MASERATI
ACADEMY

MASERATI 4200cc
F136 UC – F136 UD

Engine Overhaul Course

May 2008

English Version

Training Documentation for Maserati Service Network

FOREWORD

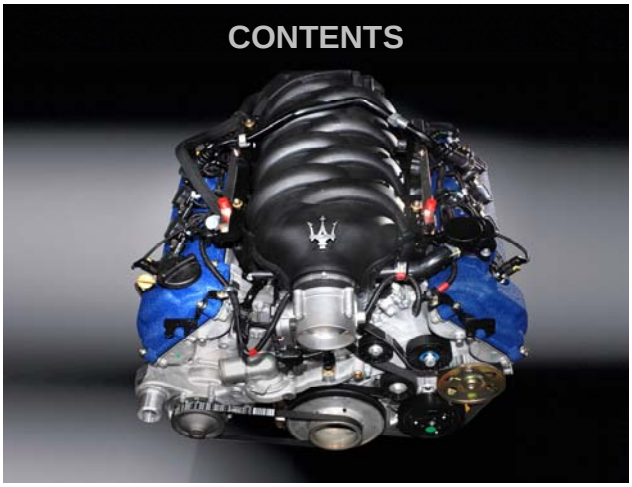
The purpose of this manual is to ensure the precise and rapid execution of the various maintenance/repair operations. It is intended for workshop managers and mechanics, and is designed to support their theoretical and practical training.

The document is divided into four main sections:

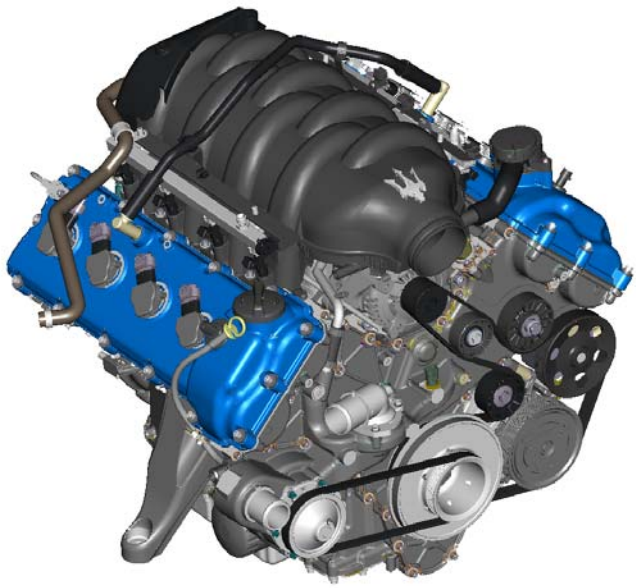
- **Technical description**
- **Engine disassembly**
- **Dimensional check**
- **Engine assembly**

In addition to the photos and diagrams in the manual, a summary booklet of CAD extrapolations is provided for easier and more intuitive engine wiring.
The operations are extensively illustrated to facilitate identification of the necessary component or assembly, as well as any tools required for the operation at hand. For quick reference purposes, tightening torques are summarised at the end of the technical manual.

As regards individual operations such as disconnection and connection, assembly and disassembly, procedures are indicated according to the requirements of the operation being described.
In addition to operating instructions, technical data is provided for the purpose of carrying out tuning, tests and checks. Every effort has been made to ensure that this data is up-to-date at the time of publication.



INTRODUCTION



Derived from the F136S power unit and upgraded with a wet sump lubrication system, the new-generation engine guarantees the same high torque and power delivered by dry sump engine technology, but has been optimised and revised to enhance its reliability.

Continuous timing variators on the intake camshafts. Controlled by a low-pressure hydraulic system;

Motor-driven throttle (Drive by Wire).

Cylinder heads in hardened aluminium/silicon alloy with high volumetric and thermodynamic efficiency combustion chamber.

Crankcase in hardened aluminium and silicion alloy, completely redesigned with cast-iron cylinder liners.

Single-cast crankshaft in hardened steel, individually balanced, resting on five main bearings.

Integrated Bosch Motronic ME7 ignition-injection system.

Four overhead camshafts (two per bank) and four valves per cylinder, controlled by hydraulic tappets.

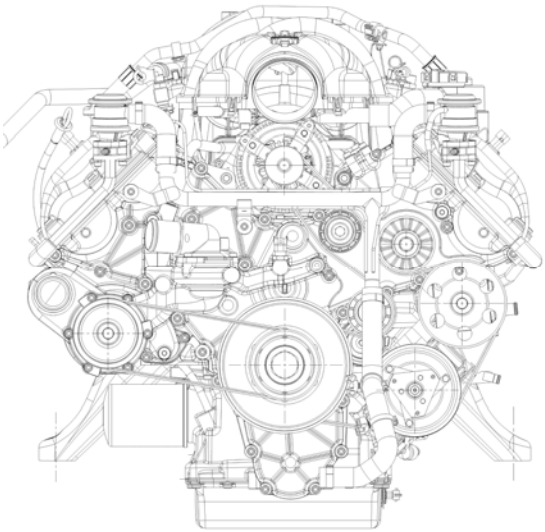
Timing controlled by chains whose tension is guaranteed by two hydraulic tensioners.

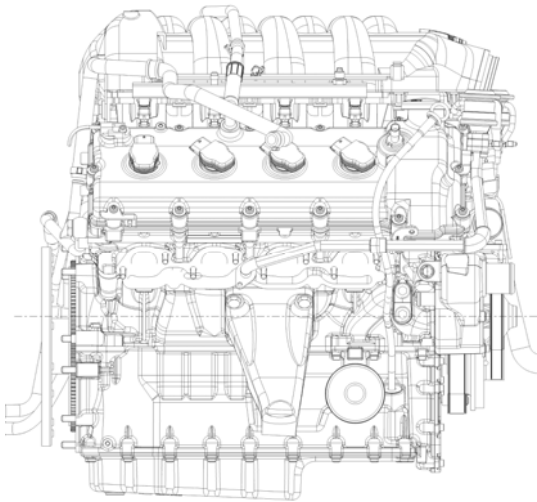
Wet-sump lubrication by means of an oil pump integrated into the engine, oil/water heat exchanger integrated into the upper crankcase.

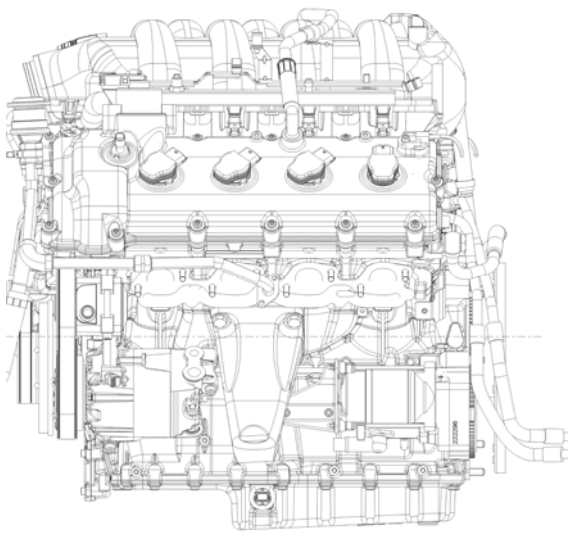
Cooling circuits comprising circulation of an antifreeze mix and water circulation pump driven by engine pulley.

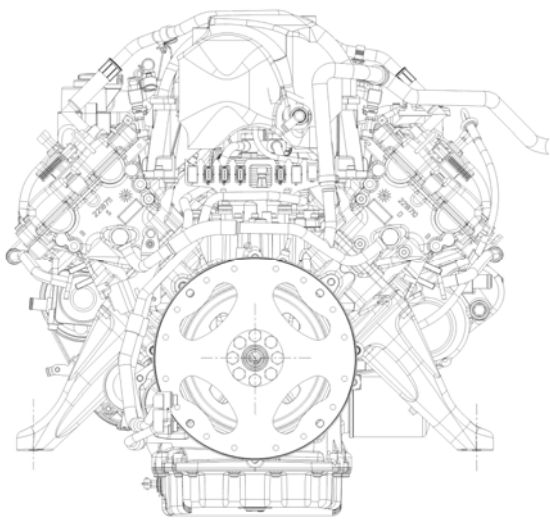
Plastic intake manifold with optimised duct lengths.

Engine Views









General Characteristics

Type code	**F136 UC(M139 P**
Cycle	**Eight**
Number and position of cylinders	**8-90° V**
Number of valves per cylinder	**4**
Bore and stroke	**Ø 92, stroke 79.8 mm**
Displacement per unit	**530.479 cm^3**
Total displacement	**4244 cm^3**
Combustion chamber volume	**52.74 cm^3**
Height of combustion chamber in head	**6.6 mm**
Compression ratio	**11:1**

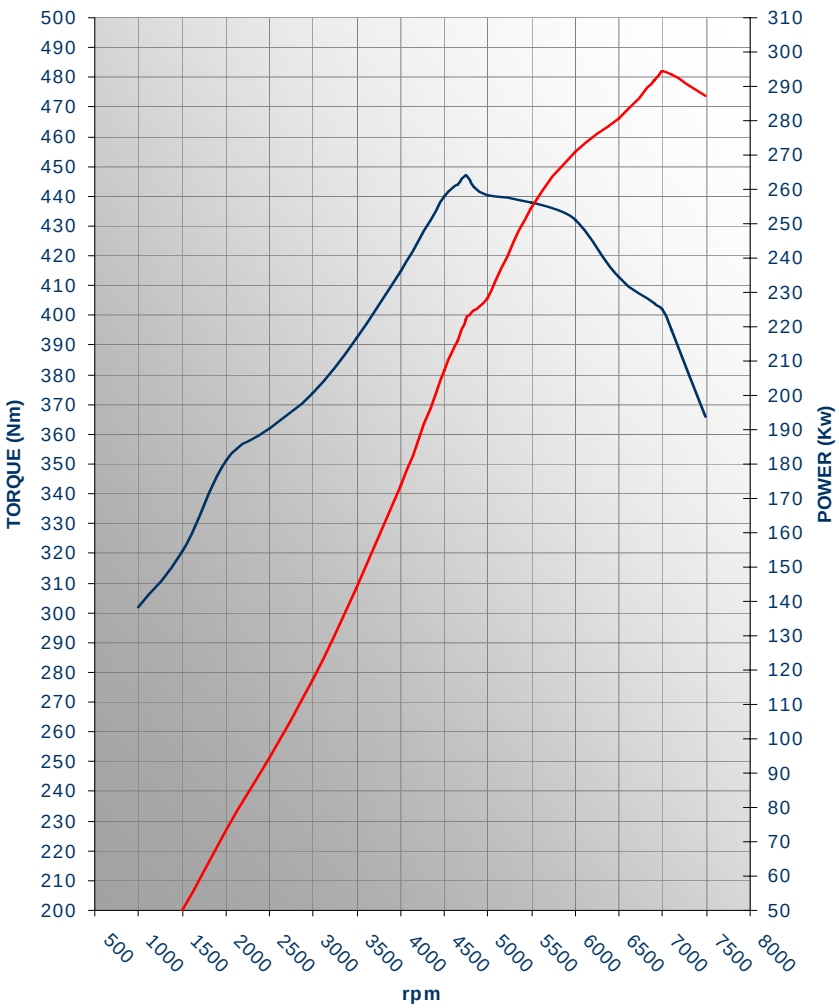
Valve timing with 4 valves per cylinder and hydraulic clearance compensation ∅ **35 mm**

Intake valve	∅ **37.8 mm**
Exhaust valve	∅ **31.0 mm**

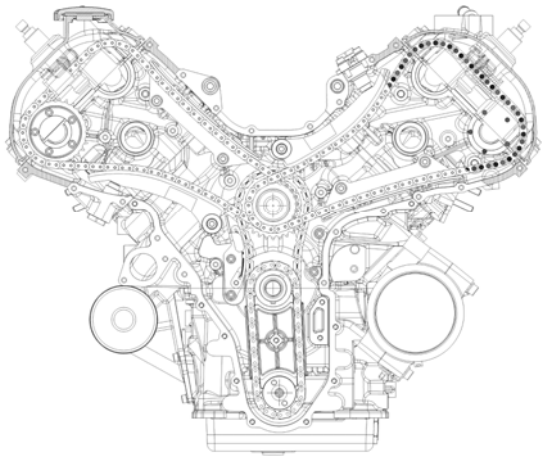
Lift on exhaust valves without clearance:

Intake	**9.5 mm ±0.05**
Exhaust	**9.3 mm ±0.03**
Timing adjustment on intake stroke	**50°**
Timing variator deactivated	**-15°**
Timing variator activated	**35°**
Intake valve lift at TDC with variator deactivated	**0.05 mm**
Exhaust valve lift at TDC with timing 0°	**0.57mm**
Firing order:	**1.8.6.2.7.3.4.5**

Max. power (EEC)	**298 Kw – 405 HP**
Corresponding speed	**7100 rpm**
Max. torque (EEC)	**460 Nm – 47 kgm**
Corresponding speed	**4750 rpm**
Max. permitted engine speed	**7250 rpm**
Injection	**Bosch Motronic ME7.1.1**
Fuel supply pressure	**3.8 bar**
Ignition coil	**Bosch - ELDOR**
Ignition spark plugs	**NGK PMR8B**
Alternator	**Nippondenso 12V - 150 A**
Battery	**FIAM 12V 100Ah - 850A**

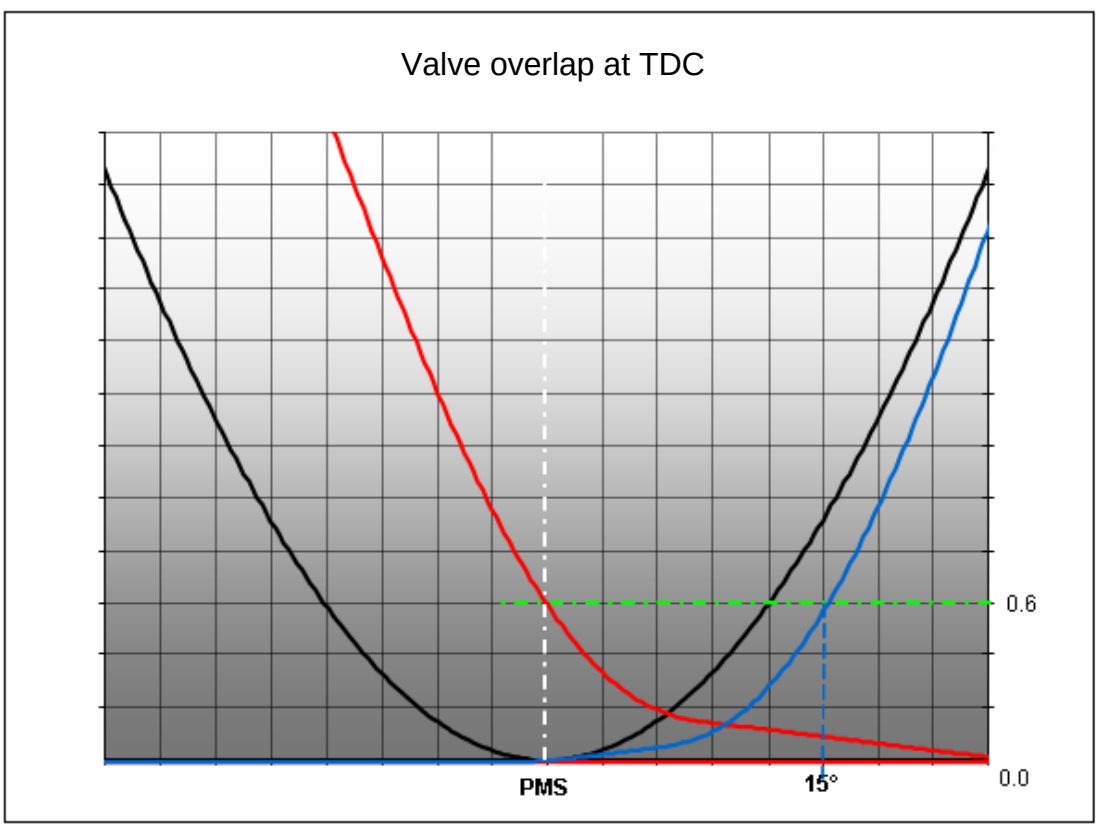


Engine Timing Adjustment F136 UC



INTAKE TIMING ADJUSTMENT F136UC

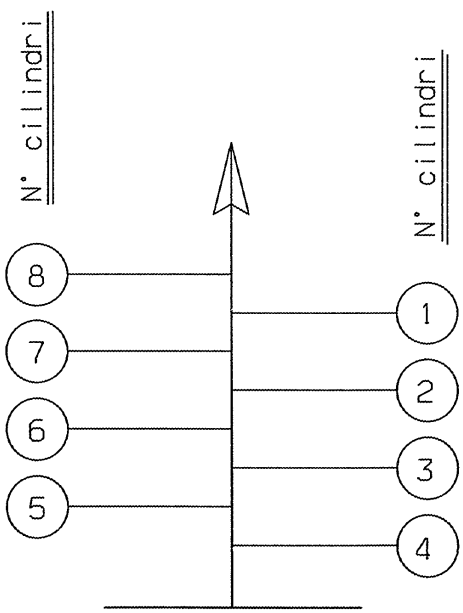
Rotate the crankshaft by **15°** after TDC; this corresponds to a stroke of 1.75 mm of the piston after top dead centre.
Check that the downstroke of the tappet (which began before the TDC), consequently the opening of the intake valve, is **0.59±0.08** mm.



EXHAUST TIMING ADJUSTMENT F136UC

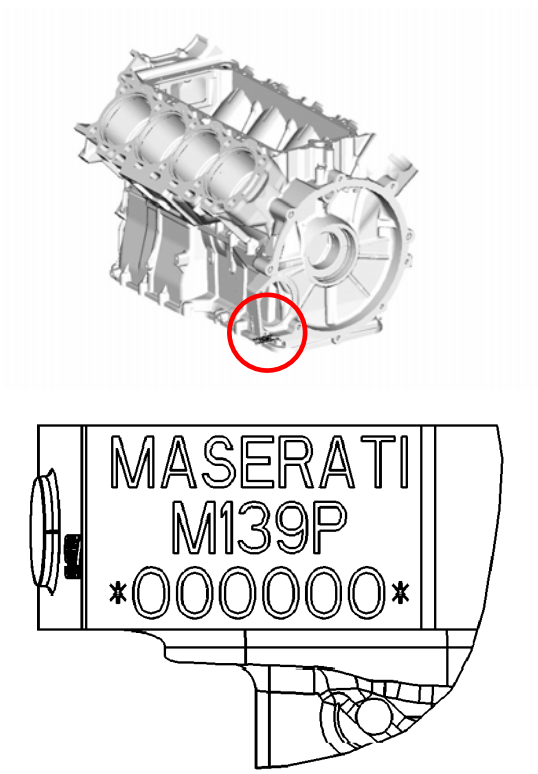
Rotate the engine in clockwise direction and position the first piston at TDC with the camshafts in the balanced position (exhaust closed and intake open). Make sure that the corresponding dial gauge is set to zero.
Place the tip of the dial gauge on the tappet of an exhaust valve.
The dial gauge stem must be in a position which is as perpendicular as possible with respect to the tappet surface.
Reset the dial gauge measuring the shift of the exhaust tappet.
Rotate the crankshaft in clockwise direction until one exhaust valve is closed.
Check that the downstroke of the tappet, consequently the opening of the exhaust valve, is **0.57±0.08** mm.

Cylinder Numbering



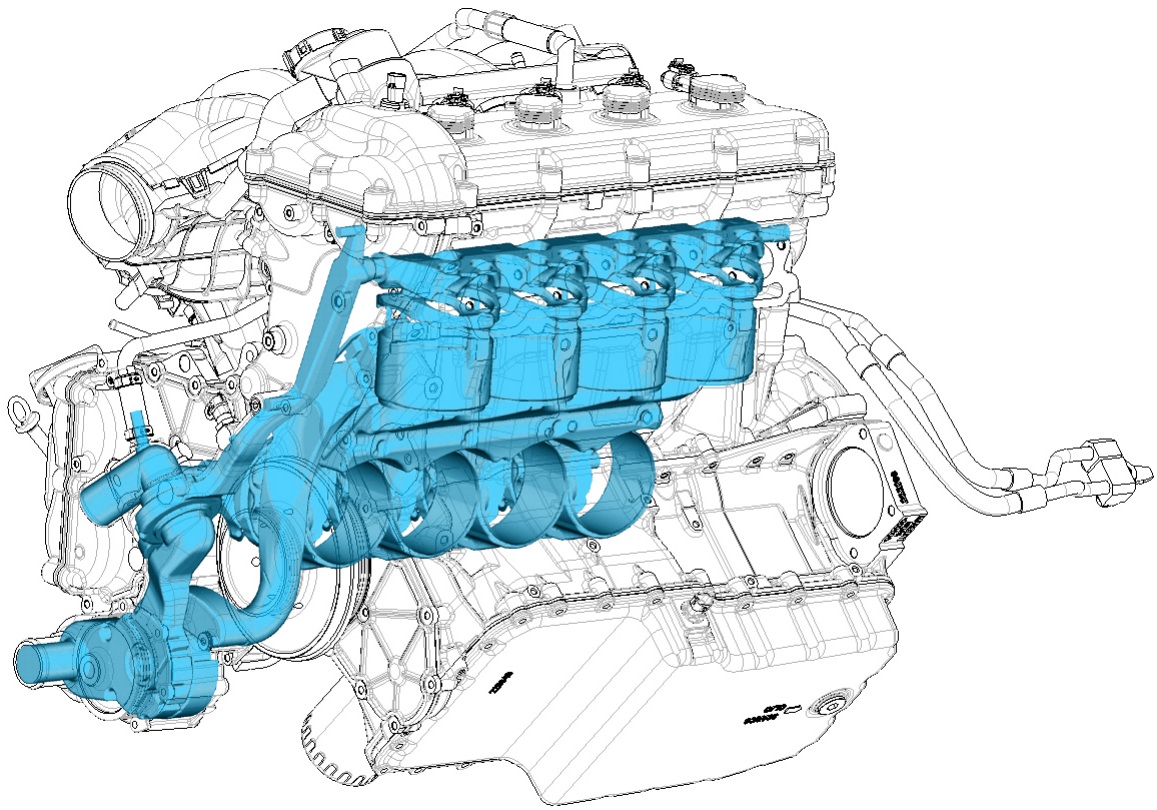
ENGINE FLYWHEEL

Location of Engine Code and Number



COOLING SYSTEM

Coolant circulation is activated by a **centrifugal pump**, which is driven by the camshaft by means of a poly-V drive belt



Pump

Centrifugal water pump with bypass incorporating the thermostatic valve.

Circuit

Maximum pressure 3.4 bar water pump outlet

Radiator

The water radiator is located in the front of the engine compartment.

The electric suction fans are located on the radiator hood and are common to the water radiator, AC condenser and hydraulic steering coil.

Expansion tank

Located on the right-hand side of the engine compartment.

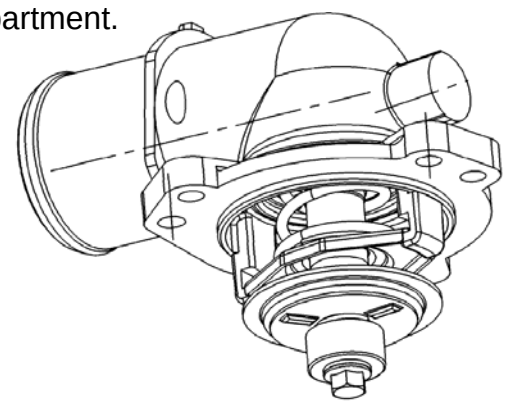
Thermostatic valve

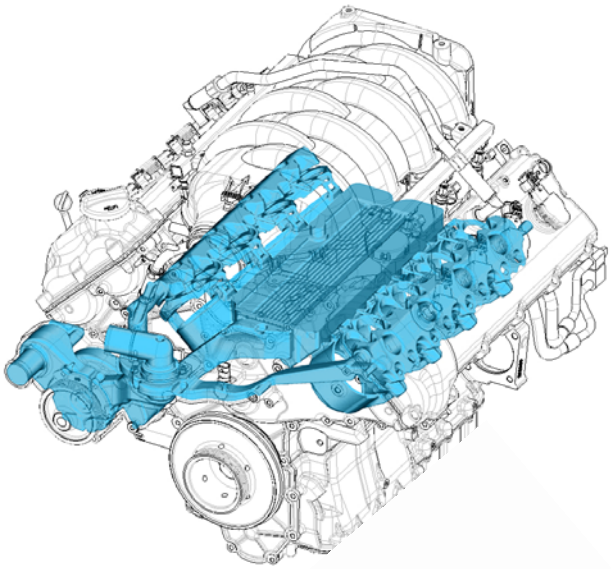
Integrated with water union, located on the front sump

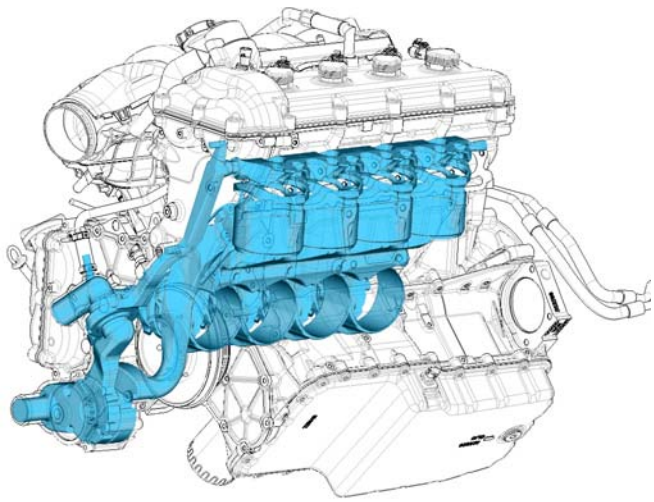
Stroke start temperature 85°C±2

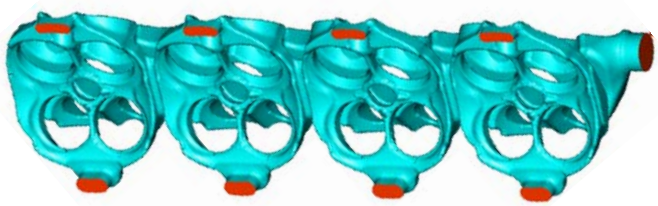
Valve closing temperature 95°C±2

Max. operational temperature 130°C







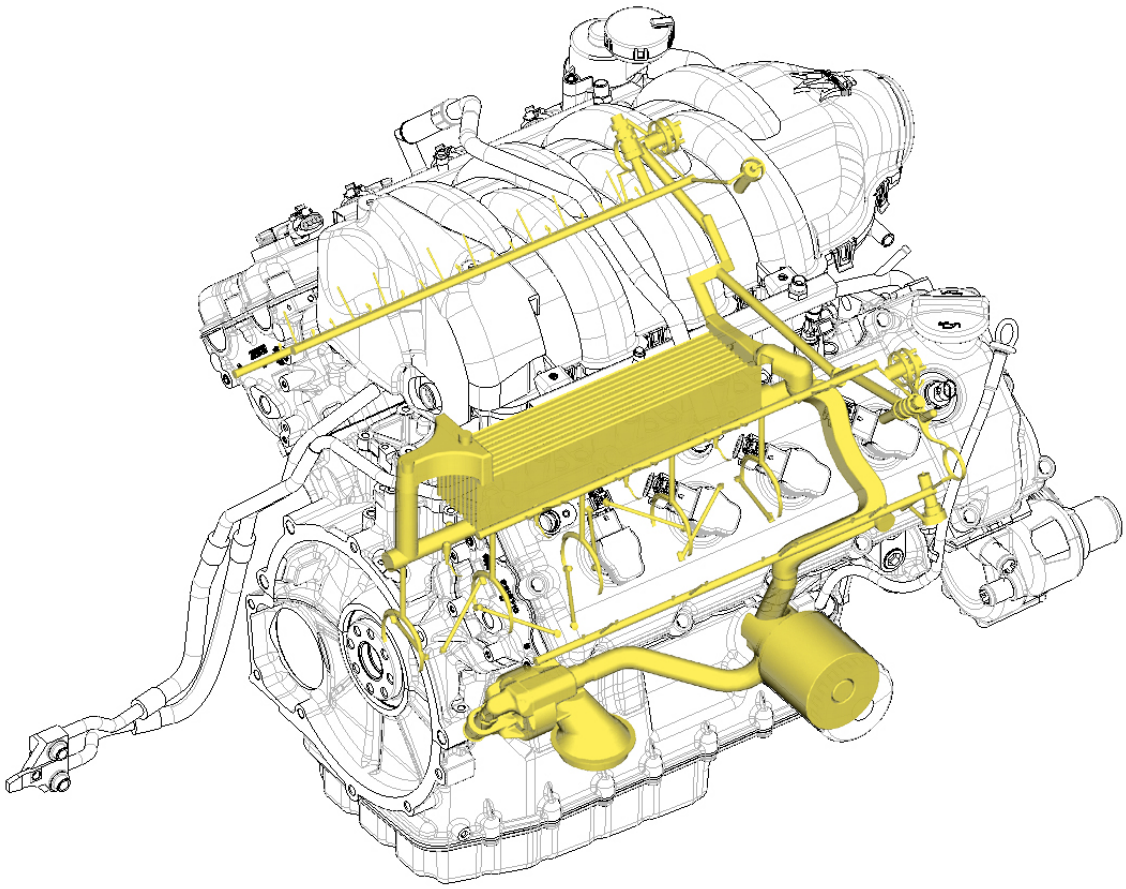


Engine head water cavity

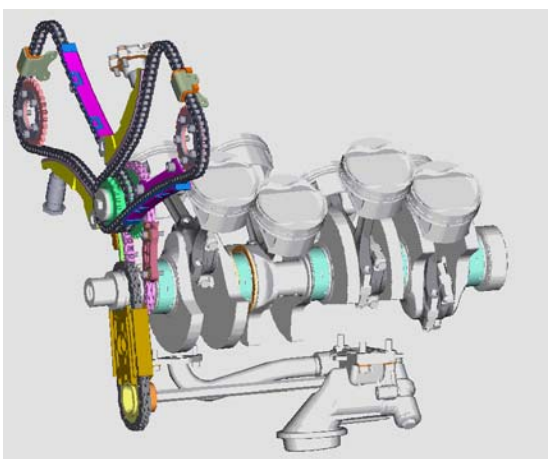
RPM	Radiat[illegible]	ressure	H2O Pump Line Pressure	H2O_PORT
rpm	[illegible]		bar	L/h
995.4	0.25827		0.3529	1647
1501.7	0.27797		0.4406	2899
1999.5	0.28722		0.5575	4037
2496.6	0.28579		0.6904	5033
2999.7	0.28371		0.8481	6014
3496.8	0.28414		1.0196	6928
3996.8	0.28535		1.2596	8071
4496.8	0.3006		1.4834	8959
4994.5	0.28539		1.7831	10098
5493.9	0.29204		2.0798	11128
5997.5	0.2873		2.4042	12118
6498.9	0.27827		2.7568	13182
6996.4	0.27058		3.104	14143
7496.9	0.26032		3.4373	14939

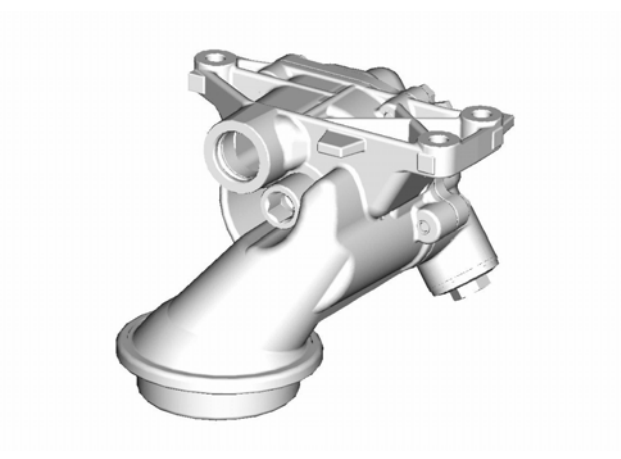
LUBRICATION SYSTEM

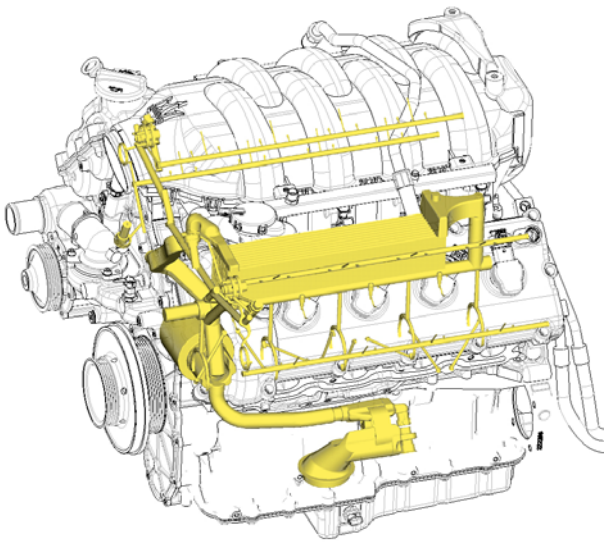
Lubrication is performed by the wet-sump system by means of an oil pump integrated into the engine crankcase and corresponding strainer.
Oil is cooled by the oil/water heat exchanger which is integrated into the engine block.

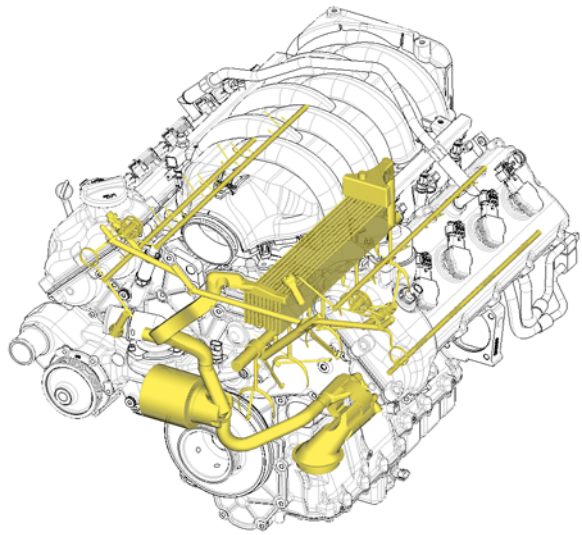


Oil reservoir
The engine oil reservoir is integrated to the engine by means of the oil sump.
Lubrication pressure
4 bar with oil temperature of 100°C at 6000 rpm
Quantity of oil in sump
Max. level 9 L

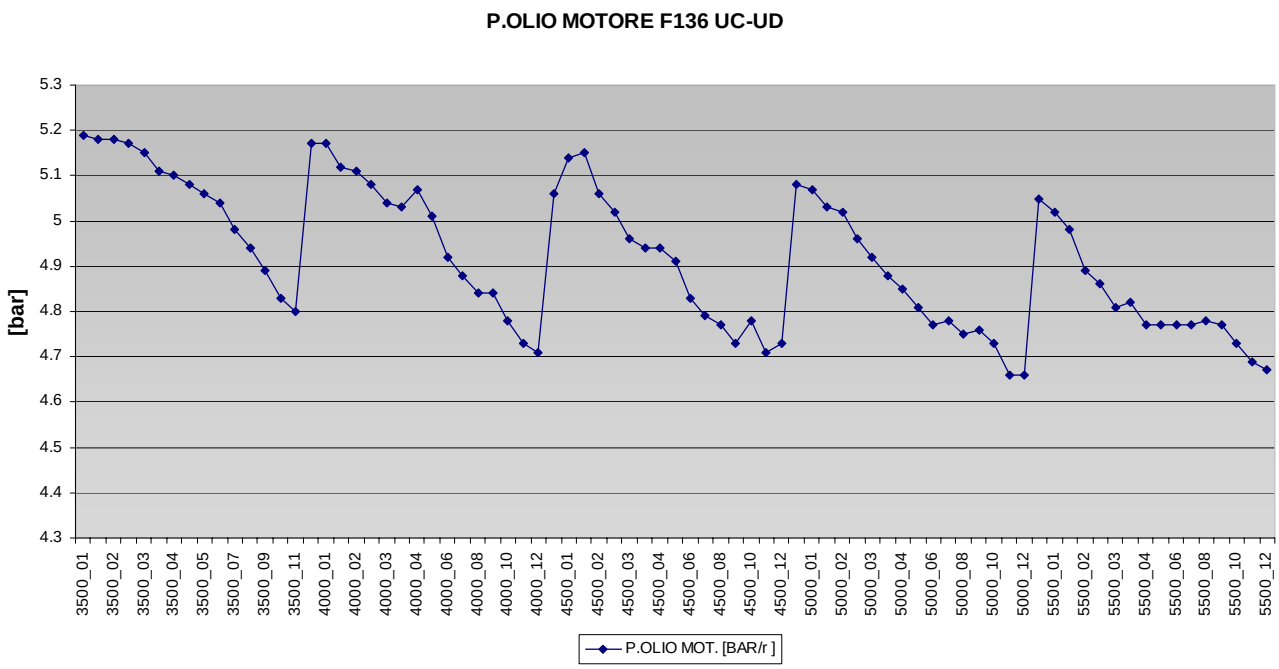


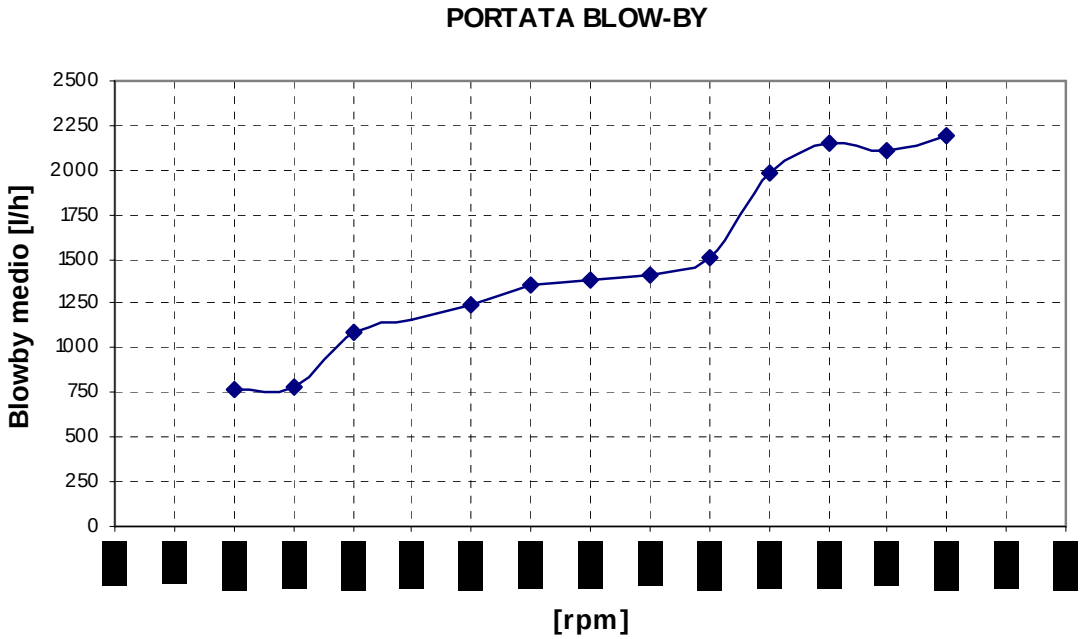


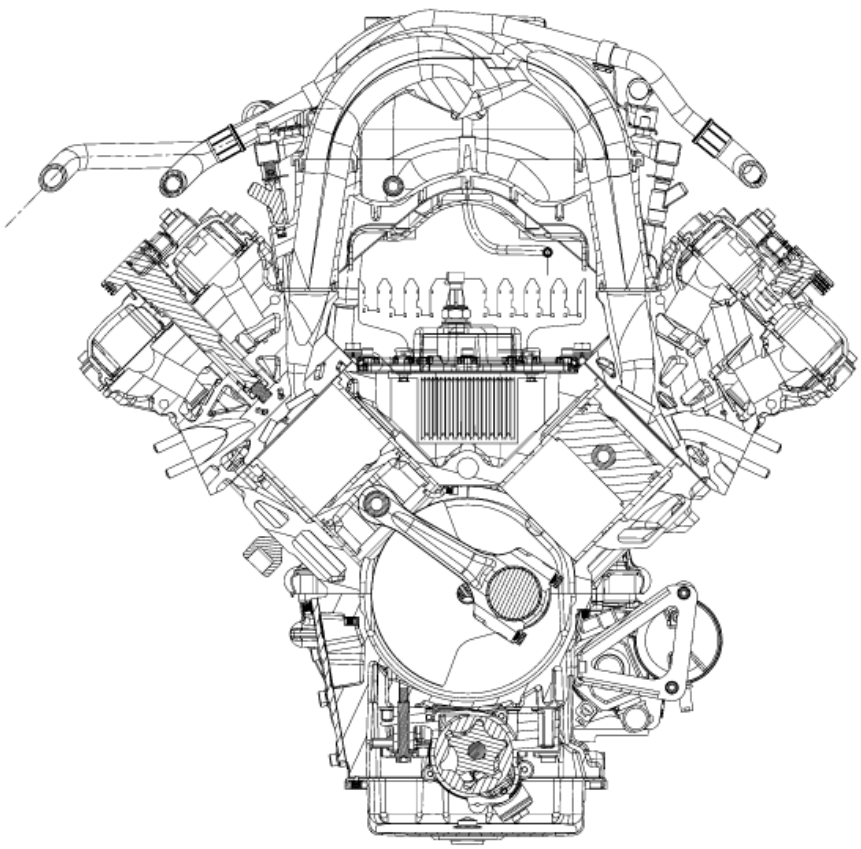




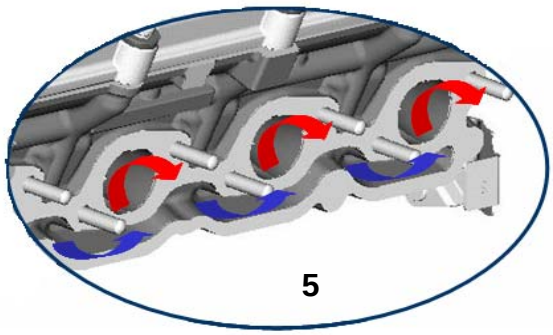
Throttle opening	RPM	EFF. AVE. PR.	ENG. OIL. P.	FR. SUMP P.
%	rpm	[BAR]	[BAR/r]	[BAR/as]
9.25	3500	0.50	5.19	1.014
10.49	4000	0.50	5.17	1.013
11.58	4500	0.50	5.06	1.011
13.01	5000	0.50	5.08	1.011
14.28	5500	0.50	5.05	1.013
99.89	5500	12.00	4.67	1.008

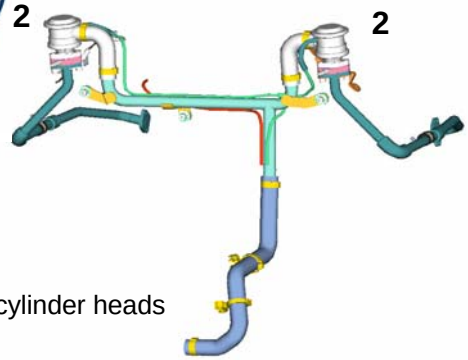


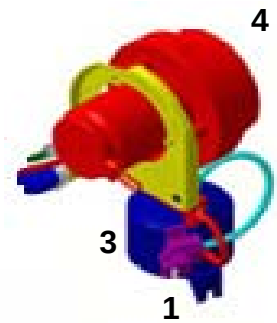

PORTATA BLOW-BY
Blowby medio [l/h]
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
[rpm]



SECONDARY AIR SYSTEM







1. Solenoid valve
2. Pneumatic valves
3. Vacuum tank
4. Secondary air pump
5. System for secondary air injection into cylinder heads (wet sump engine)

In order to reduce emission levels in accordance with the prescriptions set down in the various regulations, the catalytic converters must reach their operating temperature very rapidly following a cold start.

