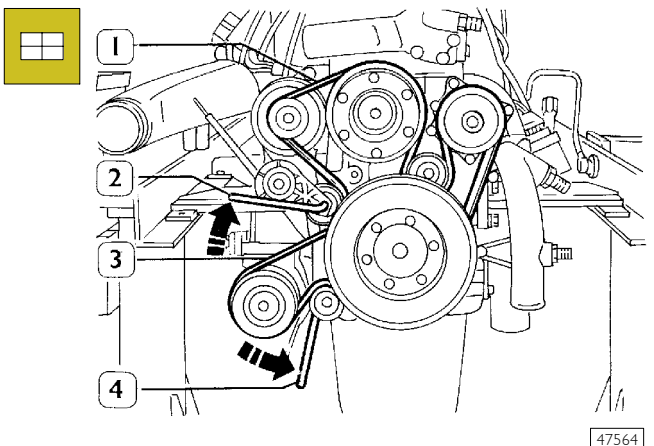


DIAGRAM FOR THE INSTALLATION OF FAN BELTS - WATER PUMP - ALTERNATOR AND CONDITIONER COMPRESSOR

- 1. Alternator - 2. Fan - 3. Water pump - 4. Crankshaft - 5. Conditioner compressor.

Figure 86



To install belts (1-3), use the appropriate tools (2-4.) to work on the tensioners, as shown by arrows.

Engine coolant temperature sensor (85 I 53)

This N.T.C. type sensor located on the water outlet sump on the engine head left measures coolant temperature for the various operating logics with a hot or cold engine and identifies injection enrichment requirements for a cold engine or fuel reduction requirements for a hot engine.

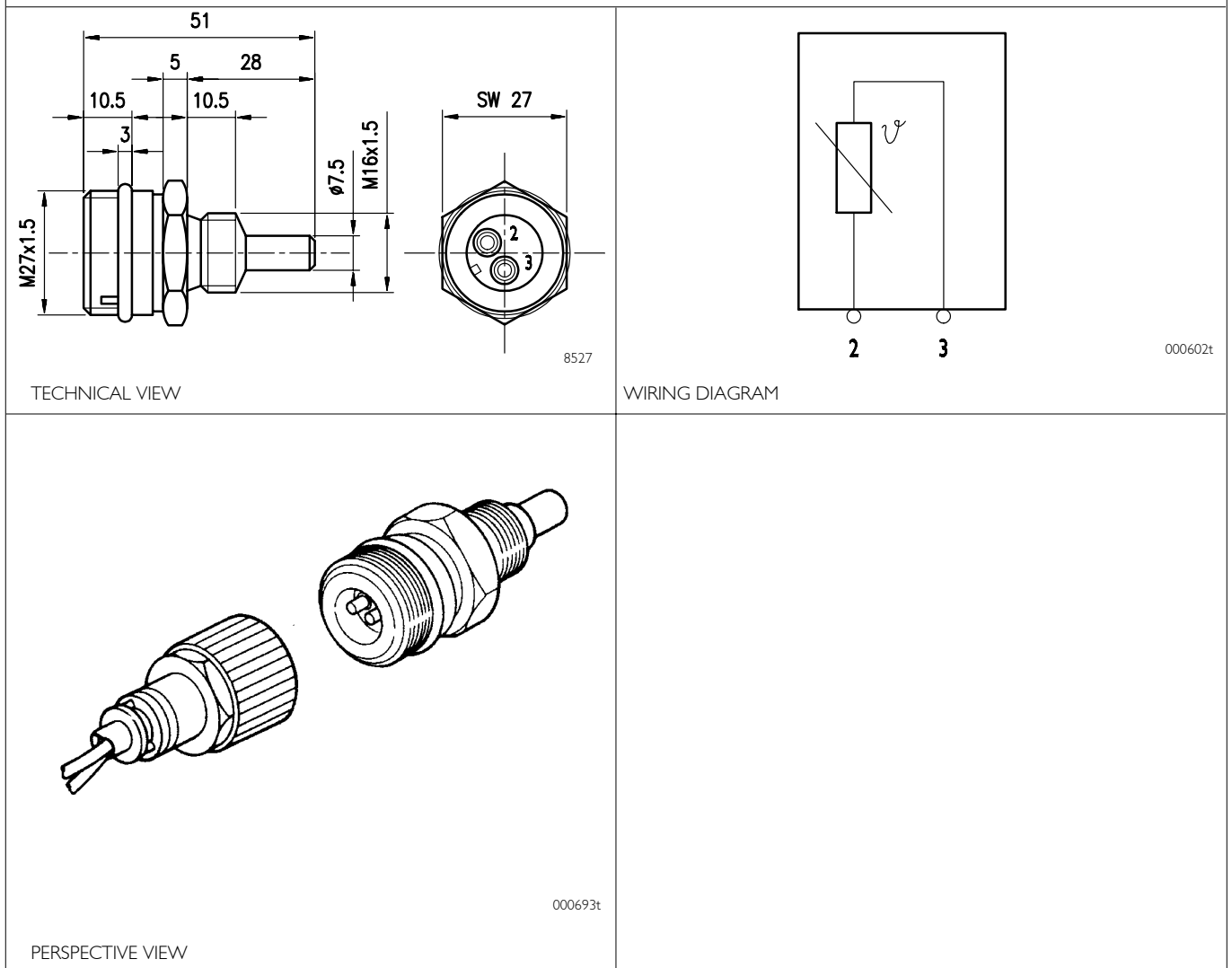
It is connected to electronic center pins A5/A22.

Sensor behavior as a function of temperature:

- 10 °C 8,10 ÷ 10,77 kOhm
- + 20 °C 2,28 ÷ 2,72 kOhm
- + 80 °C 0,29 ÷ 0,364 kOhm

At 60 to 90 °C, voltage at A5 and A22 ranges from 0.6 to 2.4V.

Figure 8


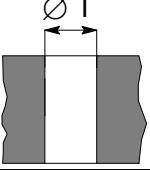
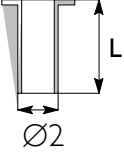


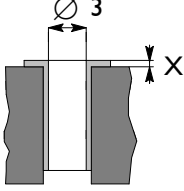
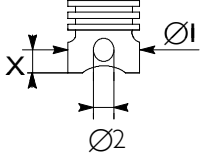


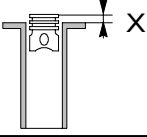
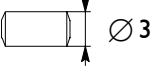



Connector	Function	Cable colour
2	To EDC center pin A 5	—
3	To EDC center pin A 22	—

PART THREE - TROUBLESHOOTING

PART FOUR - MAINTENANCE PLANNING

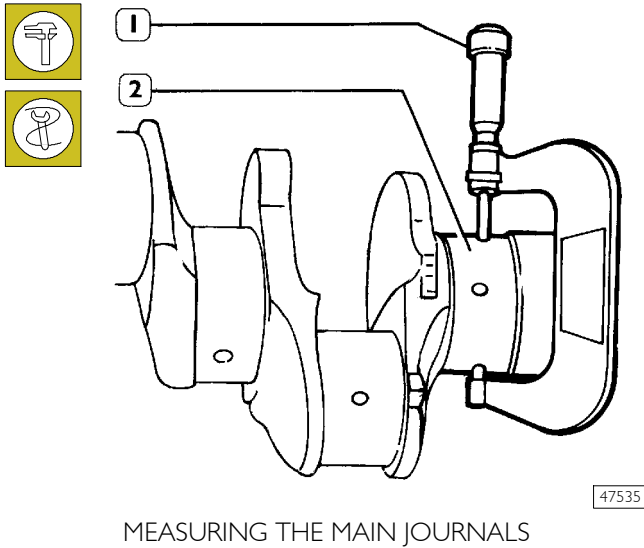
ASSEMBLY CLEARANCE DATA

	Type	F2B
CYLINDER BLOCK AND CRANK MECHANISM COMPONENTS		mm
	Cylinder sleeve bore upper $\varnothing 1$ lower	130.200 to 130.225 128.510 to 128.535
	Cylinder liners: outer diameter: upper $\varnothing 2$ lower length L	130.161 to 130.186 128.475 to 128.500
	Cylinder sleeve - crankcase bore upper lower	0.014 to 0.064 0.010 to 0.060
	Outside diameter $\varnothing 2$	
	Cylinder sleeve inside diameter $\varnothing 3$ A* inside diameter $\varnothing 3$ B* Protrusion X	115.000 to 115.012 115.010 to 115.022 0.035 to 0.065
* Available dia. class		
	Pistons: measuring dimension X outside diameter $\varnothing 1$ A• outside diameter $\varnothing 1$ B•• outside diameter $\varnothing 2$	18 114.888 to 114.900 114.898 to 114.910 46.010 to 46.018 114.898 to 114.910
<ul style="list-style-type: none"> • Class A pistons supplied as spares. •• Class B pistons are fitted in production only and are not supplied as spares. 		
	Piston - cylinder sleeve	0.100 to 0.124
	Piston diameter $\varnothing 1$	-
	Pistons protrusion X	0.32 to 0.99
	Gudgeon pin $\varnothing 3$	45.994 to 46.000
	Gudgeon pin - pin housing	0.010 to 0.024

Measuring main journals and crank pins

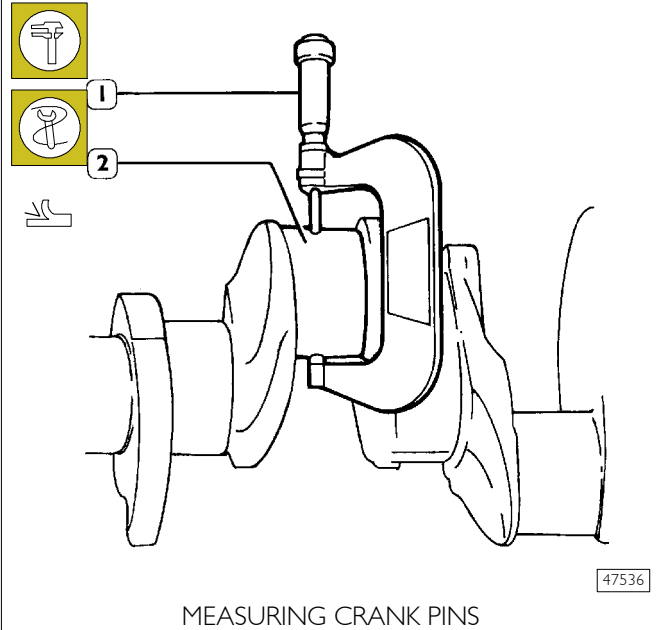
Before grinding the crank pins using a micrometer (1), measure the main journals and the crank pins (2) and decide, on the basis of the undersizing of the bearings, the final diameter to which the pins are to be ground.

Figure 16



NOTE It is advisable to enter the values found in a table (Figure 18).

Figure 17



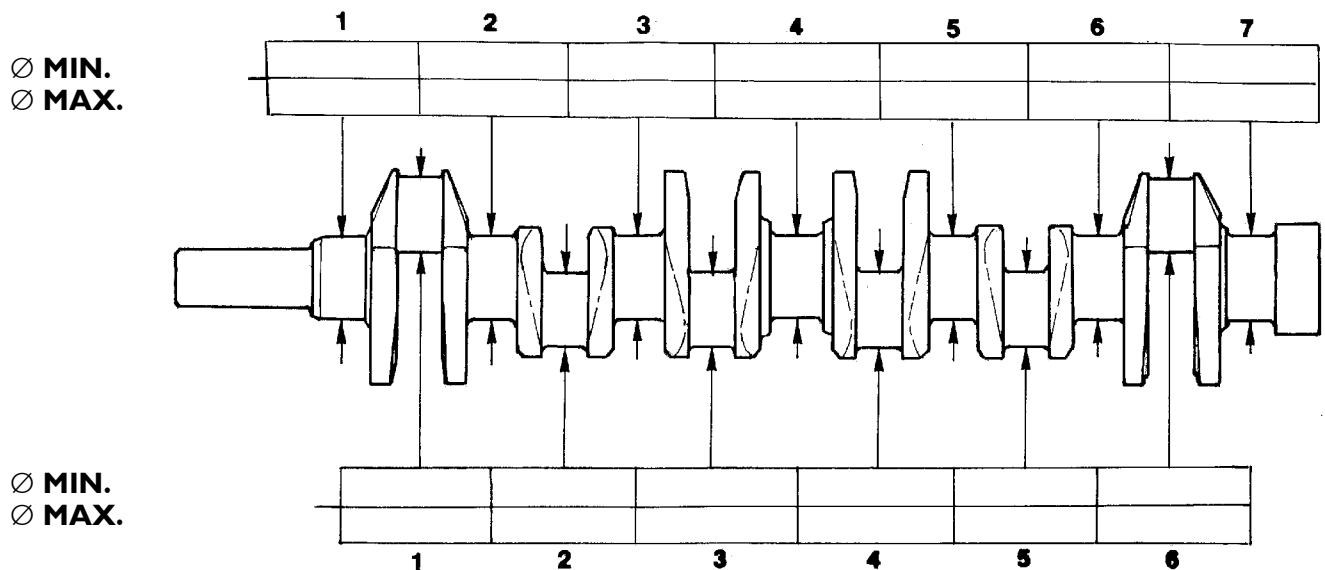
During grinding, pay attention to journal and crank pins values specified in figures 14 and 15.

NOTE All journals and crank pins must also be ground to the same undersizing class, in order to avoid any alteration to shaft balance.

Figure 18

Fill in this table with the measurements of the main journals and the crank pins.