One way of speeding up heating of the catalytic converters is to retard to ignition advance when the engine is cold; another method is to install a secondary air injection system.

During the "light off" period (brief interval after cold starting during which the catalytic converter is inoperative) the engine runs in "Open Loop" mode with a rich mixture (Lambda ≅ 0.75). Combustion is incomplete in the cylinder and the exhaust gas contains a high concentration of HC and CO.

By injecting air in the vicinity of the exhaust valve a chemical reaction occurs in the duct between the HC, CO (both of which are present in excess) and the O_2 present in the injected air. In this manner the unburnt fuel is subsequently burnt in the exhaust system.

The heat generated by this process causes rapid heating of the catalytic converters; Moreover, emissions are significantly reduced thanks to this "completion" of the combustion process.

The secondary air system is composed of an electric pump controlled by a relay, two pneumatic valves that close the line when the system is inoperative, and a solenoid valve that controls the pneumatic valves by means of the vacuum provided by a connection with the plenum chamber.

The secondary air system is activated by the ECU after a cold start and only when engine temperature is in the range -7 to + 40°C. In these conditions the engine runs in "Open Loop" conditions.

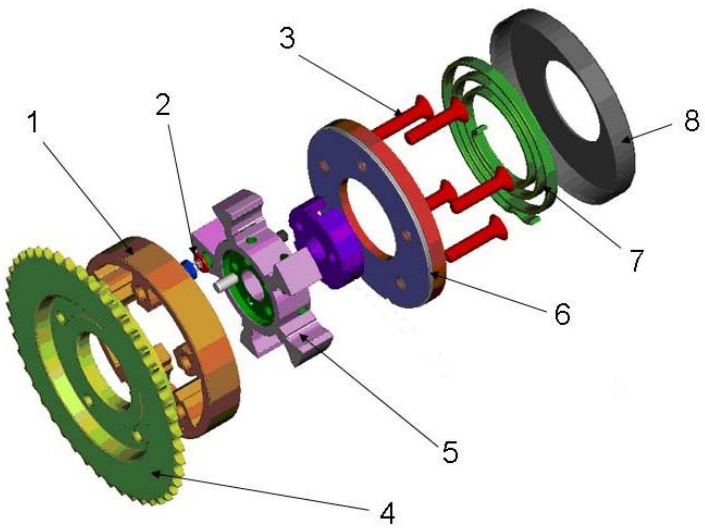
During this phase the signal emitted by the oxygen sensors is used to calculate the temperature of the catalytic converters, based on a mathematical calculation model.

TIMING ADJUSTMENT SYSTEM

The adoption of continuous timing variators on the intake camshafts mean that 82% of torque is available from 2500 rpm. This translates into exceptional pick-up capacity even with long gears, allowing comfortable driving on motorway journeys and, in general, the engine's full potential can be exploited over the entire operating range.

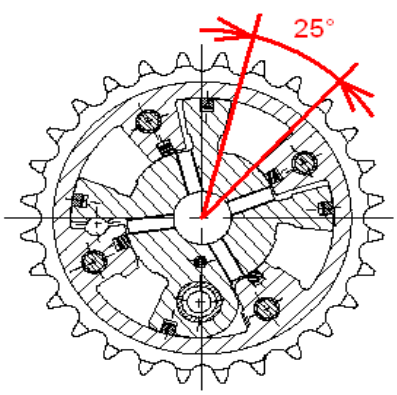
The timing of the intake camshafts can be modified continuously between maximum retarded and maximum advanced position.

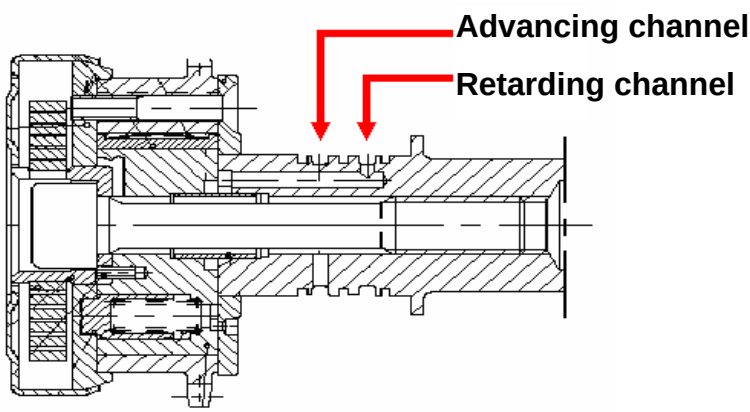
Angular rotation: 25°±0.25' corresponding to 50 crankshaft degrees.
Oil volume for complete actuation: 15.54 cm^3



1. Stator
2. Fastening pin
3. Fastening screws
4. Cogwheel
5. Rotor
6. Rear flange
7. Clock spring
8. Front flange

The Variable Valve Timing (VVT) system uses a hydraulic actuator on each intake camshaft which is operated by engine oil pressure (low pressure type). The VVT-actuator consists of a external part (stator), which is fixed to the timing gear, and an internal part (rotor), which is fitted on the intake camshaft. The mutual shape of rotor and stator internally create different chambers: four advancing chambers and four retarding chambers. The division of oil pressure in the advancing chambers and retarding chambers determines the position of the VVT-actuator.

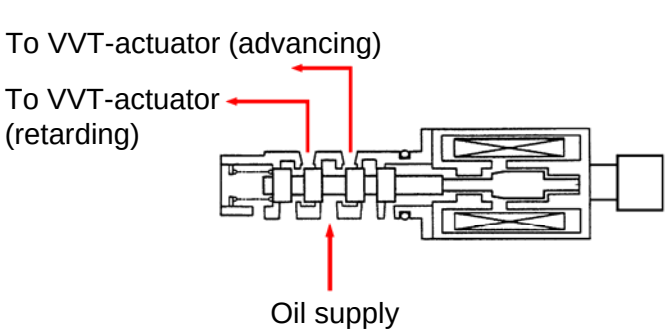


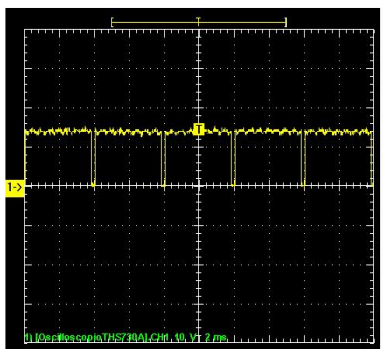


The division of oil pressure in the advancing chambers and retarding chambers determines the position of the VVT-actuator.

ACTUATOR CONTROL

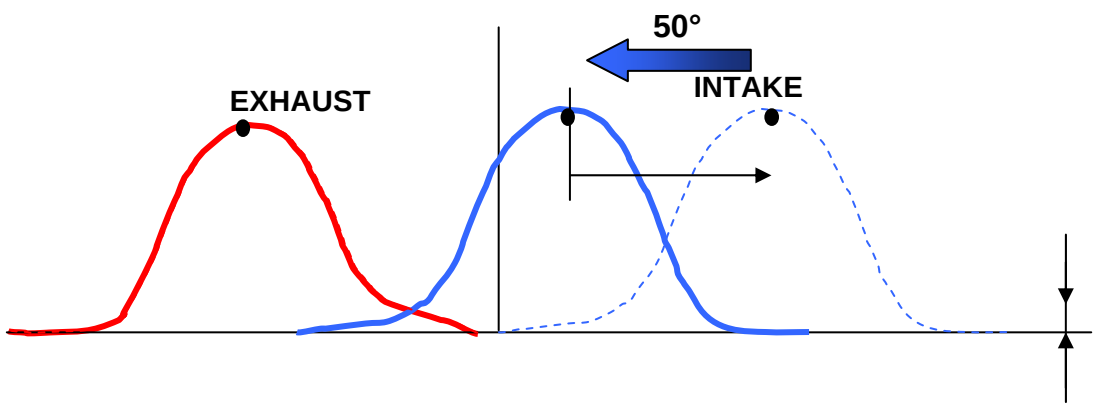
Each VVT-actuator is regulated by a solenoid valve which controls the oil supply towards the advancing chambers and retarding chambers.





The solenoid valves are controlled directly by the engine control module (NCM) by means of a PWM signal (pulse width modulation) and on the basis of programmed mapping (which depends on the engine load and RPM). The engine control module constantly monitors the actual position of the VVT-actuators by comparing the signals from the crankshaft position sensor and the camshaft position sensors. When the oil control solenoid valve is in its rest position, the oil supply is connected to the retarding channel, while the advancing side circuit is drained towards the sump.

ACTUATION MODE



Variator deactivated: Timing -15°

Variator activated Timing 35°

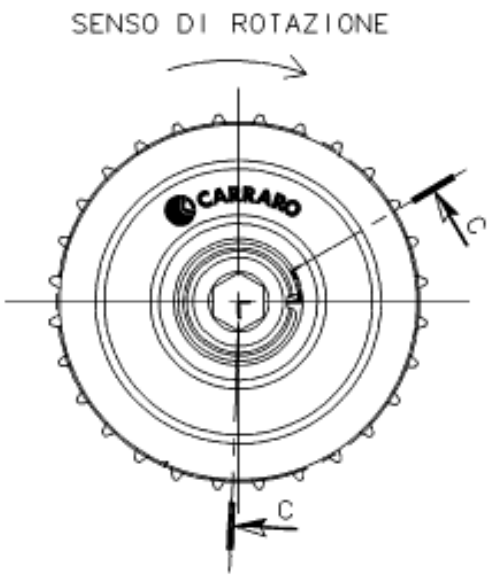
Engine idling: intake timing is retarded. Late opening of the intake valves minimises valve overlap. This guarantees stable combustion and smooth idling.

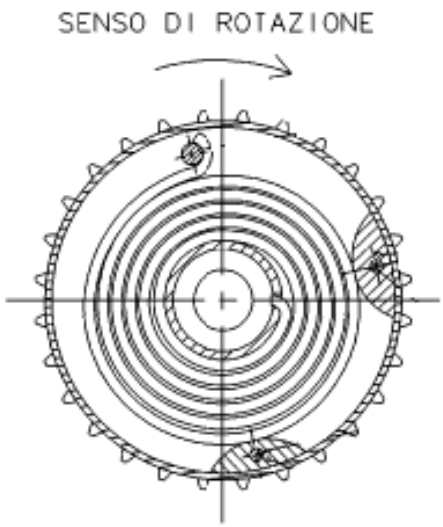
Low and middle revs, medium to high load: intake timing is advanced. Early opening of the intake valves creates high valve overlap. Exhaust gasses are partially re-burned which lowers combustion temperature and reduces emissions of NOx. Early closing of the intake valves at low revs improves volumetric efficiency.

High revs, full load: intake timing is retarded. Late closing of the intake valves improves volumetric efficiency as a result of the high inertia of the incoming air.

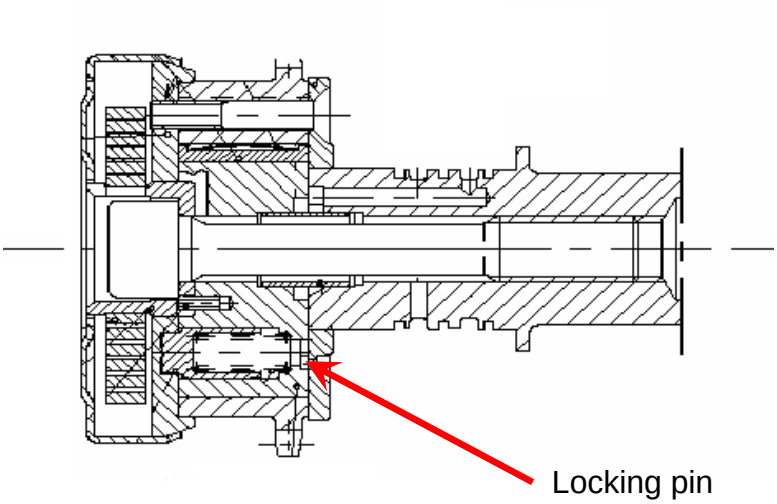
ADVANCED ADJUSTMENT

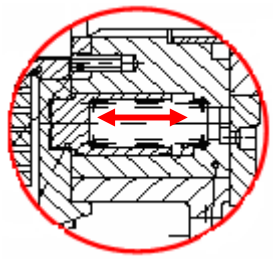
Inside the VVT-actuator, a clock spring is installed. The applying force of the spring is assisting the oil pressure when moving the rotor in the forward (advancing) direction. This is necessary because of the high valve operating reaction forces, tending to move the rotor in its backward position.



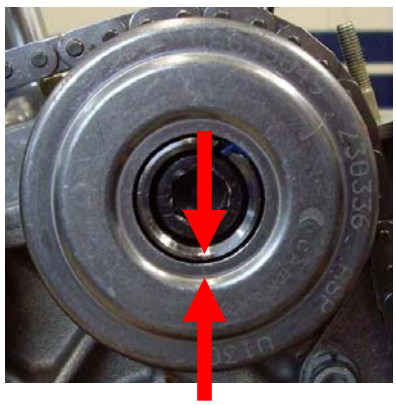


MECHANICAL LOCKING SYSTEM: when switching off the engine, the solenoid valve is brought back to the retarded position, this to make sure the VVT-actuator returns to its rest position, against the force of the internal spring.
Inside the rotor of the VVT-actuator, a locking pin is installed. When the VVT-actuator is in its rest position, the locking pin is pushed into the stator by the force of a spring. In this condition the VVT-actuator is mechanically locked in its maximum retarded position. When the VVT-actuator is operated, the locking pin is lifted by oil pressure and the rotor is unlocked.





Note: when removing/installing the VVT-actuator, always make sure the actuator is locked in its rest position. This can be verified by means of reference marks on the actuator housing (see picture). Engine timing procedure can only be performed correctly when the VVT-actuators are in their rest position.



Electrical timing check

The diagnostics system can be used to check the correct electrical timing of the engine, by reading the values taken on both banks. In the parameters environment, with the vehicle in a steady state and running at idling speed, it is possible to ascertain the correctness of the electrical timing, especially in the case of repeated misfiring.

115°
295°
475°
655°

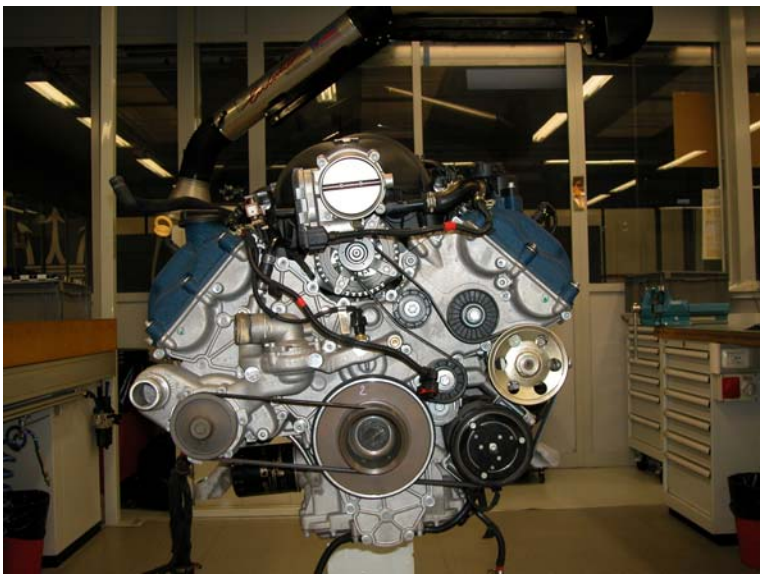
Engine Control System: Bosch Motronic ME 7.1.1

The Bosch Motronic ECU manages and controls the engine functions. The management system is divided in two 4-cylinder units, with an ECU and integrated ignition/injection and fuel pump controls. Air flow meter, throttle angle potentiometer, RPM and timing sensors, and motor-driven throttle body.
Linear oxygen sensor and ON/OFF on each exhaust branch, closed loop carburetion, detonation/diagnostics/misfire sensors. CAN serial line for interfacing with other vehicle control systems that interact with the engine management system.
The main objective of the engine control system is delivering engine torque ("Torque based" model). This strategy is applicable in all conditions of engine operation. Mototronic essentially identifies three different torque request levels: driver torque request, external torque request, and internal torque request.

- Engine control unit
- Air flow meter
- Air temperature sensor
- Water temperature sensors
- Accelerator pedal
- RPM sensor
- Timing sensors
- Timing variators with solenoid valves
- Knock sensors
- Oxygen sensors (pre- and post-cat.)
- Motor-driven throttle
- Injectors
- Coils
- Fuel pump
- Anti-evaporation system
- DMTL system
- Secondary air system

ENGINE DISASSEMBLY PROCEDURE

Position the engine, with the clutch removed, on a suitable support stand and proceed with disassembly as follows:

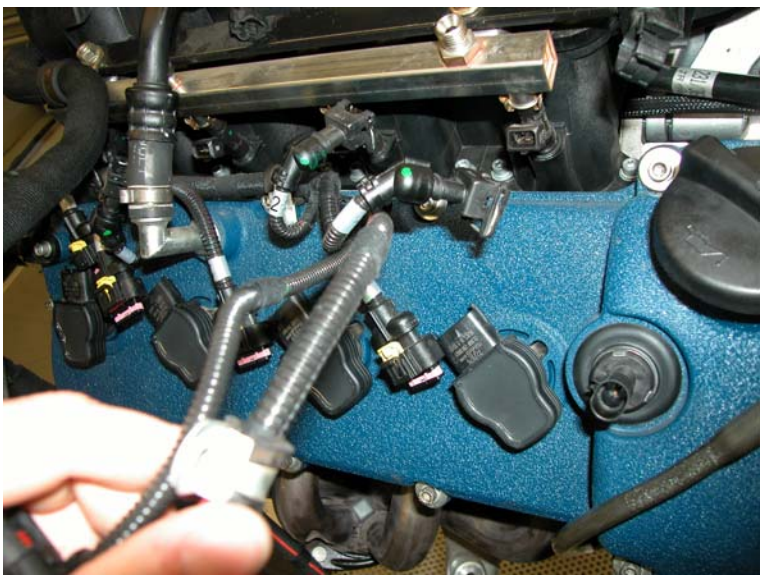


Detach the injector connections.

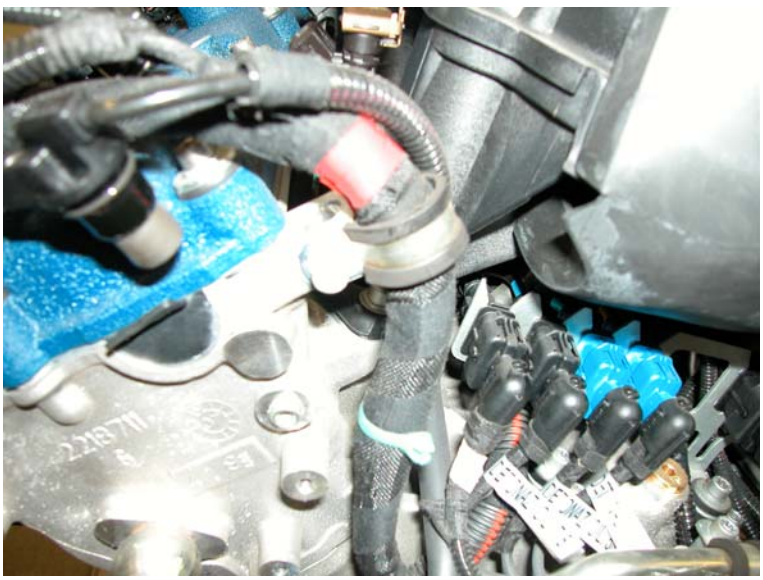
Remove the exhaust manifolds.

Disconnect the injector connectors.

Disconnect the engine outlet water temperature sensor

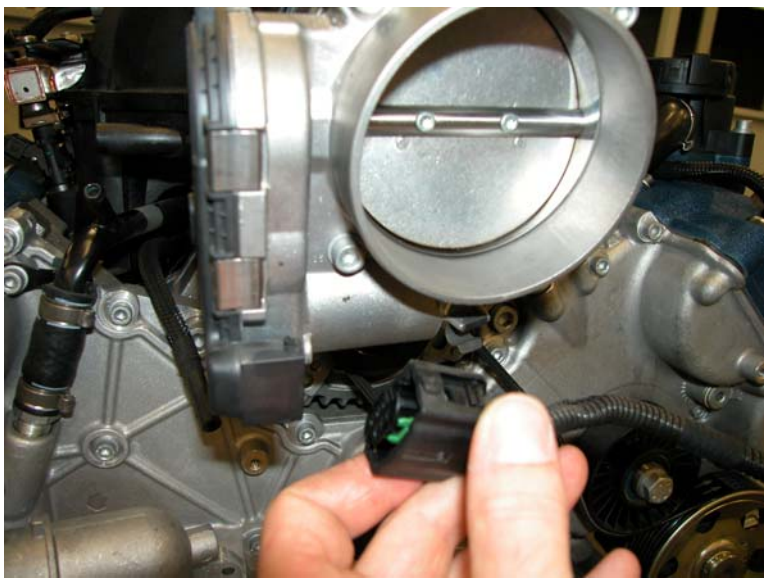


Remove the corrugated pipes from the cable grommets.



Detach the injection coil connectors, check that each cable is labelled to enable correct positioning during reassembly.

Detach the oil breather pipes from the cylinder heads and remove the link pipes

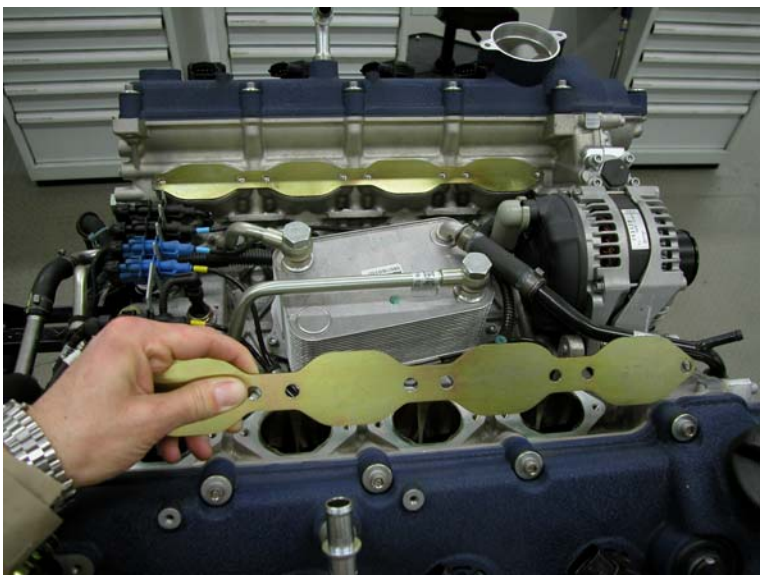


Disconnect the wiring from the motor-drive throttle

Remove the oil vapour separator

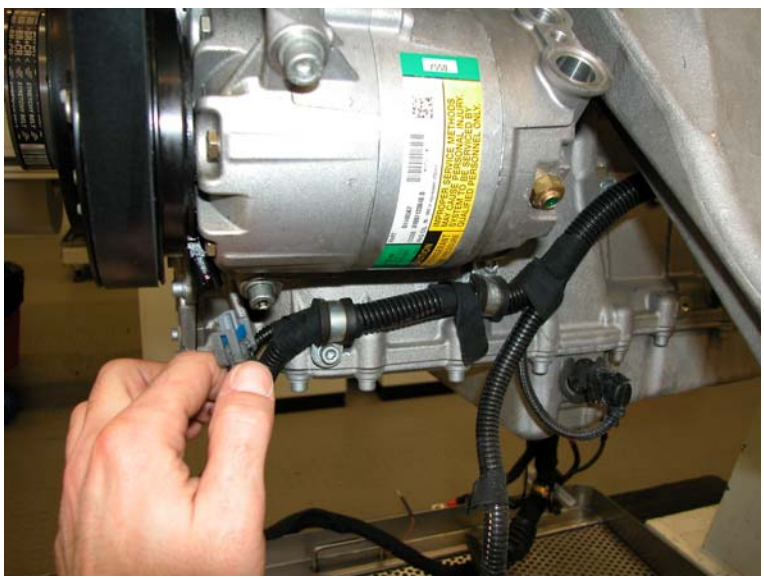
Unscrew the bolts on the intake manifold

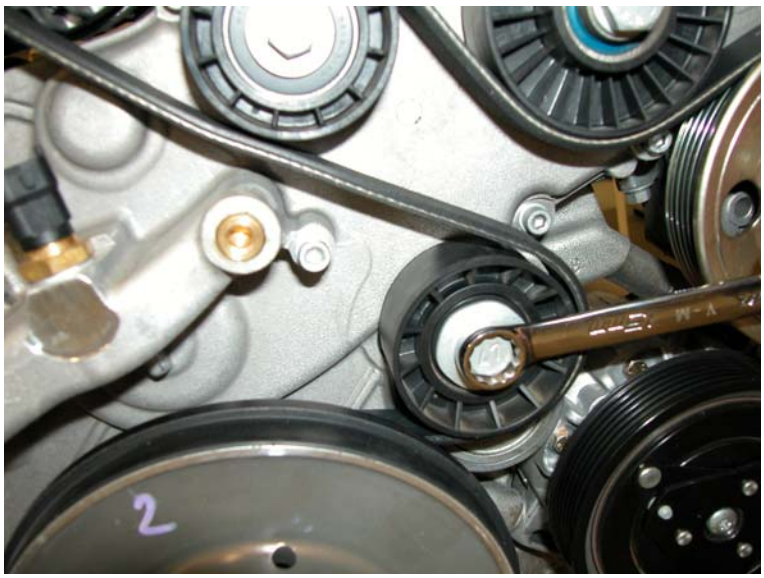
Remove the intake manifold by lifting it upwards



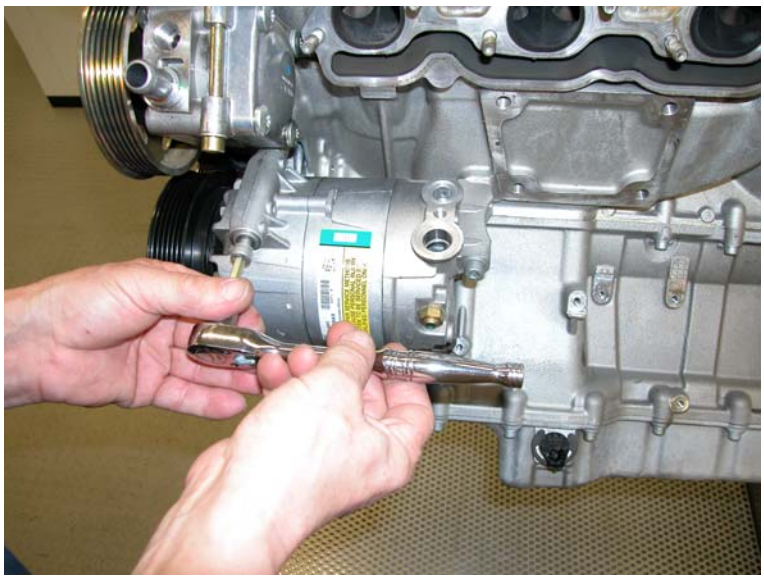
Fit tools **AV 3608**, securing them with two nuts to prevent foreign matter from entering the cylinders.

Remove the section of corrugated pipe which ends at the oxygen sensors

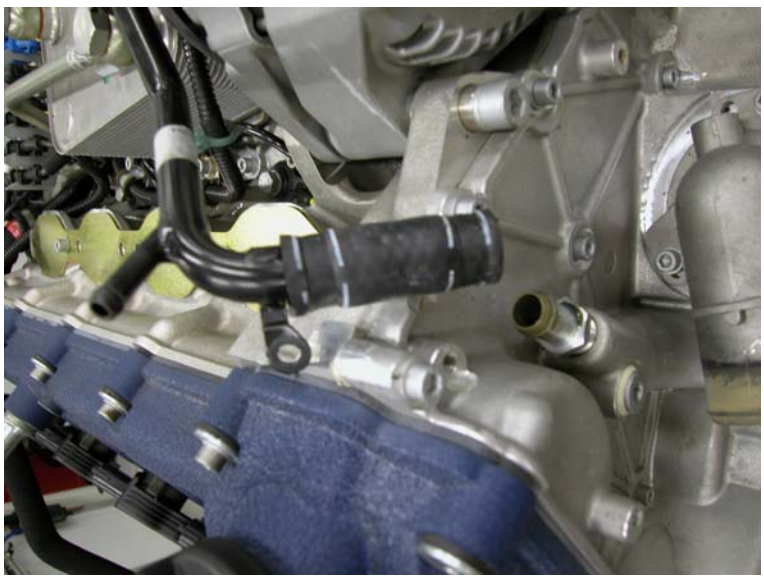




Loosen the poly-V belt by rotating the tensioner and then, while keeping the tensioner in place, pull the belt off the pulleys and remove it.



Remove the AC compressor



Disconnect the water pipe linking the automatic gearbox water/oil heat exchanger to the front sump

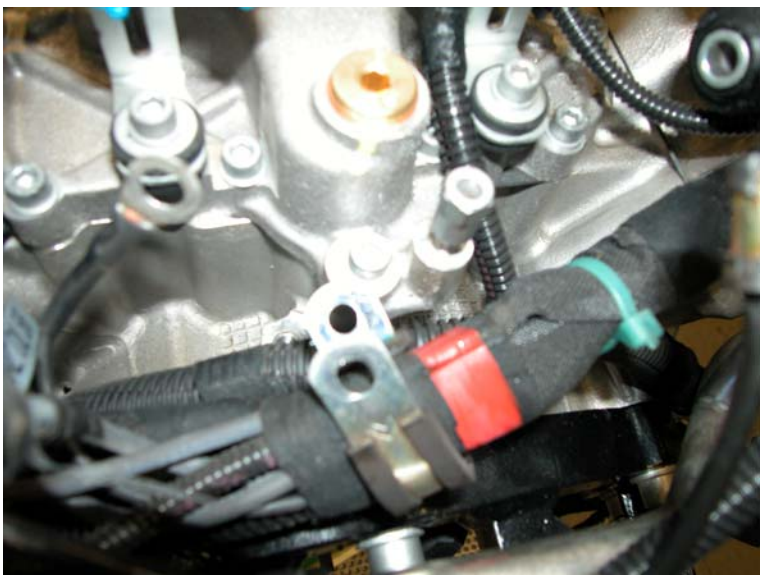
Disconnect the pipes from the water/oil heat exchanger

Remove the water/oil heat exchanger

Detach the connections of the detonation sensors, timing sensors and RPM sensor on the support bracket.

CAUTION

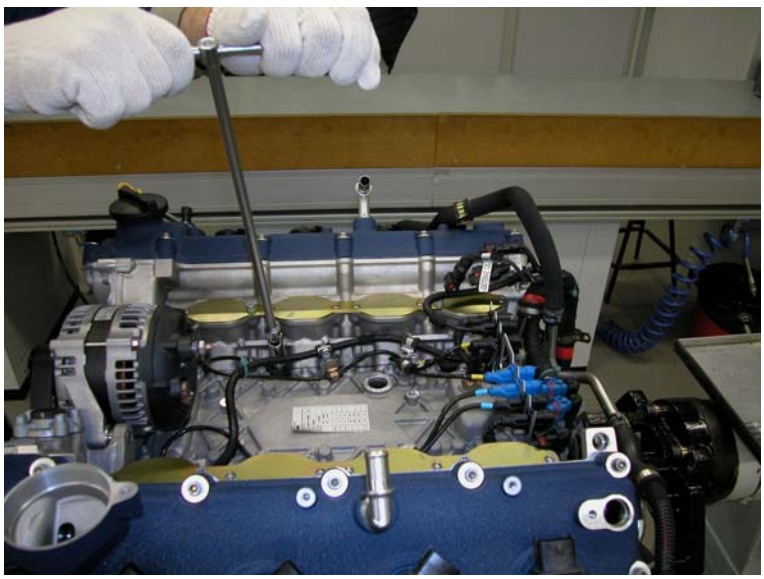
Check the labels to ensure that each sensor is matched with the corresponding wire and if necessary consult the electrical system manual.



Unscrew the retaining clamps on the injection wiring.

Remove the ground connection from the engine wiring.

Detach the connections on the alternator and remove the wiring.

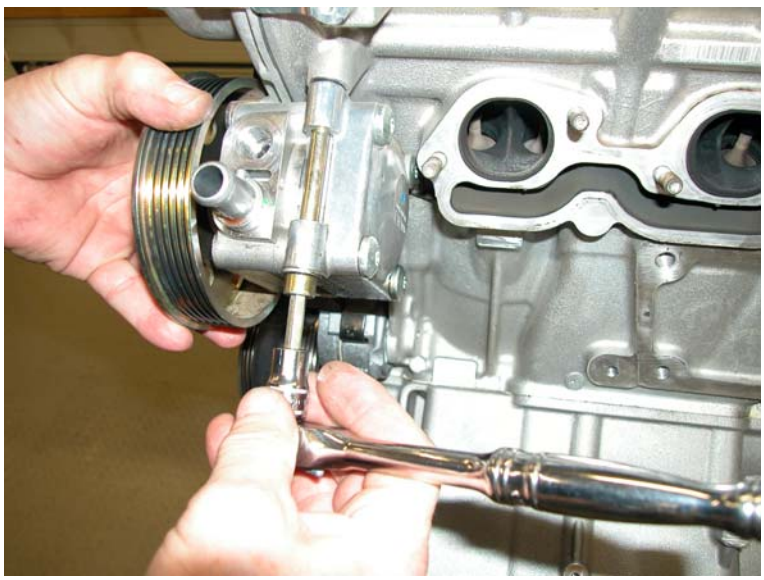


Remove the fastening screws on the detonation sensors.

Remove the passenger compartment heating pipes, followed by the RPM sensor and engine wiring

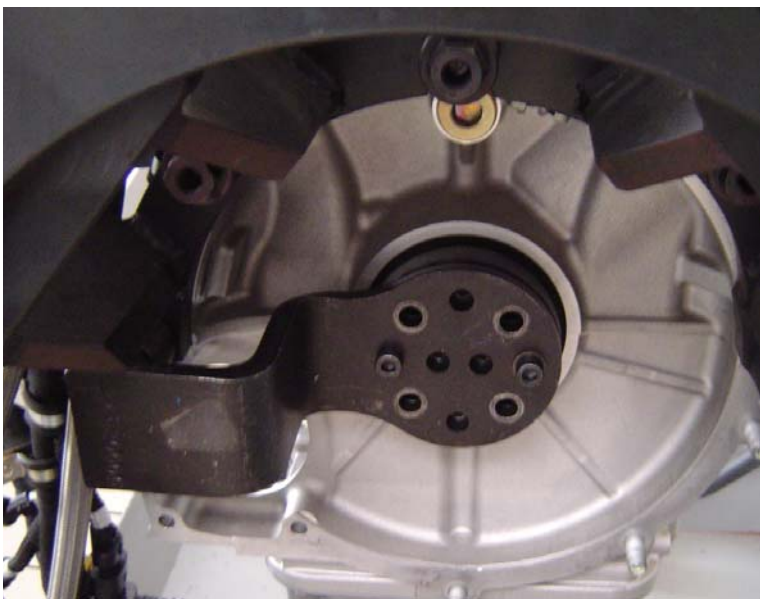
Remove the alternator

Remove the 6 mm screw from the hydraulic steering pump by means of the holes on the pulley.

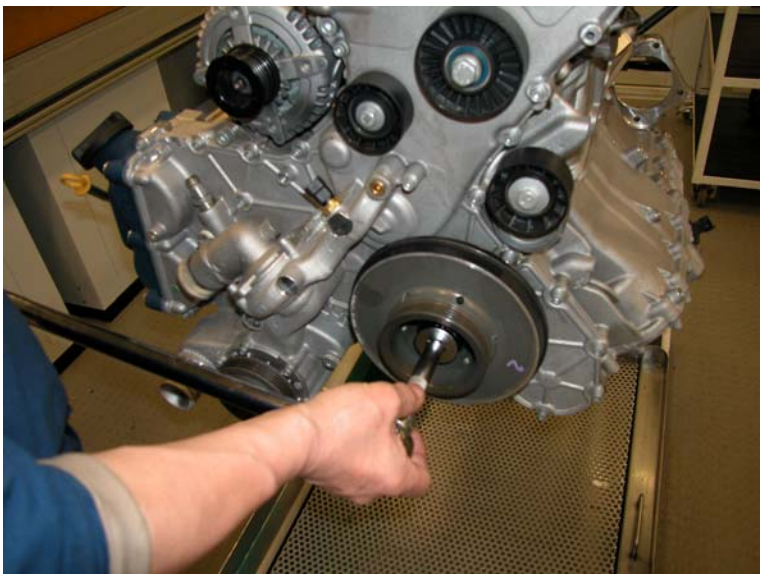


Unscrew the two 8 mm screws and remove the pump.

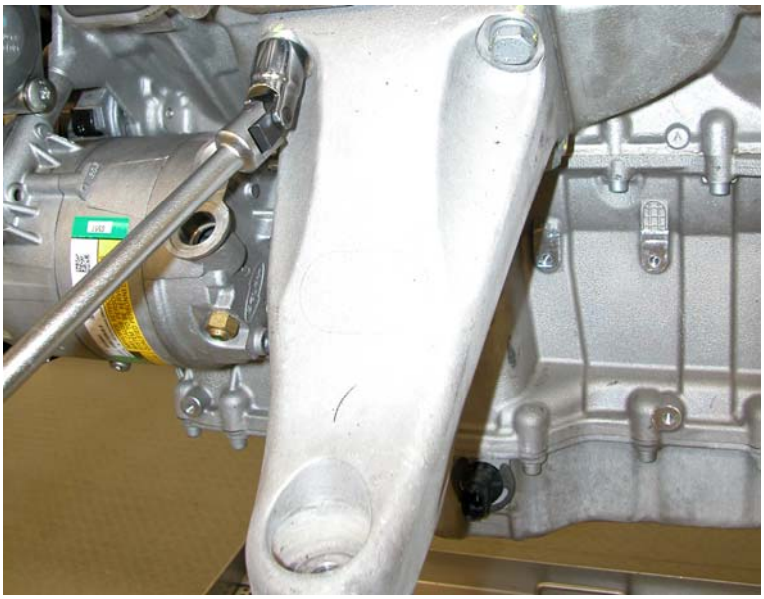
Extract the clutch shaft support bearing using a percussion extractor



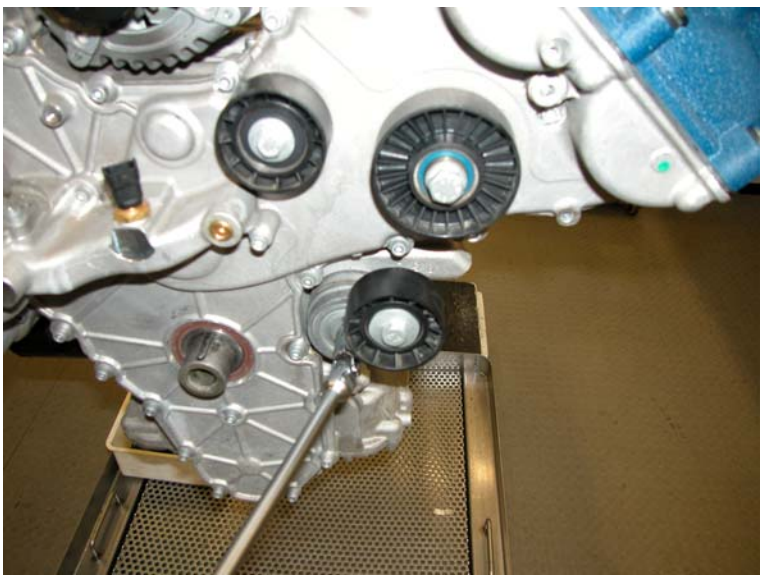
Mount tool **900026560** to lock the crankshaft.