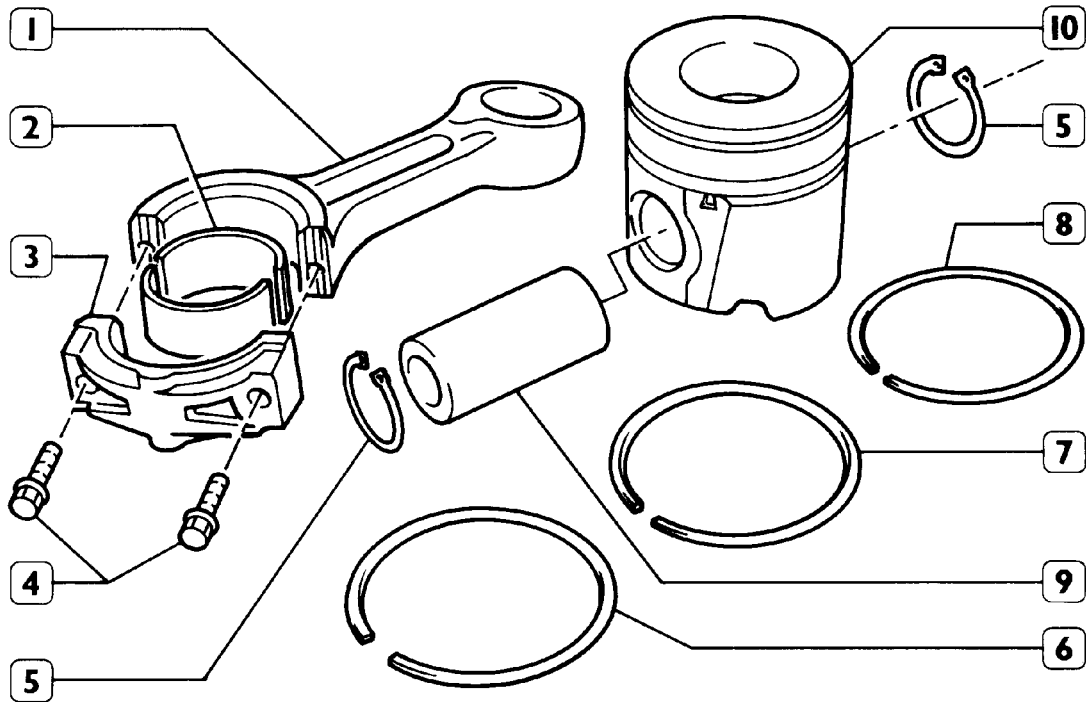
MAIN JOURNALS



CRANK PINS

PISTON-CONNECTING ROD ASSEMBLY

Figure 36



47580

PISTON CONNECTING ROD ASSEMBLY

- 1. Connecting rod body - 2. Half bearings - 3. Connecting rod cap - 4. Cap fastening screws - 5. Split ring - 6. Scraper ring with spiral spring - 7. Bevel cut sealing ring - 8. Trapezoidal sealing ring - 9. Piston pin - 10. Piston

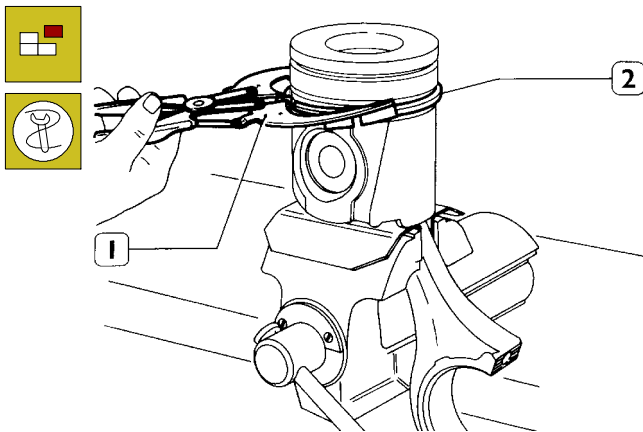
Make sure the piston does not show any trace of seizing, scoring, cracking; replace as necessary.

Pistons are equipped with three elastic rings: a sealing ring, a trapezoidal ring and a scraper ring.

Pistons are grouped into classes A and B for diameter.

Removal

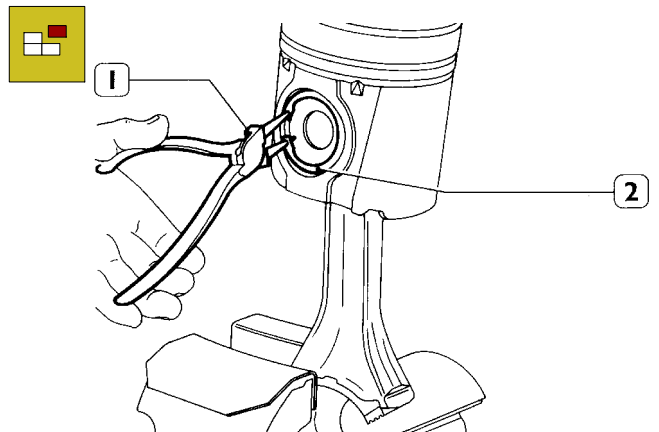
Figure 37



49023

Removal of the piston split rings (2) using the pliers 99360184 (1).

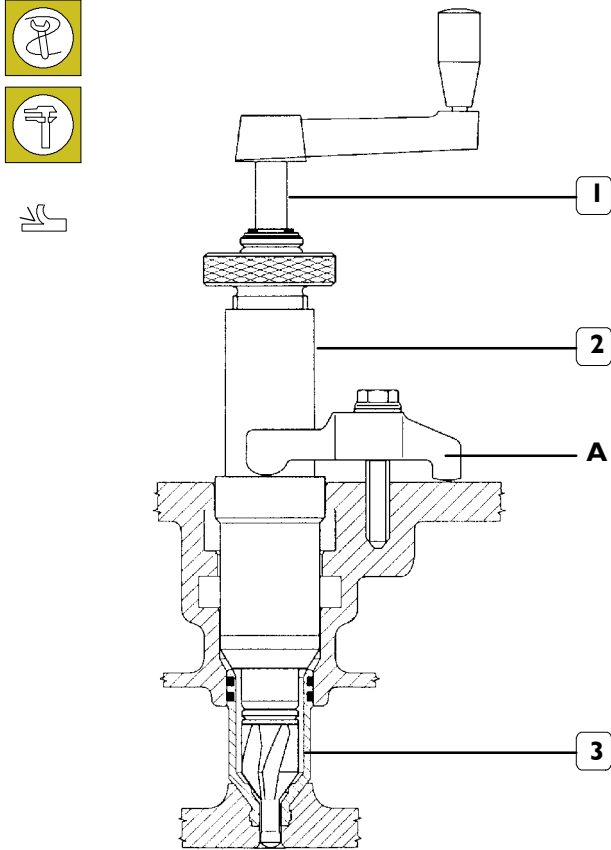
Figure 38



49024

Remove the piston pin split rings (2) using the round tipped pliers (1).

Figure 69

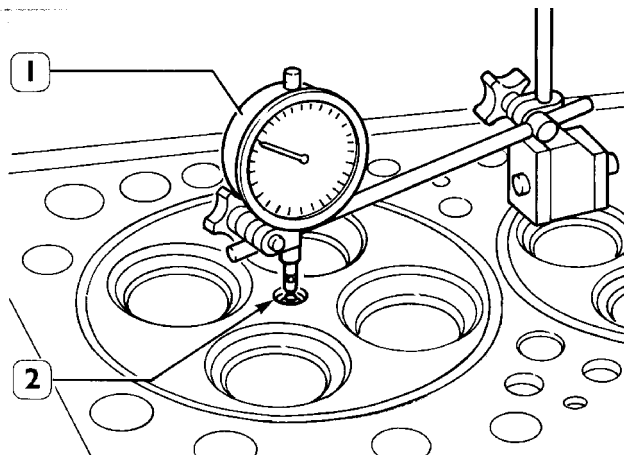


45636

- Through miller-99394041 (1) and bushing 99394014 (2), ream the injector seat in the case (3), check the injector protrusion from the cylinder head plane which must be 0.7 mm.

Checking protrusion of injectors

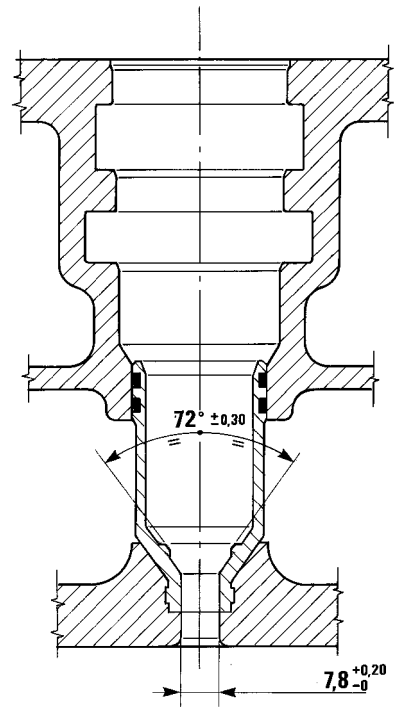
Figure 70



47585

- Using dial gauge (1), check the protrusion of the injector (2) which must be 0.7 mm.

Figure 71

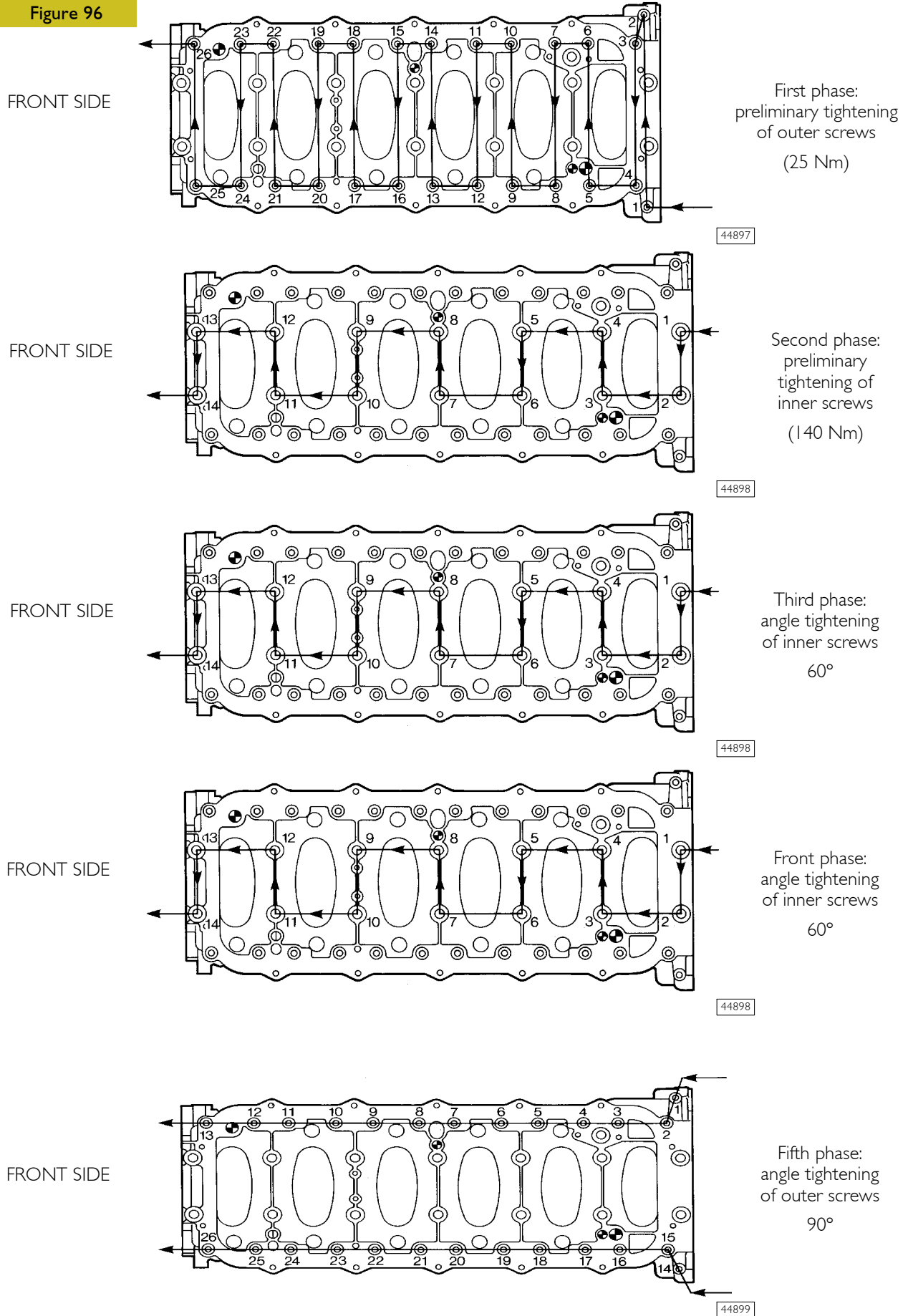


44909

INSTALLATION DIAGRAM FOR INJECTOR CASE

Underblock fixing screws tightening sequence

Figure 96



TOOLS

TOOL NO.	DESCRIPTION
99360335	Cylinder barrel compression cap (to be used with 99360334)
99360351	Tool to stop engine flywheel
99360487	Tool to take down and fit back camshaft bushes
99360500	Tool to lift crankshaft
99360551	Bracket to take down and fit engine flywheel
99360558	Tool to lift and transport rocker shaft

Part 2	
F3A CURSOR ENGINES	
	Section
General specifications	1
Fuel	2
Vehicle application	3
General overhaul	4
Tools	5
Safety prescriptions	Appendix

PREFACE TO USER'S GUIDELINE MANUAL

Section 1 describes the F3A engine illustrating its features and working in general.

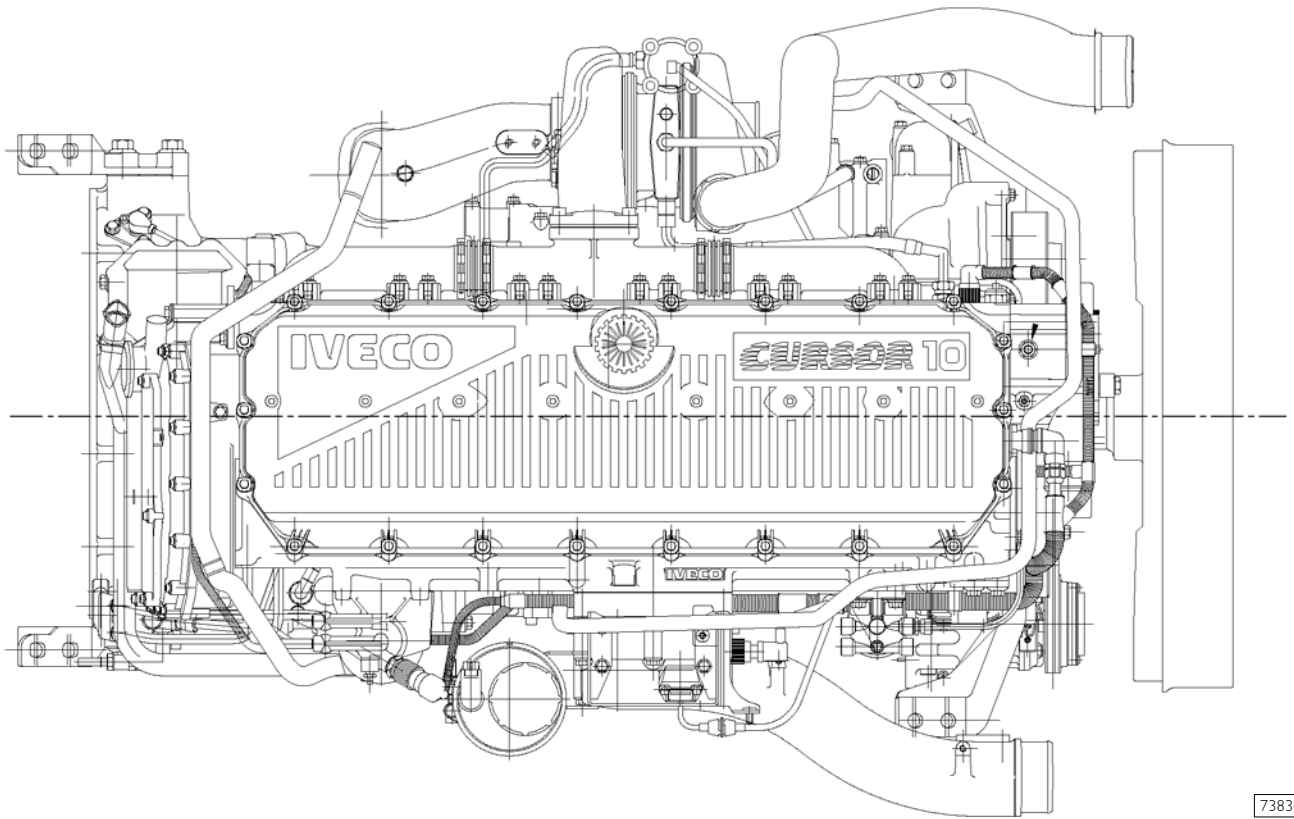
Section 2 describes the type of fuel feed.

Section 3 relates to the specific duty and is divided in four separate parts:

1. Mechanical part, related to the engine overhaul, limited to those components with different characteristics based on the relating specific duty.
2. Electrical part, concerning wiring harness, electrical and electronic equipment with different characteristics based on the relating specific duty.
3. Maintenance planning and specific overhaul.
4. Troubleshooting part dedicated to the operators who, being entitled to provide technical assistance, shall have simple and direct instructions to identify the cause of the major inconveniences.

Sections 4 and 5 illustrate the overhaul operations of the engine overhaul on stand and the necessary equipment to execute such operations.

Figure 3



73834

TOP VIEW

SECTION 2**Fuel**

	Page
FEEDING	3
FUEL SUPPLY DIAGRAM	4
<input type="checkbox"/> Fuel pump	5
<input type="checkbox"/> Injector-pump	5
<input type="checkbox"/> Injector Phases	6

CLEARANCE DATA

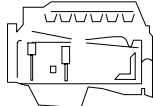





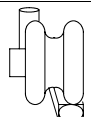

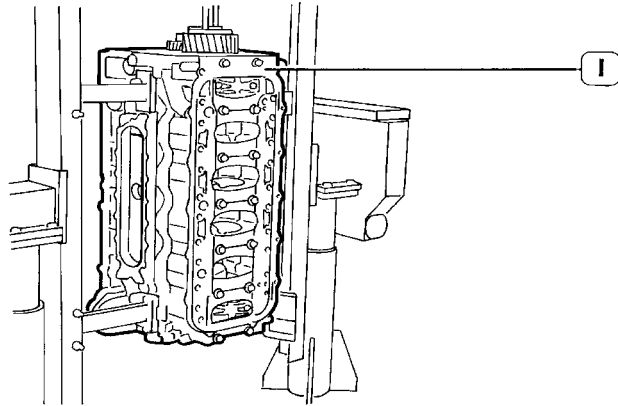
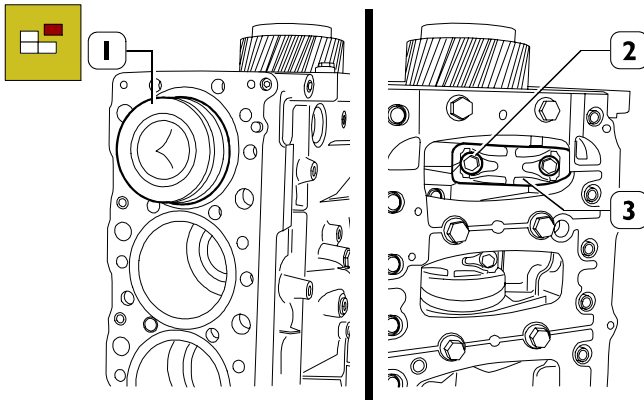
	Type	F3A0681D*B...	
	Compression ratio	17 ± 0.8	
	Max. output	kW (HP) rpm	316 (430) 2100
	Max. torque	Nm (kgm) rpm	1900 (194) 1050 ÷ 1590
	Loadless engine idling	rpm	550 ± 25
	Loadless engine peak	rpm	2550 ± 20
	Bore x stroke	mm	125 x 140
	Displacement	cm ³	10300
	SUPERCHARGING		
	Turbocharger type	HOLSET HY55V with variable geometry	
	LUBRICATION		
	Oil pressure (warm engine)	Forced by gear pump, relief valve single action oil filter	
	- idling	bar	1.5
	- peak rpm	bar	5
	COOLING	By centrifugal pump, regulating thermostat, viscostatic fan, radiator and heat exchanger	
	Water pump control	By belt	
	Thermostat	N. I	
	initial opening	~84°C ± 2 °C	
	maximum opening	94°C ± 2 °C	

Figure 31



Rotate the block (1) to the vertical position.

Figure 32

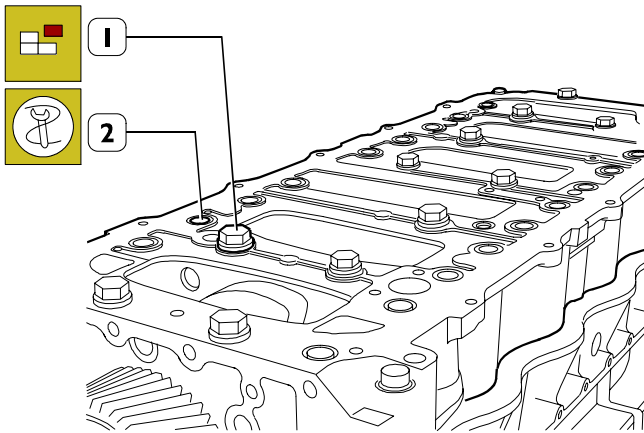


Untighten screws (2) fixing the connecting rod cap (3) and remove it. Remove the connecting rod-piston (1) assembly from the upper side. Repeat these operations for the other pistons.



Keep the big end bearing shells in their respective housings and/or note down their assembly position since, if reusing them, they will need to be fitted in the position found upon removal.

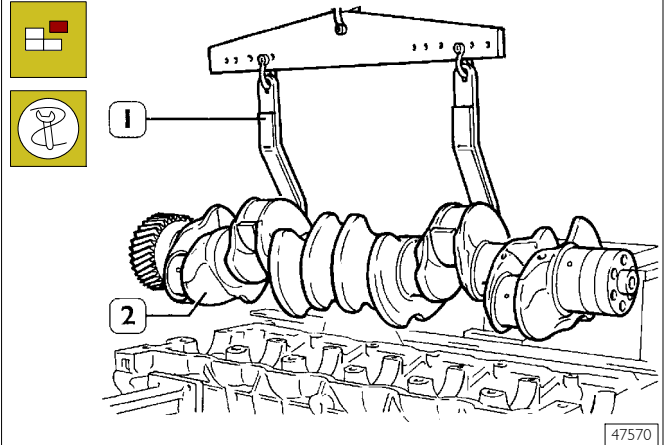
Figure 33



By means of proper and splined wrenches, untighten the screws (1) and (2) and remove the under-block.

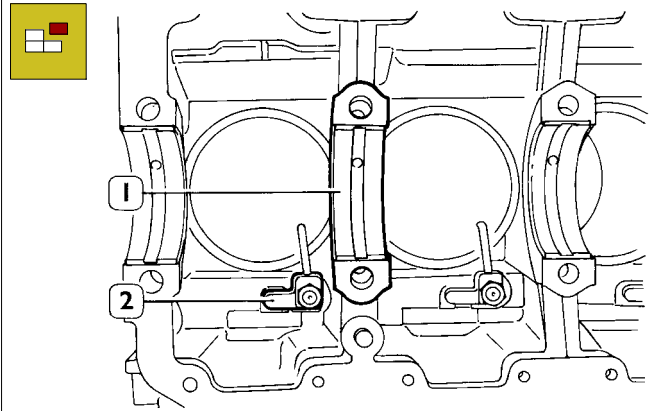
NOTE Note down the assembly position of the top and bottom main bearing shells since, if reusing them, they will need to be fitted in the position found upon removal.

Figure 34



Using tool 99360500 (1), remove the crankshaft (2).

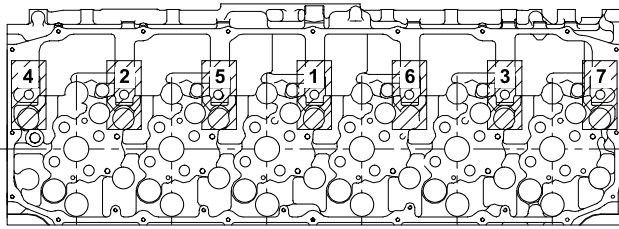
Figure 35



Remove the main bearing shells (1), unscrew the screws and take out the oil nozzles (2). Remove the cylinder liners as described under the relevant subheading.

NOTE After disassembling the engine, thoroughly clean disassembled parts and check their integrity. Instructions for main checks and measures are given in the following pages, in order to determine whether the parts can be re-used.

Figure 69

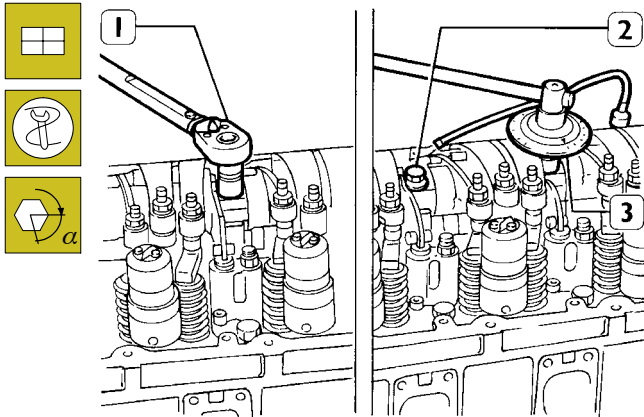


70567A

SCHEME OF SCREW TIGHTENING SEQUENCE SECURING ROCKER ARMS

Screw screws (1 - 2 - 3) until rocker arms are brought to contact relating seats on cylinder head, tighten the screws according to sequence indicated in figure operating in two steps as indicated in successive figure.

Figure 70

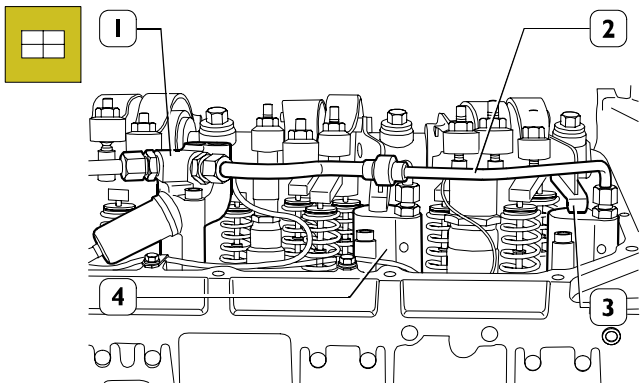


45261

Lock the screws (2) fixing the rocker-arm shaft as follows:

- 1st phase: tightening to a torque of 100 Nm (10 kgm) with the torque wrench (1);
- 2nd phase: closing with an angle of 60° using the tool 99395216 (3).

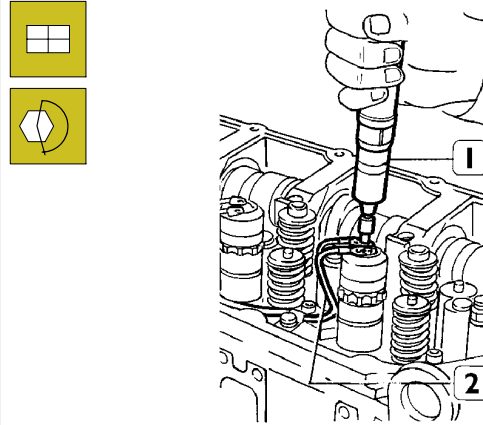
Figure 71



60574

- Mount the engine brake lever retaining springs (3).
- Connect the pipe (2) to the engine brake cylinders (4) and to the cylinder with the engine brake solenoid valve (1).

Figure 72

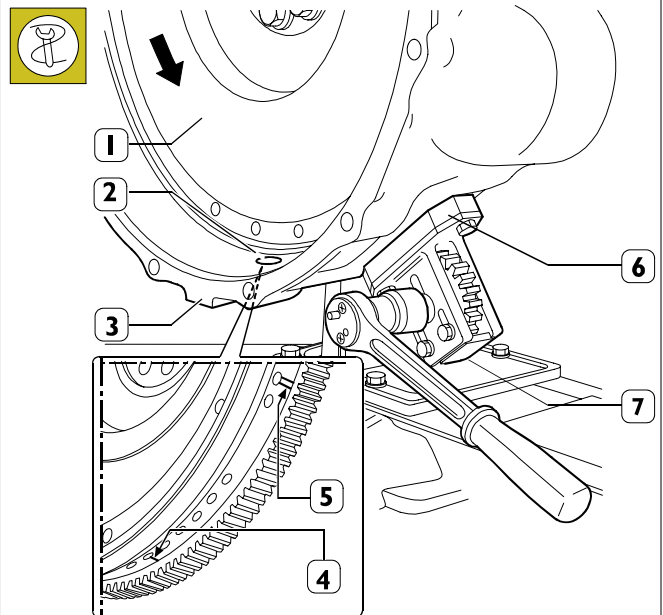


71777

Mount the electric wiring (2), securing it on the electro-injectors with a torque screwdriver (1) to a torque of 1.36 - 1.92 Nm.

Camshaft timing

Figure 73



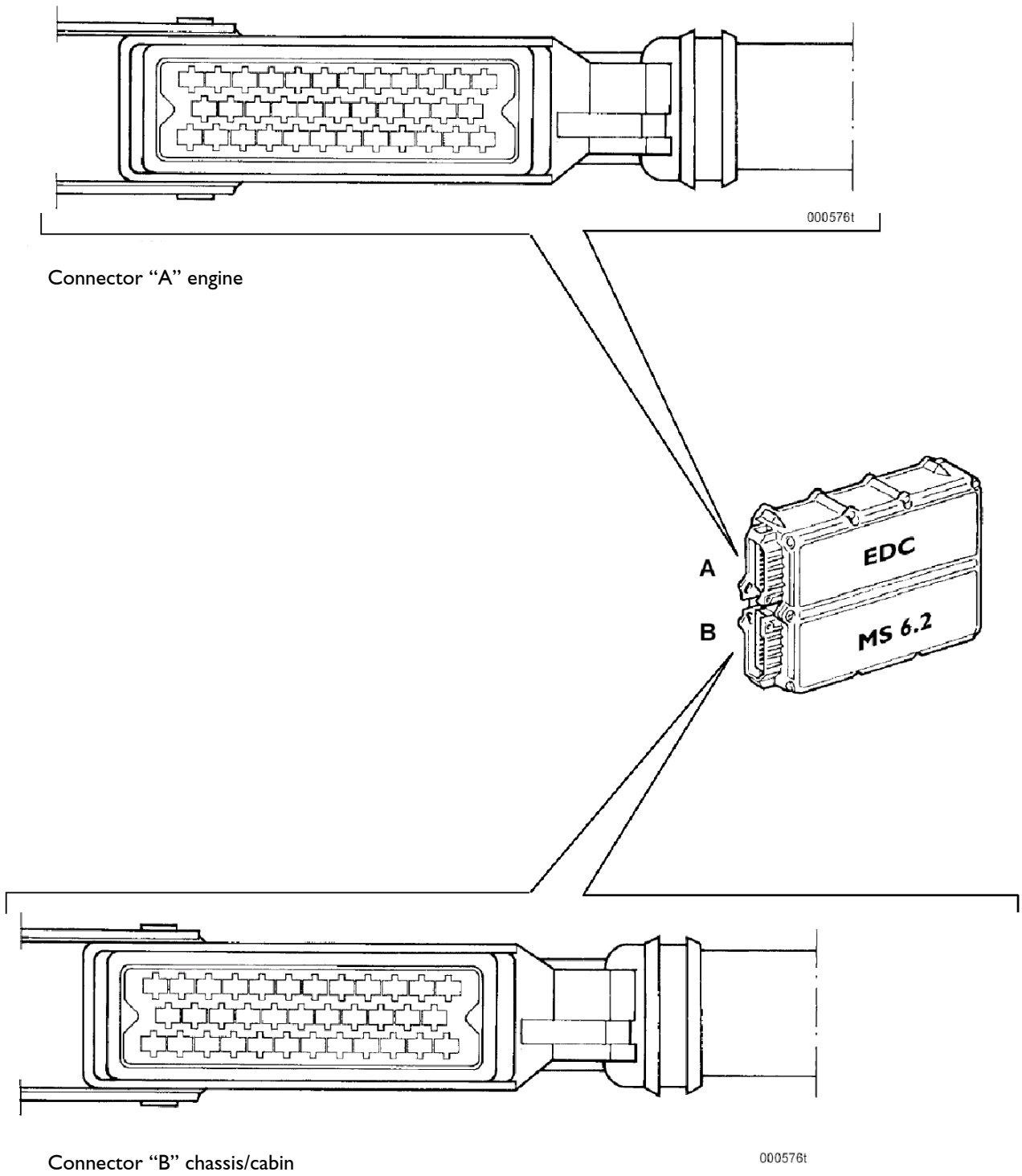
71776

Apply the tool 99360321 (7) and the spacer 99360325 (6) to the gear box (3).