Remove the torsional damper. Once the fastening screw is removed, the damper can be extracted by hand.

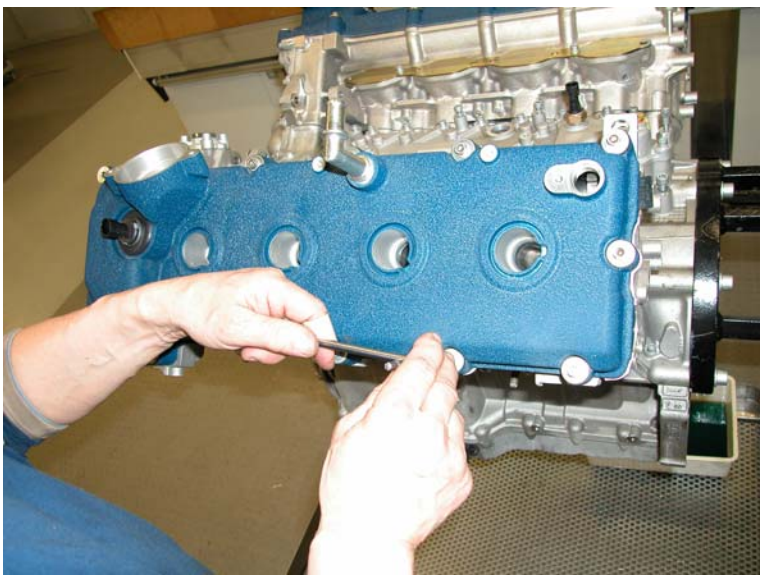


Remove the engine support legs



Remove the tensioner pulley

Remove the ignition coils



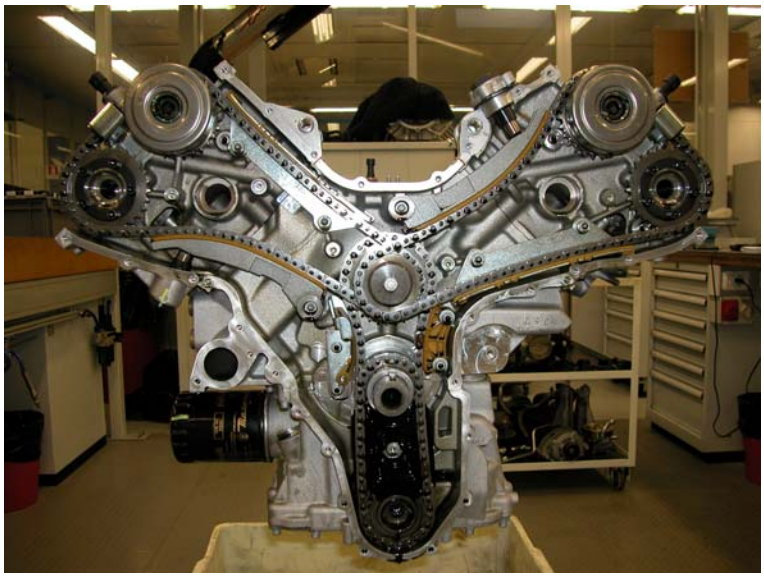
Remove the tappet covers

Remove the two fastening screws of the left-hand bank hydraulic tensioner

Position the crankshaft with the shaft key set to 9 o'clock, then remove the hydraulic tensioners

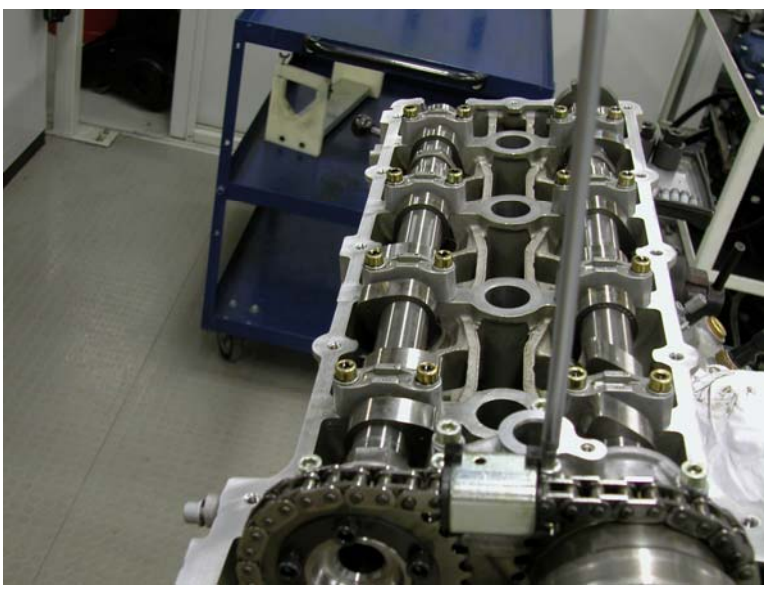
Remove the cover screws

Remove the thermostatic valve

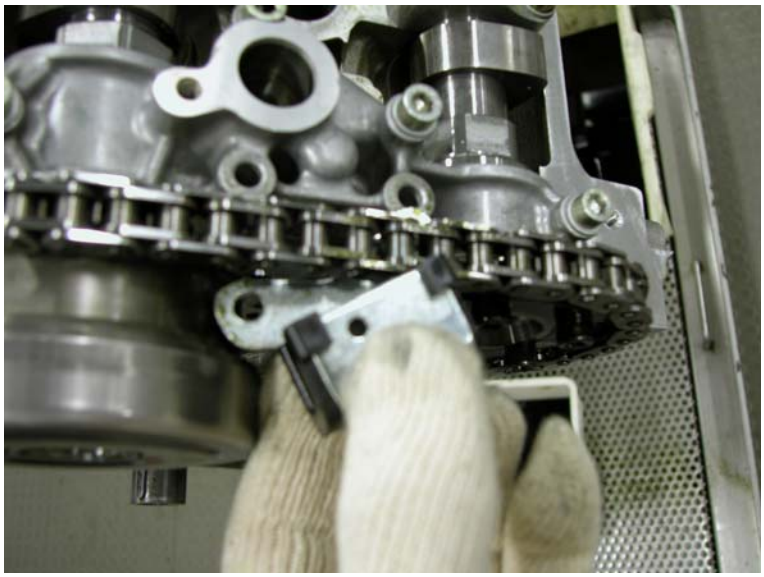


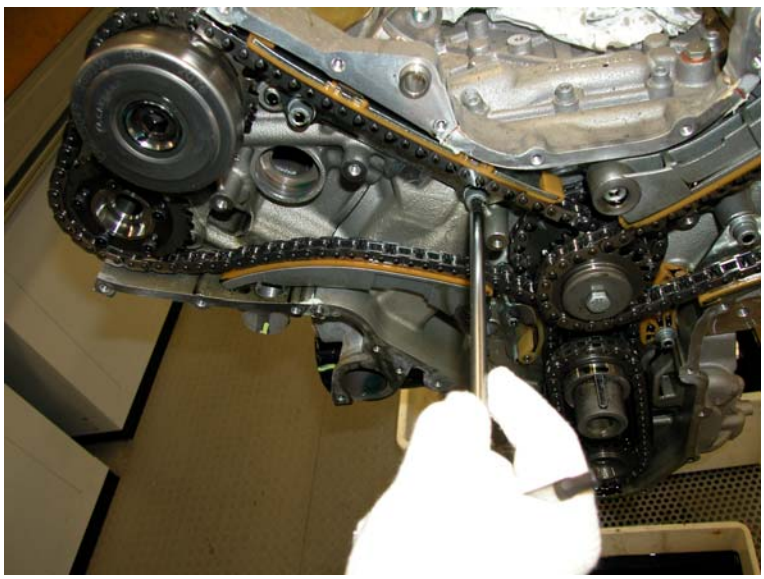
With the aid of a screwdriver, separate the front cover from the engine. Retrieve the upper gasket and remove the cover. Then remove the lower gasket, which remains stuck to the cover.

Remove the solenoid valves of the timing variators

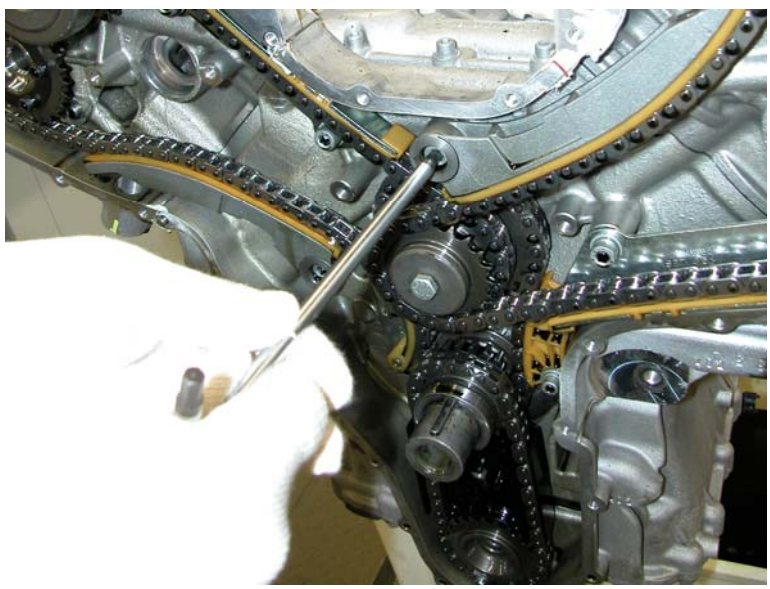


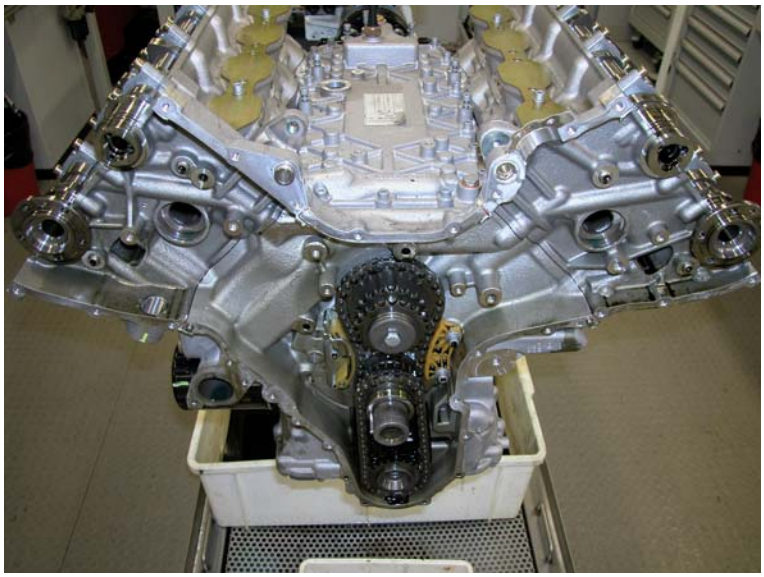
Remove the upper fixed chain guides



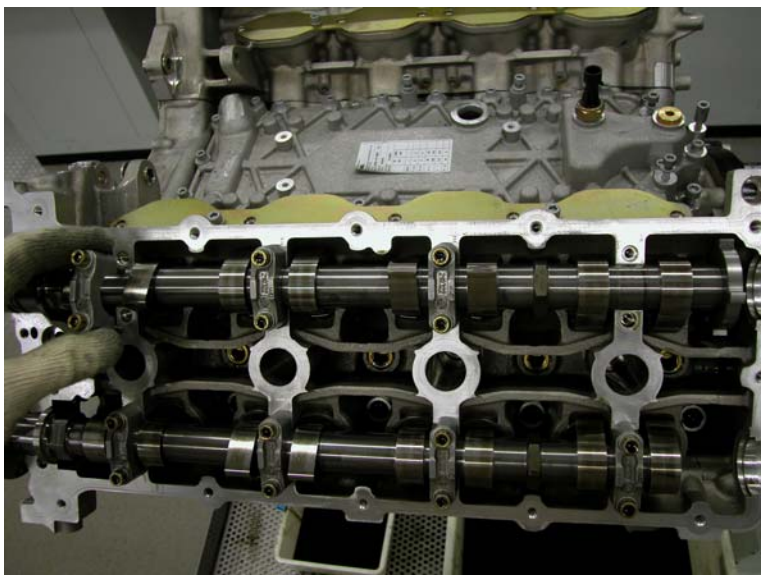


Remove the timing chain tensioner blades

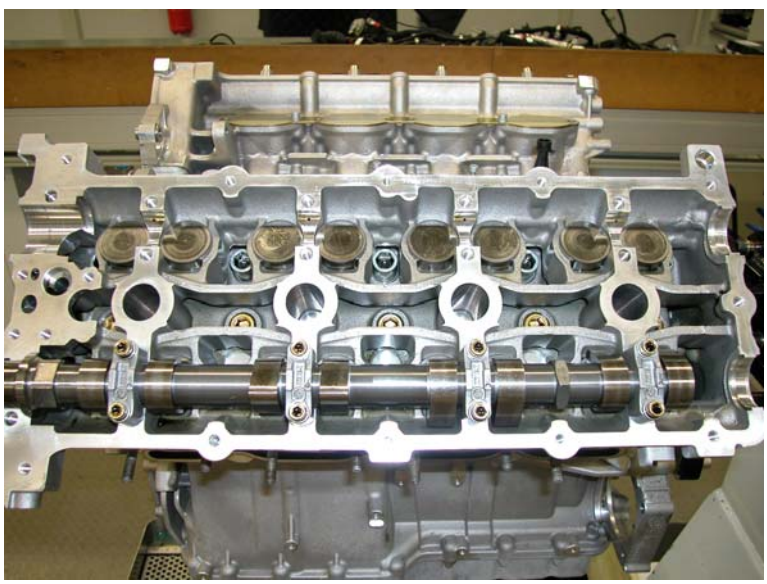




Remove the timing variators, the cogwheels of the exhaust camshafts and the timing chains.

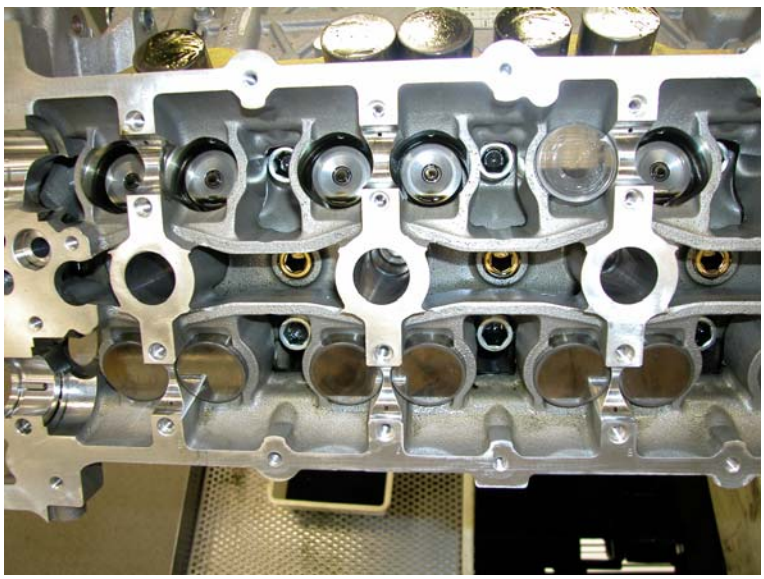


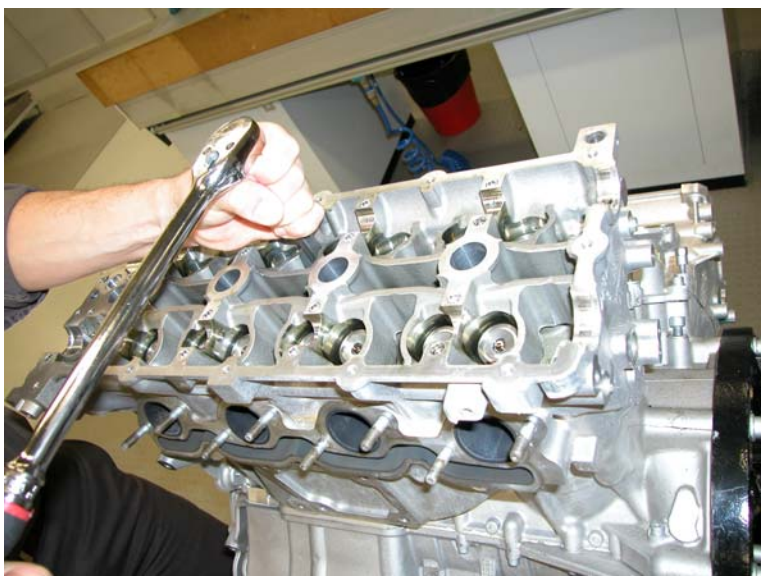
Unscrew the retaining nuts securing the camshaft caps and remove the caps, making sure that a reference number is stamped on each one



Remove the exhaust camshaft and then the intake camshaft

Extract the valve tappets from their seats, checking the reference number



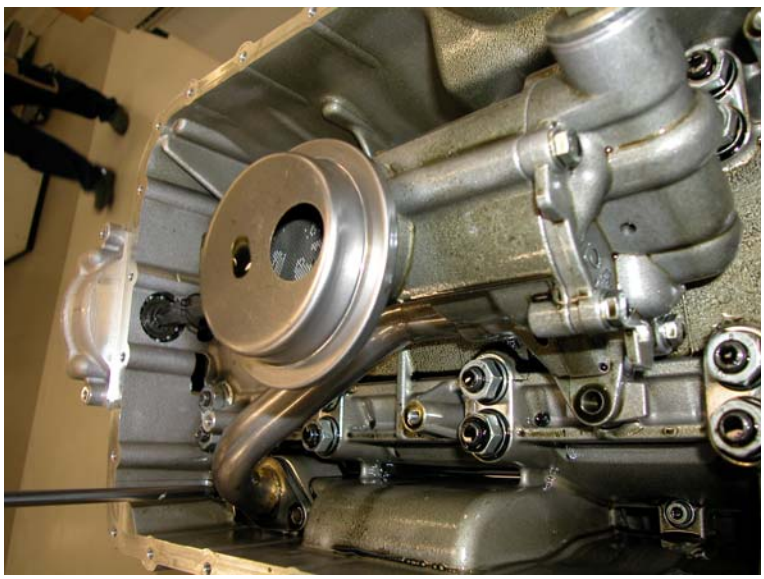


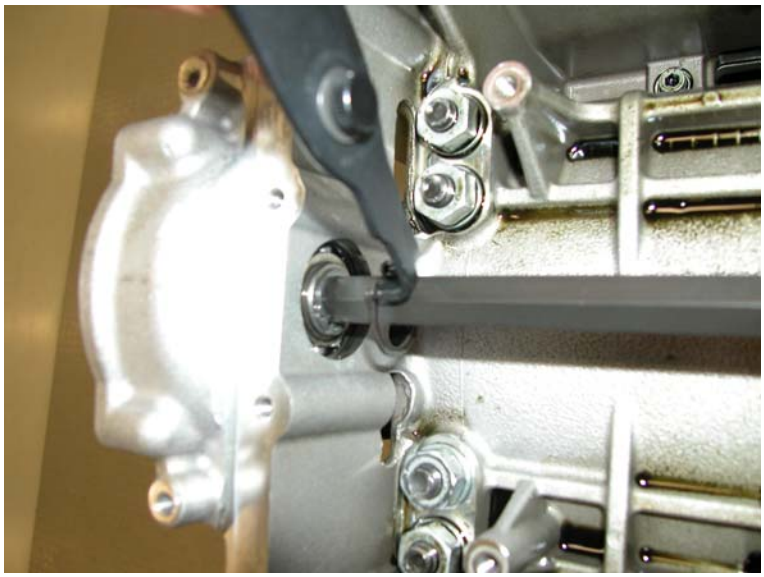
Unscrew the ten head fastening nuts

Extract the heads (if necessary with the aid of a rubber mallet) and head gaskets

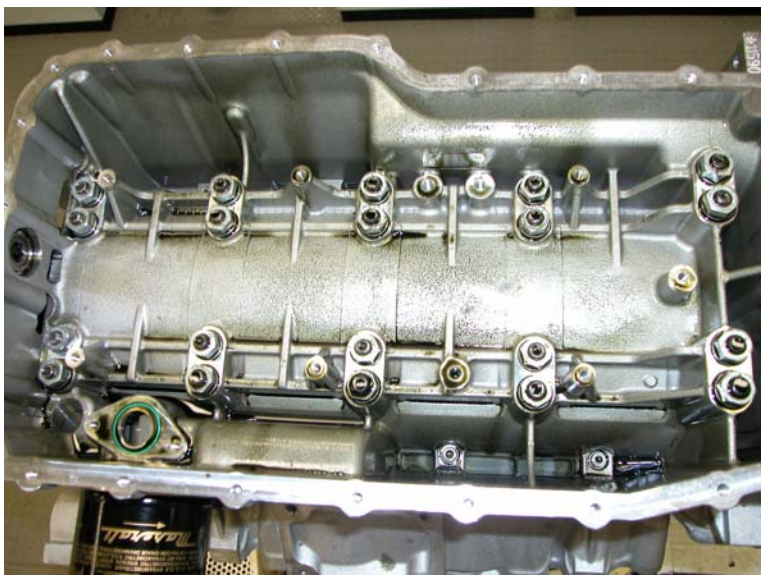
Remove the oil sump by unscrewing the perimeter screws.

Remove the oil sump



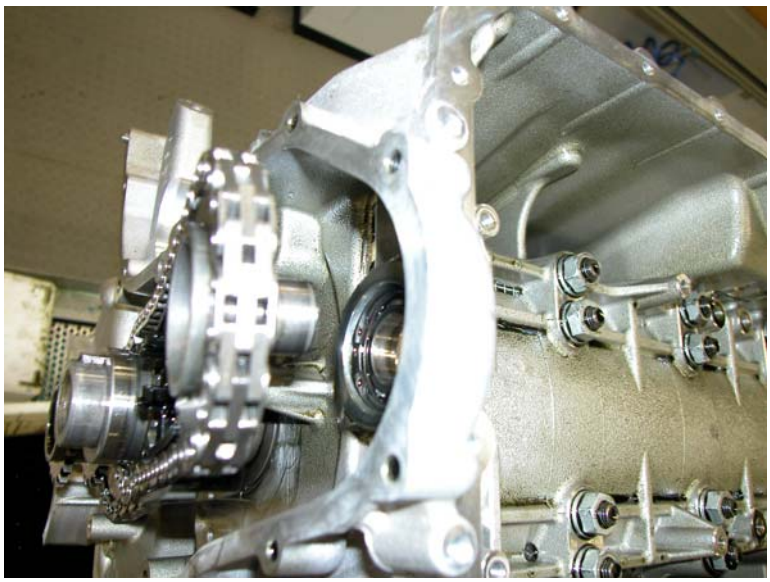


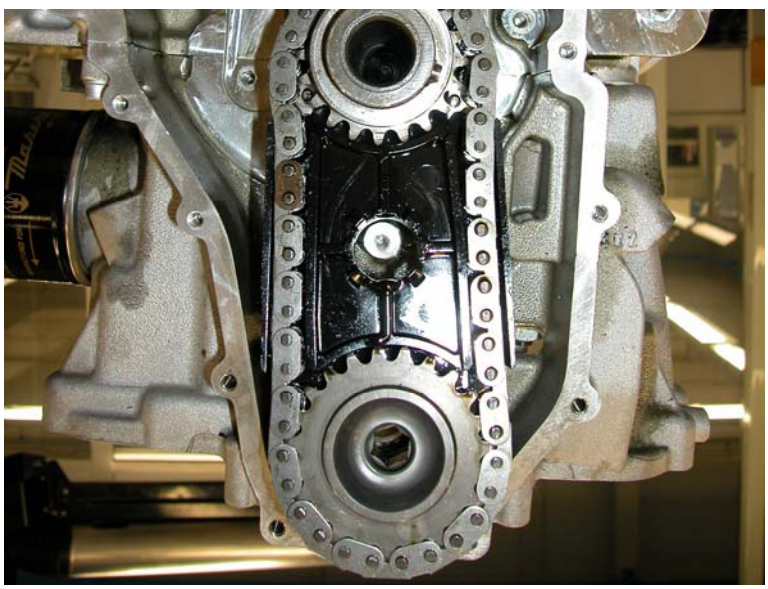
Remove the Seeger ring from the drive shaft



Unscrew the screws from the pump and remove it

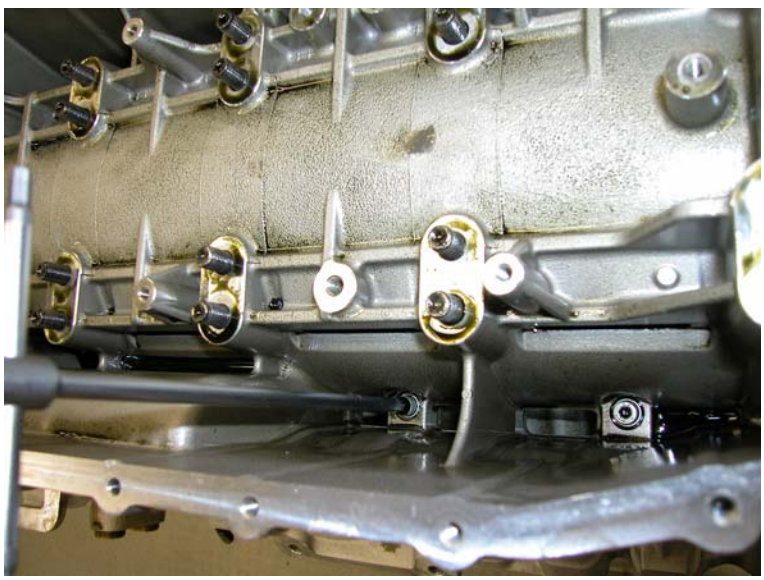
Hammer the oil pump gear outwards

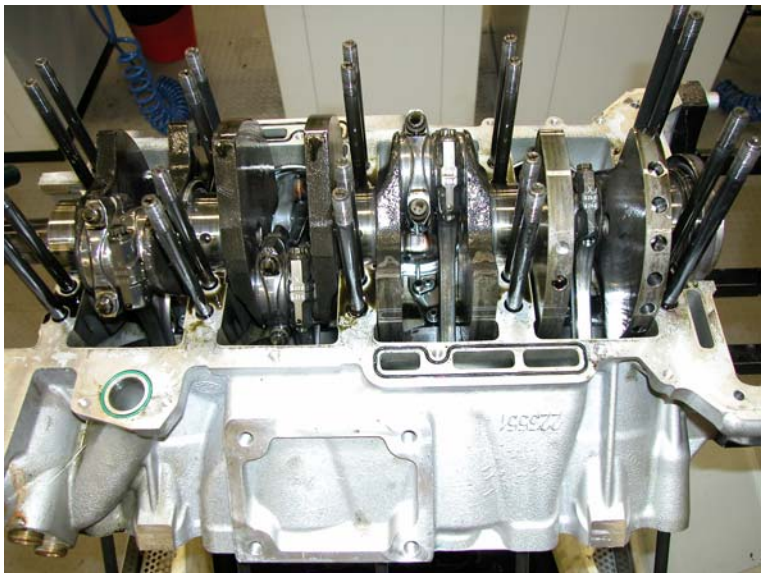




Extract the cogwheels, paying attention to the roller cages on the layshaft

Remove the subframe by unscrewing the crankcase stud nuts and the perimeter screws.
Dislodge the subframe by lightly tapping it with a mallet and then remove it



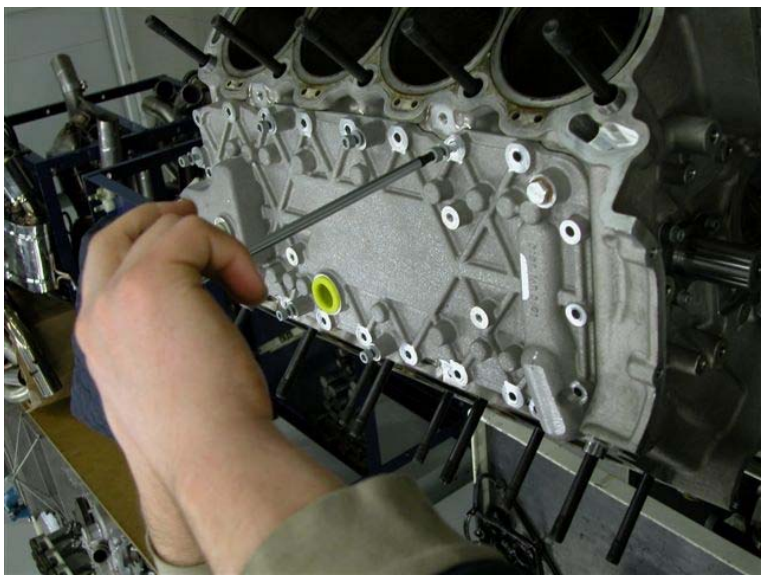


After removing the crankshaft oil seal, fit tool **AM105786** onto the crankshaft and rotate the shaft to afford easy access to the connecting rod bolts.

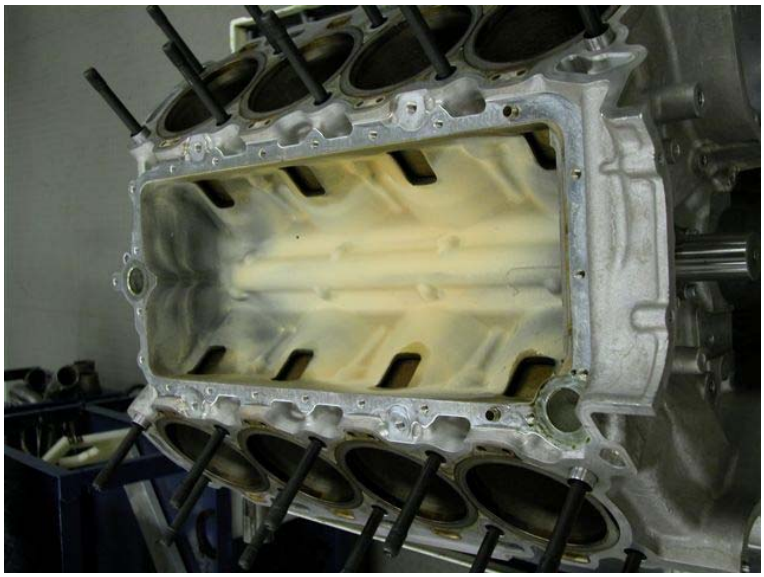
Loosen the conrod caps and dislodge them by lightly tapping with a mallet. Remove the bolts by hand, then remove the caps.

Remove the crankshaft and the corresponding bearings, paying attention to prevent the crankshaft central support washers from dropping.

Extract the pistons and remove the piston lubrication nozzles



Remove the heat exchanger



DIMENSIONAL CHECKS

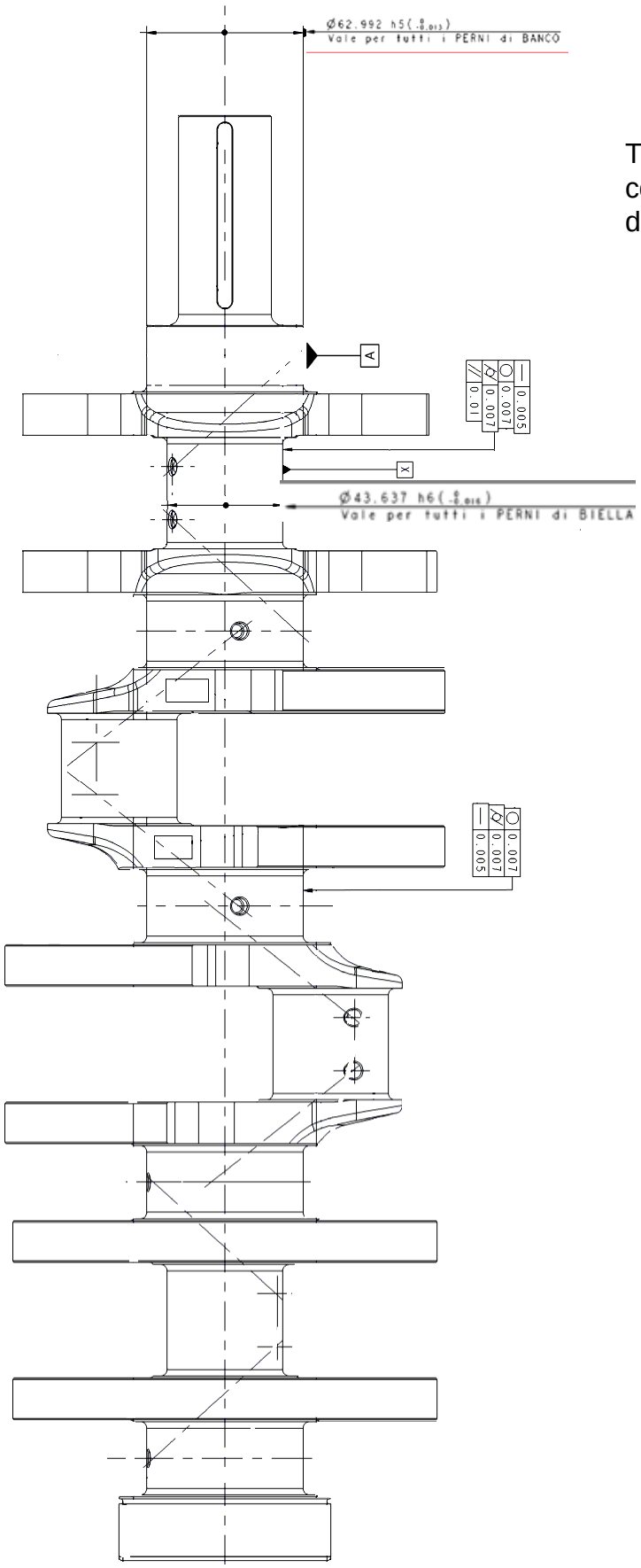
Table: axial/radial play for engine components

Coupling Description	Radial	Axial
Int. exh. valve seat /Engine head	-0.08/-0.12	
Int. exh. valve guide /Engine head	-0.032/-0.068	
Tappet / head	0.025/0.057	
Crankshaft/crankcase (Std washer)		0.12/0.24
Crankshaft/crankcase (at 20°c)	0.019/0.047	
Triple gear / support pin	0.029/0.054	0.05/0.2
Int. valve / valve guide	0.030/0.059	
Exh. valve / valve guide	0.035/0.064	
Piston/Gudgeon pin	0.005/0.016	0.16/0.69
Connecting rod/Gudgeon pin	0.0145/0.0295	
Cylinder liner/crankcase projection	0.01/0.05 mm	
Crankshaft/Connecting rod (at 20°c)	0.033/0.061	0.2/0.339
Tensioner blade secondary branch	0.1/0.25	0.15/0.45
Piston/Cylinder liner	0.044/0.076	
Gap electrode spark plug dis.194503		0.6/0.7
Gap timing sensor dis. 177673		≤ 1.5
Gap angular vel. sens. dis.164937		0.85/1.40
Oil pump control bar		1.35/2.65

VALUES EXPRESSED IN mm.

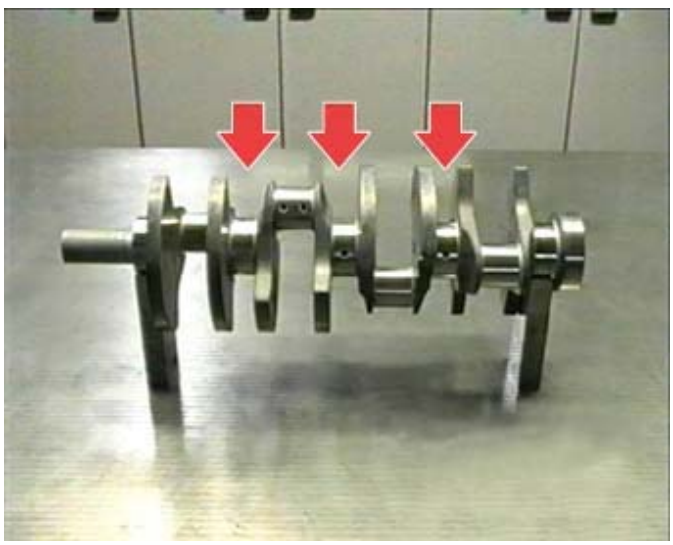
All tolerances relating to couplings between the various engine components are subject to variations and/or updates resulting from technological improvements made to the components. During the various phases of engine overhaul, always check with Maserati that the tables relating to particular coupling tolerances are valid for the engine being overhauled.

CRANKSHAFT DIMENSIONAL CHECK



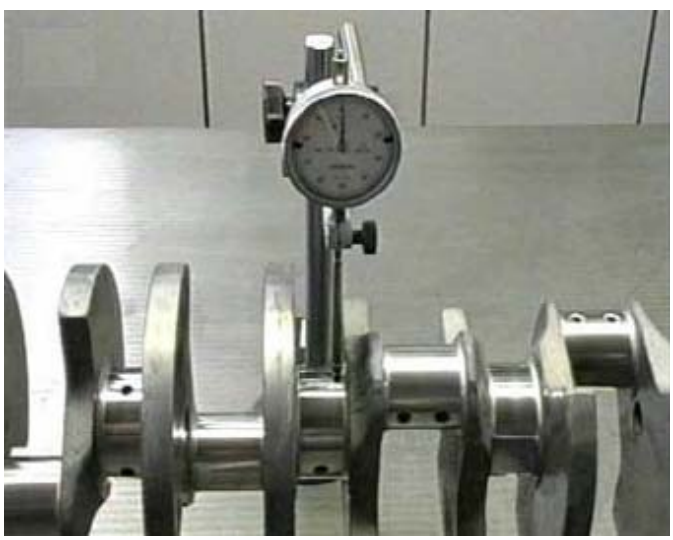
The actual measured values must conform to those indicated in the drawing.

Use a micrometer to measure the crank pins.



MAIN BEARING JOURNALS COAXIALITY CHECK

Place the crankshaft on prescribed tool **AV3135.**



Reset the dial gauge on the journal to be checked and rotate the shaft, checking the reading on the dial gauge.

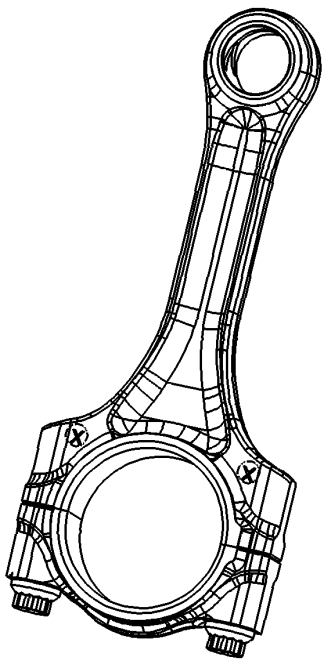
DIMENSIONAL CHECK OF ENGINE CONNECTING RODS

The checks for this component relate to the head and foot of the conrod.
To measure the diameter of the foot, apply a torque wrench set at the prescribed torque to the connecting rod cap. Use a bore gauge with a millesimal dial indicator.

Also visually check the condition of the connecting rod. It must be free from dents, grazes, chips and other visible defects.

Before fitting, check that the screw threads and the contact surfaces of the connecting rods are clean and dry.

In addition, always check the dimensional measurements, hole threads, and the cleanliness and condition of the contact surfaces.