NOTE The arrow shows the direction of rotation of the engine when running.
Using the above-mentioned tool, turn the engine flywheel (1) in the direction of rotation of the engine so as to take the piston of cylinder no.1 to approximately the T.D.C. in the phase of combustion.
This condition occurs when the hole with one reference mark (4), after the hole with two reference marks (5) on the engine flywheel (1), can be seen through the inspection window (2).

EDC MS 6.2 electronic control unit

Figure 4



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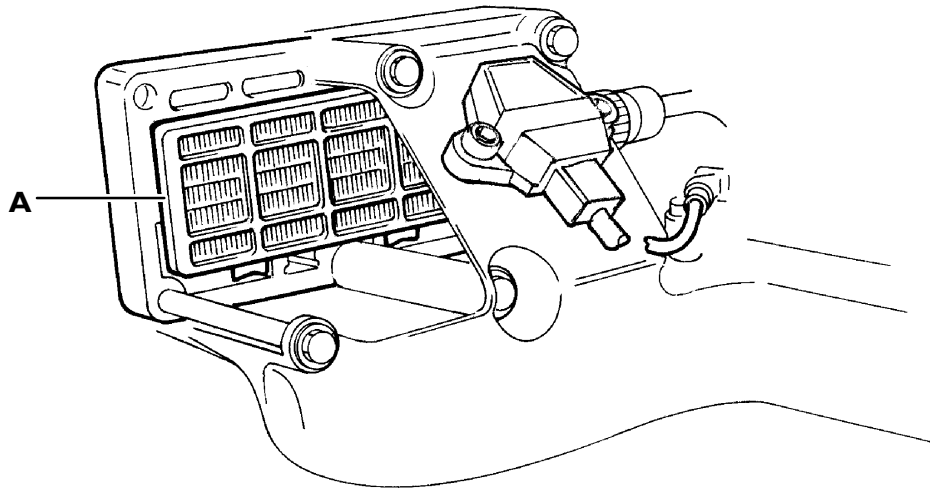
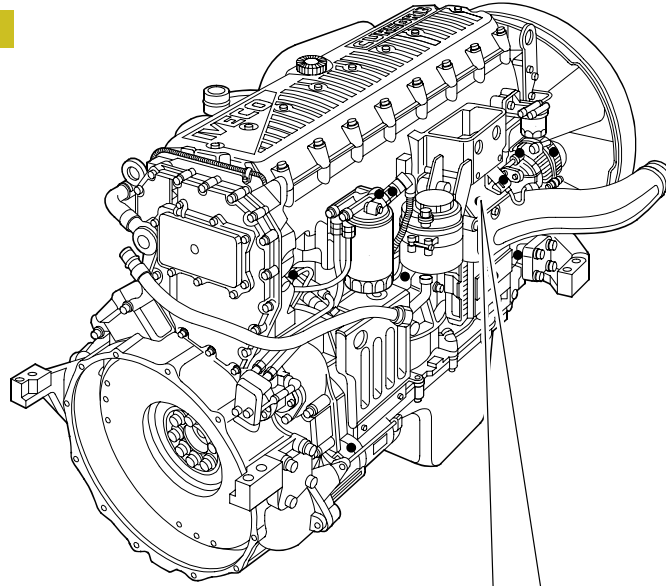


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Pre-post reheat resistor (61121)

Figure 22



000025t

A. Pre/post reheat resistor / 0.7 Ohm

This resistor located between the cylinder head and the intake duct is used to heat air in pre/post reheat operations.

By inserting the key switch, when even only one of the water, air or gas oil temperature sensors record less than 10 °C, the electronic center activates pre/post reheating and switches on the warning light on the cab instrument panel for a variable period according to temperature, after which the light starts blinking to inform the operator that the engine can be started.

The warning light goes off after engine start but the resistor continues being supplied for a variable period of time to complete post reheating.

The operation is cancelled to prevent uselessly discharging the battery if the engine is not started within 20/25 seconds with the warning light blinking.

When reference temperature is above 10 °C, actuating the ignition key makes the warning light go on for some 2 seconds to complete the test and then turns it off to indicate the engine can be started.

BLINK CODE	EDC WARNING LIGHT	POSSIBLE CAUSE	POSSIBLE RELATED ANOMALIES	RECOMMENDED TESTS OR MEASURES	REMARKS
6.1	ON steady	Faulty flywheel sensor. Reduced engine speed and power.	Engine starting may take a longer time than usual.	Fault memory reading by means of the diagnosis instrument. Check cabling, connections and component.	
6.2	ON steady	Distributing shaft sensor. Reduced engine speed and power.	Engine starting may take a longer time than usual.	Fault memory reading by means of the diagnosis instrument. Check cabling, connections and component.	
(6.1 - 6.2)	ON steady	Distributing shaft phonic wheel has rotated, due to loosened screws. The engine won't start, or stops and cannot be started again.	Reduced power with engine started (after taking the measure recommended in the next column).	Disconnect the distributing shaft sensor connector. If the engine is started, even by taking a longer time than usual, the phonic wheel is out-of-phase.	
6.4	Blinking	The engine has reached (on pulling) the out-of-rev conditions for any reason whatsoever.		Fault memory reading. Flight recorder reading to get confirmation of the engine out-of-rev condition.	
(9.1)	Blinking	Faulty EDC control unit. The engine will stop or won't start.		Contact Help Desk for control unit replacement.	No diagnosis can be made. This error may even not be stored; this depends on the control unit conditions.
9.2	ON steady	Control unit fault (EEPROM memory). Reduced engine speed and power.	Faulty memory lost; only the diagnosis of existing faults can be made.	Contact Help Desk for replacement (if any) of the control unit.	
9.4	Blinking	Main relay faulty or locked in closed position. The EDC warning light remains ON when the key is turned to OFF; yet the engine will stop.	EDC power supply remains ON after the key has been turned to OFF; danger of battery run-down.	Check cabling, connections and component.	The fault will be stored only after the next time the engine is started.

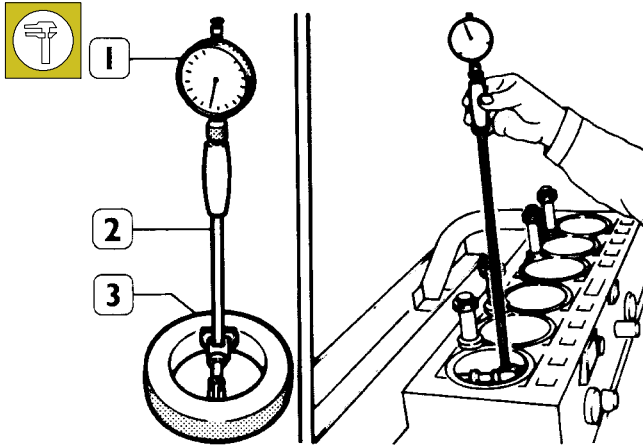
SECTION 4**General overhaul**

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REPAIR OPERATIONS CYLINDER BLOCK

Checks and measurements

Figure 1 (Demonstration)

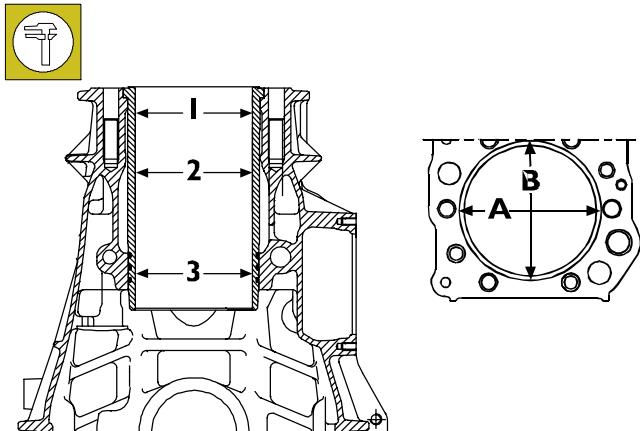


34994

Internal diameter of the cylinder liners is checked for ovalization, taper and wear, using a bore dial (1) centesimal gauge 99395687 (2) previously reset to ring gauge (3), diameter 125 mm.

NOTE If a 125 mm ring gauge is not available use a micrometer caliper.

Figure 2

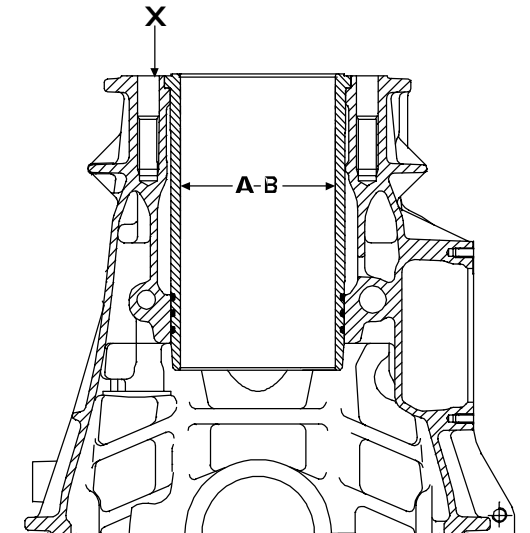


60596

1 = 1st measuring
2 = 2nd measuring
3 = 3rd measuring

Carry out measurements on each cylinder liner at three different levels and on two (A-B) surfaces, to one another perpendicular, as shown in Figure 2.

Figure 3



60595

A = Selection class \varnothing 125 – 125.013 mm
B = Selection class \varnothing 125.011 – 125.024 mm
X = Selection class marking area

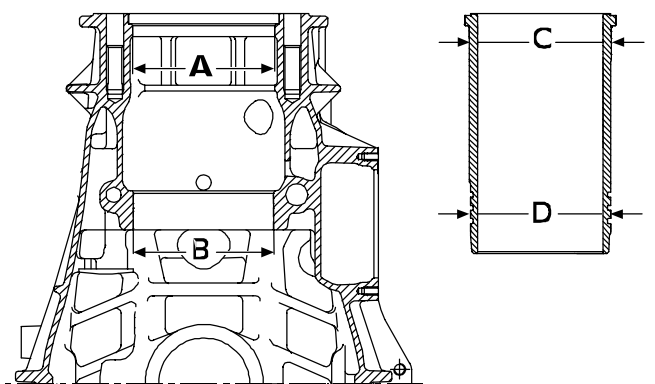
In case of maximum wear >0.150 mm or maximum ovalization >0.100 mm compared to the values indicated in the figure, the liners must be replaced as they cannot be ground, lapped or trued.

NOTE



Cylinder liners are equipped with spare parts with "A" selection class.

Figure 4



60597

A = \varnothing 142.000 to 142.025 mm
B = \varnothing 140.000 to 140.025 mm
C = \varnothing 141.961 to 141.986 mm
D = \varnothing 139.890 to 139.915 mm

The figure shows the outer diameters of the cylinder liners and the relative seat inner diameters.

The cylinder liners can be extracted and installed several times in different seats, if necessary.

Check the state of the cylinder assembly machining plugs: if they are rusty or there is any doubt at all about their seal, change them.

Selecting the big end bearing shells (journals with nominal diameter)

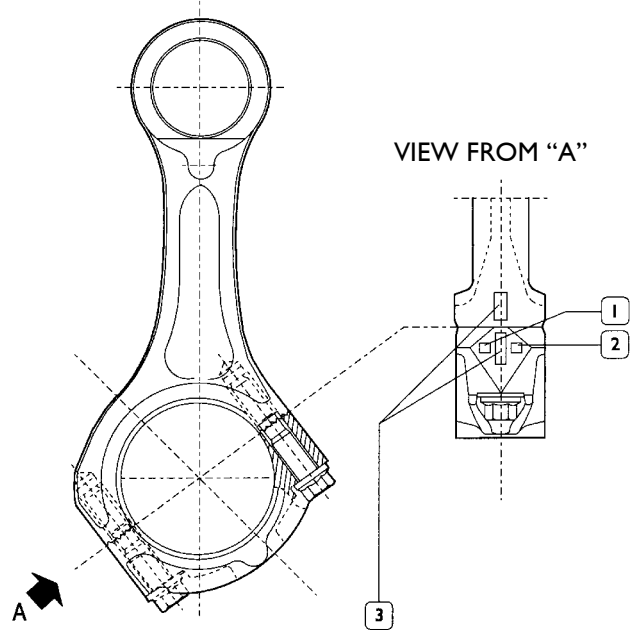
There are three markings on the body of the connecting rod in the position shown in the view from "A":

- 1 Letter indicating the class of weight:
 - A = 3973 to 4003 g.
 - B = 4004 to 4034 g.
 - C = 4035 to 4065 g.
- 2 Number indicating the selection of the diameter of the big end bearing seat:
 - 1 = 87.000 to 87.010 mm
 - 2 = 87.011 to 87.020 mm
 - 3 = 87.021 to 87.030 mm
- 3 Numbers identifying the cap-connecting rod coupling.

The number, indicating the class of diameter of the bearing shell seat may be **1, 2** or **3**.

Determine the type of big end bearing to fit on each journal by following the indications in the table (Figure 25).

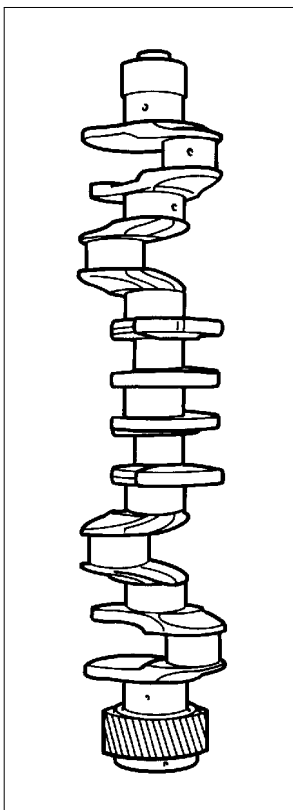
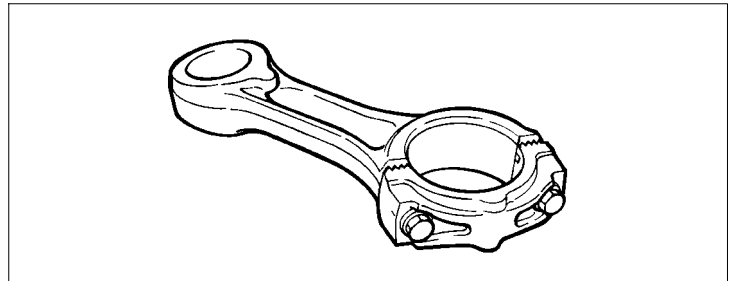
Figure 24



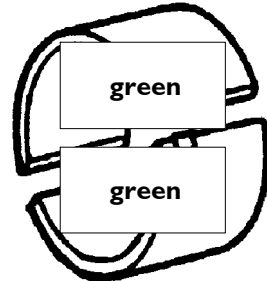
47557

Figure 25

STD.