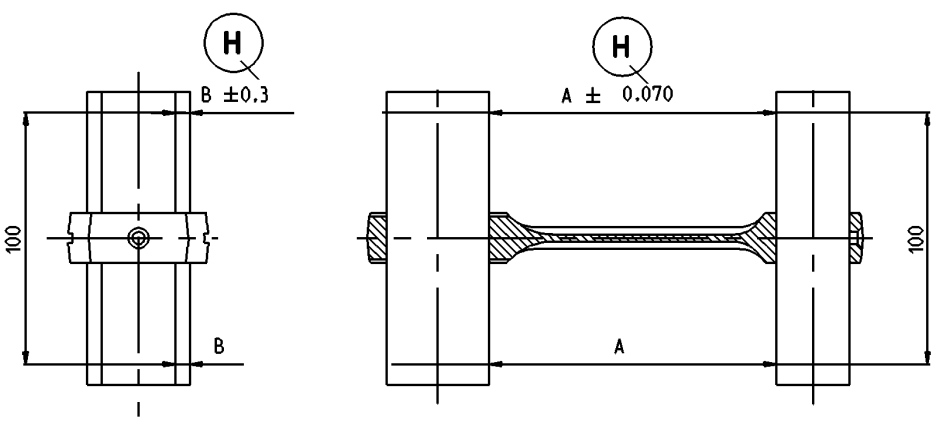
Crankshaft/connecting rods axial play 0.20 / 0.339 mm

EQUIVALENT WEIGHT 418g± 2g

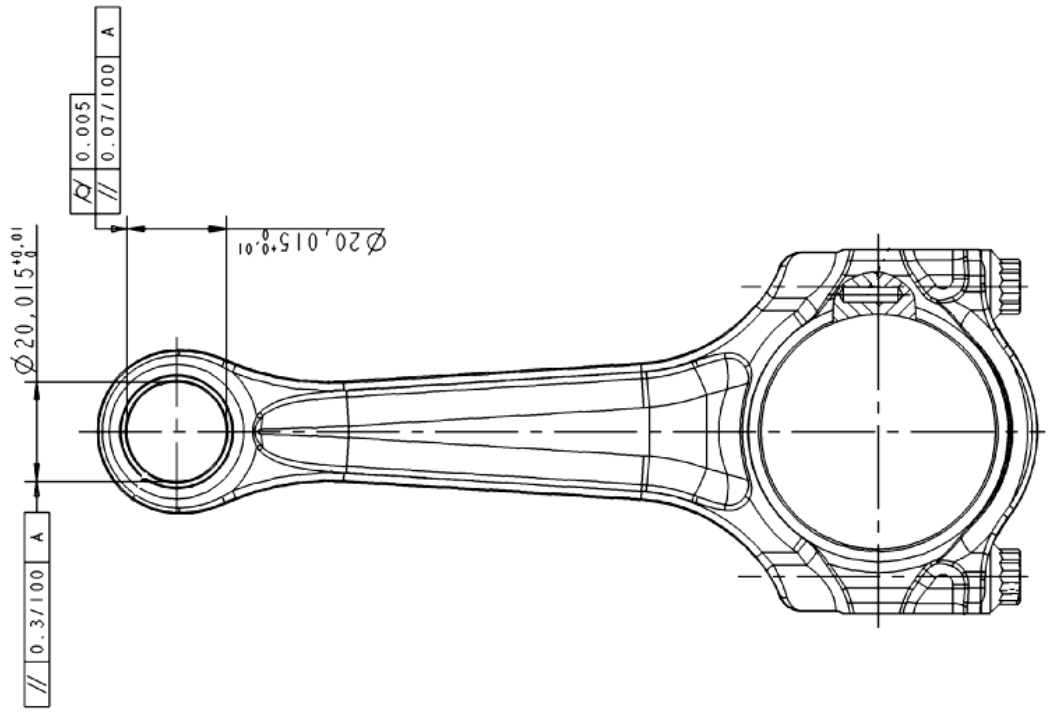
CAUTION!

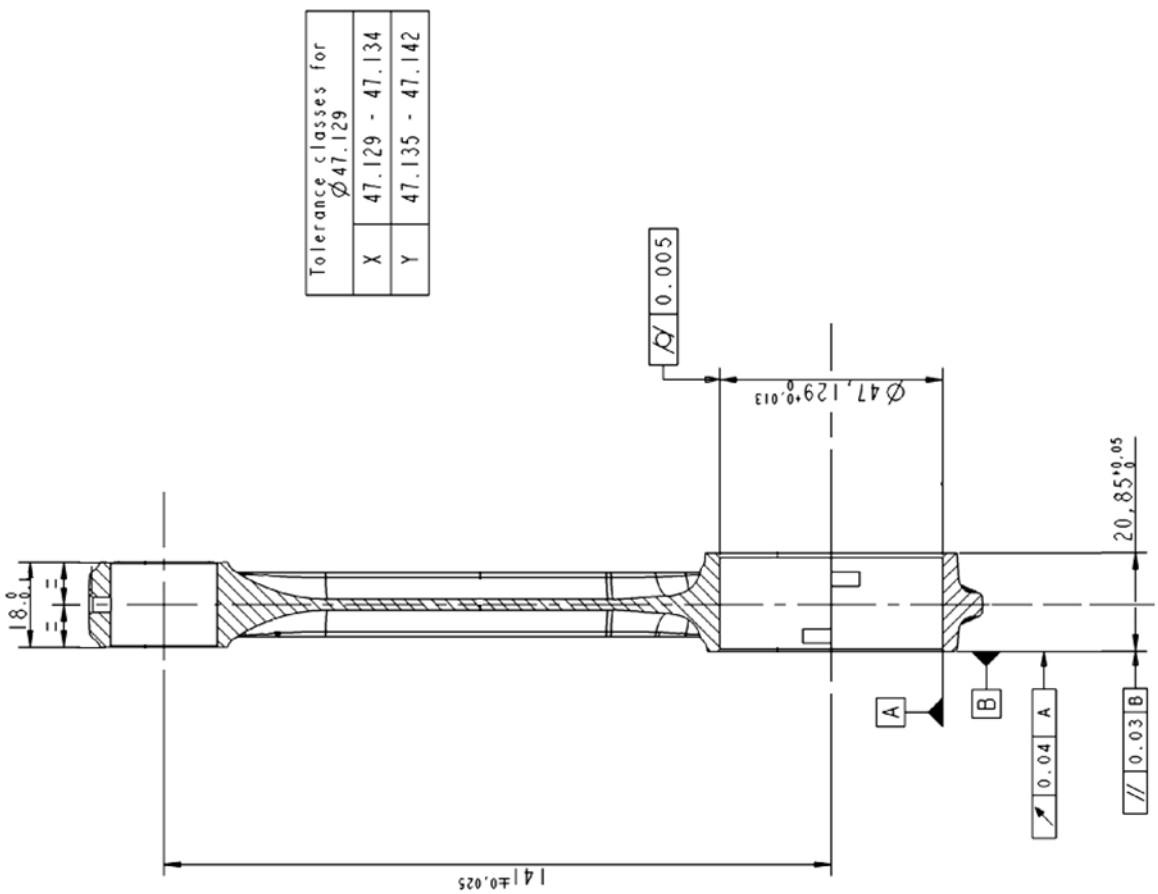
The screws must be fastened and tightened only once.

Check the squaring of the connecting rod



The actual measured values must conform to those indicated in the drawing.





CAUTION!

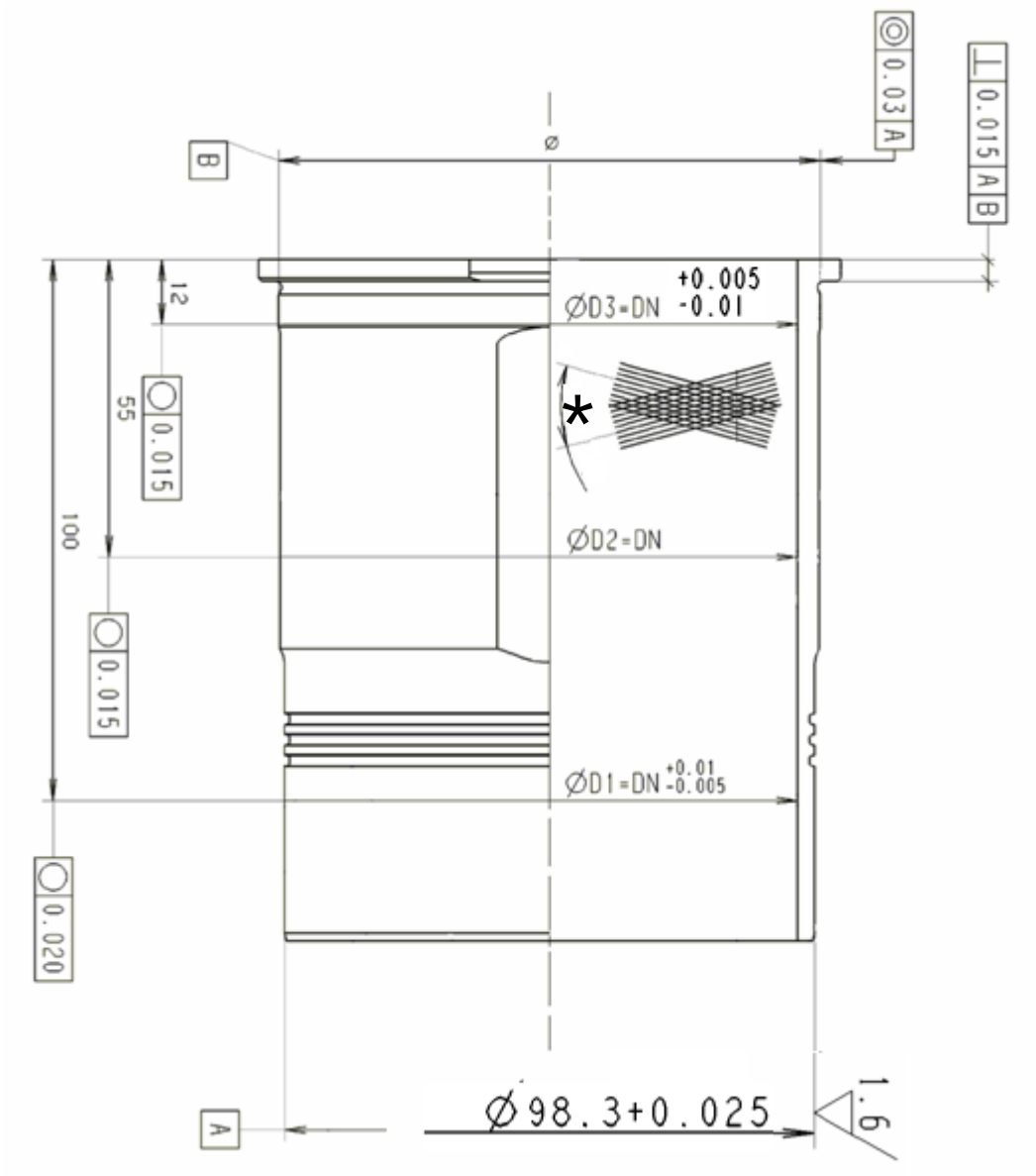
The half-bearings must only be assembled after dimensional and wear condition checks have been performed. For assembly of the new half-bearings, refer to the identification tables

CONNECTING ROD PIN TABLE		CONNECTING ROD PIN **CONNECTING ROD SEAT**	CONNECTING ROD PIN **CONNECTING ROD SEAT**
Seat displacement =0.016		47.129 - 47.135 **CLASS X**	47.136 - 47.142 **CLASS Y**
CONNECTING ROD PIN **CRANKSHAFT**	43.630 43.637 **CLASS X**	***RED* 1.730-1.735**	***BLUE* : 1.735-1.740**
		MINIMUM NOMINAL BACKLASH: 0.022	MINIMUM NOMINAL BACKLASH: 0.019
		MINIMUM EFFECTIVE BACKLASH: 0.038	MINIMUM EFFECTIVE BACKLASH: 0.035
		MAXIMUM NOMINAL BACKLASH: 0.045	MAXIMUM NOMINAL BACKLASH: 0.042
		MAXIMUM EFFECTIVE BACKLASH: 0.061	MAXIMUM EFFECTIVE BACKLASH: 0.058
CONNECTING ROD PIN **CRANKSHAFT**	43.621 43.629 **CLASS Y**	***BLUE:* 1.735-1.740**	**** BLACK:* 1.740-1.745**
		MINIMUM NOMINAL BACKLASH: 0.026	MINIMUM NOMINAL BACKLASH: 0.017
		MINIMUM EFFECTIVE BACKLASH: 0.034	MINIMUM EFFECTIVE BACKLASH: 0.033
		MAXIMUM NOMINAL BACKLASH: 0.050	MAXIMUM NOMINAL BACKLASH: 0.041
		MAXIMUM EFFECTIVE BACKLASH: 0.058	MAXIMUM EFFECTIVE BACKLASH: 0.057

JOURNAL TABLE		JOURNAL **CRANKCASE SEAT**	JOURNAL **CRANKCASE SEAT**
Seat displacement =0.020		66.675 - 66.681 **CLASS A**	66.682 - 66.688 **CLASS B**
JOURNAL **CRANKSHAFT**	62.986 62.992 **CLASS A**	***BLUE* : 1.834 - 1.839**	***YELLOW* : 1.839 - 1.844**
		MINIMUM NOMINAL BACKLASH: 0.005	MINIMUM NOMINAL BACKLASH: 0.002
		MINIMUM EFFECTIVE BACKLASH: 0.025	MINIMUM EFFECTIVE BACKLASH: 0.022
		MAXIMUM NOMINAL BACKLASH: 0.027	MAXIMUM NOMINAL BACKLASH: 0.024
		MAXIMUM EFFECTIVE BACKLASH: 0.047	MAXIMUM EFFECTIVE BACKLASH: 0.044
JOURNAL **CRANKSHAFT**	62.979 62.985 **CLASS B**	***YELLOW:* 1.839 - 1.844**	***GREEN* : 1.844 - 1.849**
		MINIMUM NOMINAL BACKLASH: 0.002	MINIMUM NOMINAL BACKLASH: -0.001
		MINIMUM EFFECTIVE BACKLASH: 0.022	MINIMUM EFFECTIVE BACKLASH: 0.019
		MAXIMUM NOMINAL BACKLASH: 0.024	MAXIMUM NOMINAL BACKLASH: 0.021
		MAXIMUM EFFECTIVE BACKLASH: 0.044	MAXIMUM EFFECTIVE BACKLASH: 0.041

Dimensional check of cast-iron cylinder liners

The actual measured values must conform to those indicated in the drawing.

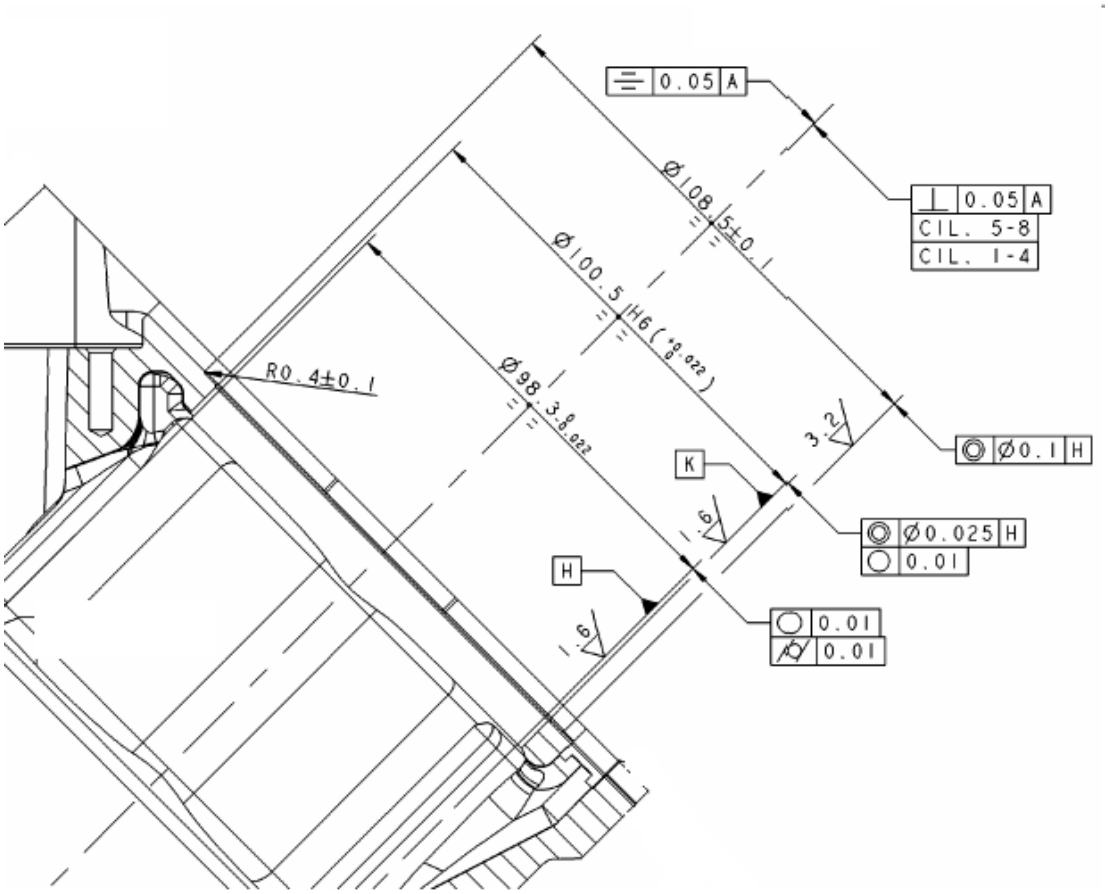


***Plateau** surface honing angle of each cylinder 35°

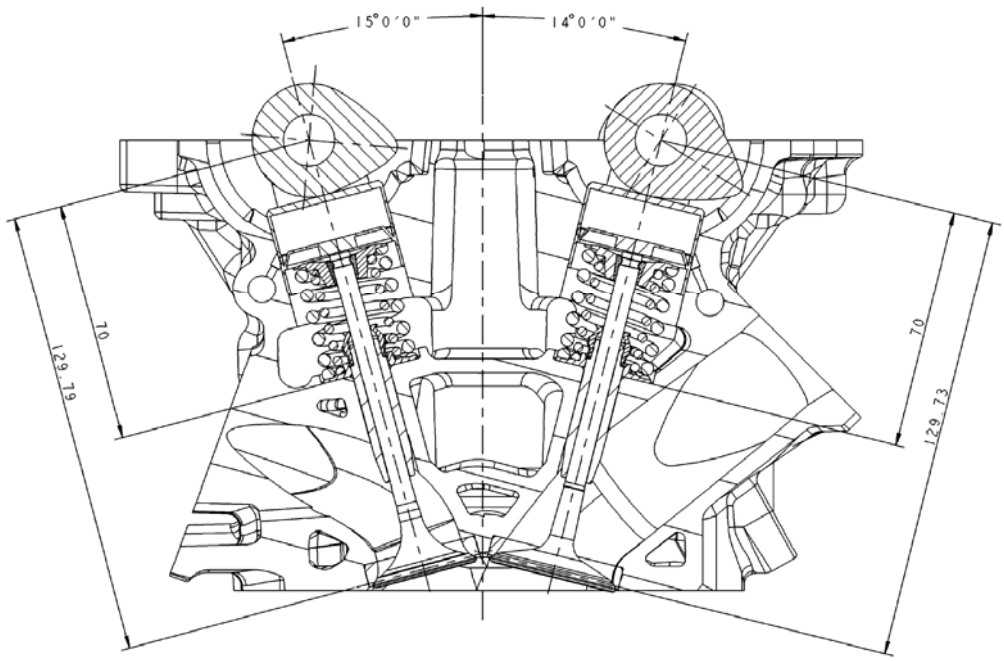
Nominal Diameter= 92.00mm

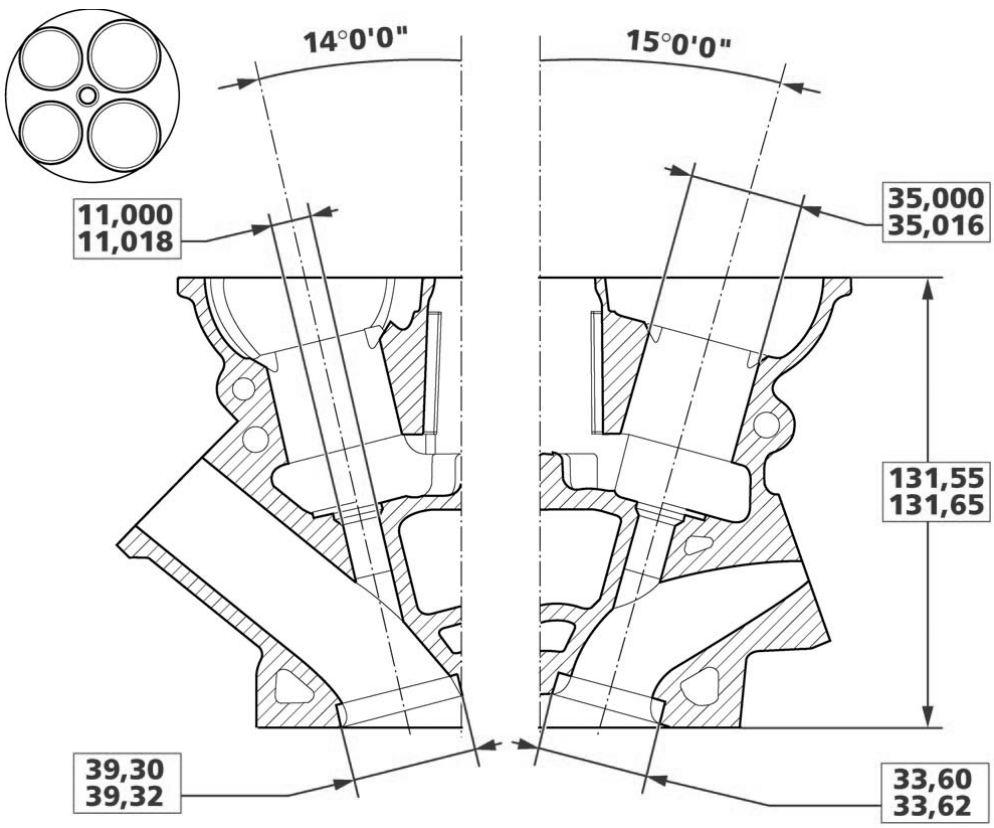
Dimensional check of cylinder liner housing in crankcase

The actual measured values must conform to those indicated in the drawing.



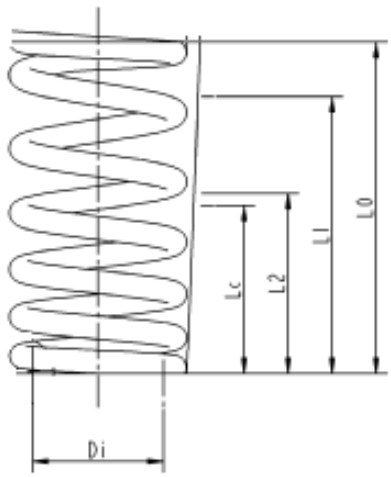
Engine head


15°0'0"
14°0'0"
70
129,79
70
129,73


14°0'0"
15°0'0"
11,000
11,018
35,000
35,016
131,55
131,65
39,30
39,32
33,60
33,62

Dimensional check of internal valve spring

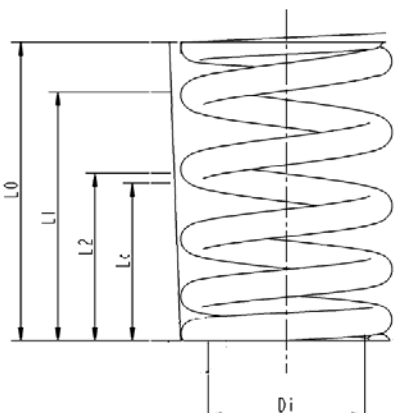
The actual measured values must conform to those indicated in the drawing.



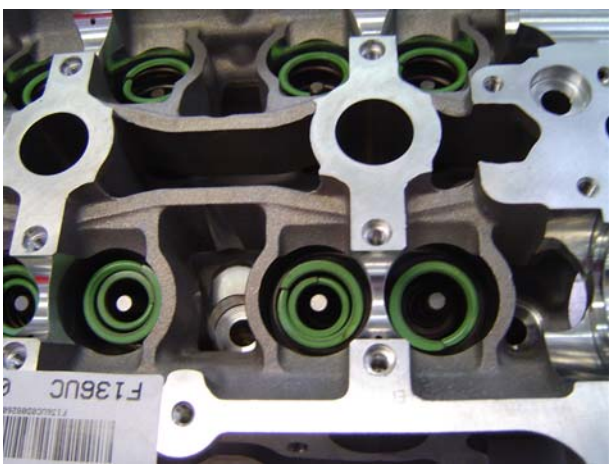
length [mm]	load [N]	tolerance [N]
31.5	97.0	±6.0
30.5	114.1	(±6.6)
29.5	131.4	(±7.3)
28.5	148.9	(±7.9)
27.5	166.9	(±8.5)
26.5	185.5	(±9.2)
25.5	204.5	(±9.8)
24.5	224.0	(±10.5)
23.5	244.1	(±11.1)
22.5	264.7	(±11.7)
21.5	286.0	(±12.4)
20.5	308.0	±13.0

Dimensional check of external valve spring

The actual measured values must conform to those indicated in the drawing.



length [mm]	load [N]	tolerance [N]
33.5	198.0	±10.0
32.5	230.4	(±11.6)
31.5	293.9	(±13.3)
30.5	297.9	(±14.9)
29.5	332.3	(±16.5)
28.5	367.3	(±18.2)
27.5	403.1	(±19.8)
26.5	439.5	(±21.5)
25.5	476.6	(±23.1)
24.5	514.9	(±24.7)
23.5	555.2	(±26.4)
22.5	600.0	±28.0

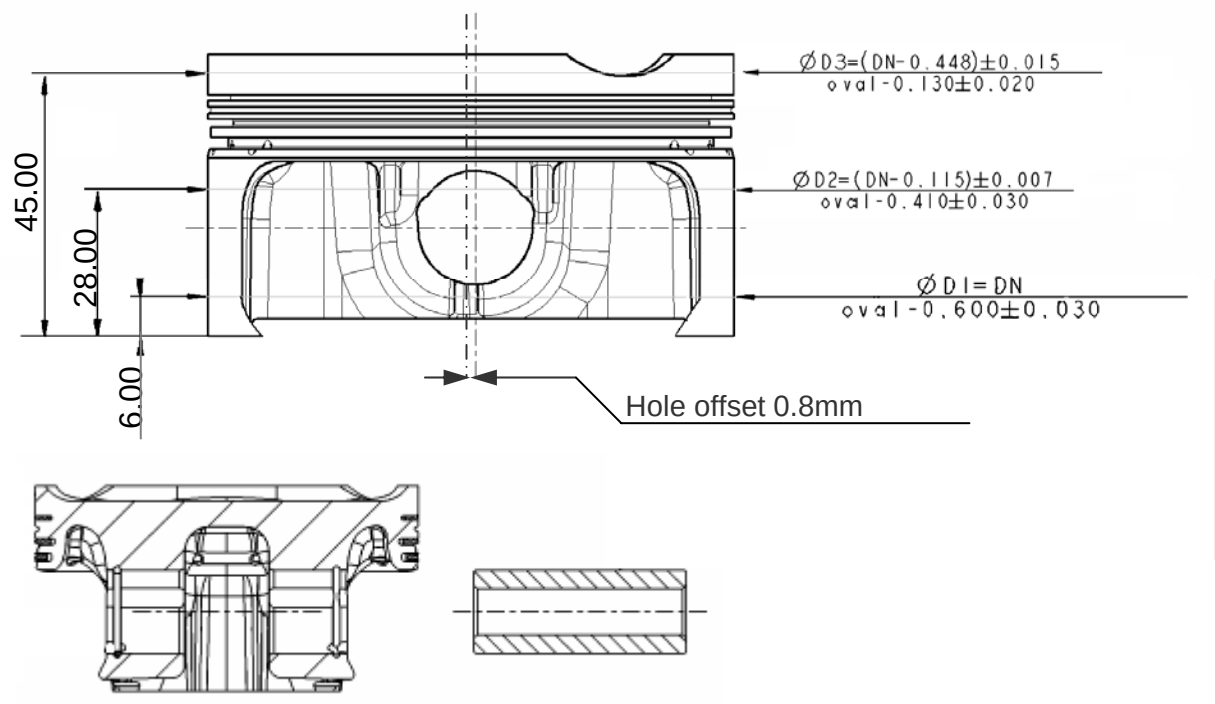


CAUTION!

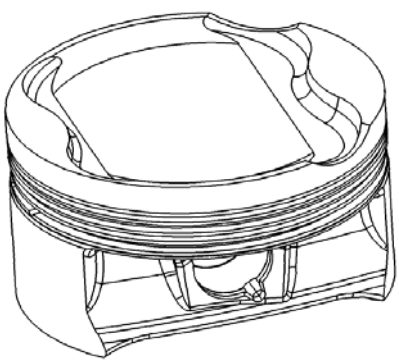
Pay attention to the direction of installation: the two springs are NOT symmetrical. The painted part must always face uppermost during insertion.

Dimensional check of pistons

The actual measured values must conform to those indicated in the drawing.
Piston nominal diameter: 92.00mm

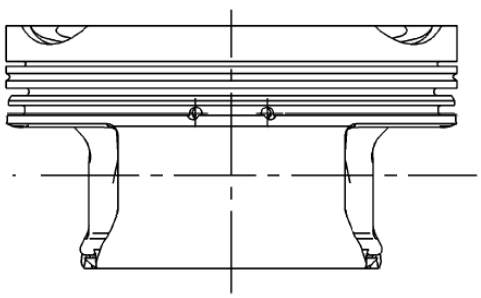


Diameter of gudgeon pin housing on piston: **Ø 20 +0.011/ +0.005**
Ext. diameter gudgeon pin: **Ø 20 0/ -0.005**



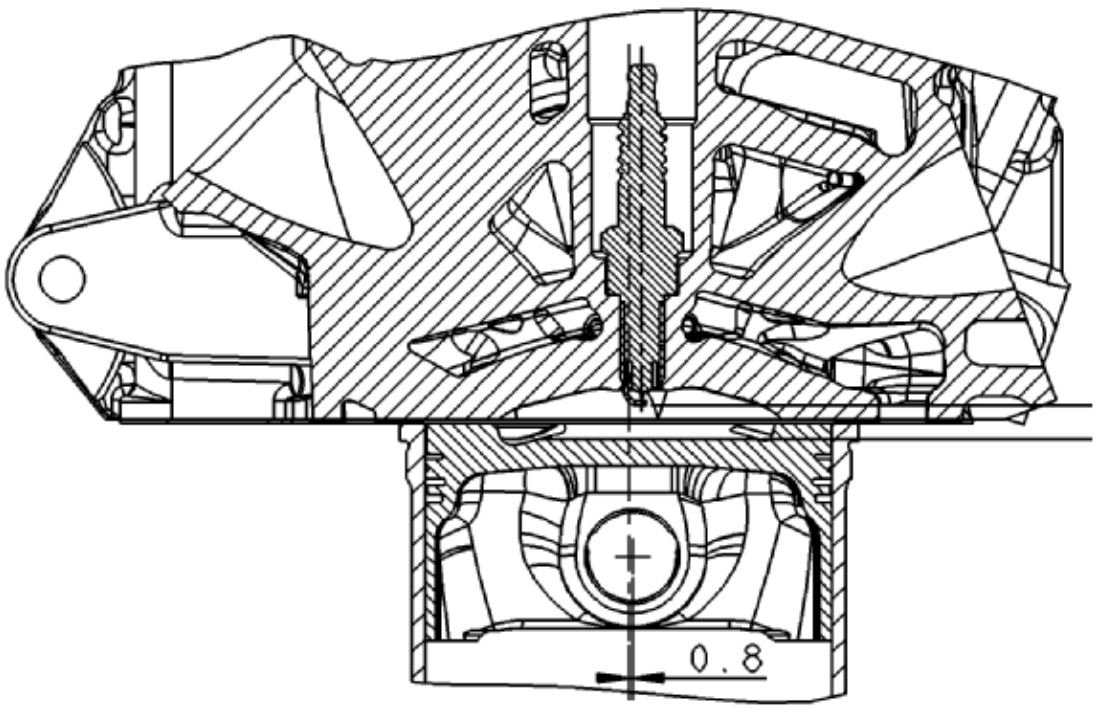
CAUTION!

The pistons are offset, which means that pistons intended for the right-hand bank are different from those for the left-hand bank.

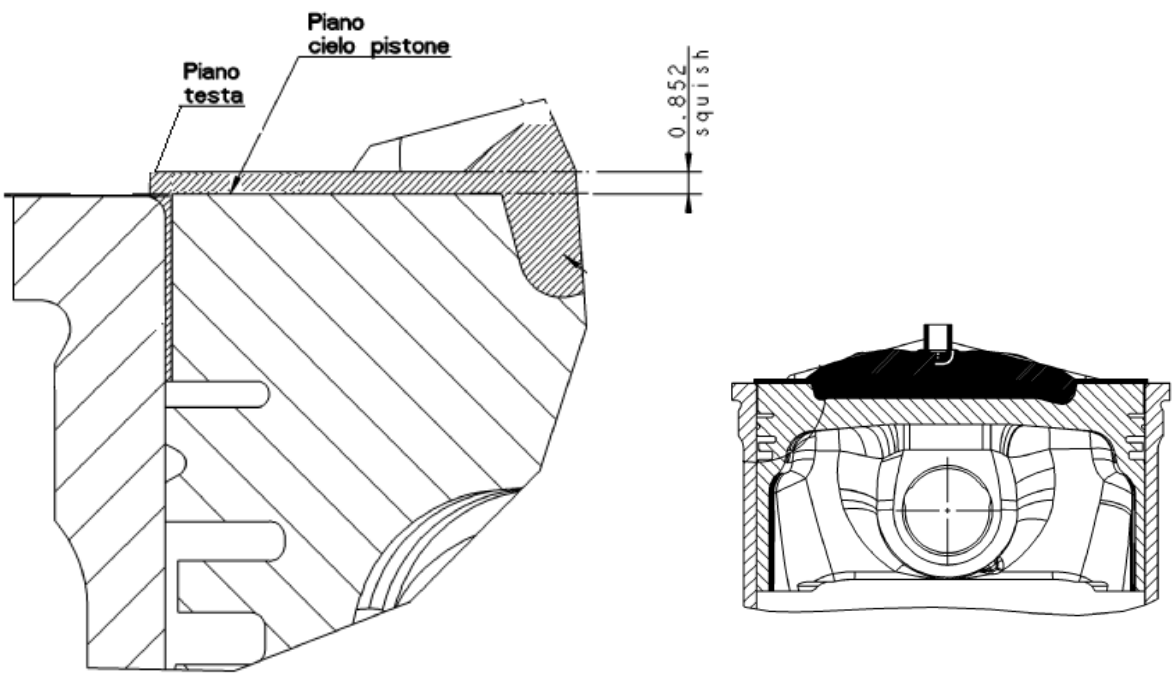


In addition to dimensional checks, always perform a careful visual inspection: The components must be free from dents, grazes, chips and other visible defects. Scoring and marks on the piston skirt resulting from careless handling may result in increased blow-by.

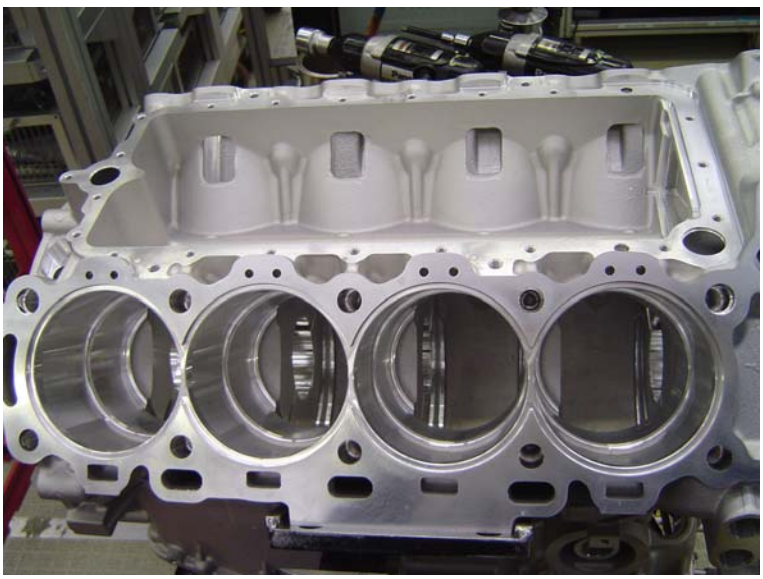
Compression ratio



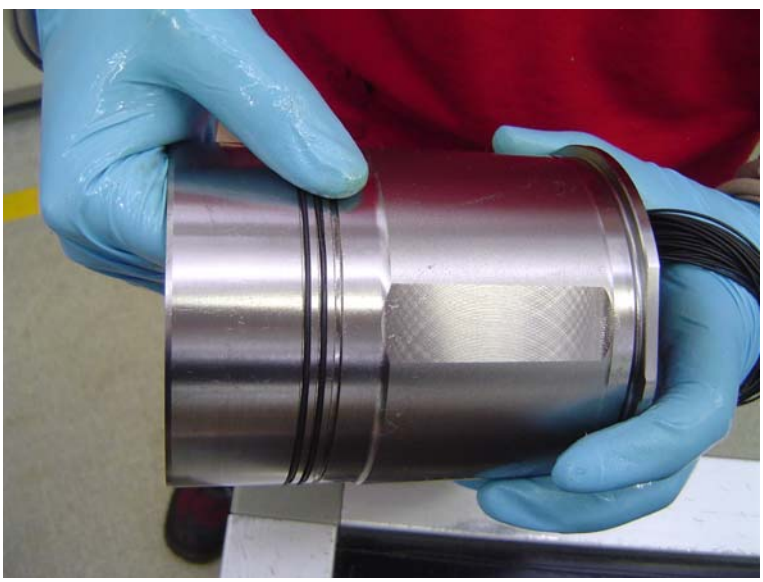
Volume of displacement per unit:	**530,479 cm^3**
Combustion chamber volume	**52.74 cm^3**
Height of combustion chamber in head	**6.6 mm**
Compression ratio	**11:1**



After checking the dimensional measurements of the cylinder liners and their respective housings in the upper crankcase, check that the liner mating surfaces are perfectly clean, then measure the projection of the liner from the crankcase as follows:
Insert the inverted liner into the crankcase and, by means of a dial gauge with feeler attachment, measure the projection of the liners from the crankcase.



Check that the projection is within the prescribed values: **0.01÷0.05 mm**.
If necessary, test each housing with different liners, so as to obtain the correct coupling.
It is important the projection is identical for all cylinder liners within the same bank. After having coupled the various liners with the respective housings, assign each one an ID number so as to prevent coupling errors during the assembly phase.

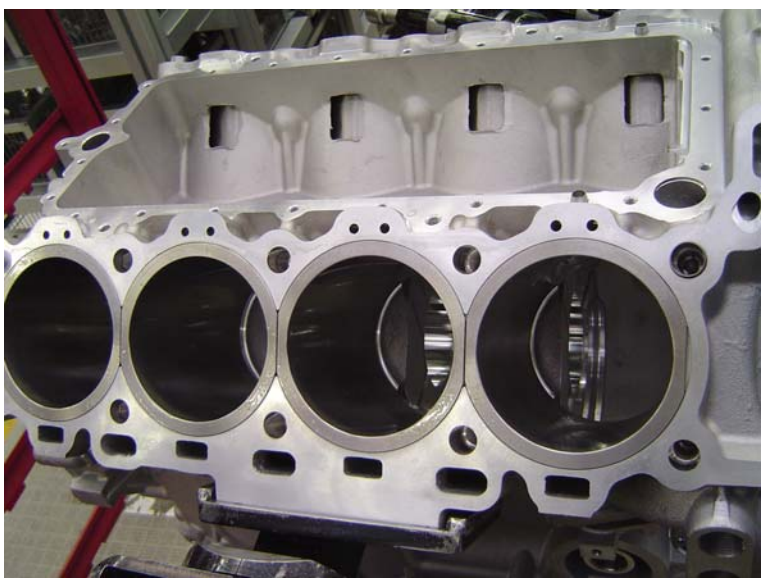


Heat the bare crankcase in an oven for approximately 90 minutes at 90°C±5°

Fit O-rings on the cylinder liners and lubricate them using SHELL HELIX ULTRA 5W40 engine oil.

Insert the cylinder liners into the crankcase, carefully following the coupling sequence used during the liner projection check

To fit the liner fully in its housing, strike the liner evenly along its perimeter using a rubber mallet.
The liners must be completely installed within **two minutes** of the crankcase being removed from the oven.

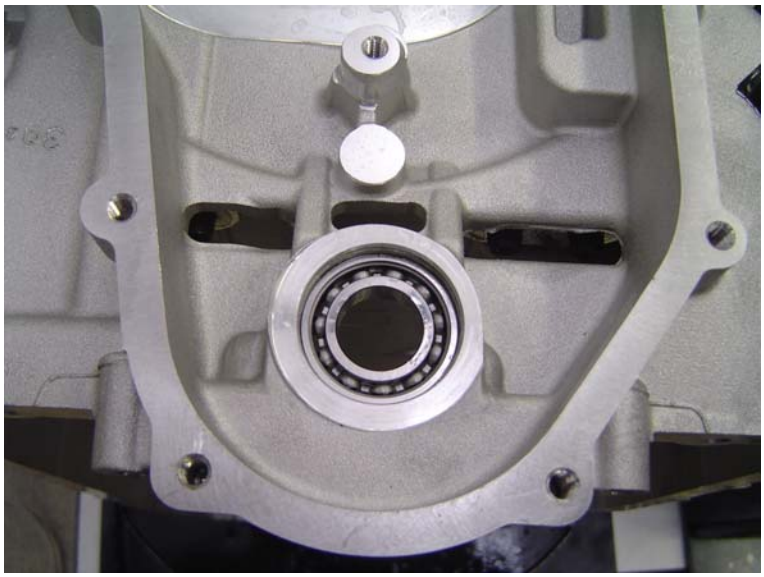


During the final stage of insertion, carefully ensure that there is no interference between the two adjoining edges on the upper rim of each liner.