Class	1	2	3
1	green	green	green
	green	green	green
2	red	green	green
	green	green	green
3	red	red	red
	red	green	red



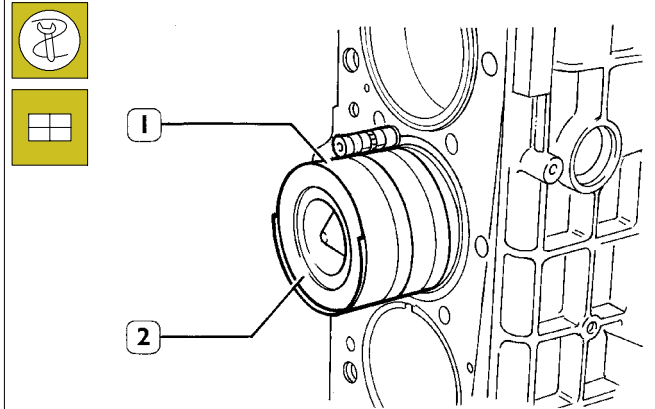
Fitting connecting rod - piston assemblies in the cylinder liners

With the aid of the clamp 99360605 (1, Figure 58), fit the connecting rod – piston assembly (2) in the cylinder liners, according to the diagram of Figure 59, checking that:

- The openings of the piston rings are staggered 120° apart.
- The pistons are all of the same class, A or B.
- The symbol punched on the top of the pistons faces the engine flywheel, or the recess in the skirt of the pistons tallies with the oil nozzles.

NOTE The pistons are supplied as spares in class A and can be fitted in class B cylinder liners.

Figure 58

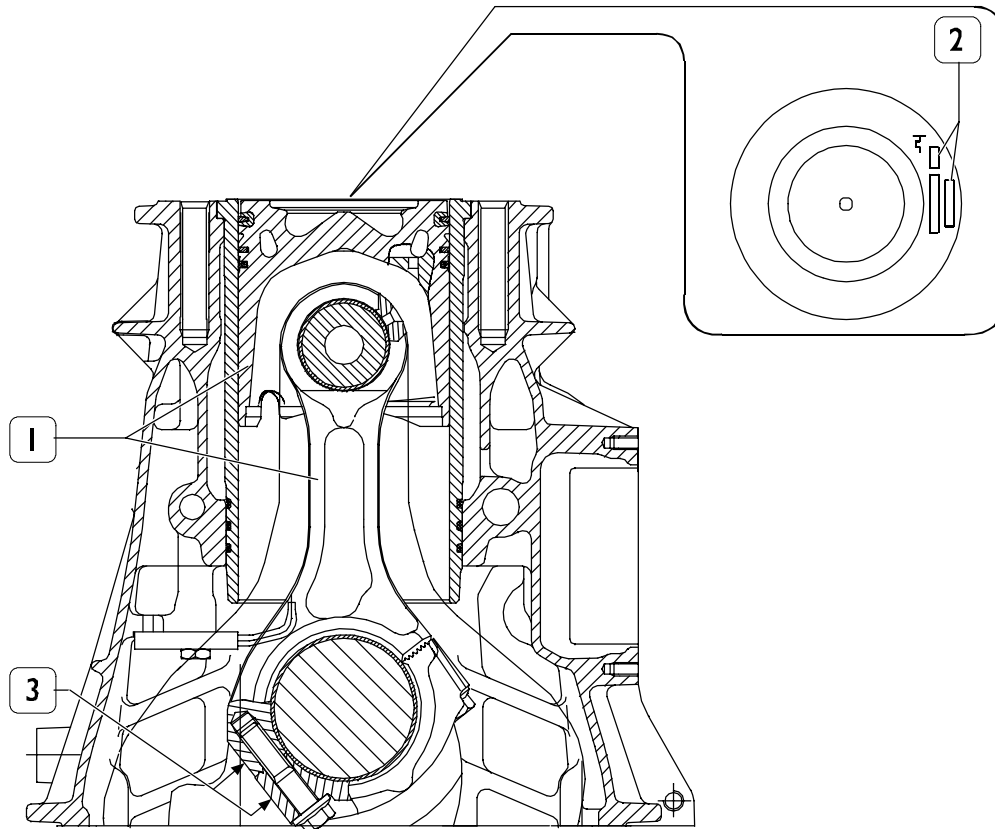


60616

Checking piston protrusion

On completing assembly, check the protrusion of the pistons from the cylinder liners; it must be 0.23 – 0.53 mm.

Figure 59

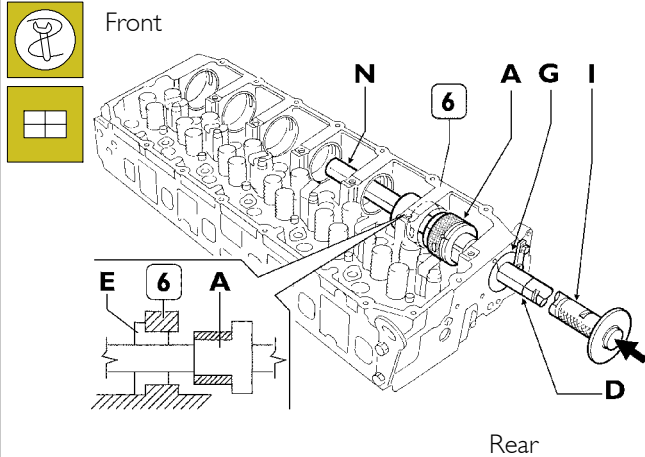


60615

ASSEMBLY DIAGRAM OF CONNECTING ROD – PISTON ASSEMBLY IN CYLINDER LINER

1. Connecting rod – piston assembly – 2. Area of punch marking on the top of the piston, symbol showing assembly position and selection class – 3. Connecting rod punch mark area.

Figure 87

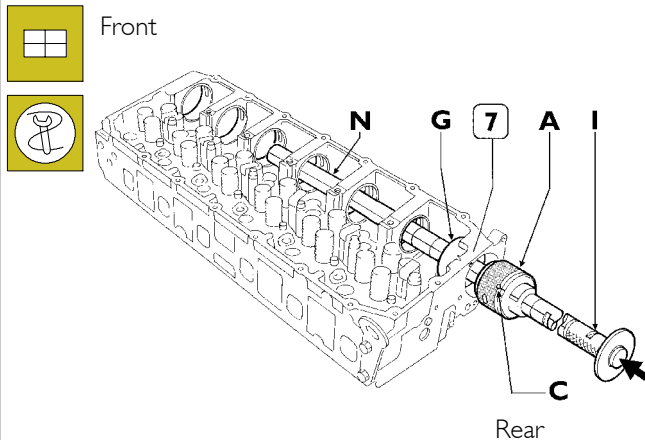


71723

To insert the bushing (6), proceed as follows:

- Unscrew the grip (I) and the extension (N).
- Position the extension (N) and the guide bushing (E) as shown in the figure.
- Repeat steps 1, 2, 3.

Figure 88



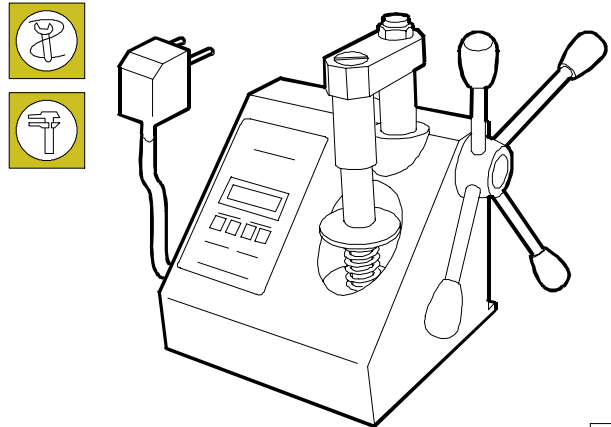
71724

To insert bushing (7), proceed as follows:

- Unscrew the grip (I) and the extension (N).
- Refit the guide (G) from the inside as shown in the figure.
- Position the bushing on the drift (A) and bring it close up to the seat, making the bushing hole match the lubrication hole in the head. Drive it home. The 7th bushing is driven in when the reference mark (C) is flush with the bushing seat.

Valve springs

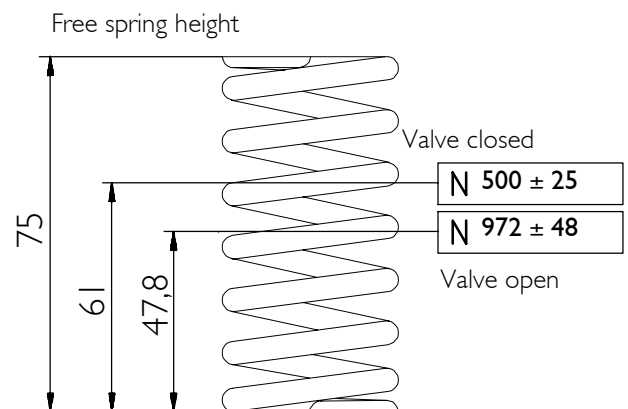
Figure 89



70000

Before assembly, the flexibility of the valve springs has to be checked with the tool 99305047. Compare the load and elastic deformation data with those of the new springs given in the following figure.

Figure 90



49034

MAIN DATA TO CHECK THE SPRING FOR INTAKE AND EXHAUST VALVES

SECTION 5

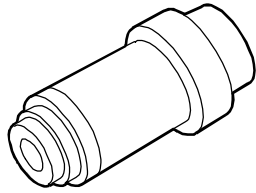
Tools

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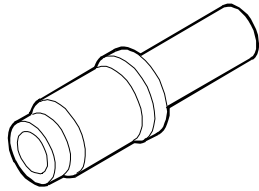
TOOLS

TOOL NO.

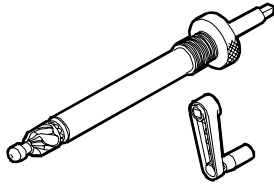
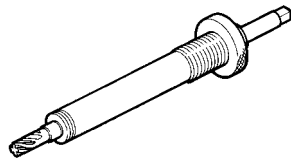
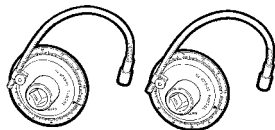
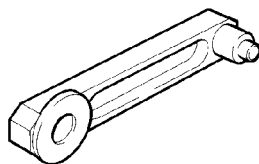
DESCRIPTION

99390805

Guide bush (to be used with 99390804)

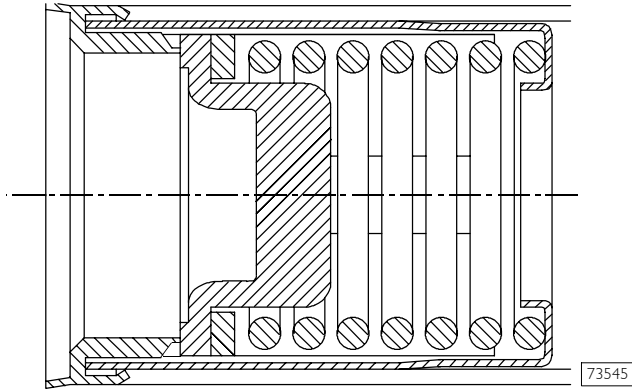
99394015

Guide bush (to be used with 99394041 or 99394043)

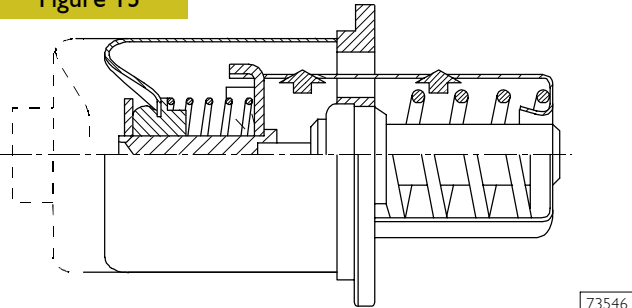
99394041Cutter to rectify injector holder housing
(to be used with 99394015)**99394043**Reamer to rectify injector holder lower side
(to be used with 99394015)**99395216**Measuring pair for angular tightening with 1/2"
and 3/4" square couplings**99395218**Gauge for defining the distance between the centres
of camshaft and transmission gear

SECTION I**General Specifications**

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By-pass valve**Figure 12**

The valve quickly opens at a pressure of: 3 bars.

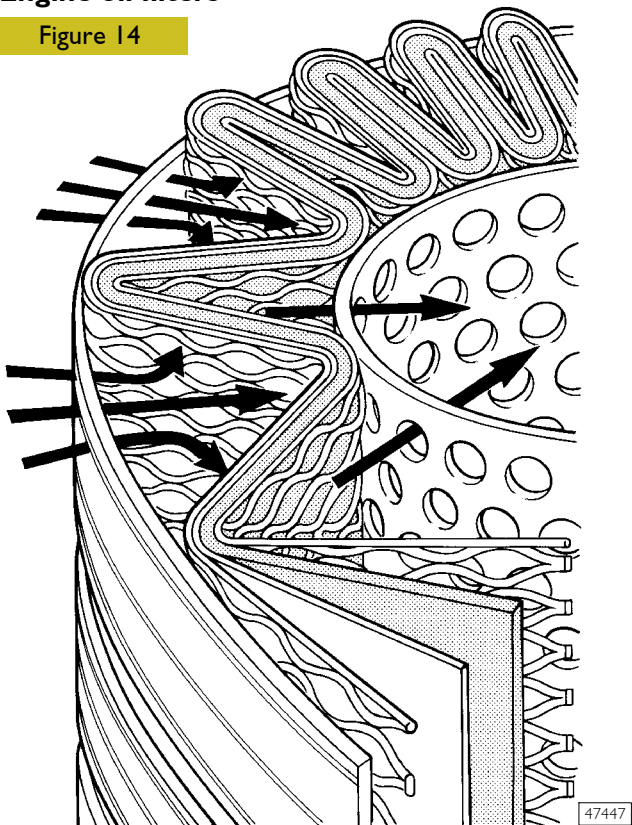
Thermostatic valve**Figure 13**

Start of opening:

- travel 0.1 mm at a temperature of $82 \pm 2^\circ\text{C}$.

End of opening:

- travel 8 mm at a temperature of 97°C .

Engine oil filters**Figure 14**

This is a new generation of filters that permit much more thorough filtration as they are able to hold back a greater amount of particles of smaller dimensions than those held back by conventional filters with a paper filtering element.

These high-filtration devices, to date used only in industrial processes, make it possible to:

- reduce the wear of engine components over time;
- maintain the performance/specifications of the oil and thereby lengthen the time intervals between changes.

External spiral winding

The filtering elements are closely wound by a spiral so that each fold is firmly anchored to the spiral with respect to the others. This produces a uniform use of the element even in the worst conditions such as cold starting with fluids with a high viscosity and peaks of flow. In addition, it ensures uniform distribution of the flow over the entire length of the filtering element, with consequent optimization of the loss of load and of its working life.

Mount upstream

To optimize flow distribution and the rigidity of the filtering element, this has an exclusive mount composed of a strong mesh made of nylon and an extremely strong synthetic material.

Filtering element

Composed of inert inorganic fibres bound with an exclusive resin to a structure with graded holes, the element is manufactured exclusively to precise procedures and strict quality control.

Mount downstream

A mount for the filtering element and a strong nylon mesh make it even stronger, which is especially helpful during cold starts and long periods of use. The performance of the filter remains constant and reliable throughout its working life and from one element to another, irrespective of the changes in working conditions.

Structural parts

The o-rings equipping the filtering element ensure a perfect seal between it and the container, eliminating by-pass risks and keeping filter performance constant. Strong corrosion-proof bottoms and a sturdy internal metal core complete the structure of the filtering element.

When mounting the filters, keep to the following rules:

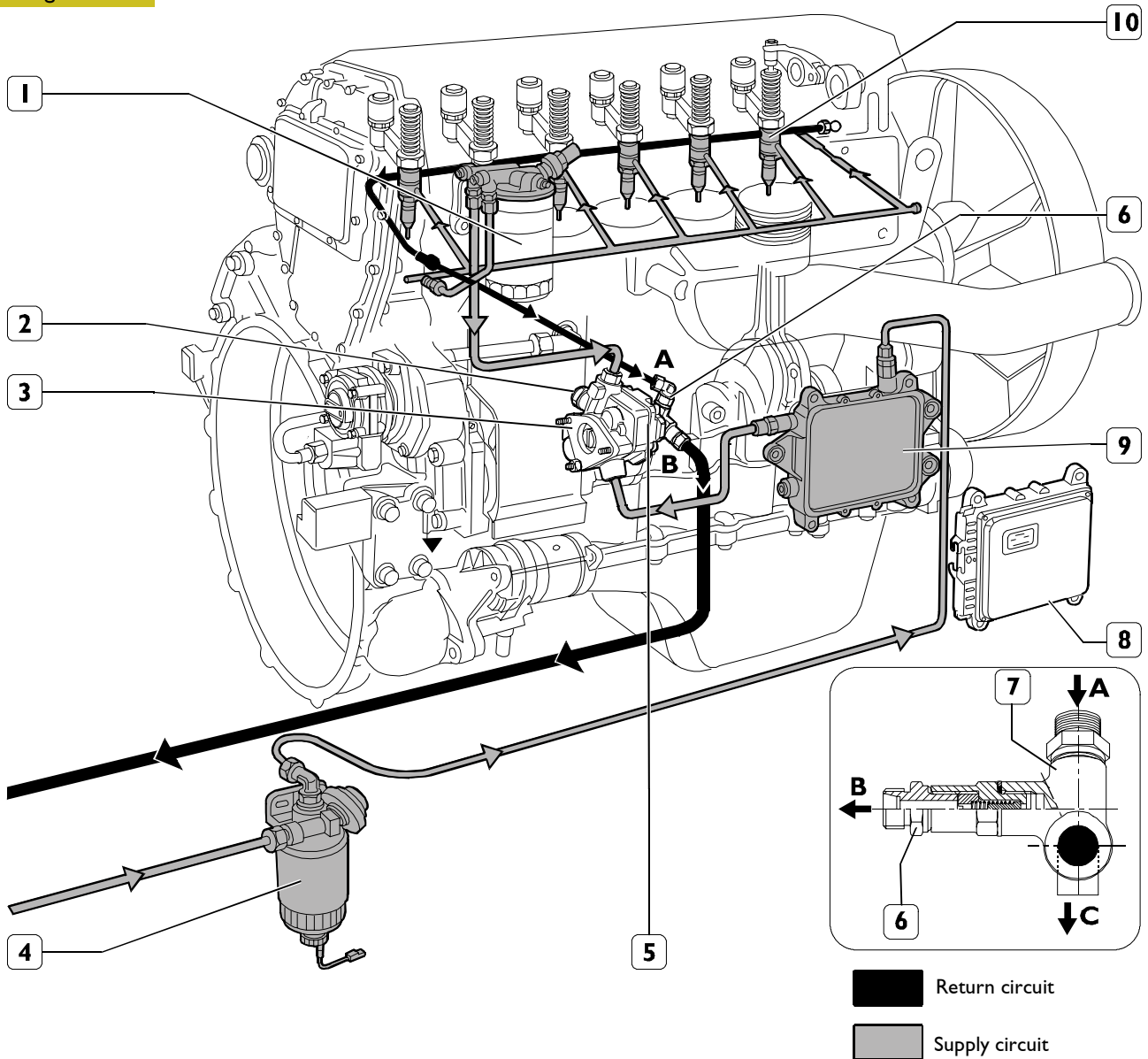
- Oil and fit new seals.
- Screw down the filters to bring the seals into contact with the supporting bases.
- Tighten the filter to a torque of 35-40 Nm.

FEEDING

Fuel is supplied via a fuel pump, filter and pre-filter, 6 pump-injectors governed by the camshaft via rocker arms and by the electronic control unit.

Scheme with pump mounted laterally

Figure 1



1. Fuel filter - 2. Pressure control valve (start of opening at 5 bar) - 3. Feed pump - 4. Fuel pre-filter with priming pump - 5. Valve, to recirculate fuel from injectors, integrated in feed pump (start of opening at 3.5 bar) - 6. Overpressure valve to return fuel to tank (start of opening at 0.2 bar) - 7. Fitting - 8. Central unit - 9. Heat exchanger- 10. Pump injectors

A. Fuel arriving at injectors - B. Fuel returning to tank - C. Fuel entering from injectors into feed pump

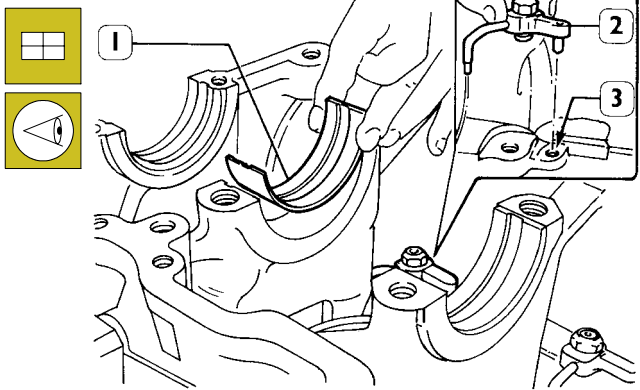
PART ONE - MECHANICAL COMPONENTS

ASSEMBLING THE ENGINE ON THE BENCH

Using the brackets 99361036, secure the crankcase to the stand 99322230.

Mount cylinder liners as described in Section 4.

Figure 42



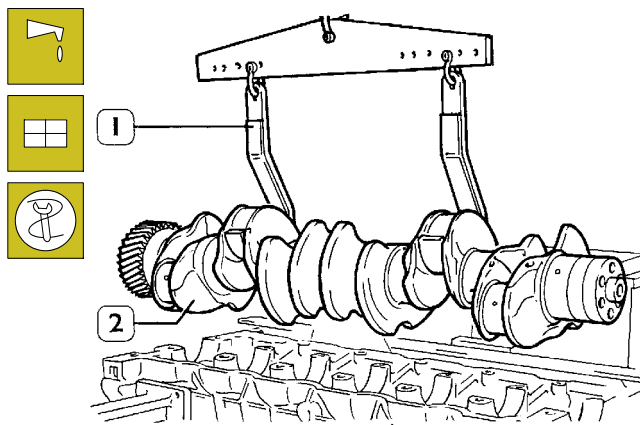
47586

Mount the oil nozzles (2), making the grub screw coincide with the hole (3) in the crankcase.

Arrange the bearing shells (1) on the main bearing housings.

NOTE Not finding it necessary to replace the main bearings, you need to fit them back in exactly the same sequence and position as in removal. If to be changed, choose the main bearings according to the procedure in chapter "Selection of main bearings and connecting rod bearings".

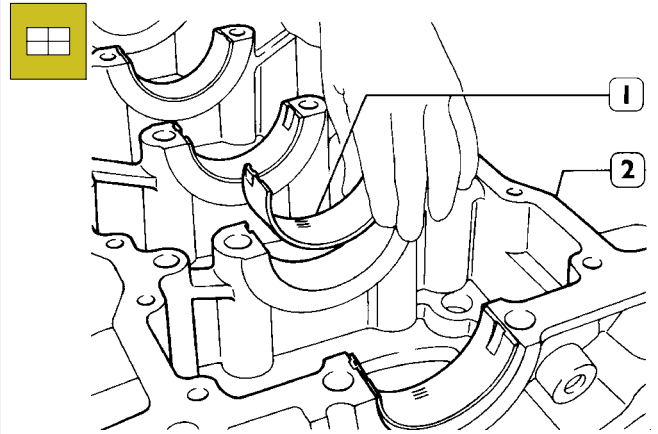
Figure 43



47570

Lubricate the bearing shells then mount the crankshaft (2) using the tackle and hook 99360500 (1).

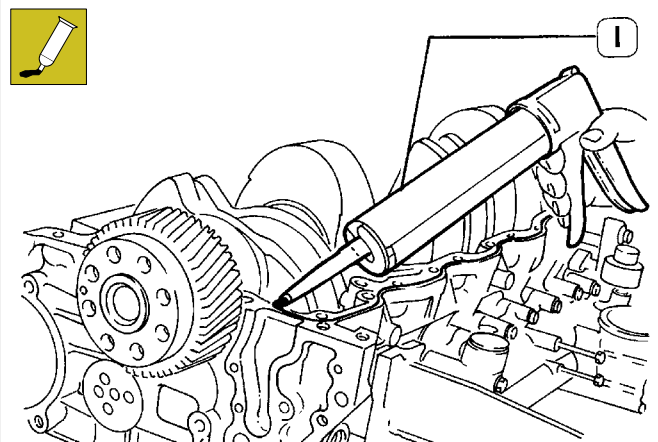
Figure 44



49021

Arrange the bearing shells (1) on the main bearing housings in the crankcase base (2).

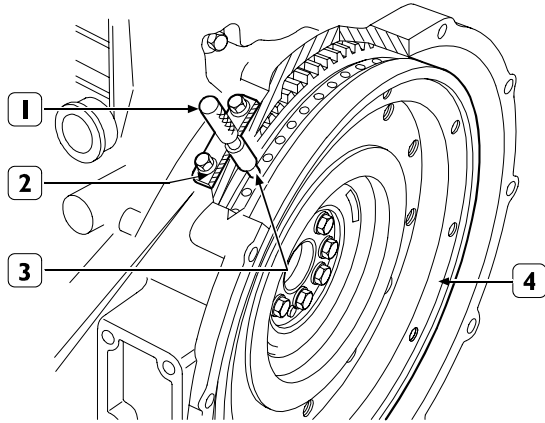
Figure 45



47595

Apply LOCTITE 5970 (IVECO No. 2992644) silicone on the crankcase using the appropriate tools (1) as shown in Figure 46.

Figure 81

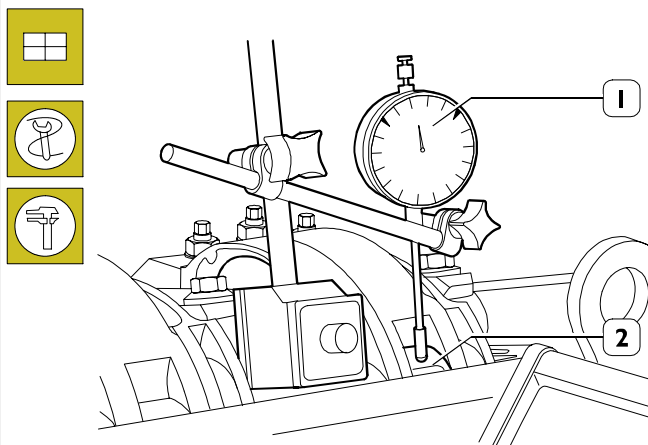


The exact position of piston no.1 at the T.D.C. is obtained when in the above-described conditions the tool 99360612 (1) goes through the seat (2) of the engine speed sensor into the hole (3) in the engine flywheel (4).

If this is not the case, turn and adjust the engine flywheel (4) appropriately.

Remove the tool 99360612 (1).

Figure 82



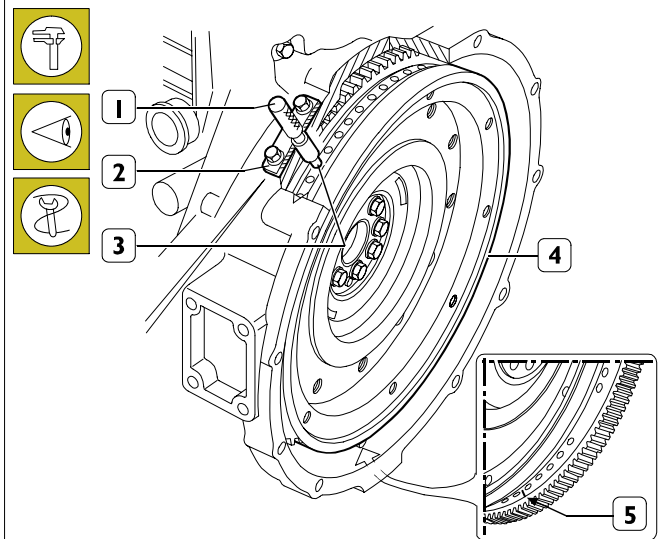
Set the dial gauge with the magnetic base (1) with the rod on the roller (2) of the rocker arm that governs the injector of cylinder no.1 and pre-load it by 6 mm.

With tool 99360321 (7) Figure 79, turn the crankshaft clockwise until the pointer of the dial gauge reaches the minimum value beyond which it can no longer fall.

Reset the dial gauge.

Turn the engine flywheel anticlockwise until the dial gauge gives a reading for the lift of the cam of the camshaft of 4.44 ± 0.05 mm.

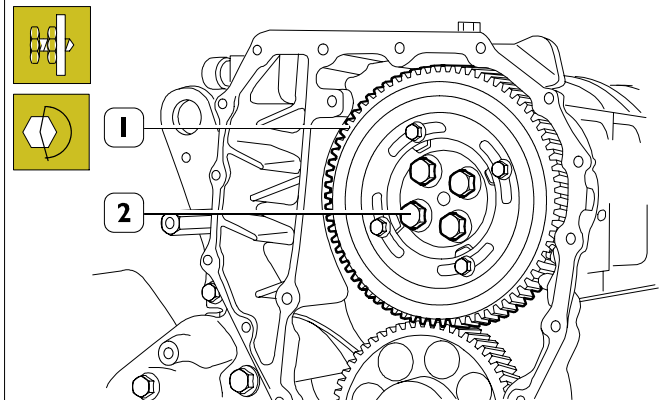
Figure 83



The camshaft is in step if at the cam lift values of 4.44 ± 0.05 mm there are the following conditions:

- 1) the hole marked with a notch (5) can be seen through the inspection window;
- 2) the tool 99360612 (1) through the seat (2) of the engine speed sensor goes into the hole (3) in the engine flywheel (4).