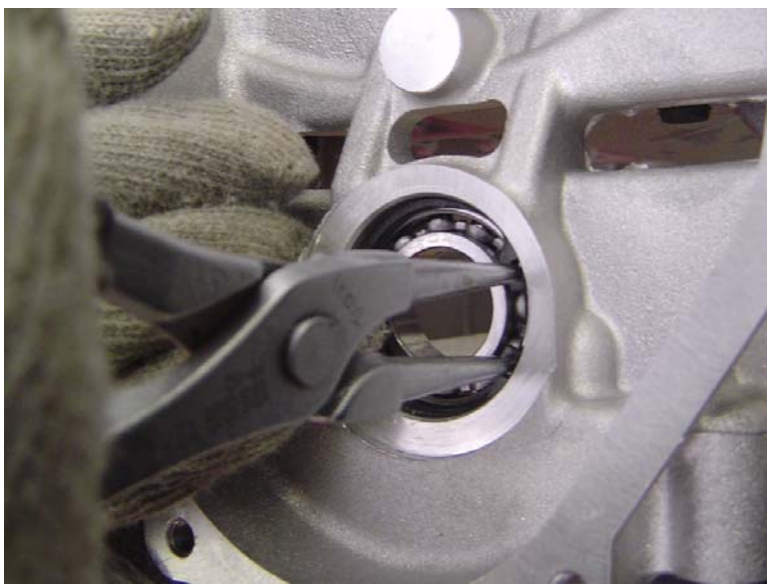
CAUTION

Ensure that there is no interference between the adjoinining edges of the upper rims.

Check once again that the overall projection of the liners for each bank is within **0.01÷0.05 mm**.



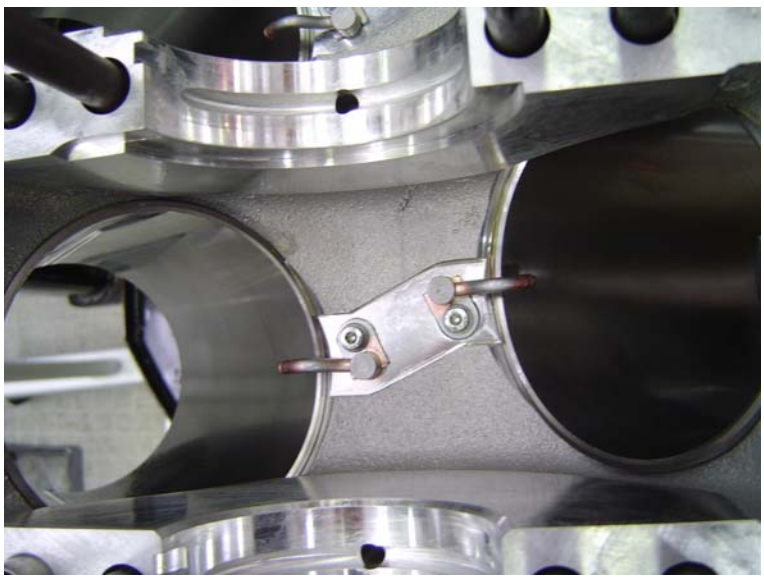
Snugly insert the oil pump gear bearing into the lower crankcase



Put the Seeger ring into the bearing housing hole.

Carefully check that the fastening ring is fully inserted in its housing.

Proceed with assembly of the unions for the piston cooling oil nozzles. Visually inspect the condition of the part and if in doubt replace it.

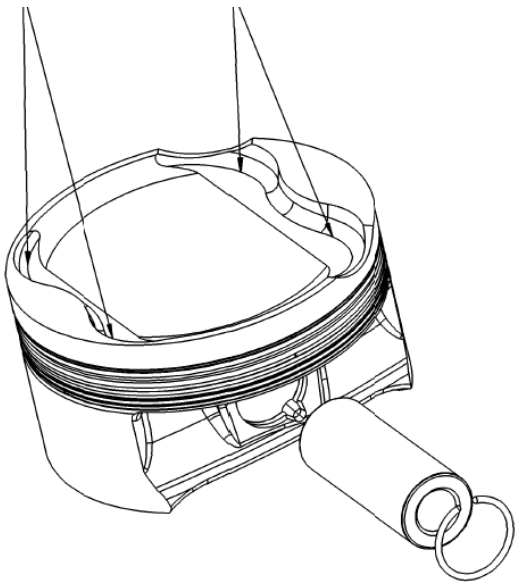


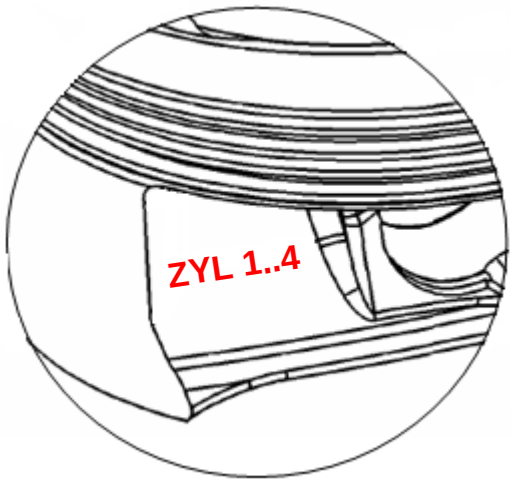
Fasten the nozzles using a screw TCEI M4x10 with corresponding washer Ø4x9x0.7.
Tighten using a torque wrench to **3Nm** after applying some **LOCTITE 242**.

ORIENTATION AND PISTON INSTALLATION DIAGRAM

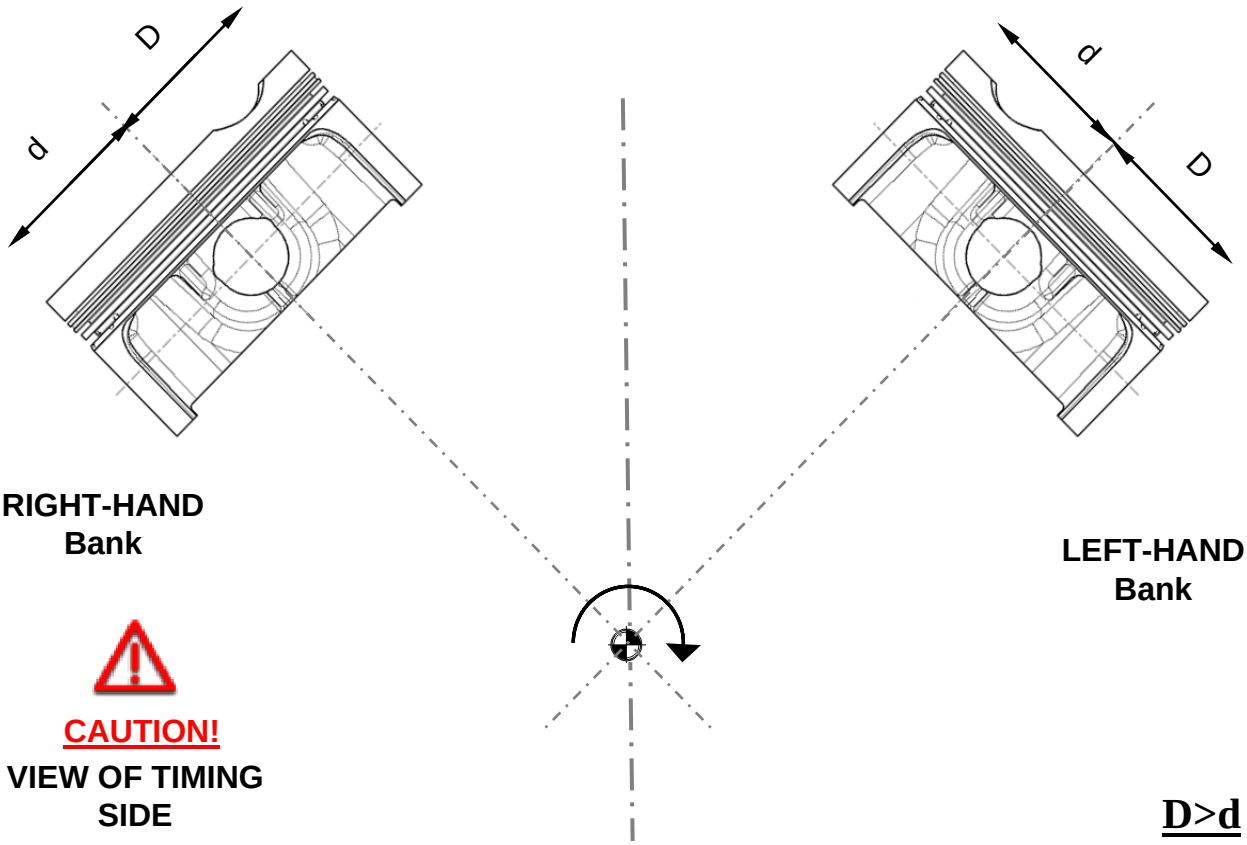
The hole for the gudgeon pin housing is NOT symmetrical with the piston pin. This offset is necessary to limit the lateral forces perpendicular to the cylinder liner. The offset follows the rotation direction of the crankshaft and, for this reason, the pistons on the right-hand bank are different from those on the left-hand bank.

Exhaust side Intake side





Identification mark indicating which bank the piston belongs to



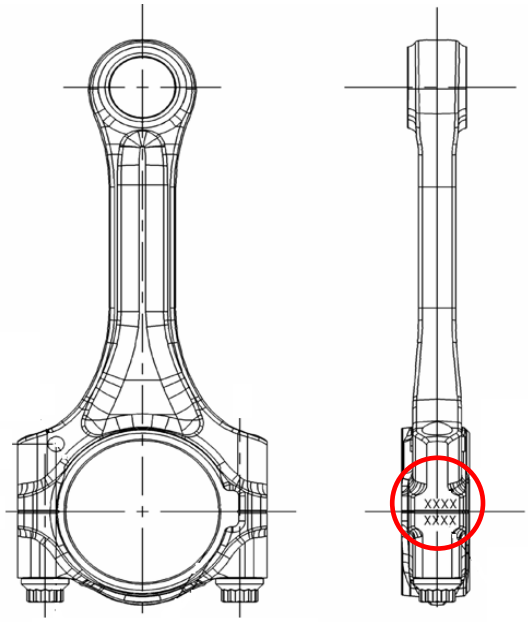
RIGHT-HAND Bank

LEFT-HAND Bank

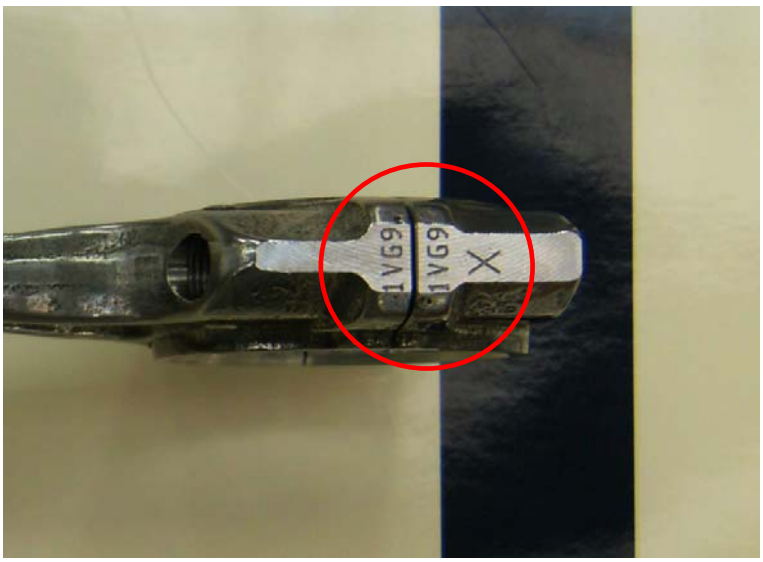
CAUTION!

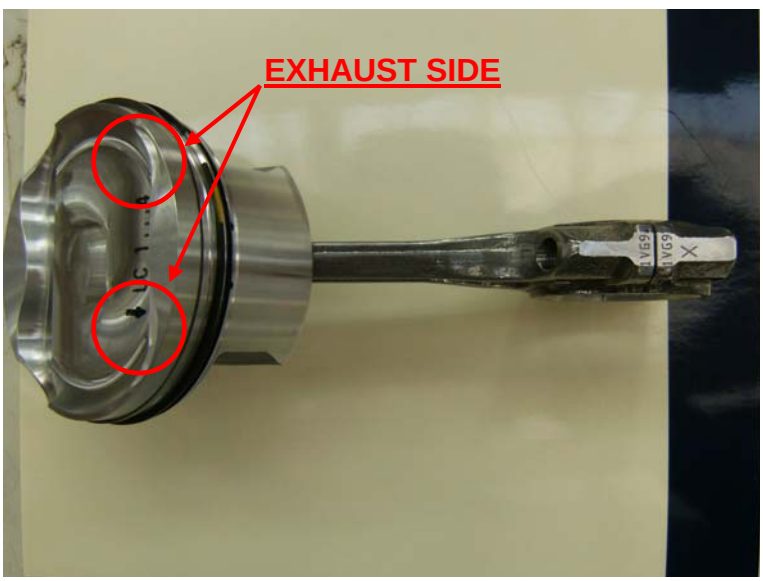
VIEW OF TIMING SIDE

D>d



After having performed the necessary dimensional checks on the pistons, piston rings and connecting rods, fit the pistons on the corresponding connecting rods, then insert them in the cylinder liners. If the pistons are new, the corresponding bank is indicated on the piston crown. As specified in the section on dimensional checks, the pistons of bank 1-4 are different to those of bank 5-8 due to the offset gudgeon pin hole.





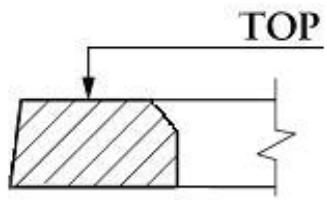
Positioning of big end bearings

The half-bearings and connecting rod must only be assembled after the necessary dimensional checks have been performed. For assembly of the half-bearings, refer to the following identification table.

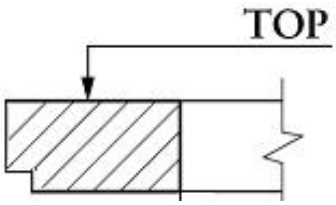
CONNECTING ROD PIN TABLE		CONNECTING ROD PIN **CONNECTING ROD SEAT**	CONNECTING ROD PIN **CONNECTING ROD SEAT**
Seat displacement =0.016		47.129 - 47.135 **CLASS X**	47.136 - 47.142 **CLASS Y**
CONNECTING ROD PIN **CRANKSHAFT**	43.630 43.637 **CLASS X**	***RED:* 1.730-1.735**	***BLUE* : 1.735-1.740**
		MINIMUM NOMINAL BACKLASH: 0.022	MINIMUM NOMINAL BACKLASH: 0.019
		MINIMUM EFFECTIVE BACKLASH: 0.038	MINIMUM EFFECTIVE BACKLASH: 0.035
		MAXIMUM NOMINAL BACKLASH: 0.045	MAXIMUM NOMINAL BACKLASH: 0.042
		MAXIMUM EFFECTIVE BACKLASH: 0.061	MAXIMUM EFFECTIVE BACKLASH: 0.058
CONNECTING ROD PIN **CRANKSHAFT**	43.621 43.629 **CLASS Y**	***BLUE:* 1.735-1.740**	**** BLACK:* 1.740-1.745**
		MINIMUM NOMINAL BACKLASH: 0.026	MINIMUM NOMINAL BACKLASH: 0.017
		MINIMUM EFFECTIVE BACKLASH: 0.034	MINIMUM EFFECTIVE BACKLASH: 0.033
		MAXIMUM NOMINAL BACKLASH: 0.050	MAXIMUM NOMINAL BACKLASH: 0.041
		MAXIMUM EFFECTIVE BACKLASH: 0.058	MAXIMUM EFFECTIVE BACKLASH: 0.057

* Currently not available as a spare

Insert the half-bearings in their respective housings both on the connecting rod and on the cap. Note that the bearing has the same width as the connecting rod head. After fitting, the part not occupied by the bearing must face towards the bevelled part of the crankshaft shoulder.



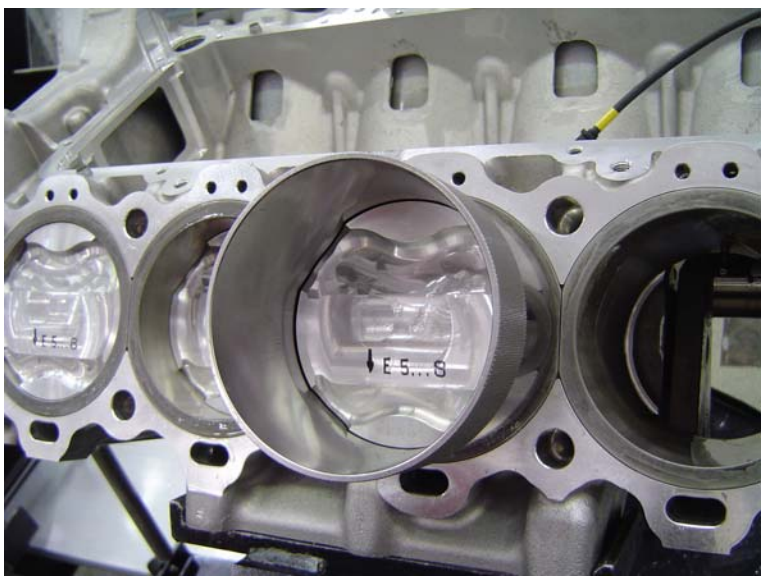
The piston rings are introduced on the pistons with a relative angle of 180°. The oil scraper ring can be mounted in any direction but pay attention to the junction point of the internal spring clip: do not position it at the upper and lower scraper ring opening.



CAUTION

DURING ASSEMBLY DO NOT CONFUSE THE POSITION OF THE PISTONS ON THEIR RESPECTIVE BANKS.

Closely inspect for wear and tear in the following areas:
1- Piston skirt
2- Circular crown
piston ring housing



Lubricate the piston skirt and piston rings using engine oil. Turn the seal rings with the respective openings to 180°. Insert the conrod-piston subassembly in the wrong liner, carefully checking that the bottom of the piston skirt juts outs slightly.

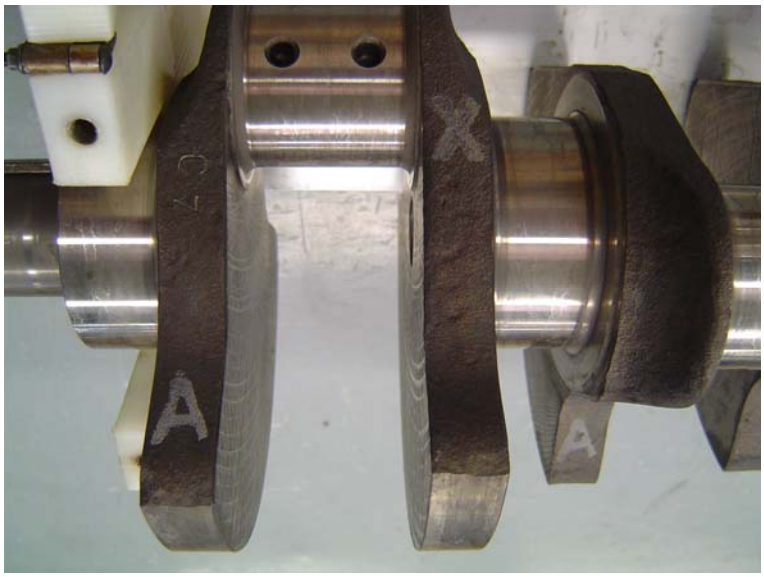
Position all the pistons at TDC in order to avoid possible interference with the crankshaft during assembly.

Positioning of main bearings

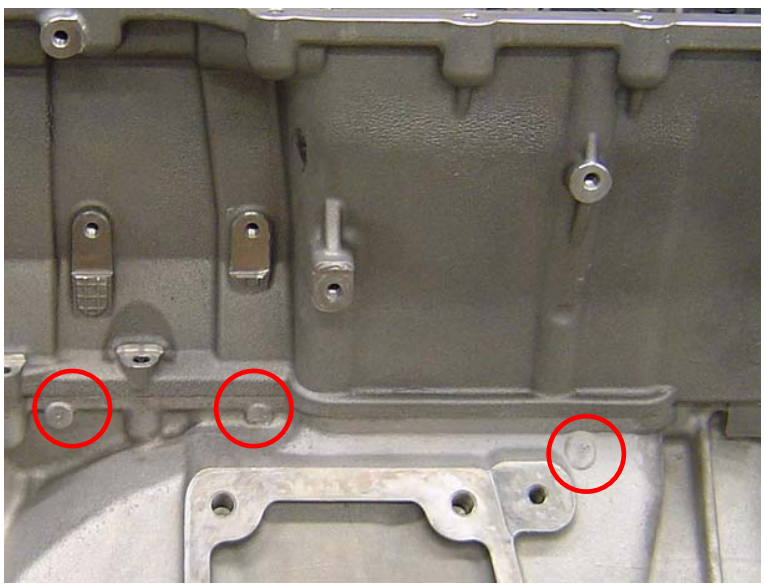
The half-bearings must only be fitted after the dimensional check has been performed. For fitting the half-bearings, refer to the identification tables.

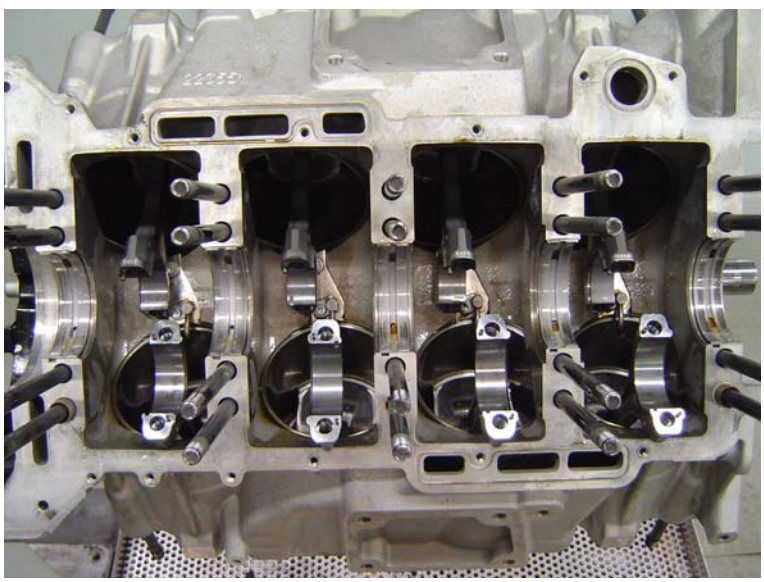
JOURNAL TABLE		JOURNAL **CRANKCASE SEAT**	JOURNAL **CRANKCASE SEAT**
Seat displacement =0.020		66.675 - 66.681 **CLASS A**	66.682 - 66.688 **CLASS B**
JOURNAL **CRANKSHAFT**	62.986 62.992 **CLASS A**	***BLUE* : 1.834 - 1.839**	***YELLOW* : 1.839 - 1.844**
		MINIMUM NOMINAL BACKLASH: 0.005	MINIMUM NOMINAL BACKLASH: 0.002
		MINIMUM EFFECTIVE BACKLASH: 0.025	MINIMUM EFFECTIVE BACKLASH: 0.022
		MAXIMUM NOMINAL BACKLASH: 0.027	MAXIMUM NOMINAL BACKLASH: 0.024
		MAXIMUM EFFECTIVE BACKLASH: 0.047	MAXIMUM EFFECTIVE BACKLASH: 0.044
JOURNAL **CRANKSHAFT**	62.979 62.985 **CLASS B**	***YELLOW* : 1.839 - 1.844**	***GREEN* : 1.844 - 1.849**
		MINIMUM NOMINAL BACKLASH: 0.002	MINIMUM NOMINAL BACKLASH: -0.001
		MINIMUM EFFECTIVE BACKLASH: 0.022	MINIMUM EFFECTIVE BACKLASH: 0.019
		MAXIMUM NOMINAL BACKLASH: 0.024	MAXIMUM NOMINAL BACKLASH: 0.021
		MAXIMUM EFFECTIVE BACKLASH: 0.044	MAXIMUM EFFECTIVE BACKLASH: 0.041

Insert the half-bearings in their respective housings. The bearings to be fitted to the upper crankcase, unlike those used for the lower crankcase, have a hollow centre with two holes permitting oil to pass through. Generously lubricate the half-bearings with SHELL HELIX ULTRA 5W40 oil.

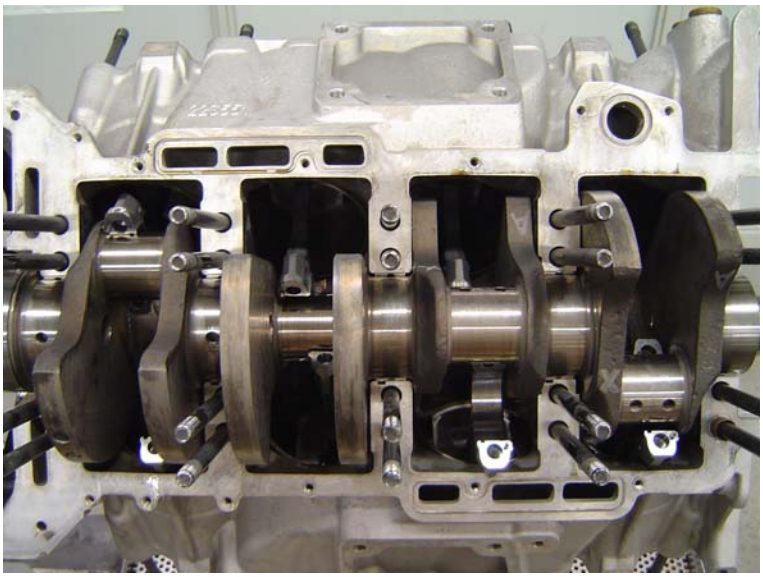


Identify the classes of the crankshaft and crankcase by checking their surface, to ensure selection of the correct main bearing halves.

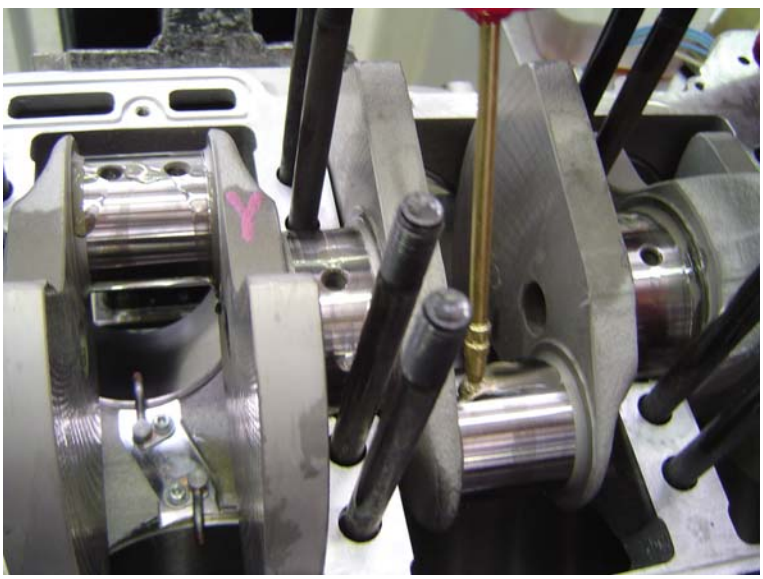




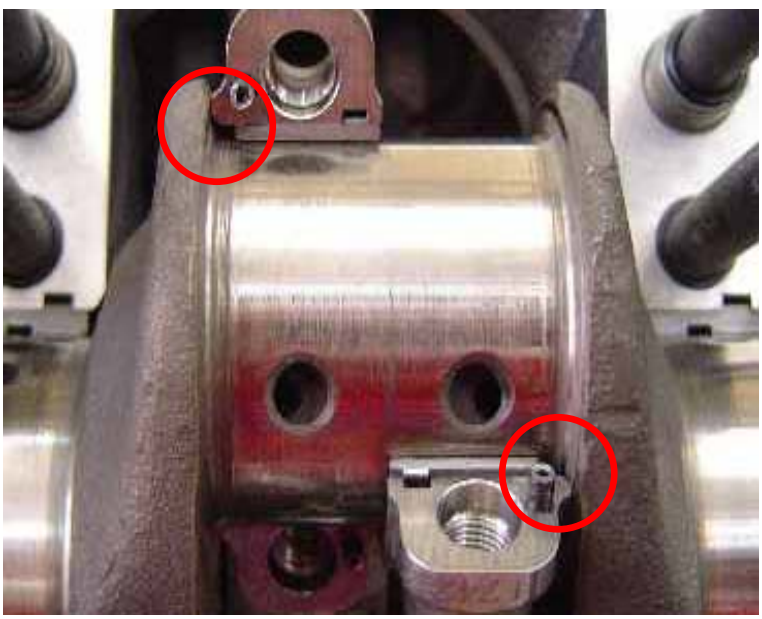
Generously lubricate the half-bearings with SHELL HELIX ULTRA 5W40 oil.



Insert the crankshaft in its seat on the upper crankcase half. Position the 6x6x70 mm tab on the timing side of the crankshaft.

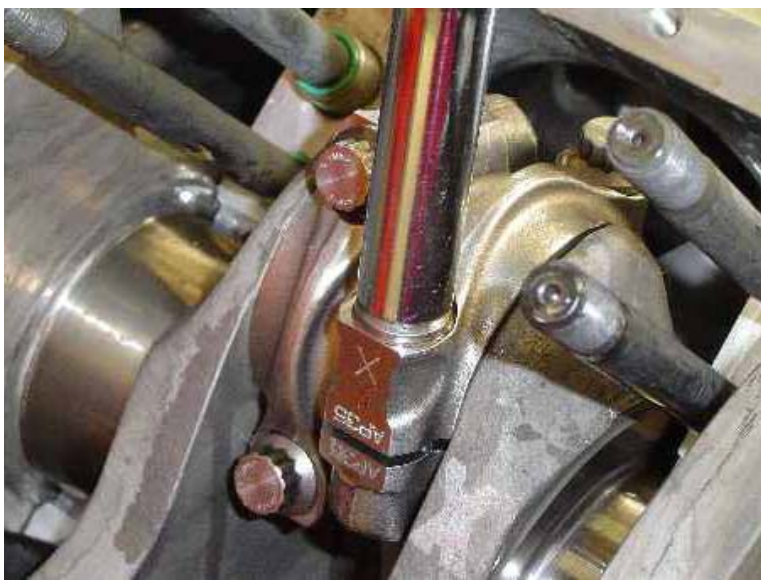


Generously lubricate the crank pins with SHELL HELIX ULTRA 5W40 oil.



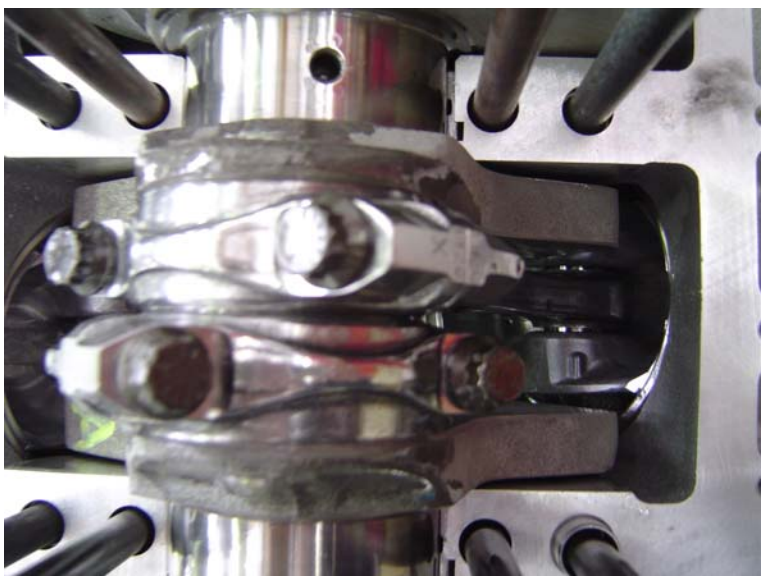
Fit the connecting rod caps, generously lubricating them with engine oil.
Pay close attention to the mounting direction of the caps: the side with the half-bearing inserted must face towards the beam which links the shaft shoulder to the respective crank button.

Pay attention to the correct mounting direction of the connecting rod and its cap. The area not covered by the bearing must face towards the beam of the crank button. Incorrect assembly may cause premature wear and fusion of the parts.



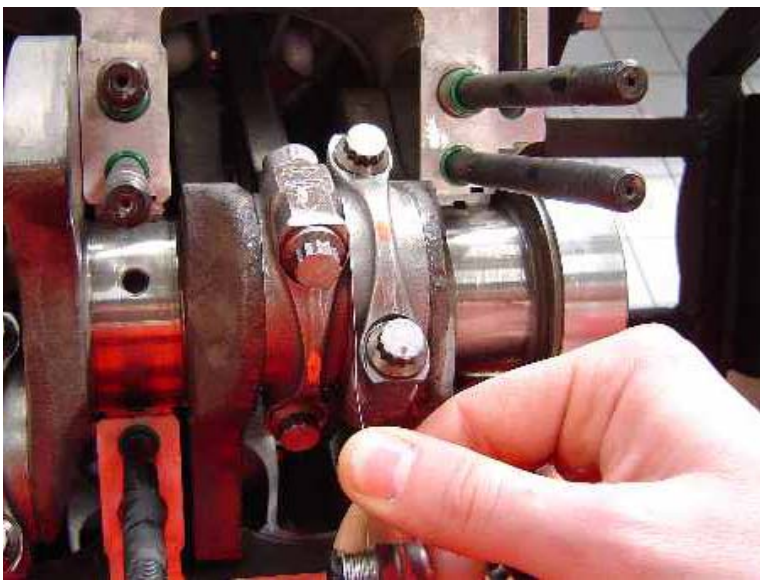
Make sure that the screws and surfaces of the connecting rod assembly are perfectly clean.

Tighten using a torque wrench as follows:
STEP 1: **20Nm** on both screws
STEP 2: **30Nm** on both screws then apply an angle of **58°±1** to both screws.



CAUTION!

If after applying a rotation angle of **58°±1** the residual torque is less than **70±10 Nm**, retighten using new screws. Tightening exerts yield stress which causes the material to deform plastically after repeated tightening attempts. This deformation drastically reduces the resistance of the material.



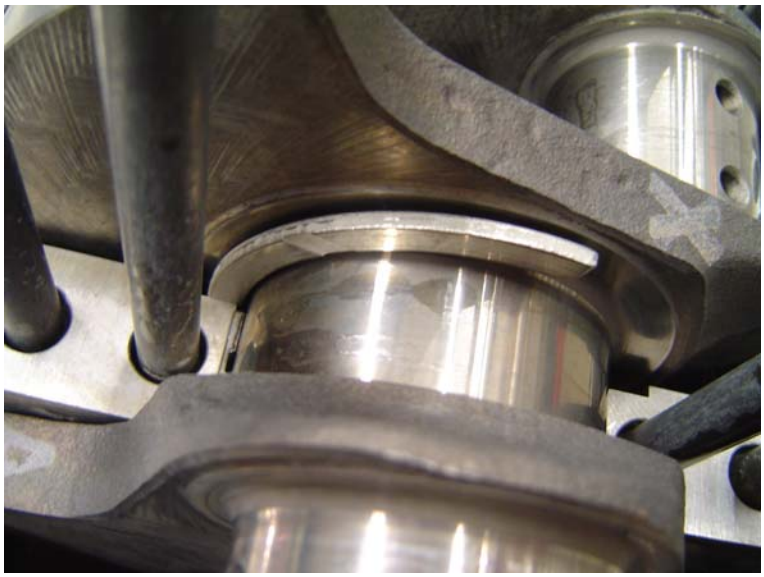
CONNECTING ROD AXIAL PLAY

Check the axial play of the connecting rods. Use a feeler gauge to check that the play is within **0.20÷0.339 mm**.

Insert the washers on the crankshaft bearing

Upper crankcase washer

Lower crankcase washer



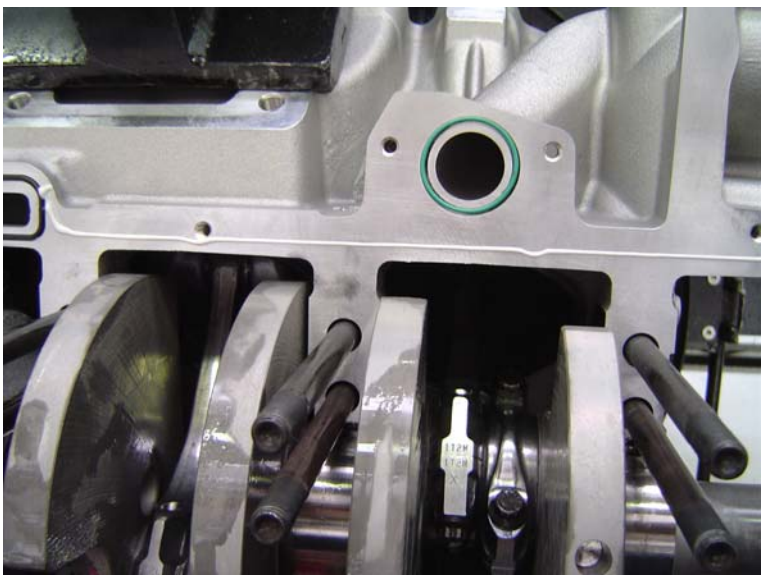
These washer rings affect the axial play of the crankshaft. They are available in different thicknesses.
(Standard, 1st Oversize, 2nd Oversize) according to the type of coupling required.

Insert the slewing rings on the upper crankcase, rotating them in their seat on the central support.

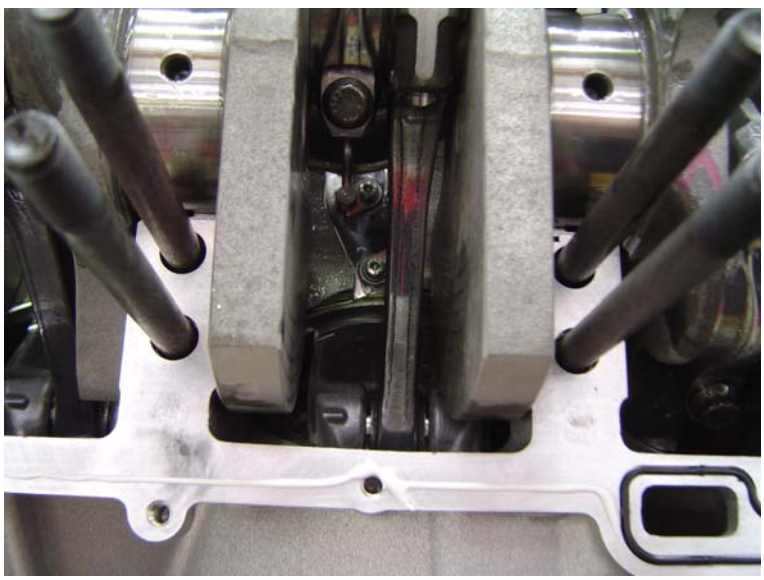
Pay attention to the mounting direction: the side with the two lubrication holes must face towards the crankshaft shoulder.

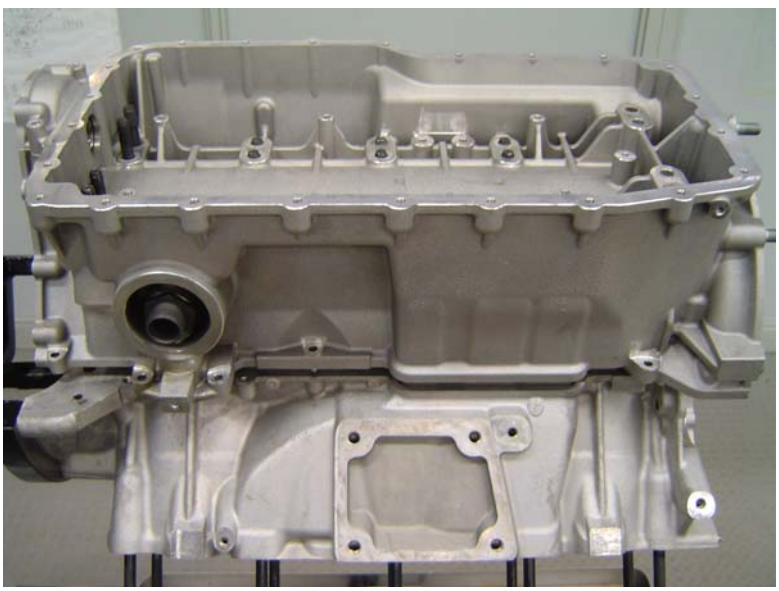
CAUTION!

Before positioning the crankcase gaskets and applying CAF4 sealant, check that the contact surfaces are perfectly clean.