Figure 84



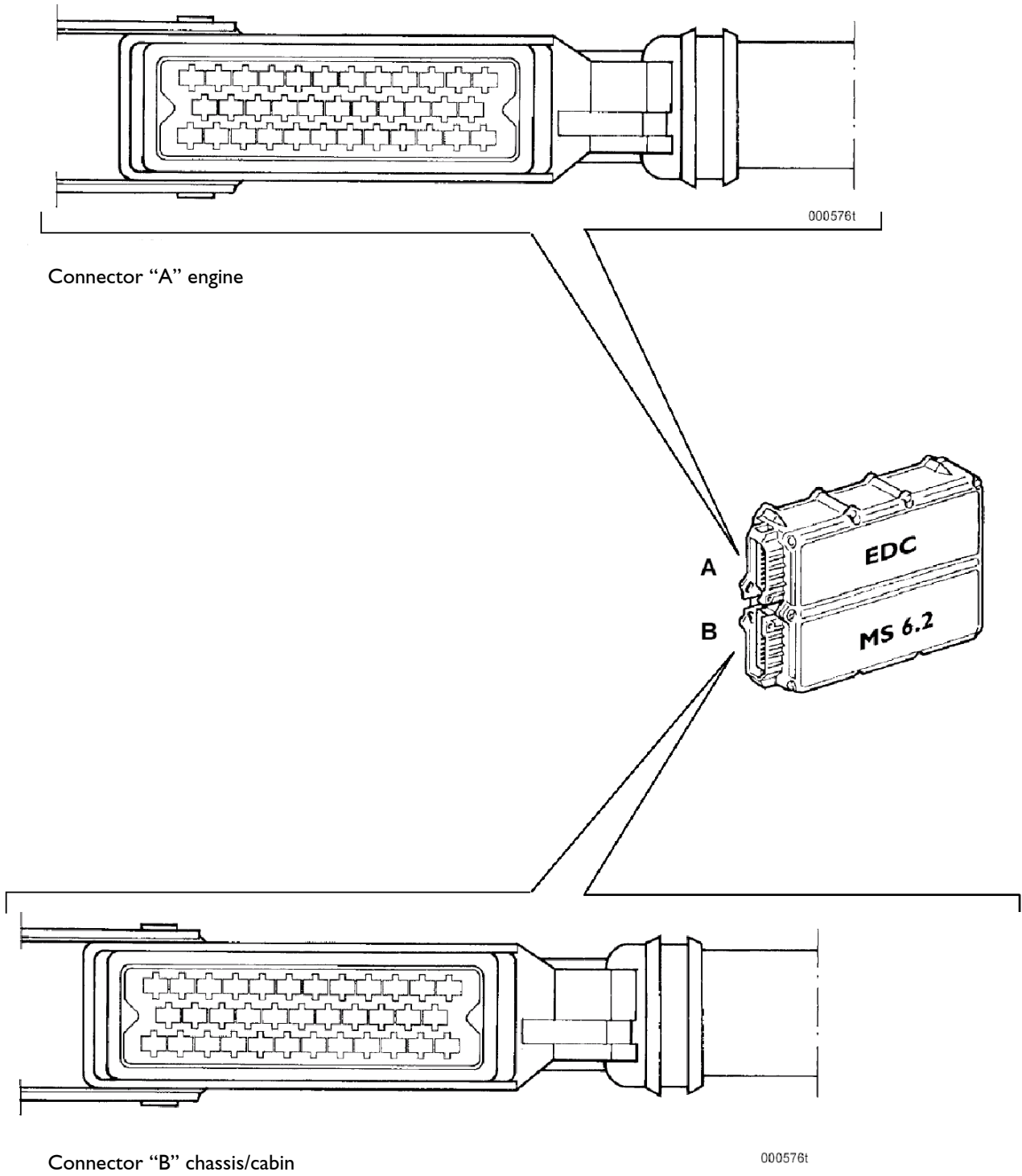
If you do not obtain the conditions illustrated in Figure 83 and described in points 1 and 2, proceed as follows:

- 1) loosen the screws (2) securing the gear (1) to the camshaft and utilize the slots (see Figure 85) on the gear (1);
- 2) turn the engine flywheel appropriately so as to bring about the conditions described in points 1 and 2 Figure 83, it being understood that the cam lift must not change at all;
- 3) lock the screws (2) and repeat the check as described above.

Tighten the screws (2) to the required torque.

EDC MS 6.2 electronic control unit

Figure 4



Air temperature sensor on manifold (85155)

Features

Vendor

BOSCH

Maximum torque

35 Nm

The device must carry Vendor identification, unit part number and manufacture date.

Together with the overfeed pressure sensor, this N.T.C. type sensor located on the intake manifold input downstream the intercooler on the engine left supplied the electronic center with the parameters required to identify proper air delivery values.

Figure 19

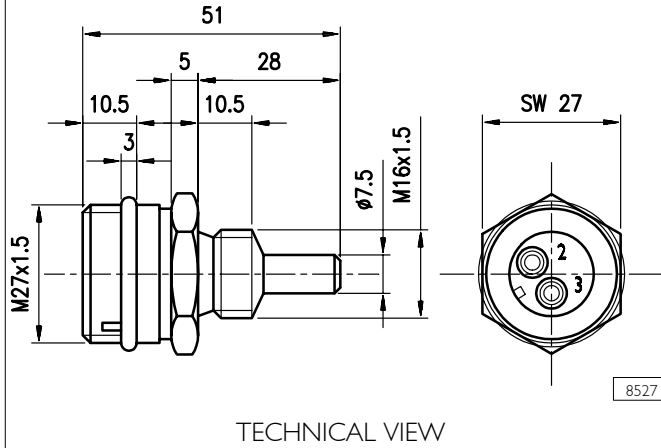


Figure 21

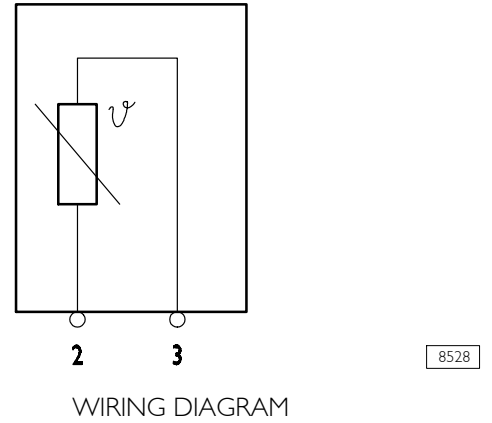


Figure 20

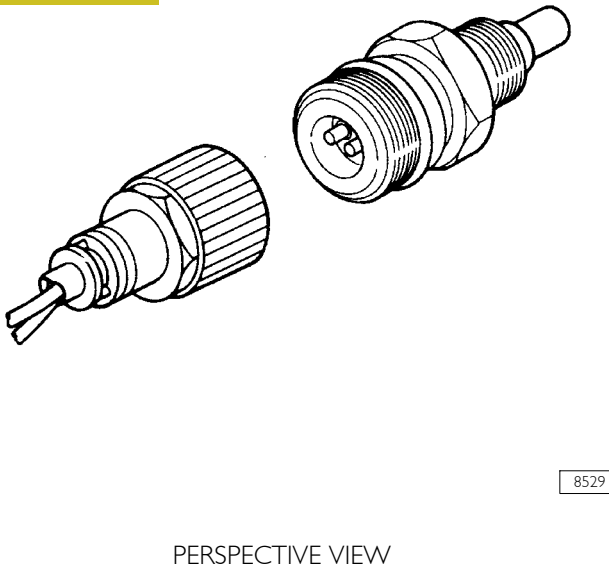
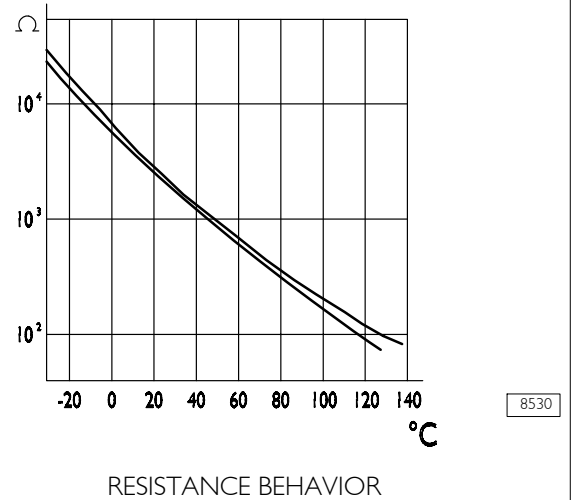


Figure 22



Connector	Function	Cable colour
1	To EDC center pin A 21	—
3	To EDC center pin A 4	—

PART 2

BLINK CODE	EDC WARNING LIGHT	POSSIBLE CAUSE	POSSIBLE RELATED ANOMALIES	RECOMMENDED TESTS OR MEASURES	REMARKS
I.1	ON steady	Faulty vehicle speed sensor. The tachograph won't work. Odd behaviour of the tachograph pointer. (if available)	Vehicle speed no longer reduced; it can be exceeded in case of poor resistance to progressing. Serration with high speeds.	Flight recorder detects high time at low speed. Check cabling, connections and component.	Control unit replacement value: 5 km/h.
I.2	ON steady	Faulty multiple-state switch. (If available)		Check cabling, connections and component.	
I.3	OFF	Faulty Cruise Control switches. (If available)	The Cruise Control won't work.	Check cabling, connections and component.	Or non-plausible switch signals (switches pressed simultaneously).
I.4	ON steady	Accelerator pedal: faulty potentiometer or non-plausible signal. Odd reaction of engine when actuating the accelerator pedal.			Engine speed can be varied by means of the CC (Set + / Set -) switch. (If available)
I.5	OFF	Faulty clutch switch. CC won't work. (If available)	Serration when changing gear.	Check cabling, connections and component.	
I.6	ON steady	Brake switch plausibility: No reaction after actuating the CC/PTO switches. (If available)	The Cruise control / PTO won't work.	Check cabling, connections and component.	
I.7	OFF	Brake switch / accelerator pedal sensor plausibility.			No reaction from the system.

OFF-PLANE OPERATIONS**EVERY 100.000 Km**

and possibly when a maintenance operation is carried out

23	Change fuel filter
----	--------------------

In the initial period at 150,000 km and then every 300,000 km

and possibly when a maintenance operation is carried out

22	Check and adjust valve clearance and injectors
----	--

Every year – Before winter

and possibly when a maintenance operation is carried out

4	Check the antifreeze percentage in the engine cooling water
---	---

Every two year

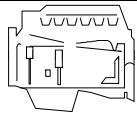
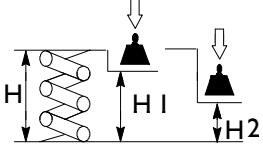
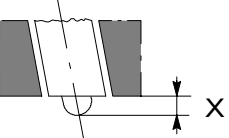
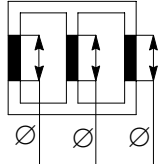
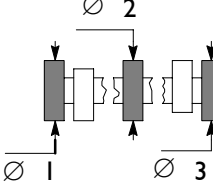
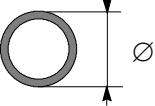
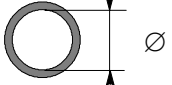



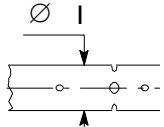
and possibly when a maintenance operation is carried out

7	Change engine coolant
---	-----------------------

13	Change cartridge and clean air filter container (1)
----	---

24	Change Blow-by filter
----	-----------------------

(1) Early air filter clogging is usually due to environmental conditions. For this reason, the filter should be changed if clogging is signalled by the related sensor, regardless of the prescriptions that shall be observed if no specific indications have been provided.

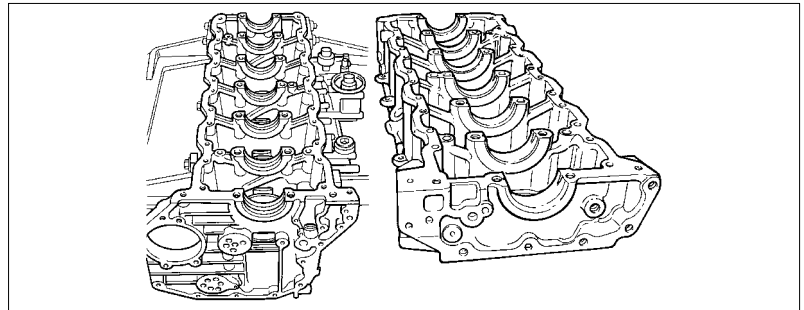
 Type	F3B	
	mm	
 <p>Valve spring height:</p> <p>free height H</p> <p>under a load of:</p> <p>575 ± 28 N H1</p> <p>1095 ± 54 N H2</p>		<p>72,40</p> <p>58</p> <p>45</p>
 <p>Injector protrusion X</p>	X	0.53 to 1.34
 <p>Camshaft bushing housing in the cylinder head: 1 ⇒ 7</p>	∅	88.000 to 88.030
 <p>Camshaft bearing journals: 1 ⇒ 7</p>	∅	82.950 to 82.968
 <p>Outer diameter of camshaft bushings: ∅</p>	∅	88.153 to 88.183
 <p>Inner diameter of camshaft bushings: ∅</p>	∅	83.018 to 83.085
 <p>Bushings and housings in the cylinder head</p>		0.123 to 0.183
 <p>Bushings and bearing journals</p>		0.050 to 0.135
 <p>Cam lift:</p>		<p>9.30</p> <p>9.30</p> <p>11.216</p>
 <p>Rocker shaft ∅1</p>	∅1	41.984 to 42.000

Selecting the main bearing shells (Journals with nominal diameter)

After reading off the data, for each of the main journals, on the crankcase and crankshaft, you choose the type of bearing shells to use according to the following table:

Figure 22

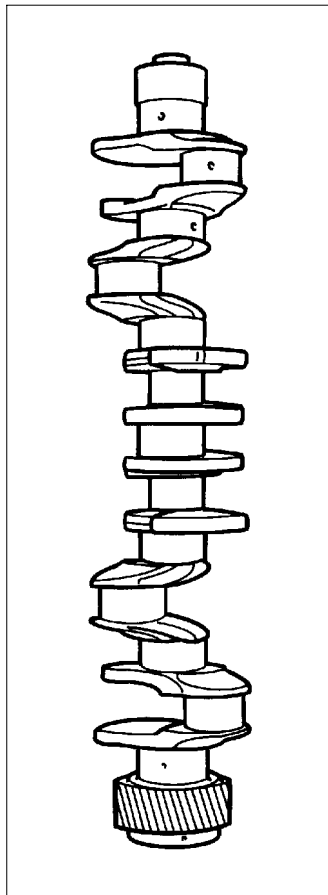
STD.



1

2

3



1

green

green

green

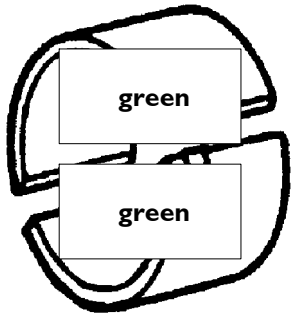
green

green

green

2

red



green

red

green

3

red

red

green

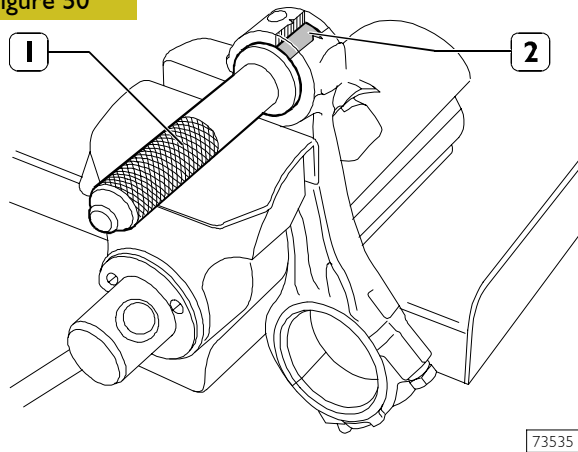
red

red

green

Connecting rods bushings

Figure 50

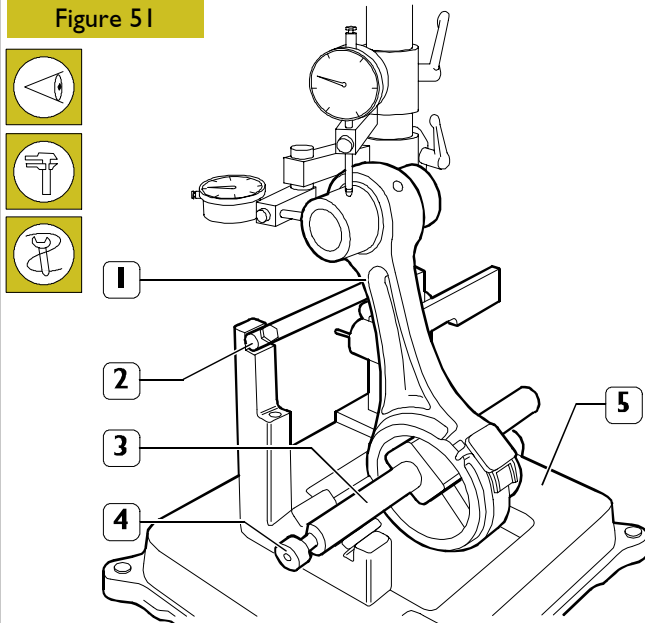


73535

Check the bushing in the small end has not come loose and shows no sign of scoring or seizure; replace it if it does. The bushing (2) is removed and fitted with a suitable drift (1). When driving it in, make absolutely sure that the holes for the oil to pass through in the bushing and small end coincide. Using a boring machine, rebore the bushing so as to obtain a diameter of 54.019 – 54.035.

Checking connecting rods

Figure 51



61696

Checking axis alignment

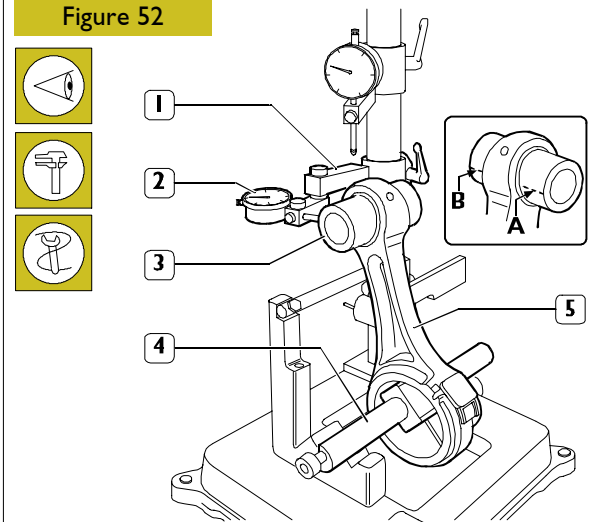
Check the alignment of the axes of the connecting rods (1) with device 99395363 (5), proceeding as follows:

Fit the connecting rod (1) on the spindle of the tool 99395363 (5) and lock it with the screw (4).

Set the spindle (3) on the V-prisms, resting the connecting rod (1) on the stop bar (2).

Checking torsion

Figure 52



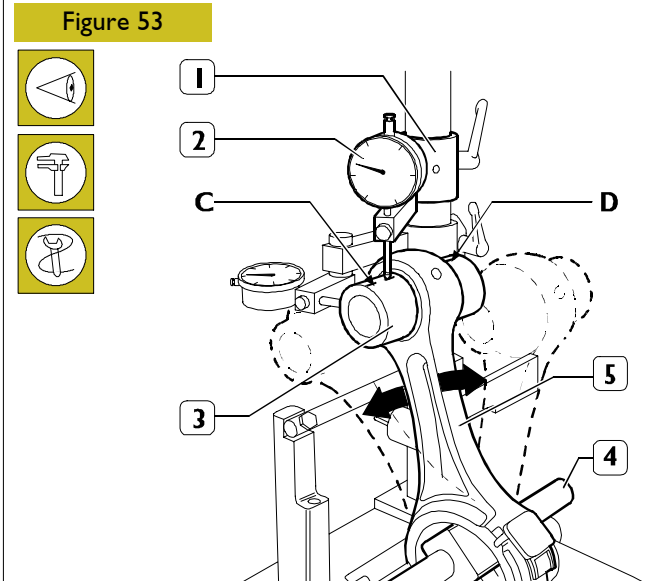
61694

Check the torsion of the connecting rod (5) by comparing two points (A and B) of the pin (3) on the horizontal plane of the axis of the connecting rod.

Position the mount (1) of the dial gauge (2) so that this pre-loads by approx. 0.5 mm on the pin (3) at point A and zero the dial gauge (2). Shift the spindle (4) with the connecting rod (5) and compare any deviation on the opposite side B of the pin (3): the difference between A and B must be no greater than 0.08 mm.

Checking bending

Figure 53



61695

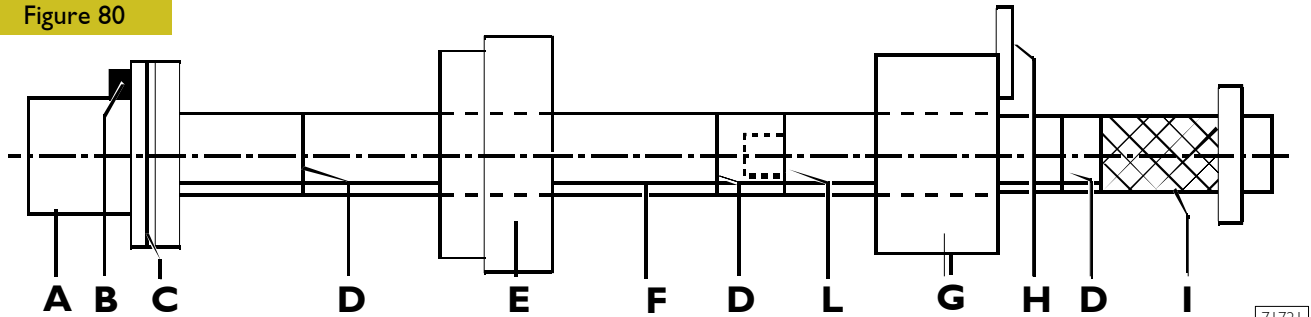
Check the bending of the connecting rod (5) by comparing two points C and D of the pin (3) on the vertical plane of the axis of the connecting rod.

Position the vertical mount (1) of the dial gauge (2) so that this rests on the pin (3) at point C.

Swing the connecting rod backwards and forwards seeking the highest position of the pin and in this condition zero the dial gauge (2). Shift the spindle (4) with the connecting rod (5) and repeat the check on the highest point on the opposite side D of the pin (3). The difference between point C and point D must be no greater than 0.08 mm.

Replacing camshaft bushes using beater 99360499

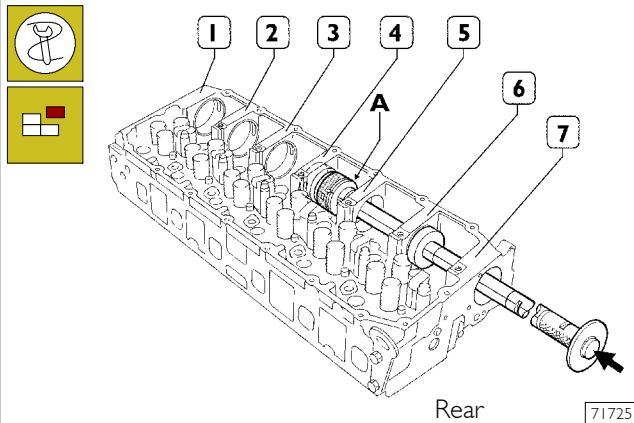
Figure 80



A. Drift with seat for bushings to insert/extract. - B. Grub screw for positioning bushings. - C. Reference mark to insert seventh bushing correctly. - D. Reference mark to insert bushings 1, 2, 3, 4, 5, 6 correctly (red marks). - E. Guide bushing. - F. Guide line. - G. Guide bushing to secure to the seventh bushing. - H. Plate fixing yellow bushing to cylinder head. - I. Grip. - L. Extension mount.

Removal

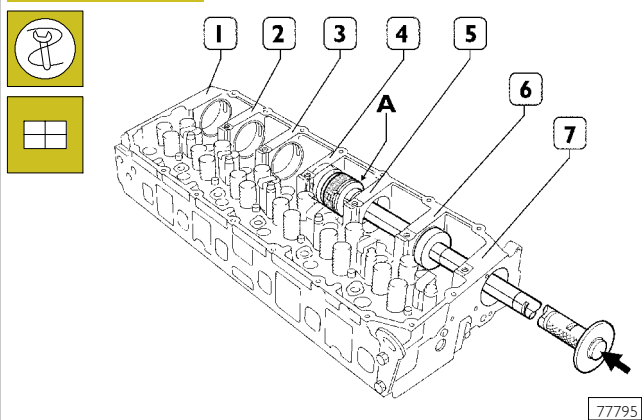
Figure 81



The sequence for removing the bushes is 7, 6, 5, 4, 3, 2, 1. The bushes are extracted from the front of the single seats. Removal does not require the drift extension for bushes 5, 6 and 7 and it is not necessary to use the guide bushing. For bushes 1, 2, 3 and 4 it is necessary to use the extension and the guide bushings. Position the drift accurately during the phase of removal.

Assembly

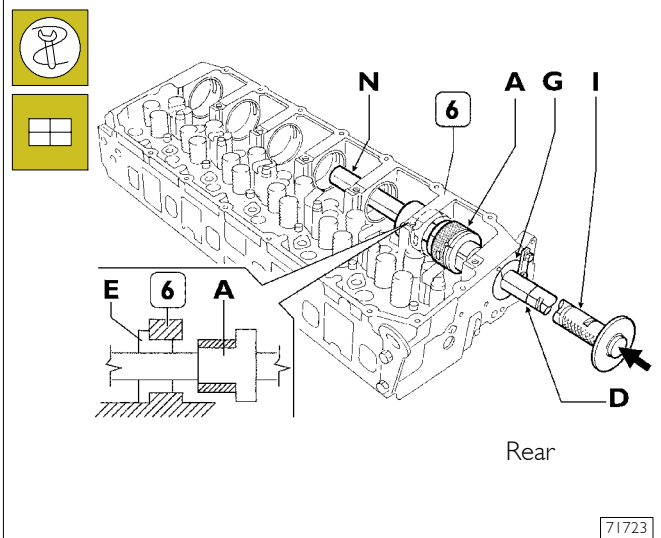
Figure 82



Assemble the drift together with the extension. To insert bushings 1, 2, 3, 4 and 5, proceed as follows:

- 1 Position the bushing to insert on the drift (A) making the grub screw on it coincide with the seat (B) (Figure 80) on the bushing.
- 2 Position the guide bushing (E) and secure the guide bushing (G) (Figure 80) on the seat of the 7th bushing with the plate (H).
- 3 While driving in the bushing, make the reference mark (F) match the mark (M). In this way, when it is driven home, the lubrication hole on the bushing will coincide with the oil pipe in its seat. The bushing is driven home when the 1st red reference mark (D) is flush with the guide bushing (G).

Figure 83

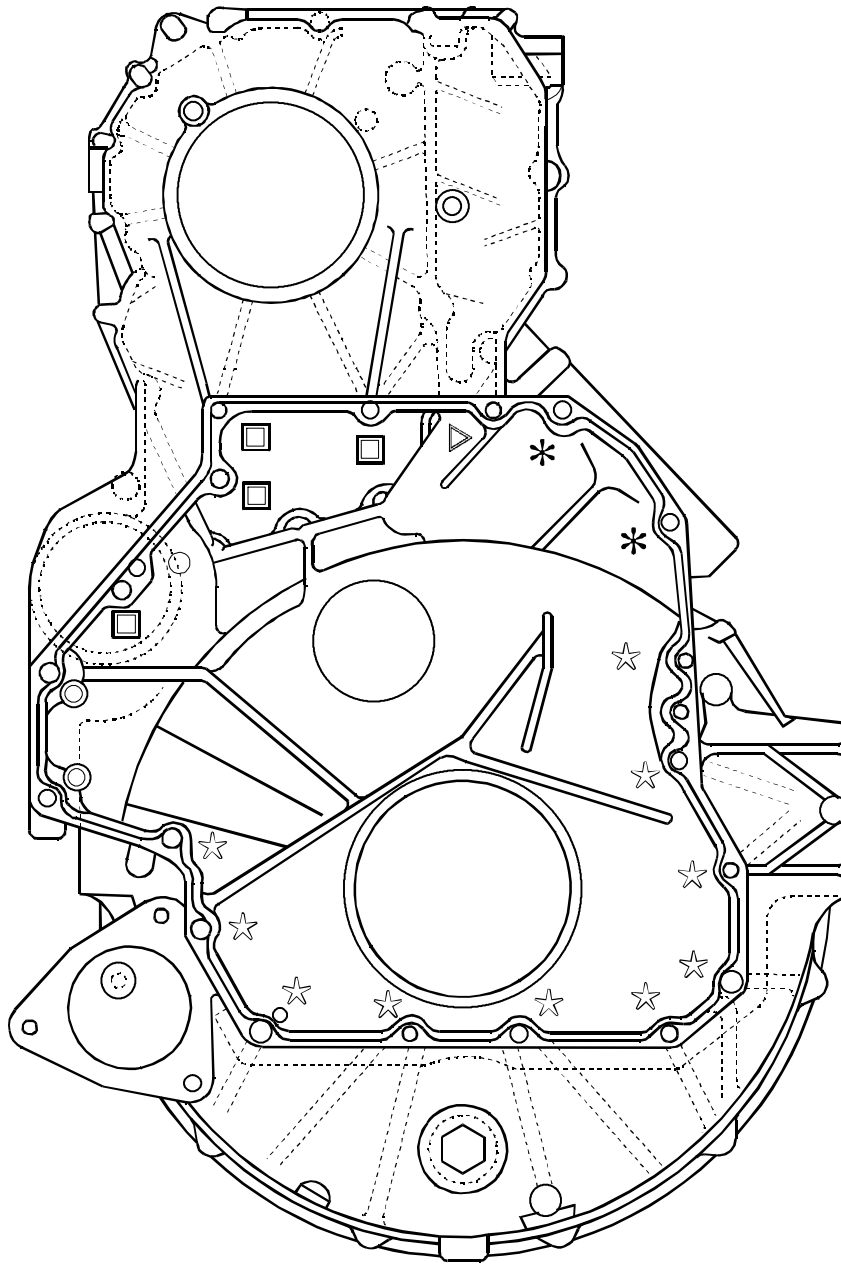


To insert the bushing (6), proceed as follows:

- Unscrew the grip (I) and the extension (N).
- Position the extension (N) and the guide bushing (E) as shown in the figure.
- Repeat steps 1, 2, 3.

Diagram of tightening sequence of screws fixing gearbox to crankcase

Figure 105



60633

Tightening sequence

- ☆ 10 screws M12 × 1.75 × 100
- 2 screws M12 × 1.75 × 70
- ◻ 4 screws M12 × 1.75 × 35
- △ 1 screw M12 × 1.75 × 120
- * 2 screws M12 × 1.75 × 193

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