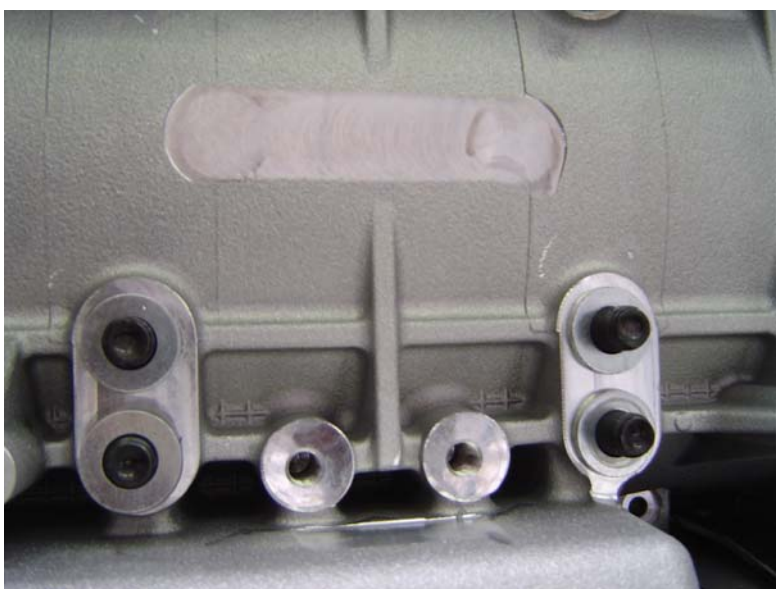


Position the oil seal gaskets and spread the CAF4 sealant along the perimeter of the upper and lower crankcase.





Couple the upper crankcase with the lower crankcase within 10 minutes of the sealant being applied.

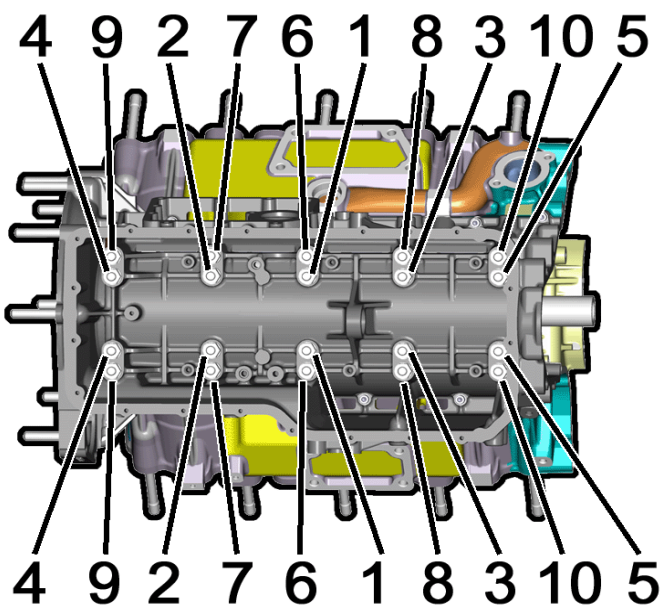


Then tighten the crankcase within two minutes of coupling, without any stoppages.

CAUTION!

Position the washers on the lower crankcase. Washers Ø10-20x 2.5 have a lapped surface with a different grade of surface finishing. The machined part must be fitted without lubrication to the stud bolt, facing the crankcase.

Lubricate the upper face of the washer and the threaded part of the crankcase stud bolts using Molycote 1000 grease. Fit the fastening nuts M10x1.25x8 and check that the part showing the resistance class is facing uppermost, rather than towards the washer.



PROCEED WITH TIGHTENING ACCORDING TO THE PRESCRIBED TIGHTENING SEQUENCE

TIGHTEN THE NUTS TO A PRELOAD TORQUE OF **15 NM**.
TIGHTEN THE INNER NUTS, APPLYING A TIGHTENING ANGLE OF **135°±1.**
TIGHTEN THE OUTER NUTS, APPLYING A TIGHTENING ANGLE OF
105 °±1

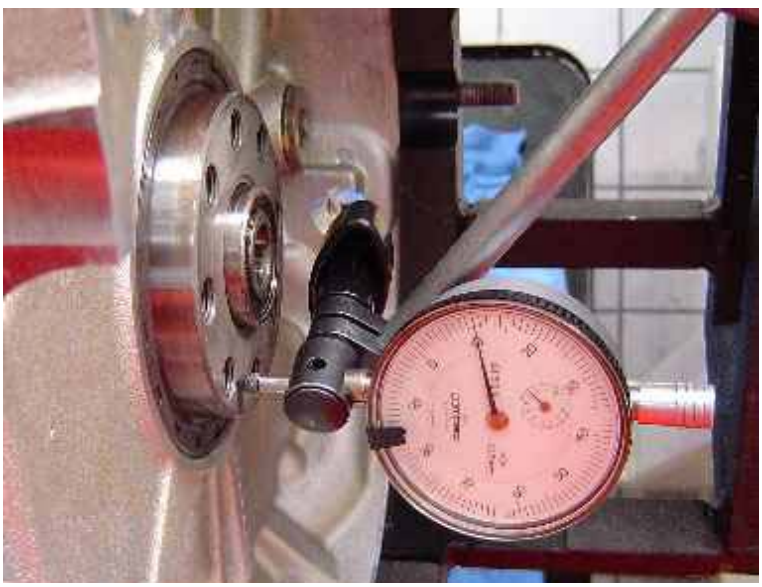
Tighten the screws TCEI M6x25 at the outer seam of the subframe to a torque of 10 Nm.

Remove any excess silicone that may have escaped after tightening.

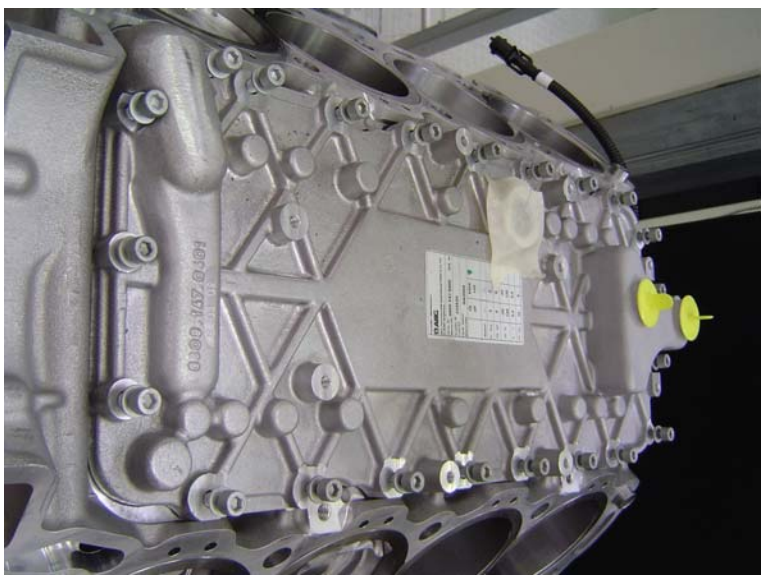
Before assembling the flywheel side crankshaft oil seal, ensure that the oil seal housing is perfectly clean.

Insert the clutch side crankshaft oil seal using tool **900027060**.

Position of the oil seal after press fitting. Check the resistance torque transmitted during rotation of the crankshaft. This check must be performed with the engine positioned horizontally.



Firmly attach a magnetic base to the crankcase and use a centesimal dial gauge to measure the axial play. The value must be between **0.12** and **0.24 mm.**

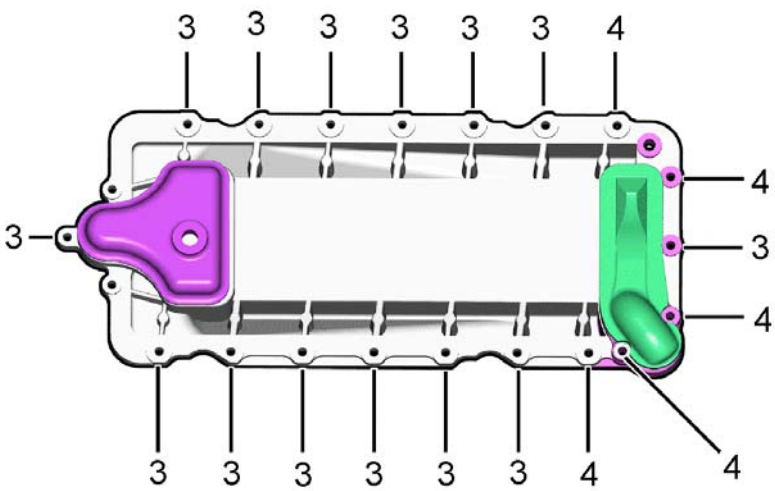


Place the seal gasket between the heat exchanger and the crankcase and install the heat exchanger.

CAUTION!

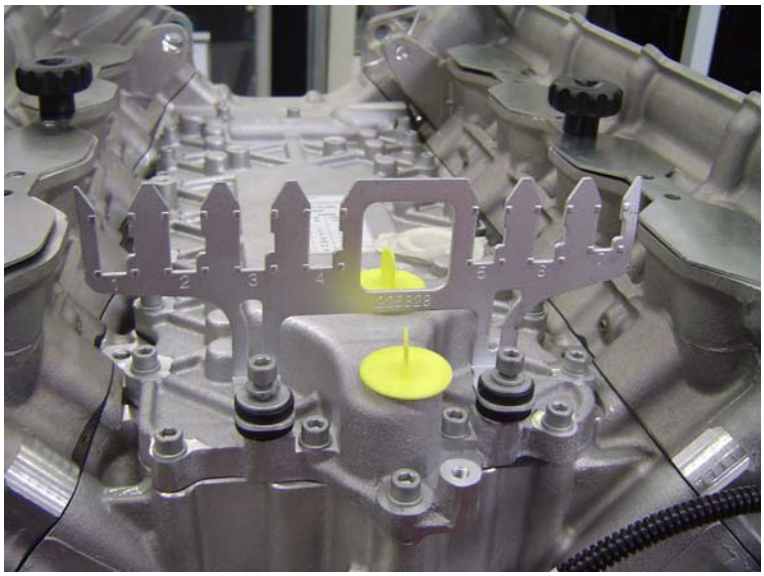
During assembly of the water/oil heat exchanger, it is good practice to visually inspect the condition of the cooler element. Carefully clean the component so as to guarantee maximum heat dissipation during operation.

To ensure there are no leakages or bleeding, before assembly perform a press test by immersing the heat exchanger in a container of water, plugging one of the two intakes and blowing air in through the other intake.

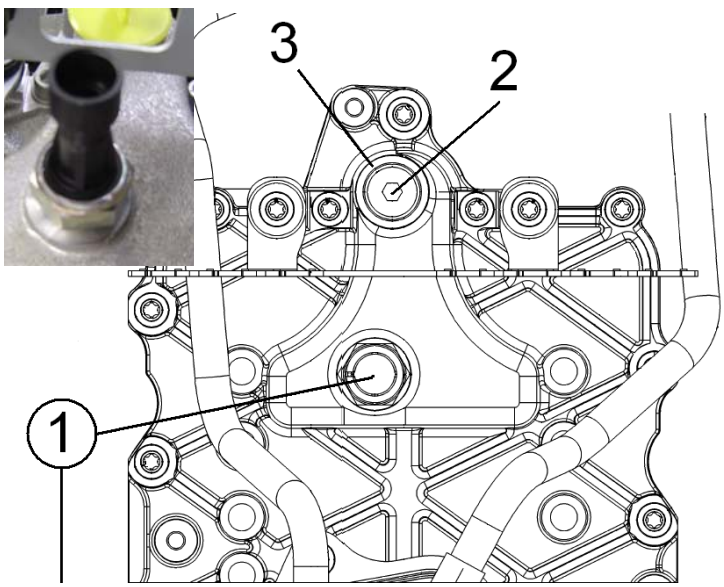


3 14 x screws TCEI M6x25 with washer. Tightening Torque: 10Nm

4 5 x screws TCEI M6x30 with washer for fastening to oil intake area. Tightening Torque: 10Nm

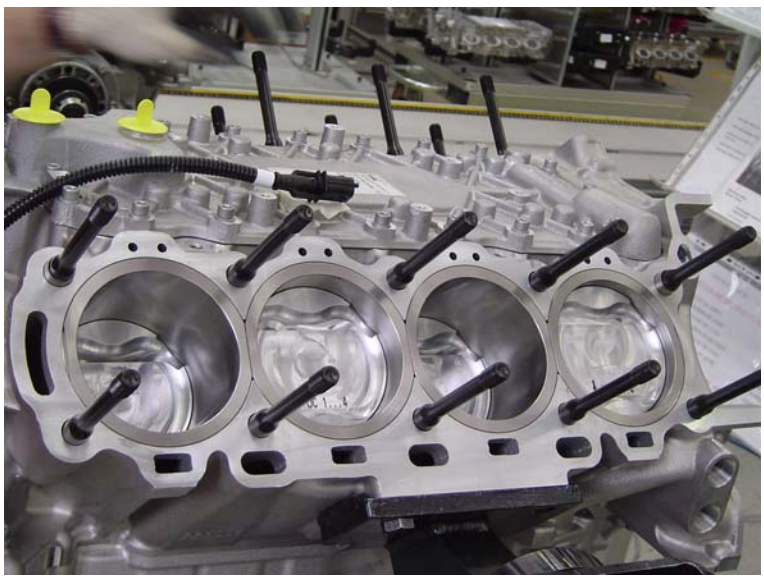


Fit the wiring bracket on the water/oil heat exchanger and tighten using screws TCEI M6x35 equipped with washer. Tighten to a torque of 10Nm



Fit the electrical oil pressure transmitter complete with gasket. Tighten to a torque of 32 Nm

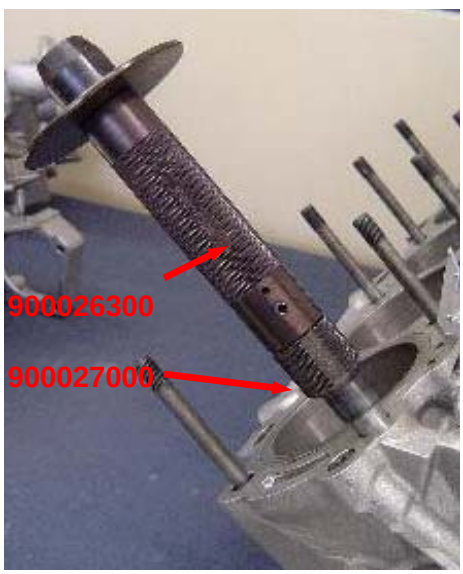
Fit the angular velocity sensor and secure it with screw TCEI M6x14 and corresponding washer. Tightening torque: 8 Nm.

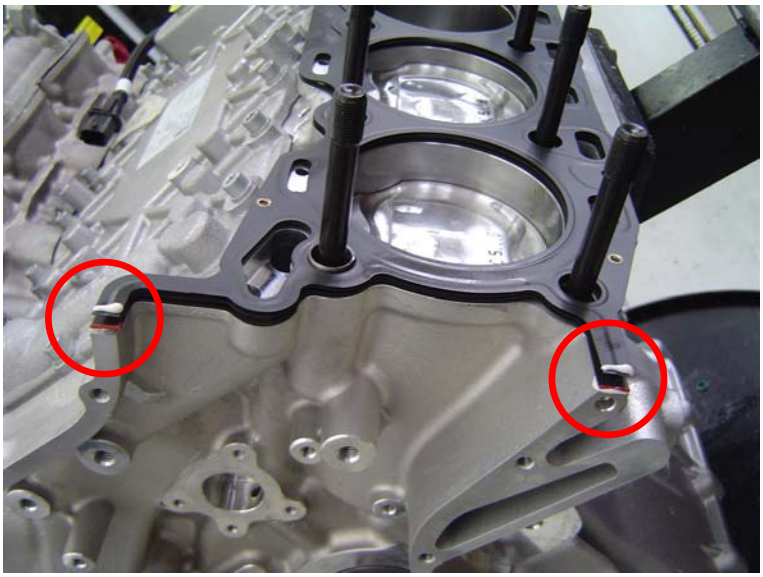


Before fitting the head gaskets, check that the mating surface is perfectly clean.

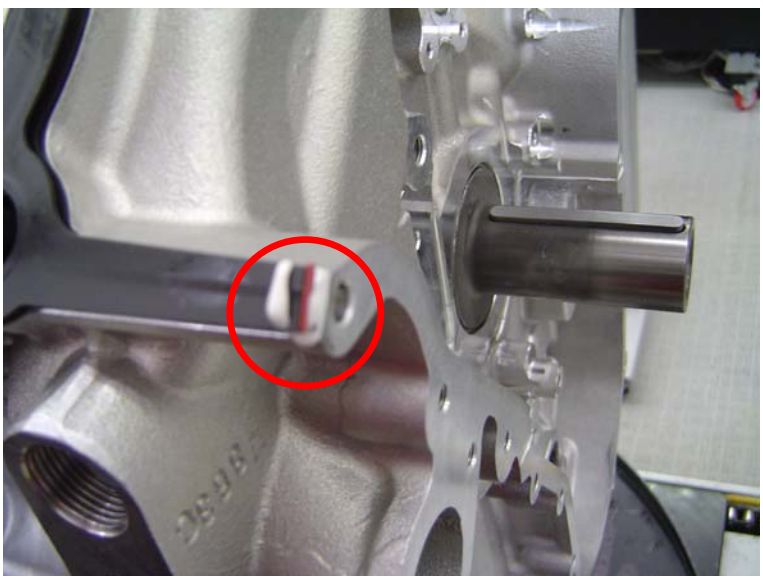
If the the head centering bushes are damaged or need to be removed, retrieve them using punch **900026300** equipped with tool **900027000**.

Position the head gaskets on the two banks.



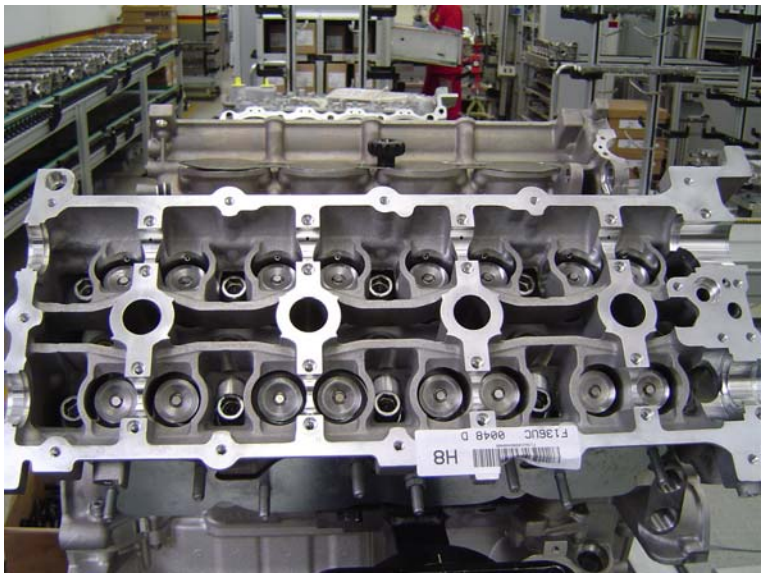


Apply a small quantity of CAF4 silicone sealant to the timing side ends of the head gaskets.



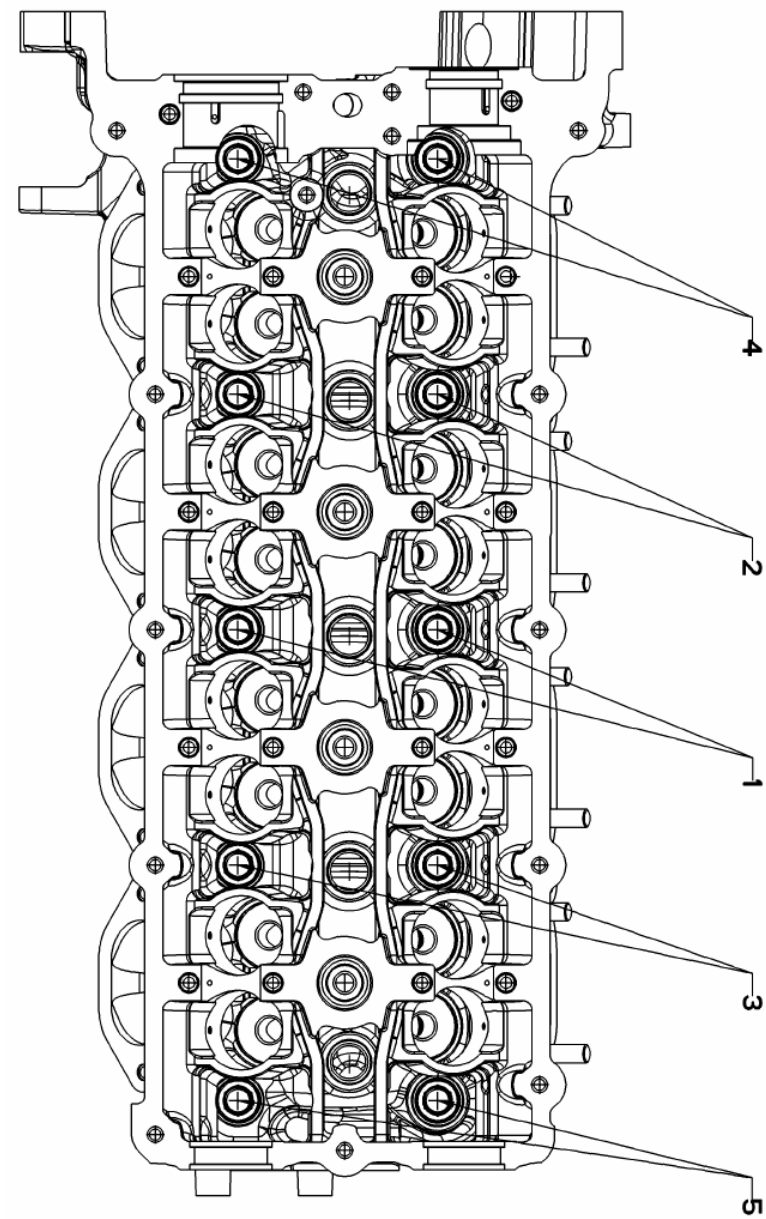
CAUTION!

Before fitting the engine head, rotate the crankshaft so that all of the pistons are located under TDC. This is achieved by rotating the crankshaft until the tab on the crankshaft (timing side) is set at 9 o'clock



Assemble the engine heads

Position the washers ∅11.25x2x2.5, without lubrication, so that the lapped surface is in contact with the cylinder head.
Lubricate the crankcase stud bolt and the top of the washers with **MOLYCOTE BR2 grease.**
Fasten the nuts M11x1x18.

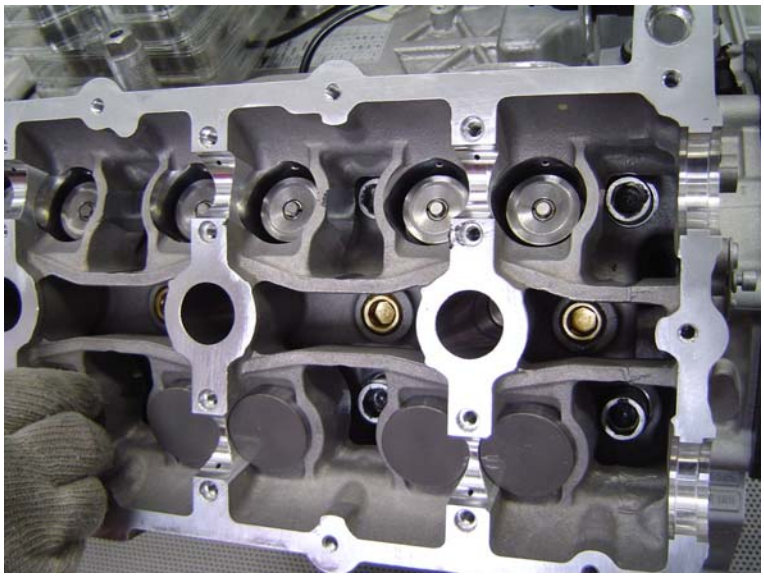


HEAD TIGHTENING PROCEDURE:

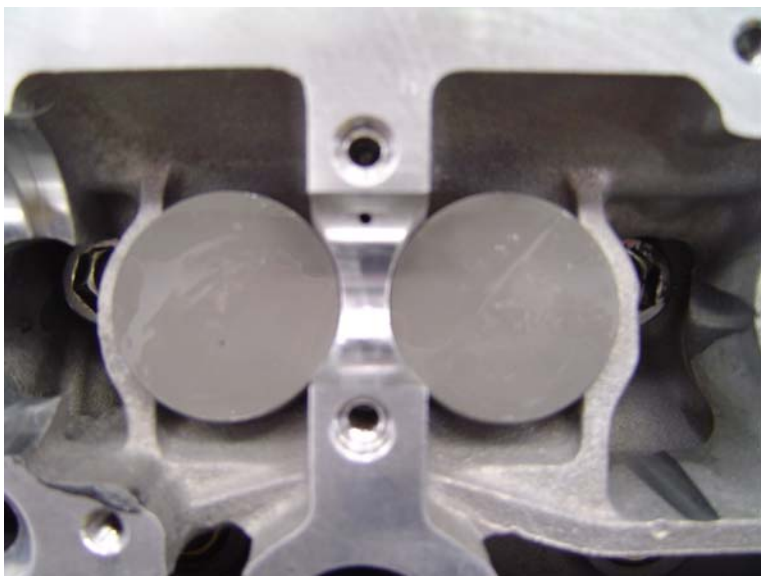
STEP 1: 60 Nm
STEP 2: 90°
Resulting torque 85Nm±15

For correct tightening of the head on the crankcase, follow the sequence indicated in the figure.

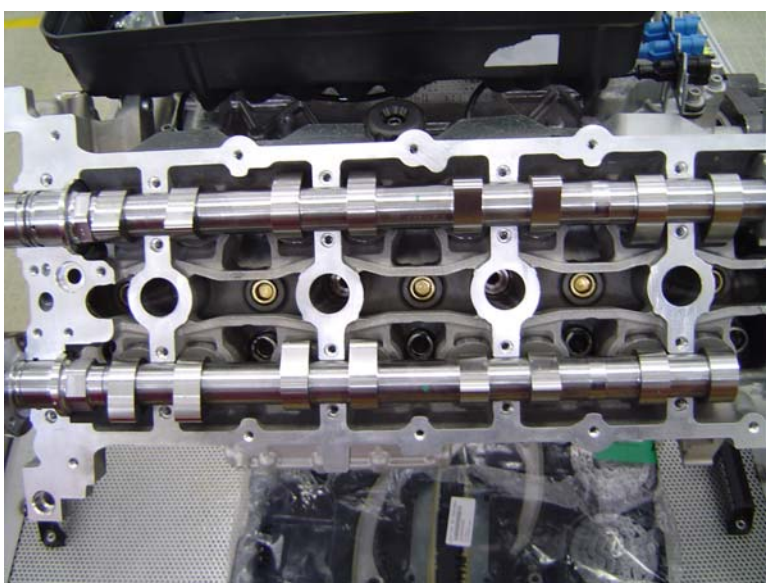
Follow the same tightening procedure for both engine heads.



Lubricate the housings of the hydraulic tappets on the engine heads.

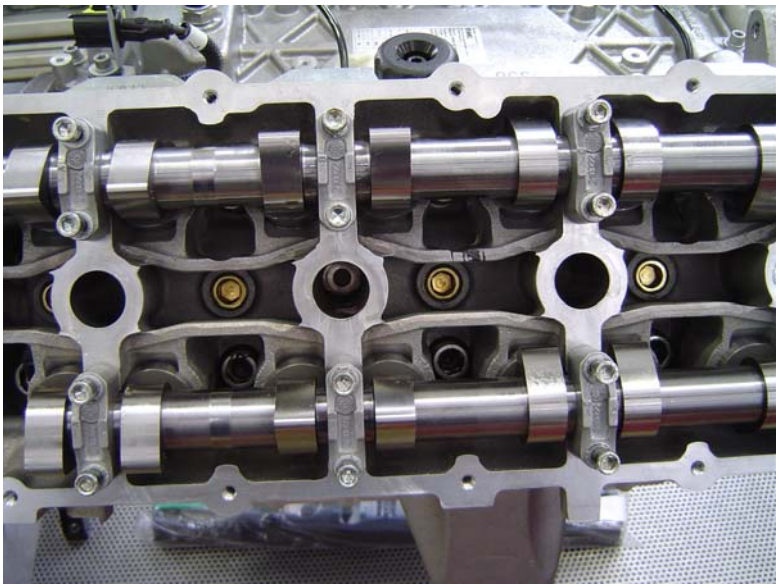


Insert the new hydraulic tappets in the appropriate housings on the engine heads.

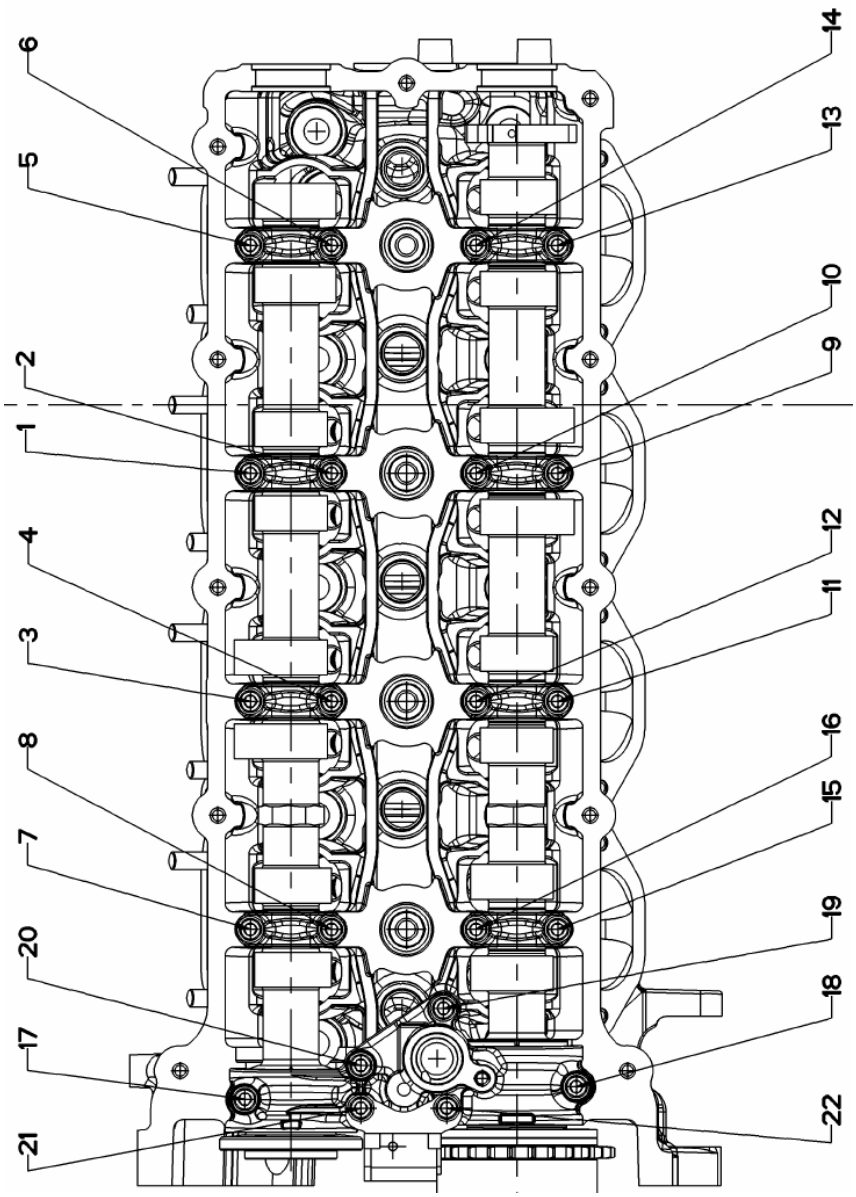


CAMSHAFT ASSEMBLY

Lubricate the camshaft bearings and position the camshafts on the engine head. This operation must be performed on both engine heads.



Ensure that the numbers on the engine head and cap match up. The camshaft caps undergo final machining once mounted on the engine heads. The fixing cap and the position on the head are then identified by means of numbering engraved on both the cap and the head. Each fixing cap has its own number, which corresponds to its respective position on the head.

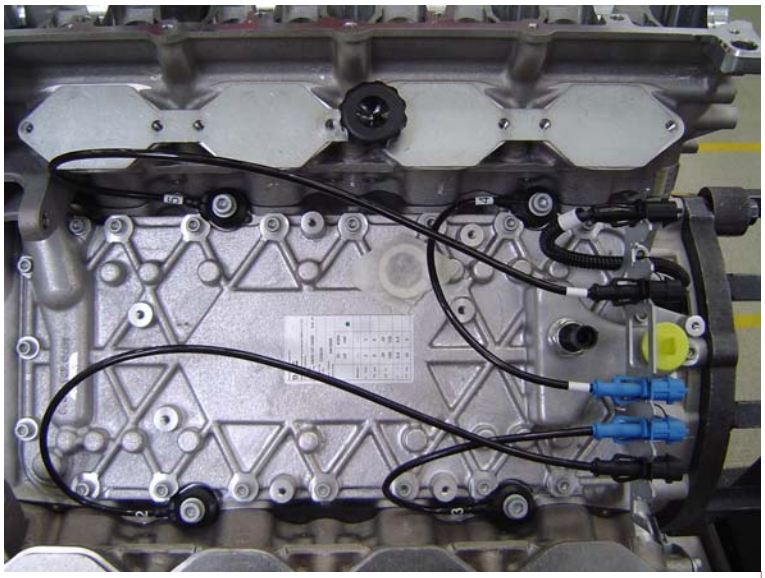


The numbering (on the cap and head) must be read in the same direction.

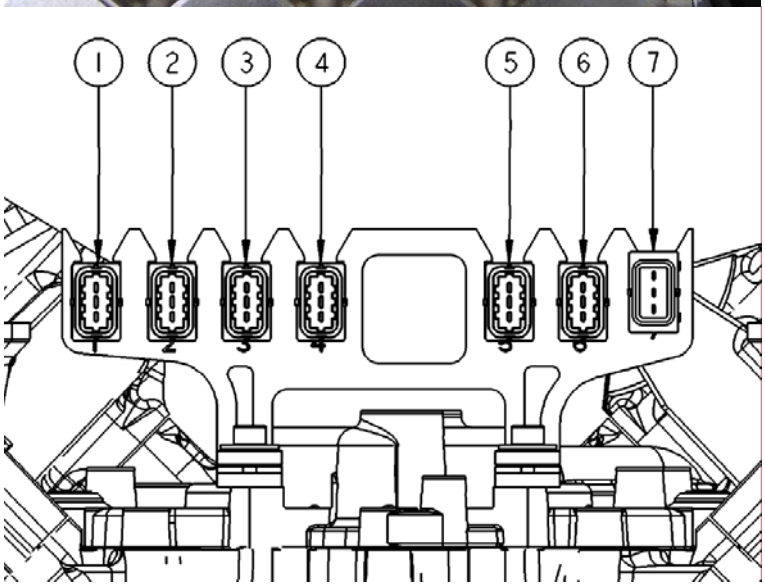
Tighten the middle caps with screws TCEI M5x14 equipped with conical washer ∅ 6-12x1.2mm. Tightening torque 5Nm +30°

Tighten the front fixing caps with screws TCEI M6x45 equipped with conical washer ∅ 6-12x1.2mm Tightening torque 5Nm +30°

The numbering (on the cap and head) must be read in the same direction.



For correct operation of the knock sensors, it is important that assembly be performed in compliance with the correct tightening procedure.
Install the sensors and secure them using screws TE M8x30.
Tightening torque 20 Nm.



Timing side

1 EXH. TIMING SENSOR LEFT-HAND BANK

2 DETONATION SENSOR BETW_CYL.7-8_LH_BANK

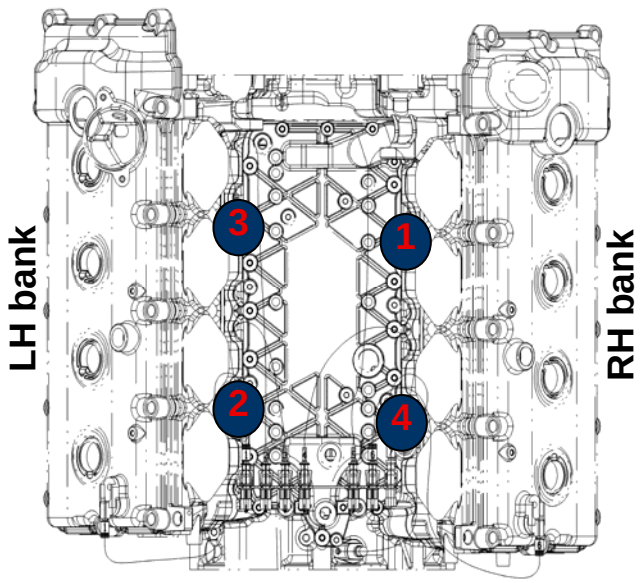
3 DETONATION SENSOR BETW_CYL.5-6_LH_BANK

4 DETONATION SENSOR BETW. CYL.3-4 RH BANK

5 DETONATION SENSOR BETW_CYL._1-2_RH_BANK

6 INT. TIMING SENSOR RIGHT-HAND_BANK

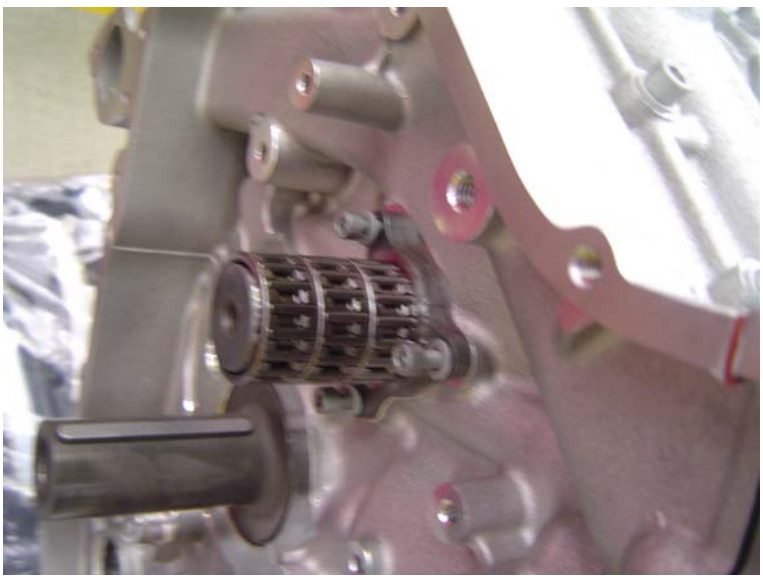
7 ANG. VELOCITY SENSOR RIGHT-HAND_BANK



Sensors positioning

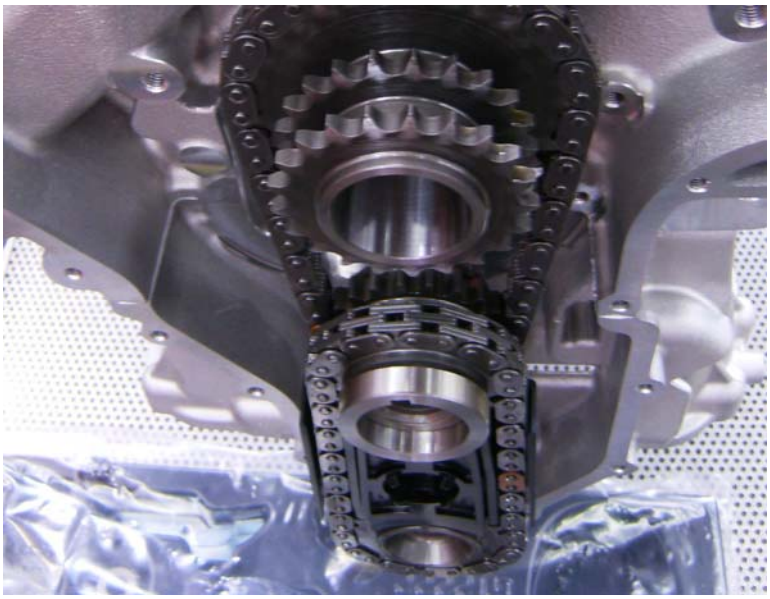
1. Cylinders 1 - 2
2. Cylinders 5 - 6
3. Cylinders 7 - 8
4. Cylinders 3 - 4

Fit the timing layshaft support using four screws TCEI M5x16 equipped with conical washer ∅ 5-11x0.9
Apply Loctite 242.
Torque: 6 Nm

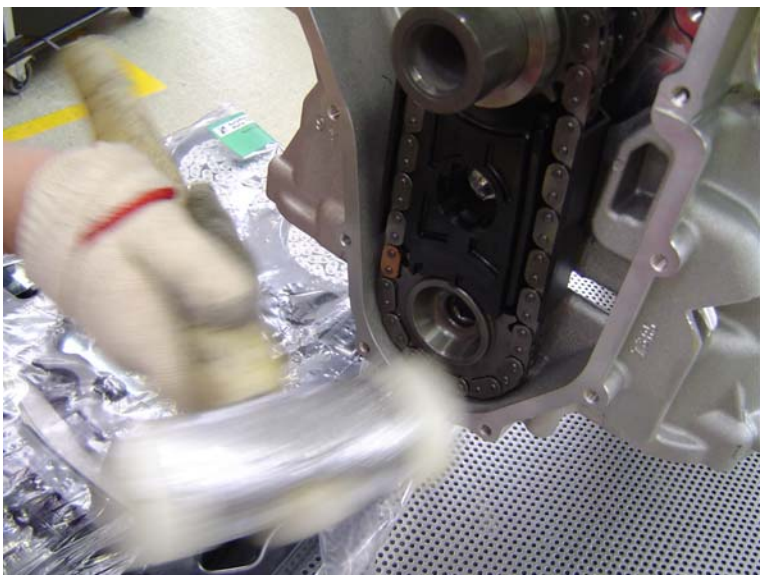


Introduce the roller cages on the timing layshaft support.

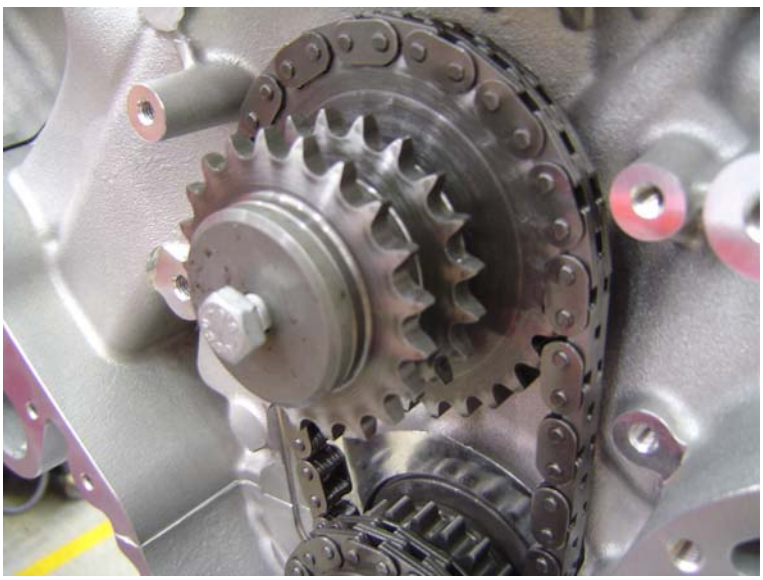
Then fit the cogwheel-chain assembly onto the camshaft and timing layshaft.



Install the complete oil pump control assembly.

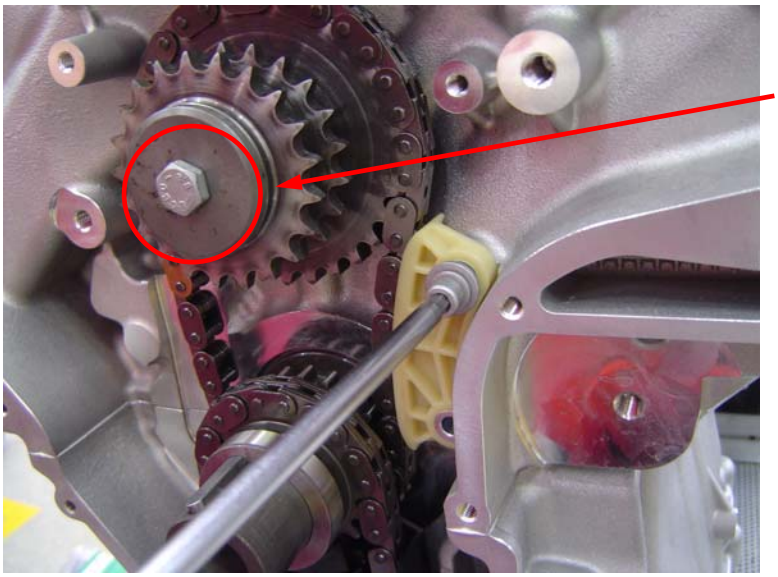


Insert the oil pump control cogwheel in its respective bearing housing.

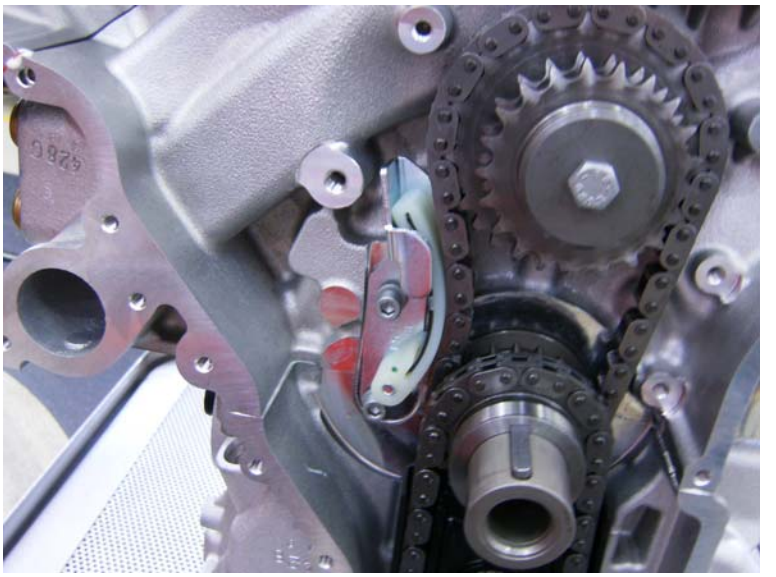


Fit screws M8x14 to secure the shoulder for the timing triple gear support.
Tighten to 25 Nm

Check the axial play between the triple gear support and the cogwheel: it must be between 0.05 and 0.20 mm**.**

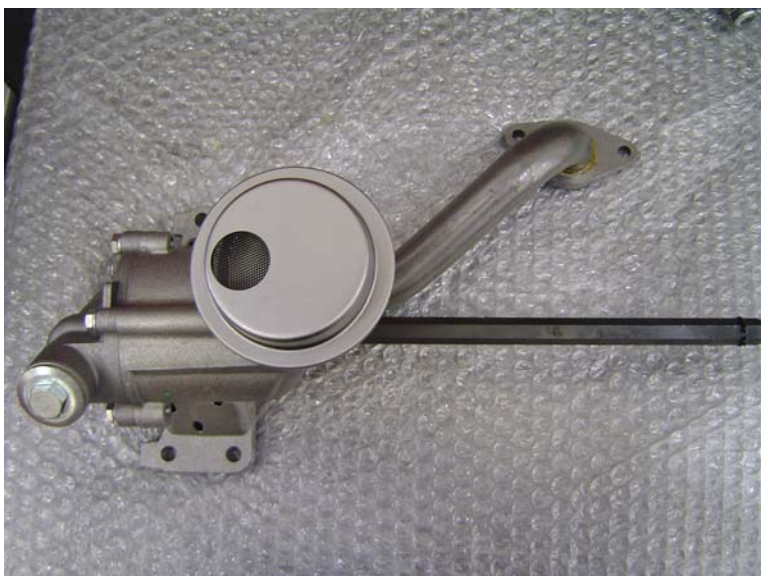


Fit the timing layshaft chain tensioners.
Fixed chain guide screws TCEI M6x22
Mechanical tensioner screws TCEI M6x14
Tightening torque: 10 Nm.

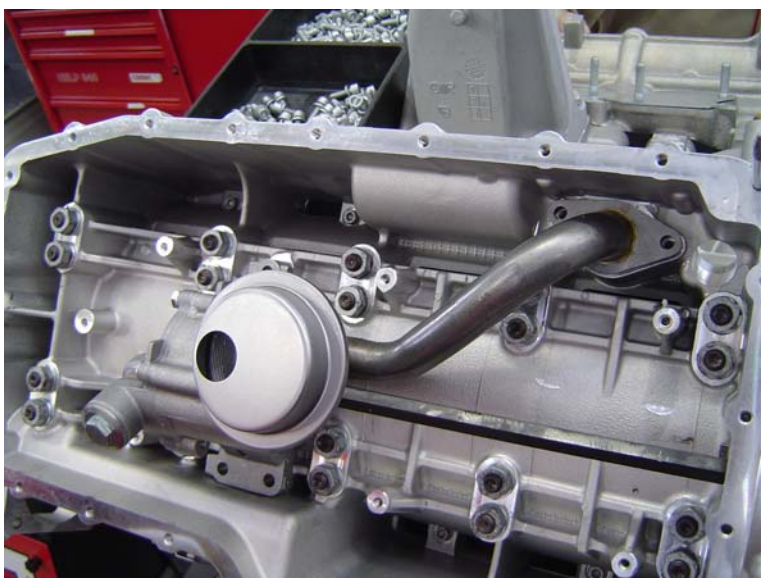


Insert the O-ring ∅ 29.87x1.78, lubricating it with tallow grease.

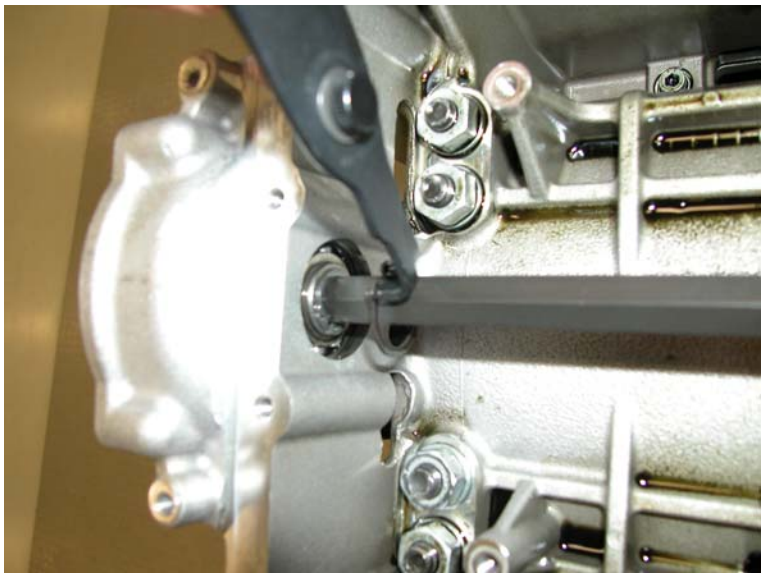
Prepare oil pump.



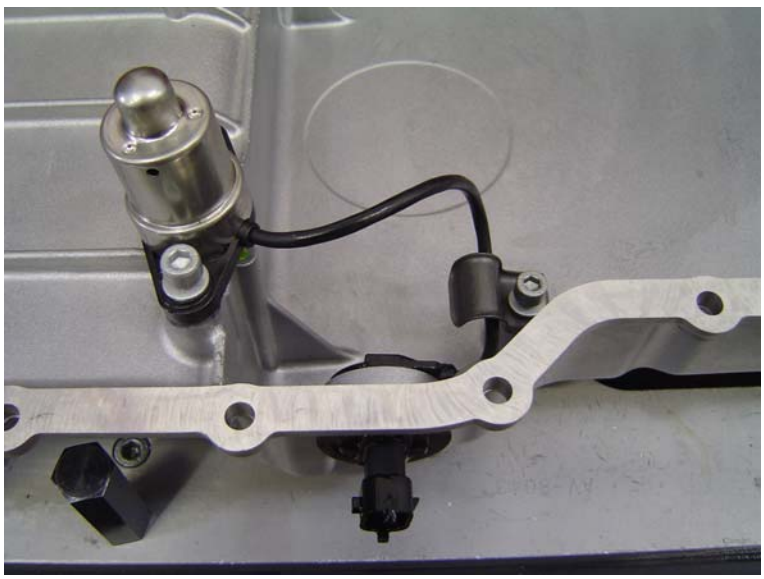
Introduce the drive shaft into the oil pump.



Install the pump in the subframe.
Fasten the pump using two screws TCEI M8x30 tightened to a torque of 25 Nm.
Fasten the supply pipe to the crankcase using screws TCEI M6x20 tightened to 10 Nm.



Fit the Seeger retaining ring onto the hexagonal bar



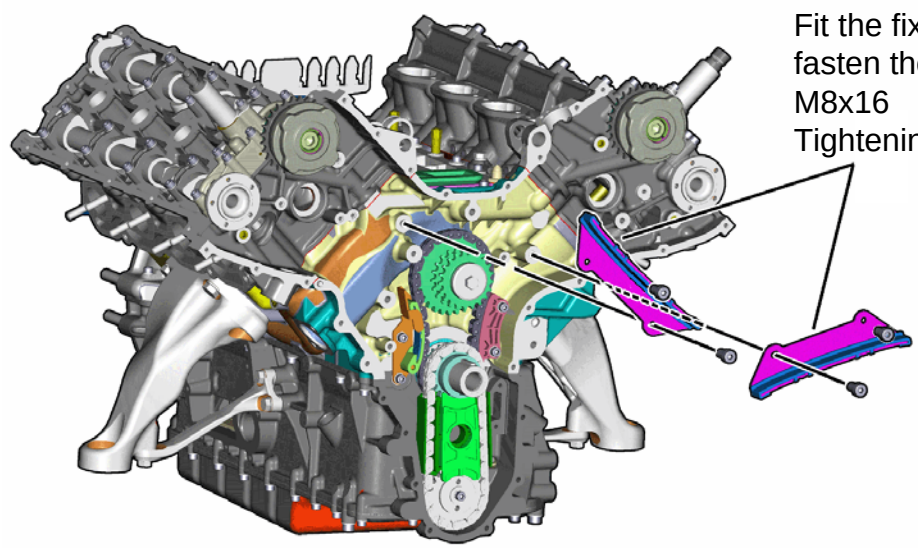
Install the oil level sensor in the sump.
Fasten the sensor and cable clip using screws TCEI M6x18.
Tightening torque: 8 Nm.

Install the Seeger ring to secure the sensor.

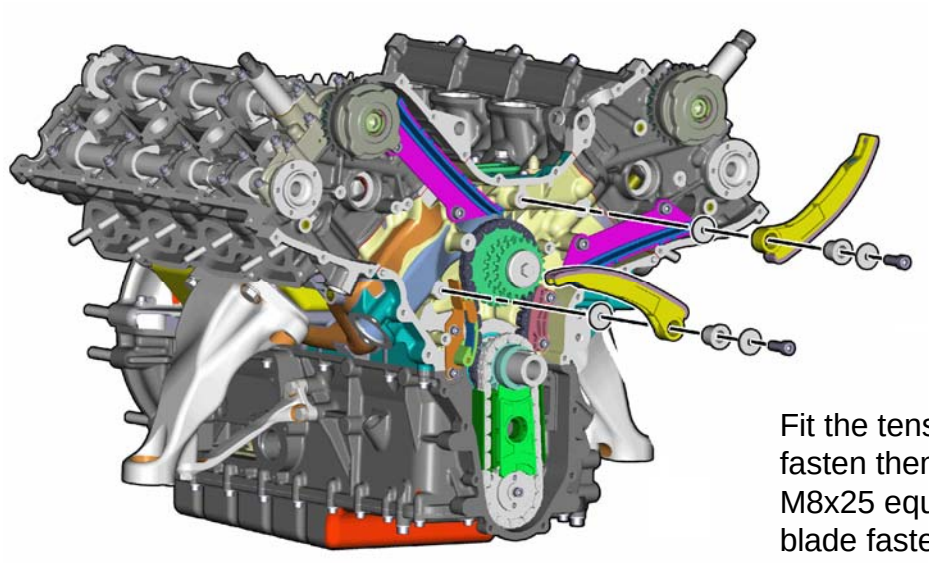
Install the shake-resistant oil partition and fasten it using screws TCEI M6x18
Tightening torque: 10 Nm

Fit the seal gasket.

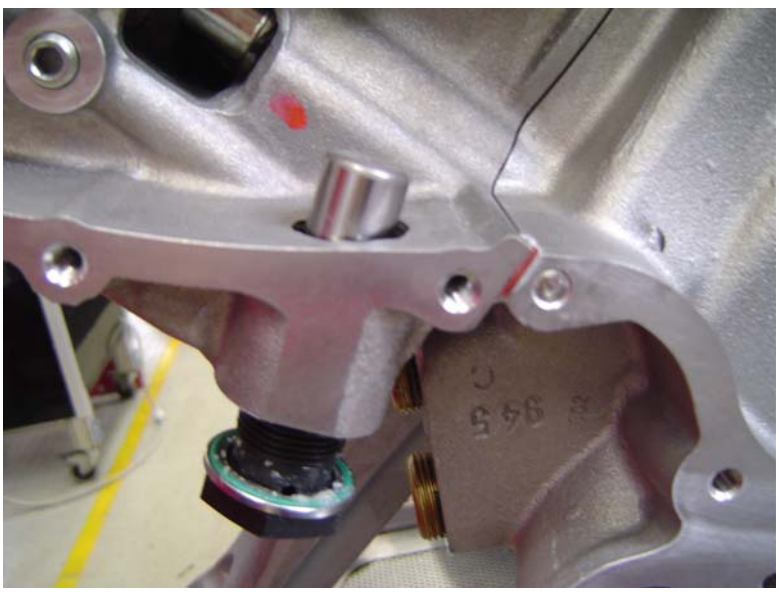
Install the oil sump and fasten it using screws TCEI M6x18
Tightening torque: 10 Nm



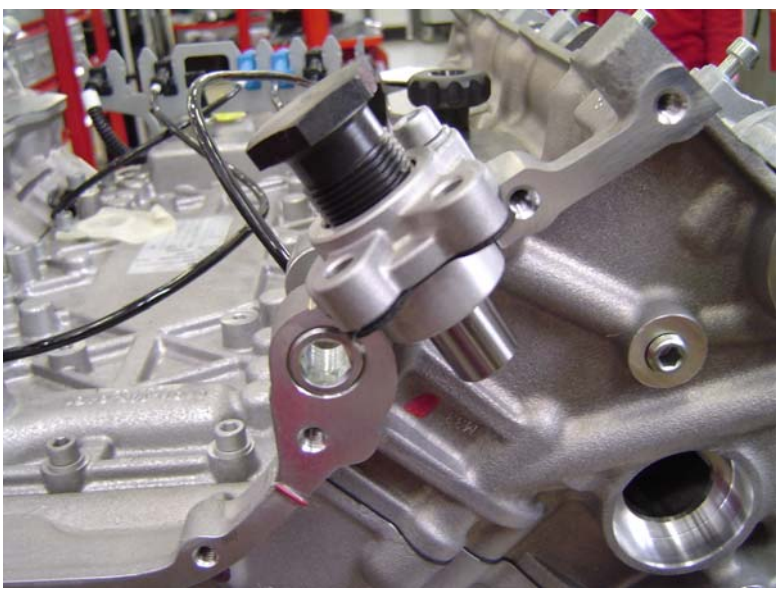
Fit the fixed chain guides and fasten them using screws TCEI M8x16
Tightening torque: 25 Nm



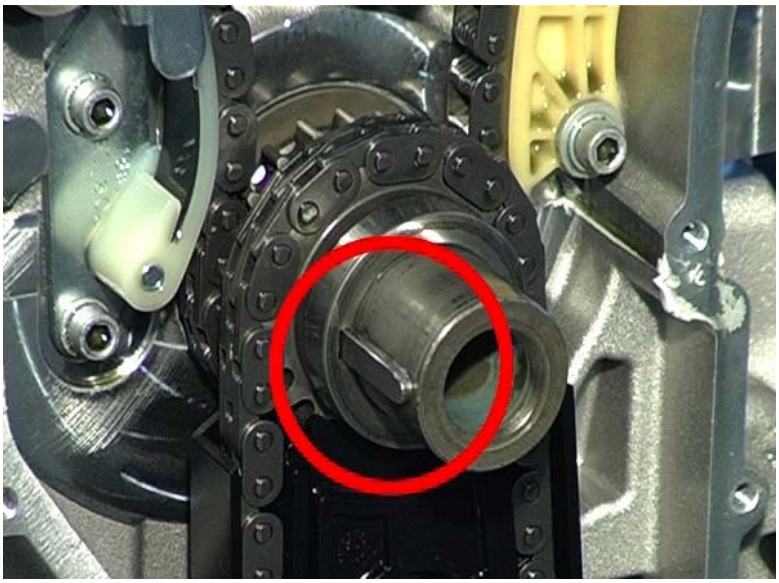
Fit the tensioner blades and fasten them using screws TCEI M8x25 equipped with tensioner blade fastening bushes. Tightening torque 25 Nm



Install the right-hand chain hydraulic tensioner equipped with suitable sealing washer



Install the left-hand side chain hydraulic tensioner



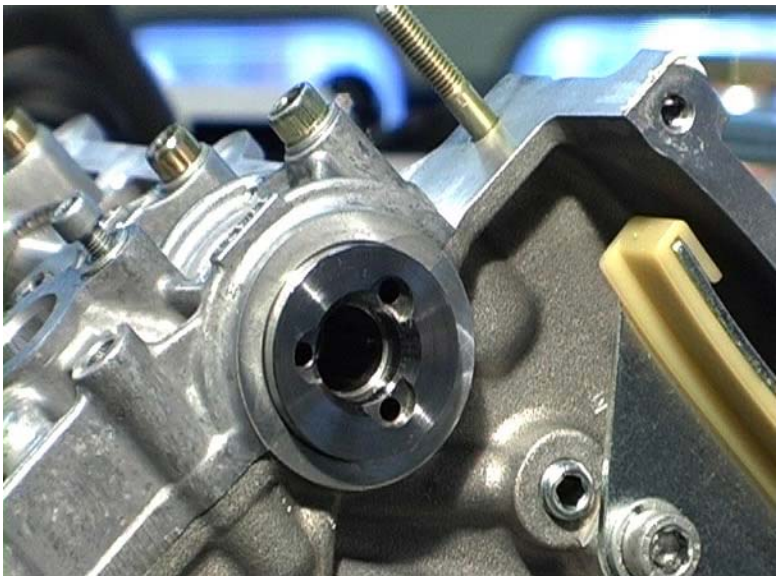
Intake Timing

Rotate the crankshaft so that the tab located on the crankshaft is set to 9 o'clock

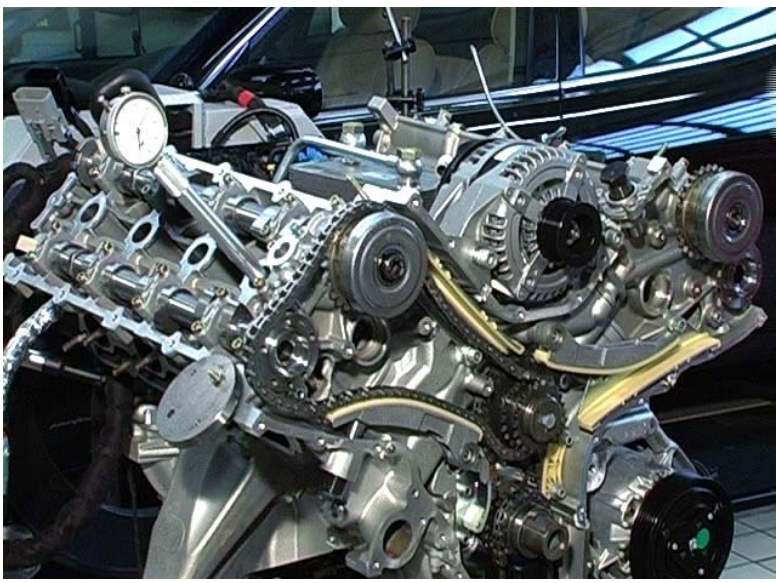
Rotate the camshafts of the two banks so as to line up the reference marks located on the ends of the shafts with the markings on the respective fastening caps.

Lock the camshafts so they cannot rotate.

Position the goniometer and rotate the crankshaft until it reaches TDC.



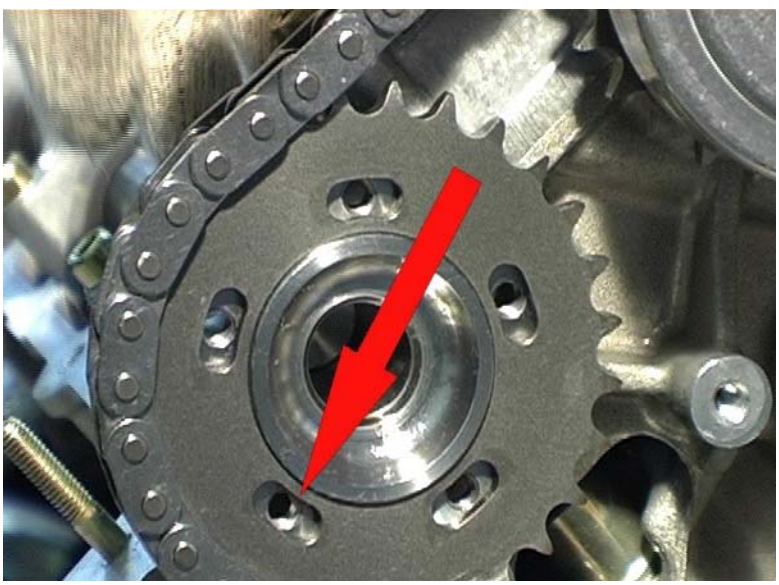
Check that the mating surfaces of the timing variator and camshaft are perfectly clean.



Before fitting the timing chains, fit the timing variators on the camshafts, tightening the screws just a few mm.

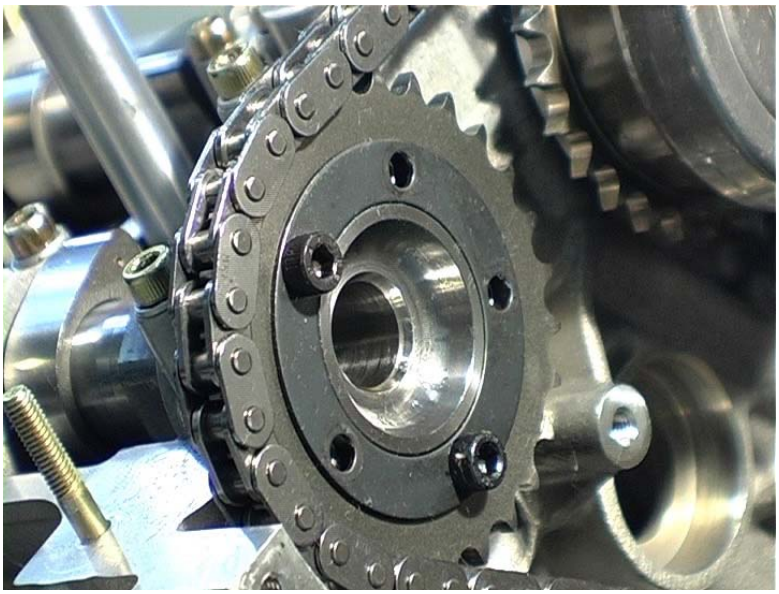
CAUTION: ***IN THE CASE OF NON-PHOSPHATED SCREWS (burnished surface colouring) LUBRICATE THE THREADING WITH ENGINE OIL.***

Position the camshaft drive chain on the right-hand bank.

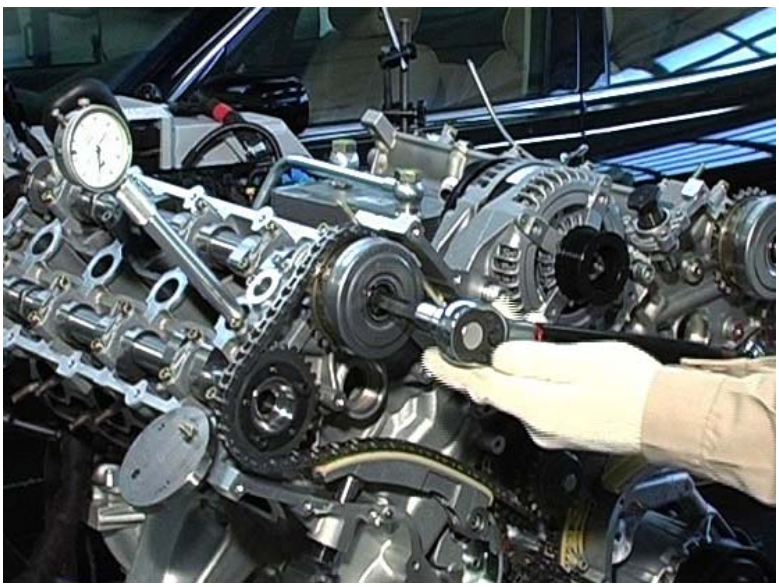


When fitting the chain, locate the exhaust gear with the corresponding slots positioned at the centre of the available adjustment area.

Then fasten the right-hand chain hydraulic tensioner

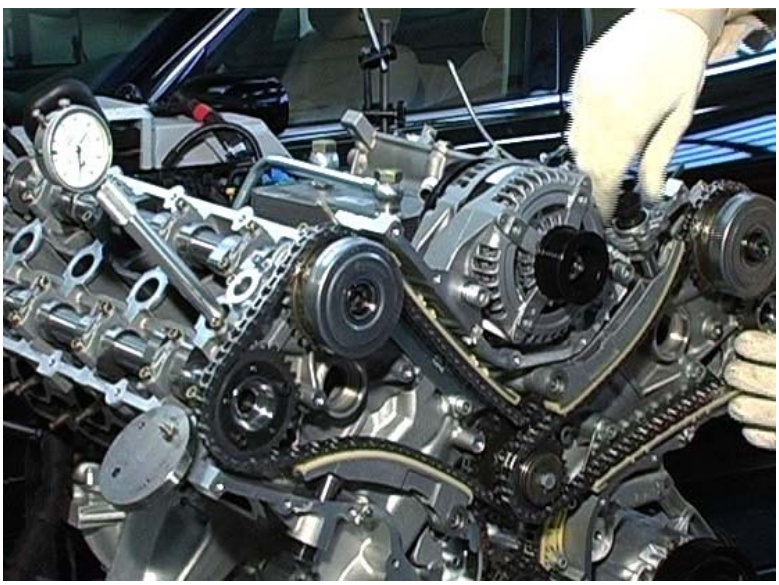


Tighten at least two fastening screws of the right-hand exhaust gear.



Tighten the fastening screw of the right-hand variator to a torque of 40Nm

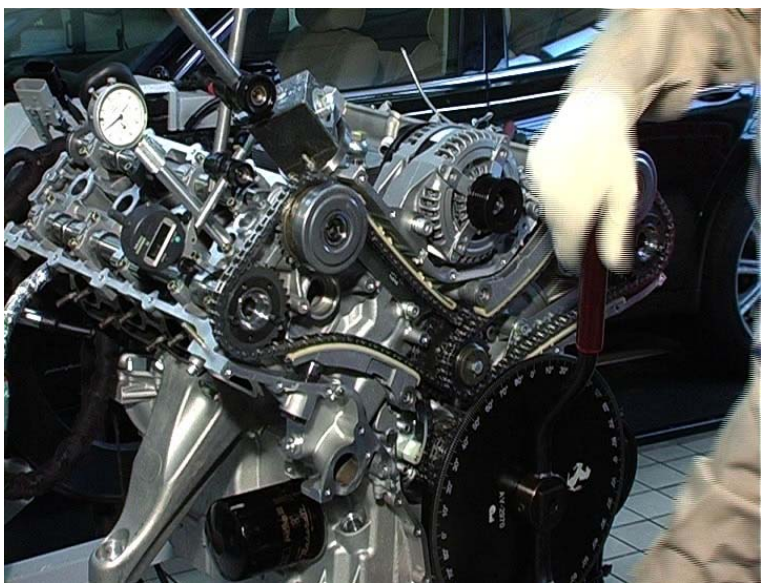
Position the camshaft driving chain on the left-hand bank, making sure that the corresponding slots are placed in the centre of the adjustment area.



Fasten the left-hand chain hydraulic tensioner

Tighten at least two fastening screws of the left-hand exhaust gear.
Tighten the fastening screw of the left-hand variator to a torque of 40Nm

Tighten the chain hydraulic tensioners using a torque wrench to **40 Nm.**



Unlock the camshafts.
Rotate the engine in clockwise direction, making sure there is no jamming.

Position the first piston at TDC, ensuring that the corresponding dial gauge is set to zero.

Position a magnetic base with its own centesimal dial gauge and long stem. The dial gauge stem must be placed in a position which is as perpendicular as possible with respect to the intake tappet surface.

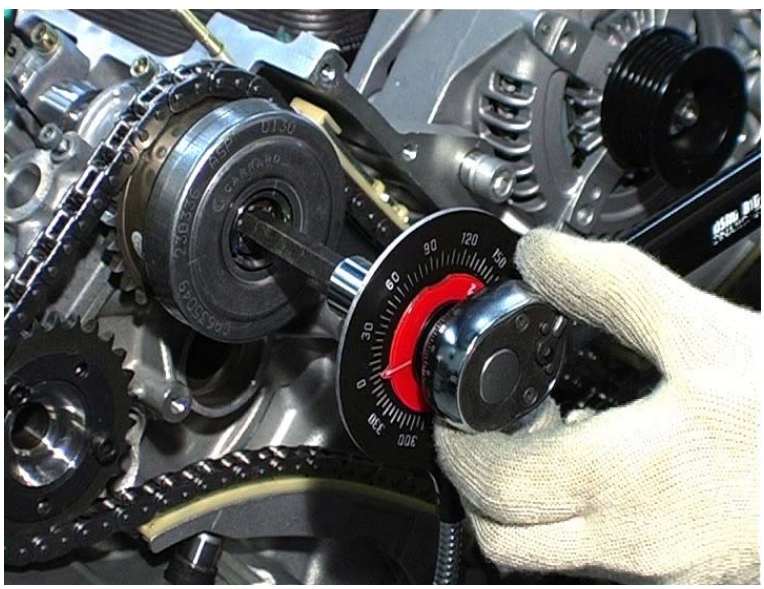
Rotate the engine in clockwise direction, positioning the intake cam just before the opening position, with the hydraulic tappet still in the rest position.

Reset the dial gauge measuring the shift of the intake tappet in this position.

Rotate the crankshaft until **15°** after TDC, corresponding to a stroke of **1.75** mm of the piston.

Check whether the downstroke of the tappet (which began before the TDC), consequently the opening of the intake valve, is **0.59±0.08** mm.

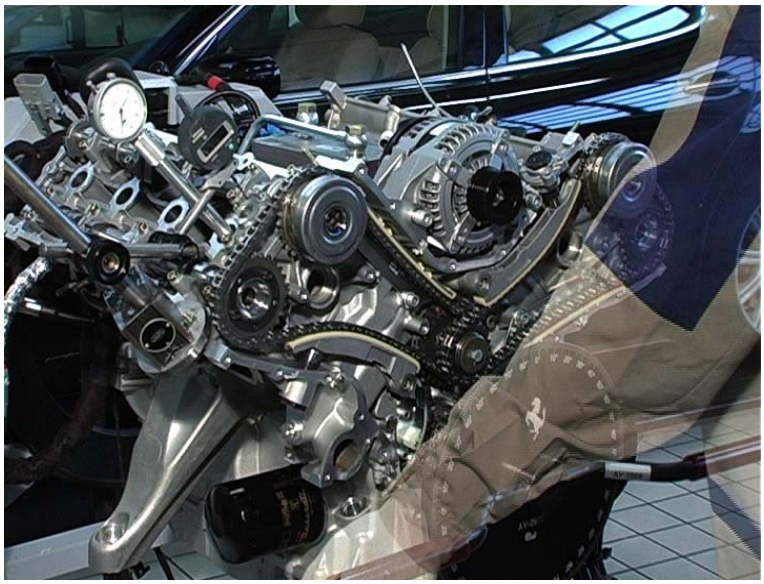
If under such circumstances the measured values do not fall within the tolerance range, make sure that the crankshaft is locked into place and then slacken the timing variator **fastening** screw and rotate the intake camshaft until the preset intake valve lift value is met.



Double check the timing values.

Use a torque wrench to tighten the timing variator fastening screw to a torque of **50 ± 1.5 Nm + 85°±1°.**

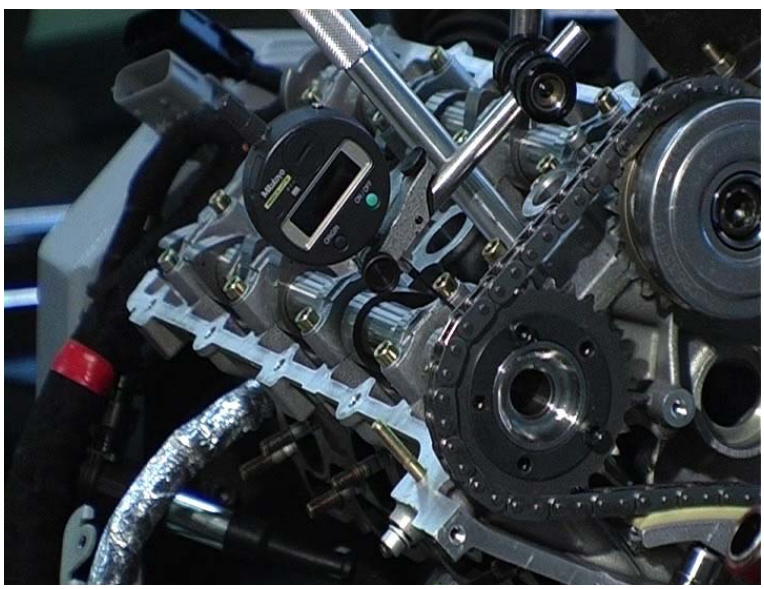
Double check the timing values.



Exhaust Timing

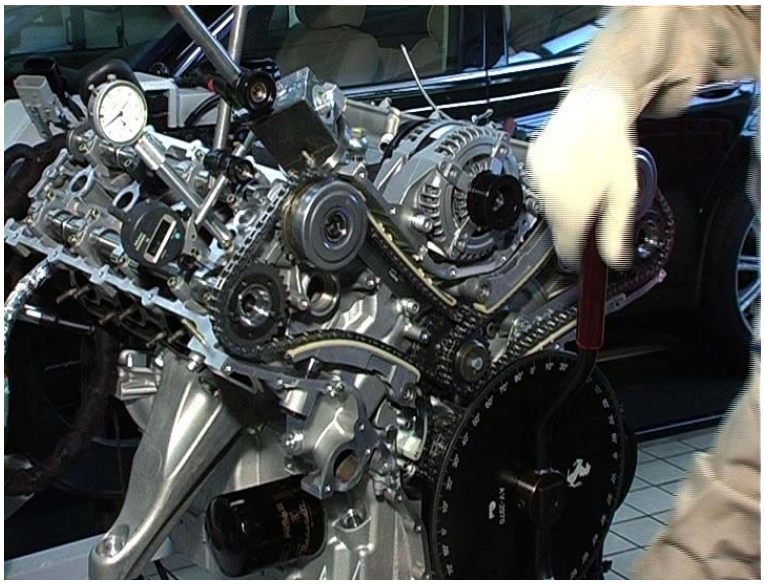
Rotate the engine in clockwise direction and position the first piston at TDC, with the camshafts in the balanced position

Ensure that the corresponding dial gauge is set to zero.

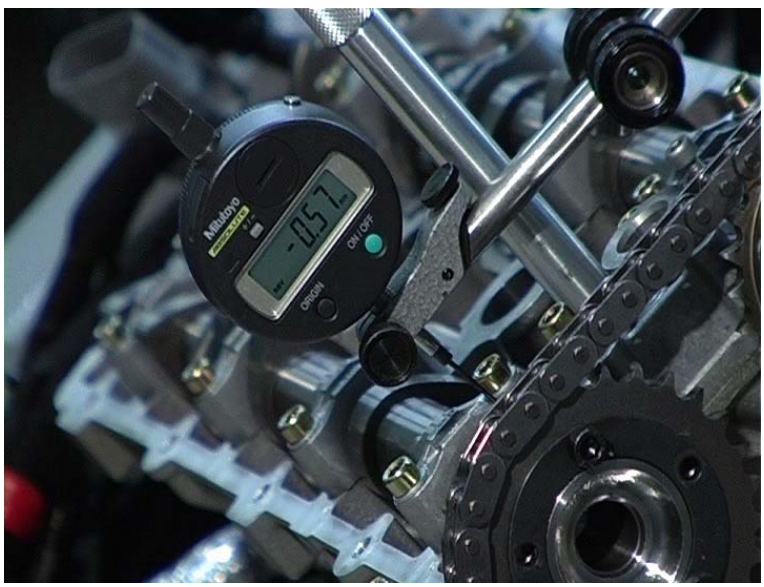


Position a magnetic base with its own centesimal dial gauge and long stem. The dial gauge stem has to be placed in a position which is as perpendicular as possible with respect to the exhaust tappet surface.

Reset the dial gauge measuring the shift of the exhaust tappet.

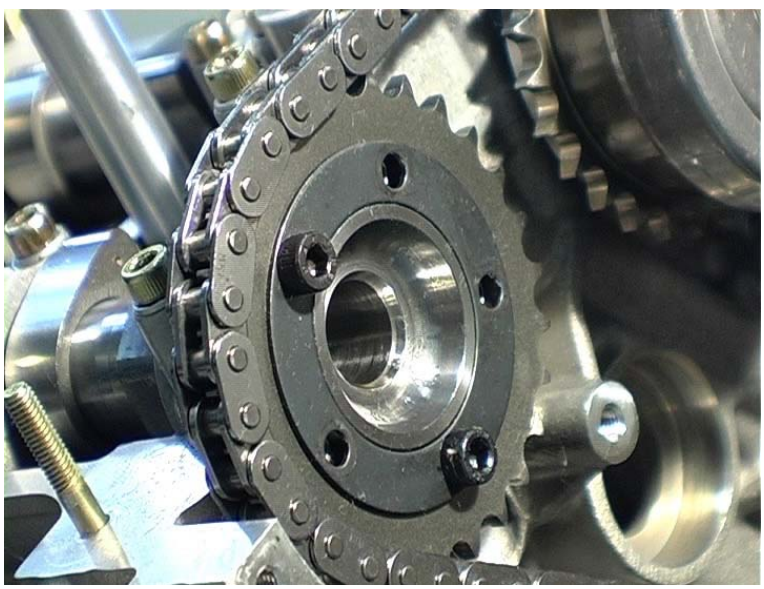


Rotate the crankshaft in clockwise direction until the exhaust valve is closed.



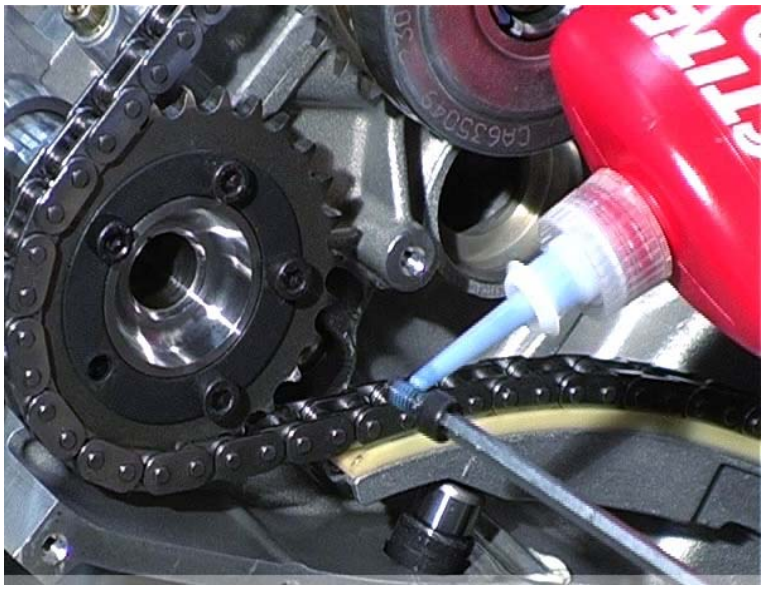
Check that the downstroke of the tappet, consequently the opening of the exhaust valve, is **0.57±0.08** mm.

If under such circumstances the measured values do not fall within the tolerance range, rotate the crankshaft and reach the TDC position.



While locking the camshaft into place, slacken the M6 screws and carry out the timing procedure by using the adjustment slots.

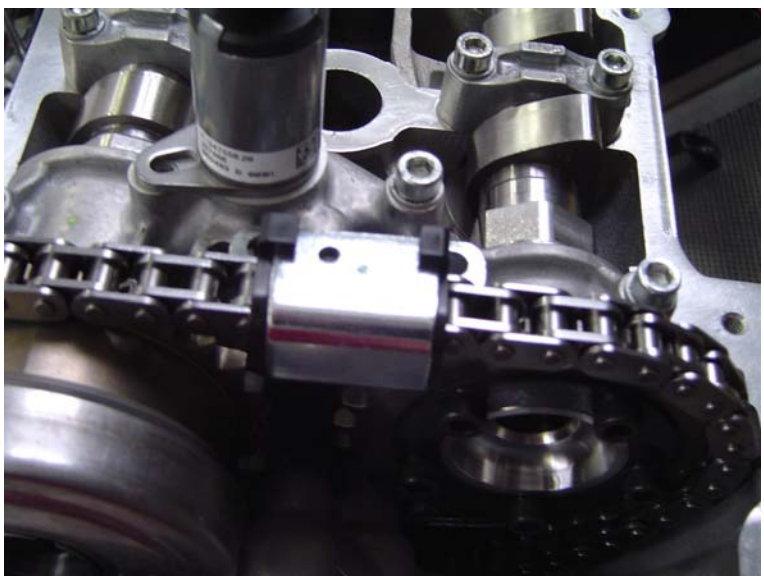
Double check the timing values.



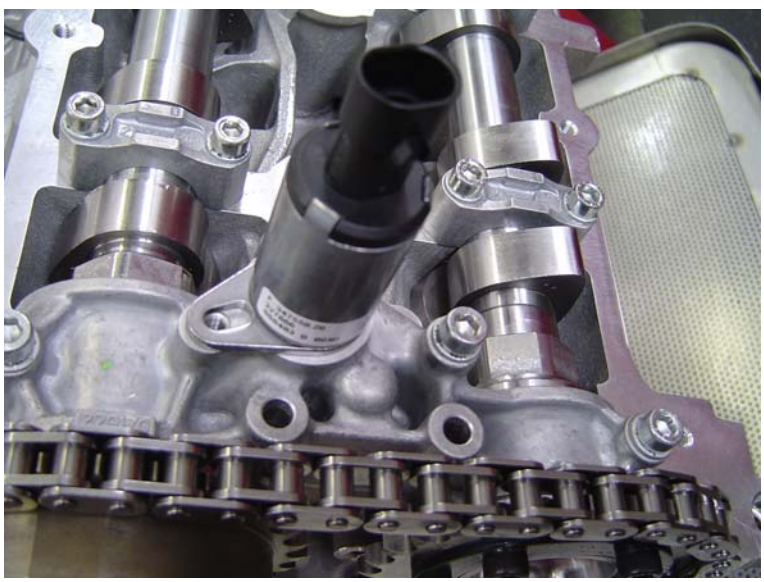
Tighten the TCEI M6 screw to the prescribed torque of **5Nm+50°** after applying some Loctite 242.

Double check the timing values.

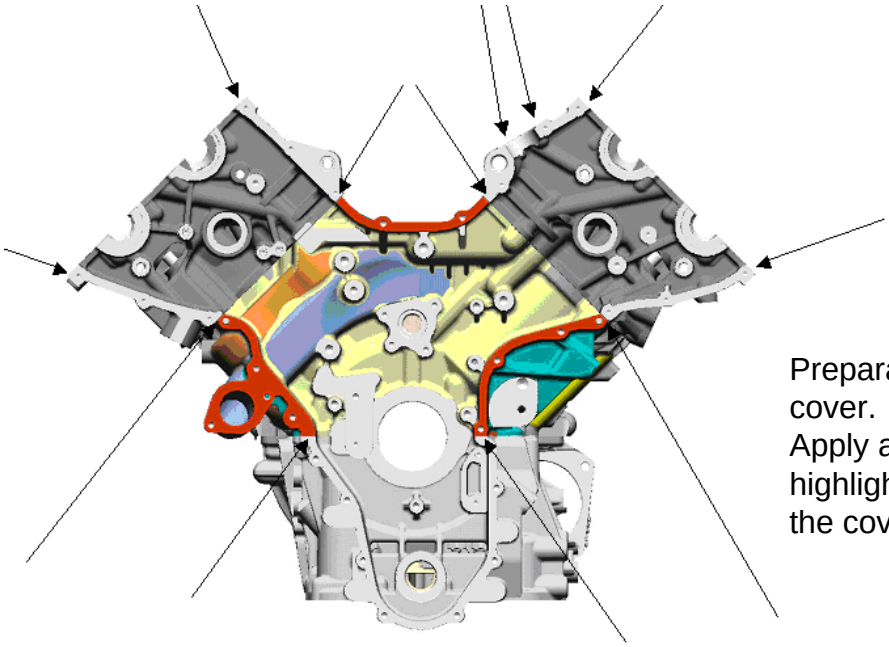
Perform the same exhaust/intake timing procedure for the left-hand bank, placing the dial gauge holder on cylinder number 8.



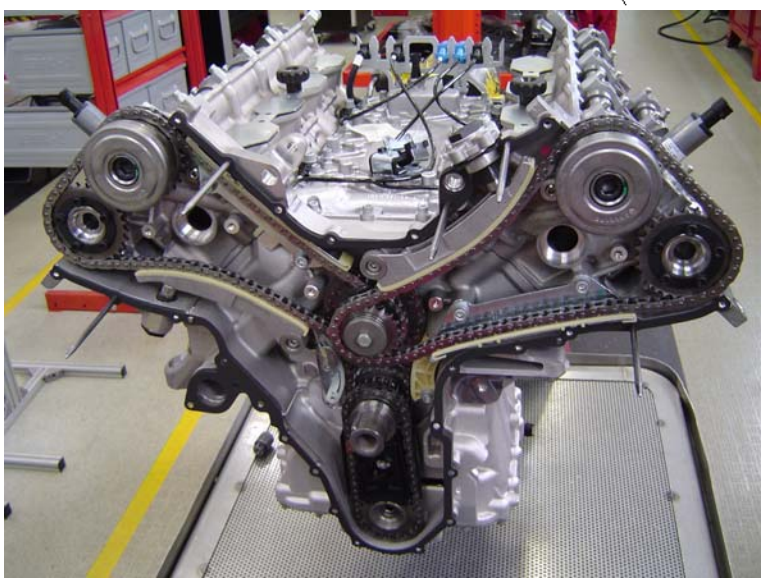
Fit the right and left upper chain guide.
Fasten the chain guide using two screws TCEI M6x45



Fit variator solenoid valve and fasten it using screws TCEI M5x16.
Tightening torque: 6 Nm.

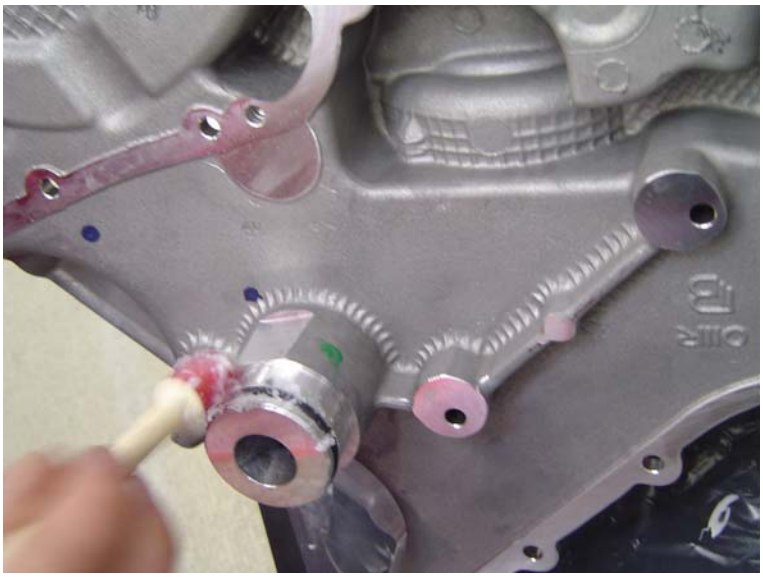


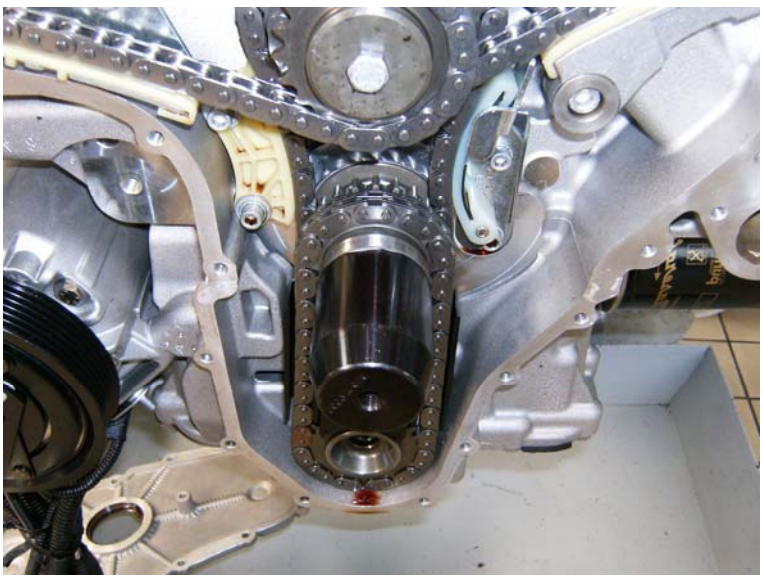
Preparation for fitting the timing cover.
Apply a coat of CAF4 to the highlighted areas to ensure that the cover is perfectly sealed.



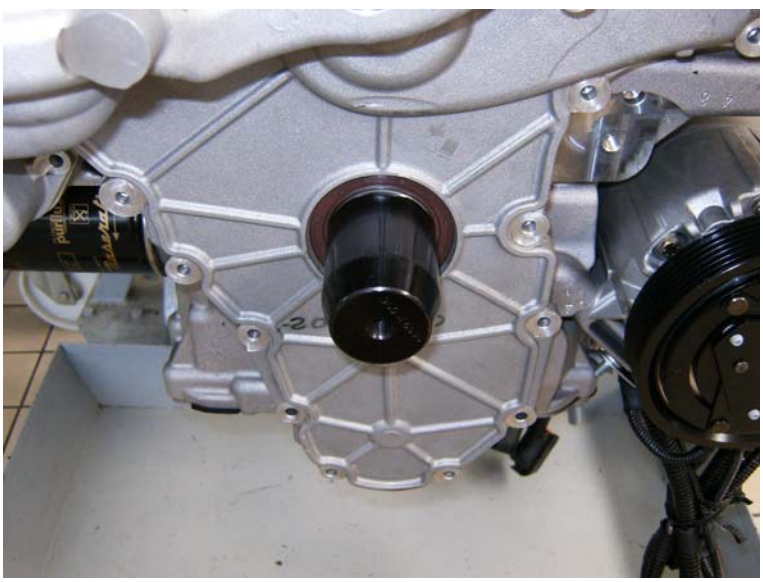
Using long M6 stud bolts, fit the seal gaskets on the engine crankcase.
Lubricate the seats of the cooling circuit sealing rings using lithium-based tallum grease.

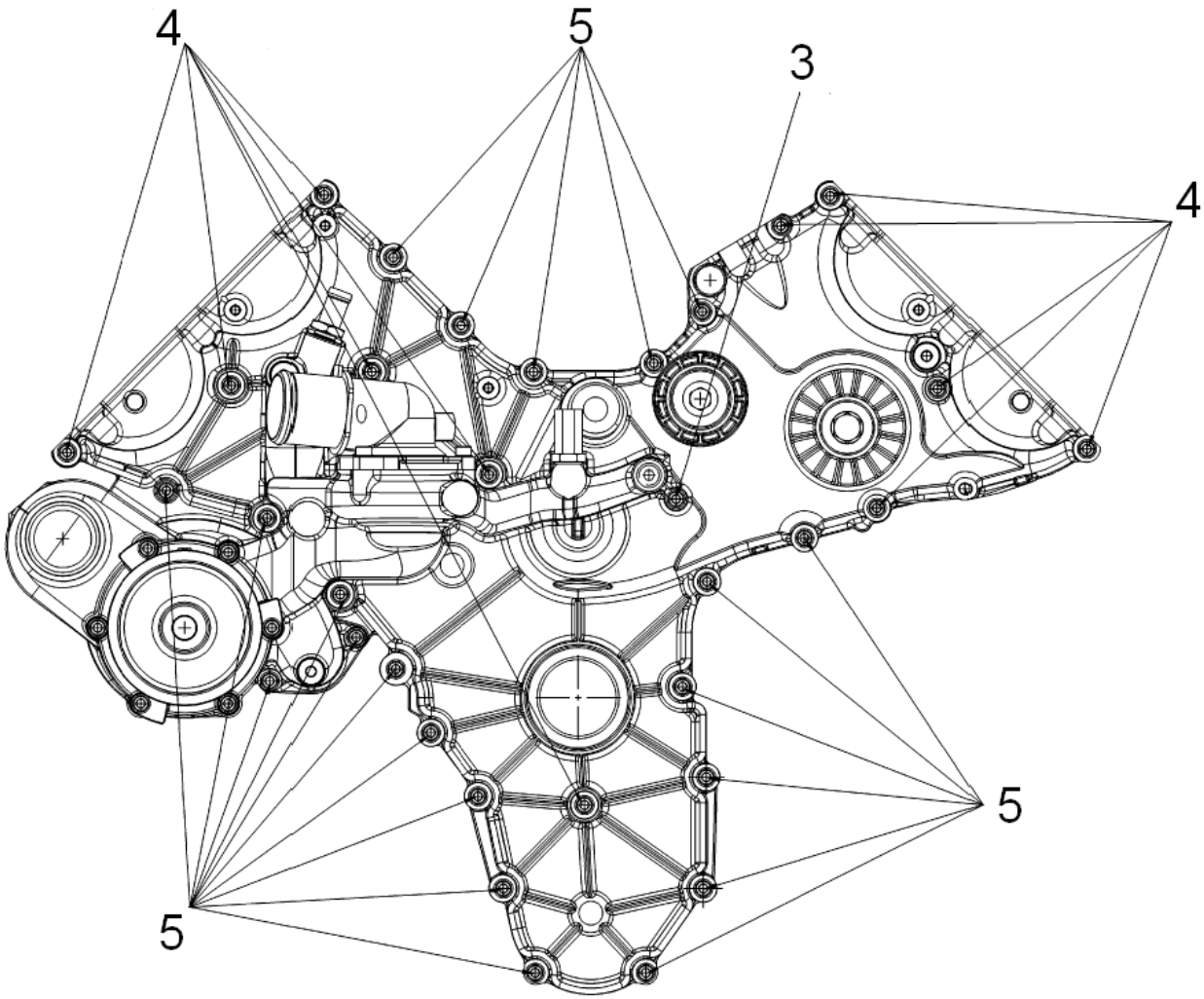
After fitting the O-ring on the timing cover, lubricate the area in question with TALLOW grease as indicated in the figure.





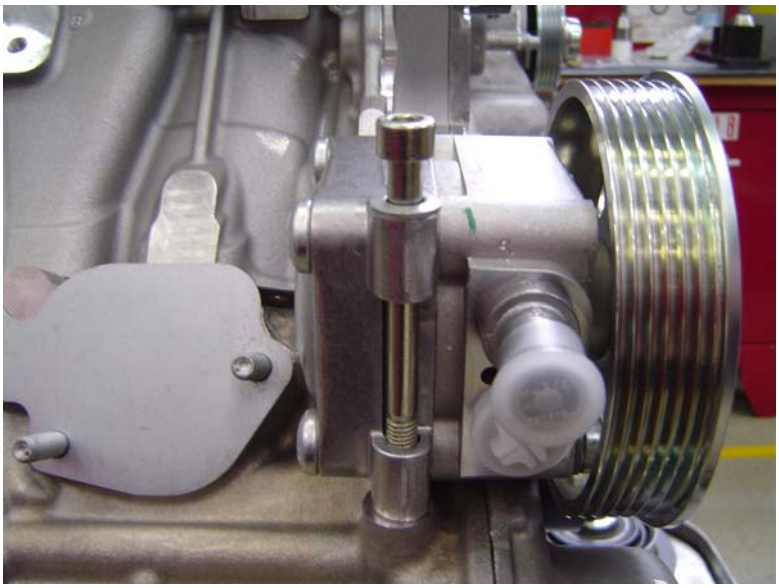
Position tool **900026590** on the crankshaft to prevent damaging the oil seal when fitting the cover.

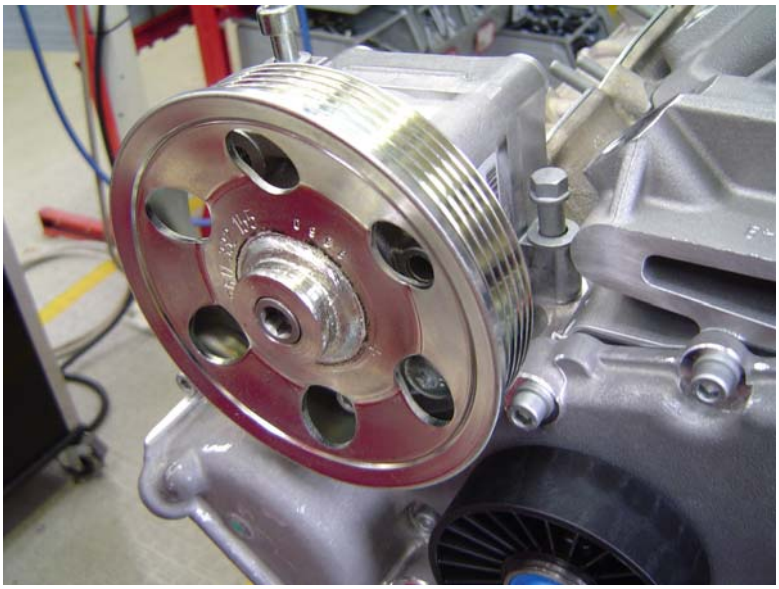


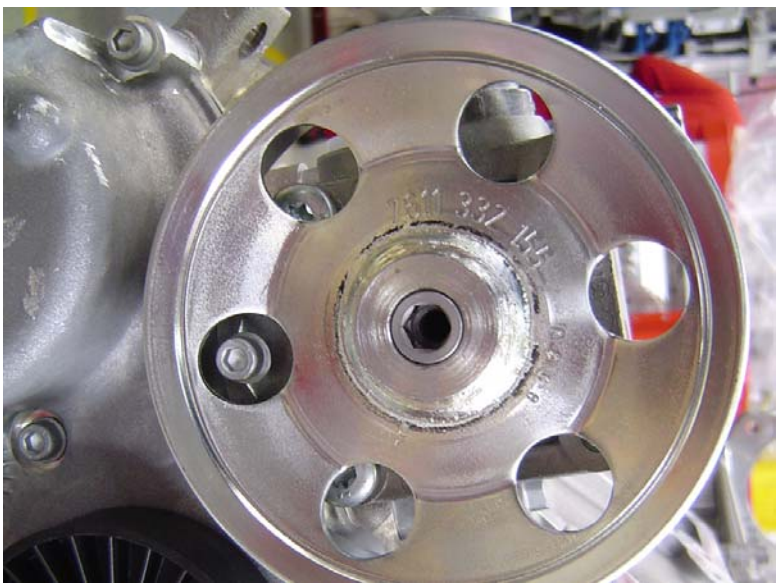


Replace the stud bolts with fastening screws. Fit the TCEI screws in the correct position by following the indications in the diagram. Tighten the screws to the prescribed torque: **10 Nm**.

3- Screw TCEI M6x80
4- Screw TCEI M6x35
5- Screw TCEI M6x18







HYDRAULIC STEERING ASSEMBLY

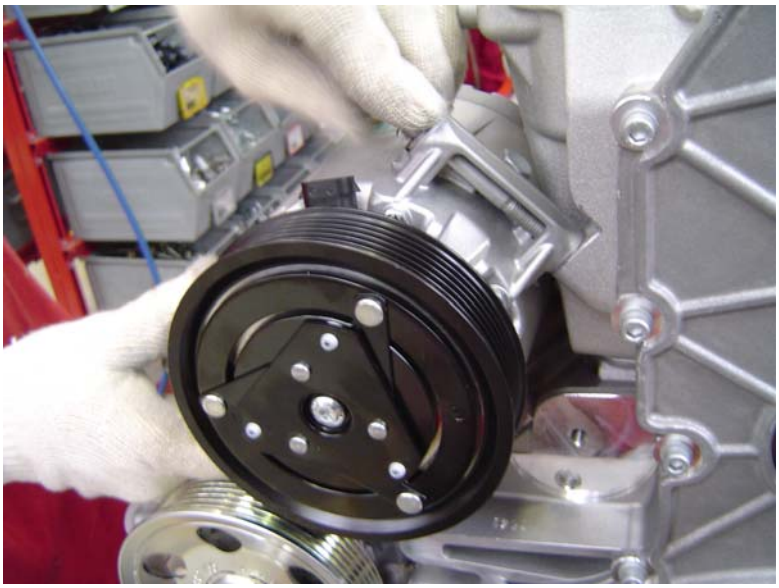
Fasten the hydraulic steering pump to the crankcase using the following fastening screws:

1 x screw TCEI M6x35 with washer Ø 6-12x1.2 (for fastening pump cover to crankcase)

1 x screw TCEI M8x95 with washer Ø 8x-16x1.4 (for fastening pump in first hole on pulley side)

1 x screw TCEI M8x35 with washer Ø 8x-16x1.4 (to fasten pump in second hole on pulley side)

Tighten the fastening screws using a torque wrench: M6 tightened to **10 Nm**; M8 tightened to **25 Nm**.

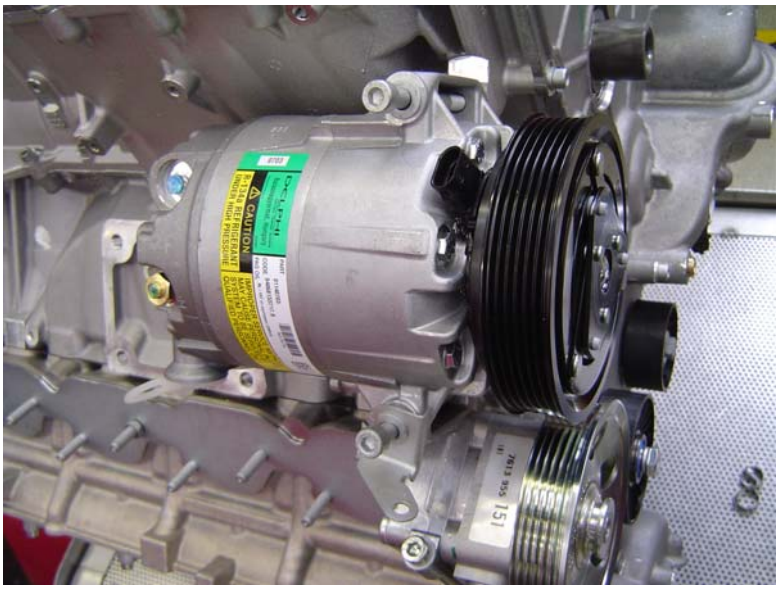


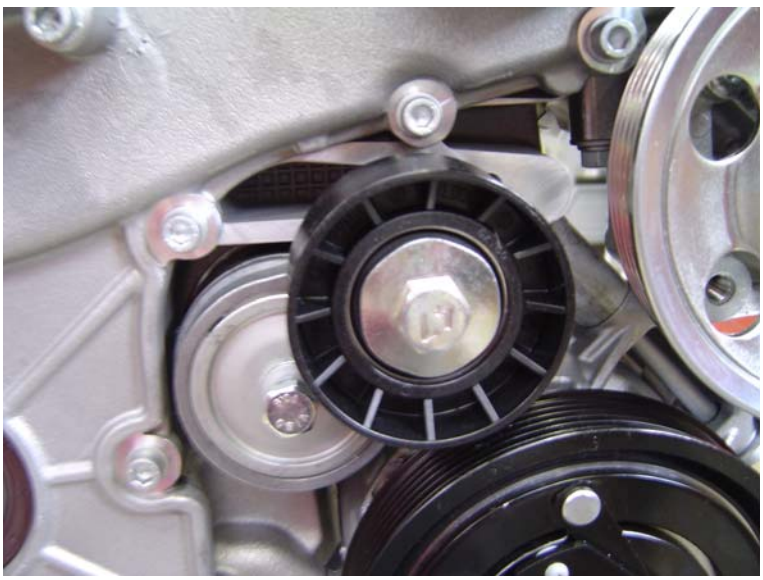
DELPHI COMPRESSOR ASSEMBLY

Fit the air conditioning compressor to the crankcase using the following fastening screws:

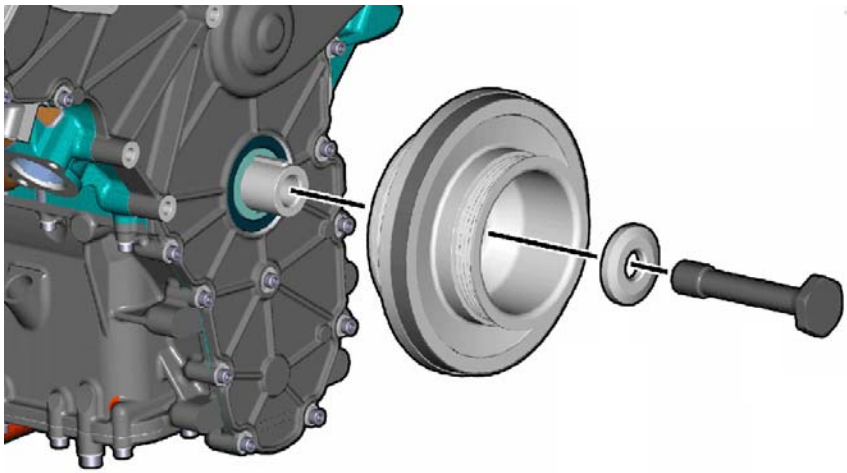
1 x screw TCEI M8x120 equipped with washer Ø 8x-16x1.4

2 x screws TCEI M8x90 equipped with two washers Ø 8x-16x1.4



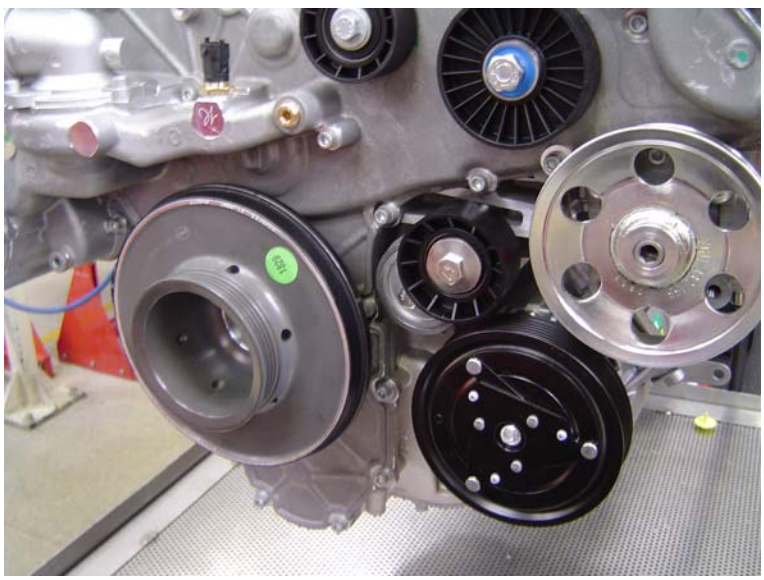


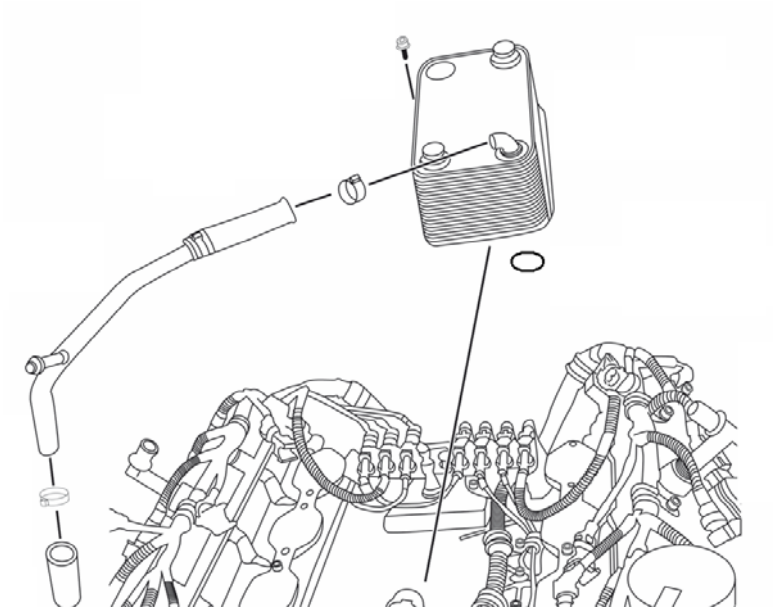
Install the tensioner pulley-bearing assembly, ensuring that it fits snugly in its corresponding seat on the timing cover. Fasten the screw TE M8x1.25x60 using a torque wrench. Tightening torque: 25 **Nm**.



To install the torsional damper, position tool **900026560** on the flywheel end of the crankshaft in order to lock the crankshaft and prevent it from rotating.

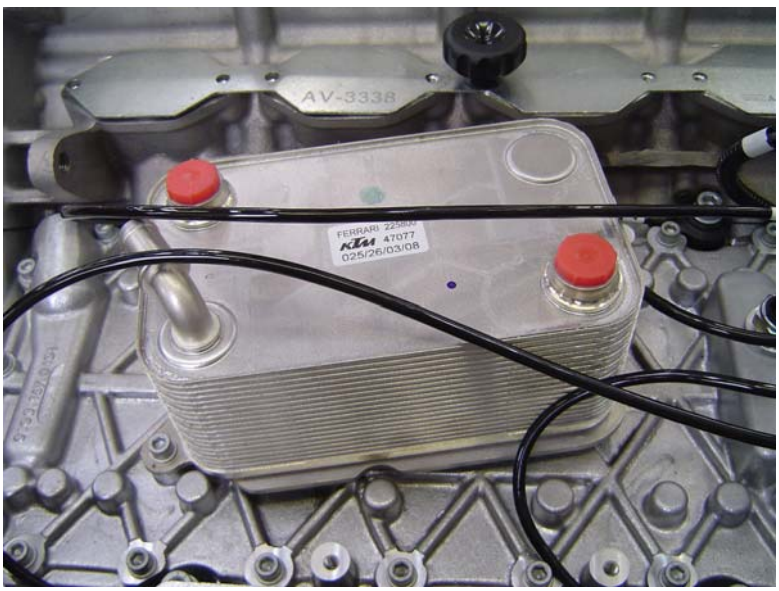
Then position the torsional damper on the crankshaft, fit the fastening screw complete with machined washer and, after applying some Loctite 242, tighten using a torque wrench to the prescribed torque: **450 Nm**.

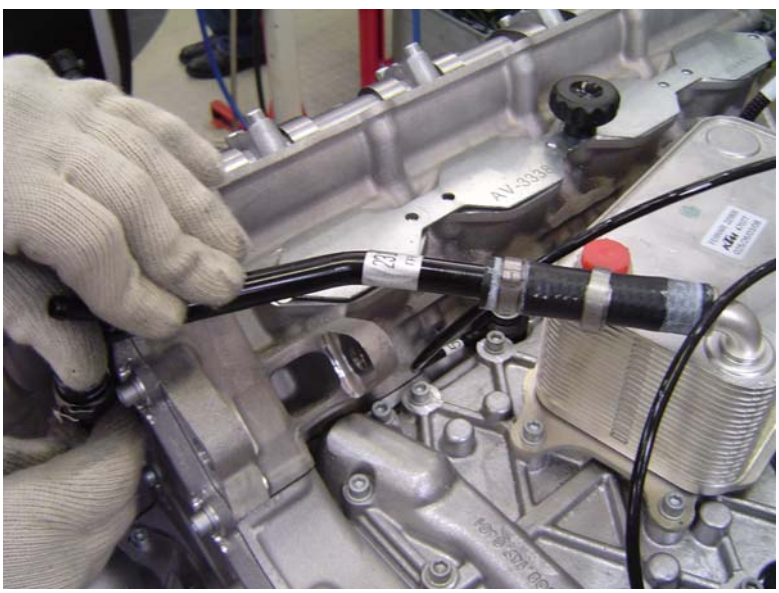




Fit the water/oil heat exchanger for the automatic gearbox, then insert the water intake O-ring after lubricating it with lithium-based tallow grease.

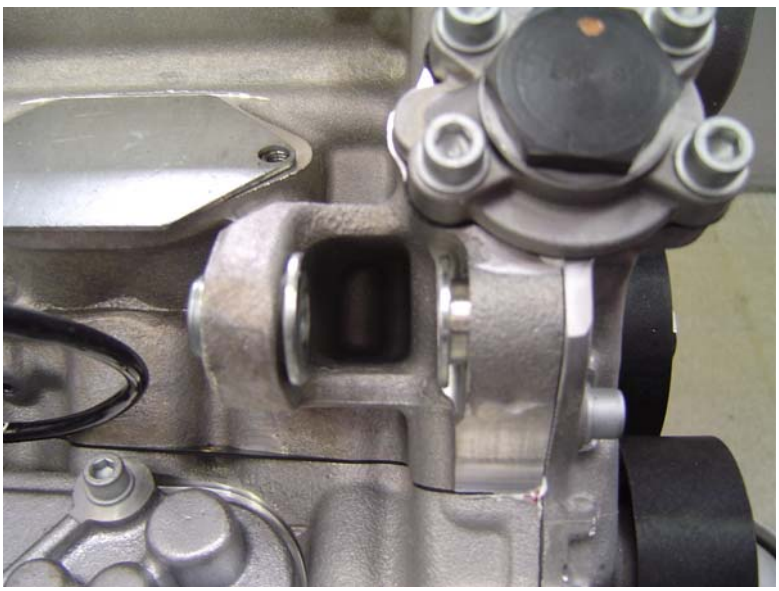
Fasten the heat exchanger using TCEI M6x18 screws. Tightening torque: 10 Nm.



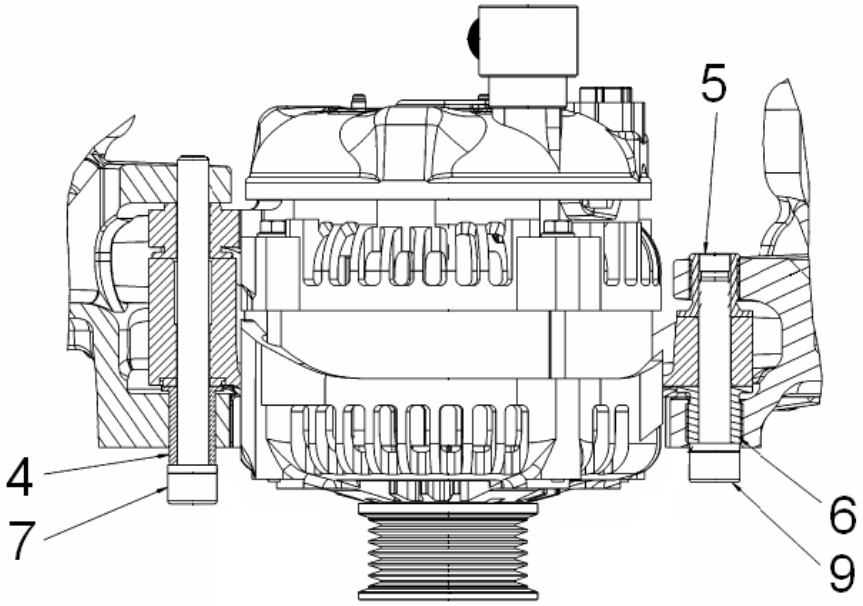


Connect the water outlet pipe from the heat exchanger to the front sump.

Fasten the pipe using clamps and TCEI M6x12 screws. Tighten to a torque of 10 Nm.



Insert the two threaded bushes into the alternator supports.



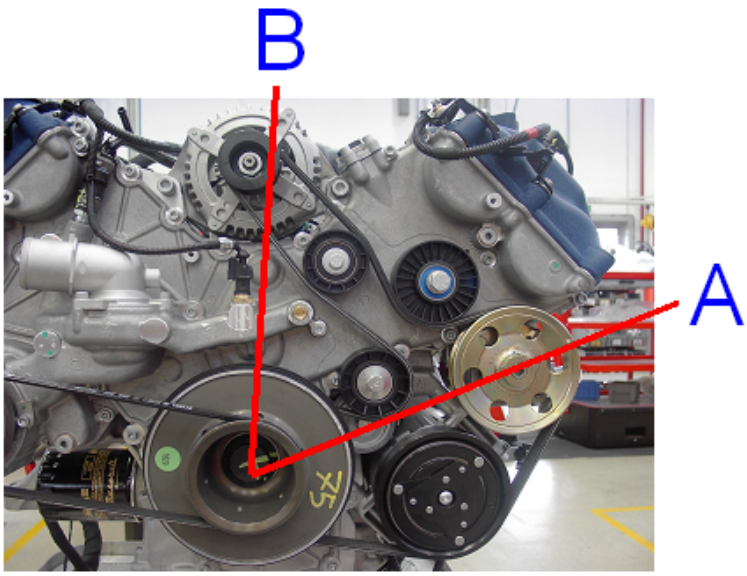
Position the alternator.

Insert screw TCEI M10x55 (ref. 4) equipped with washer.

Insert screw TCEI M10x100 (ref. 7) equipped with washer and snugly hand tighten.

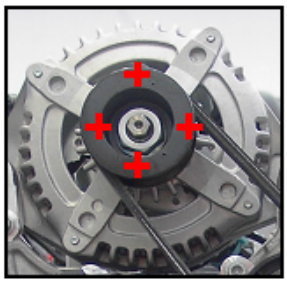
Snugly tighten bush 5.

Tighten the screws to a torque of 49Nm, keeping bush (ref. 5) in position using a reaction wrench.

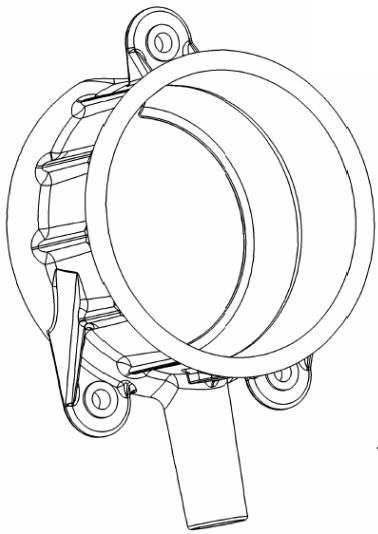


Check the plane of the alternator pulley against the plane of the hydraulic steering pulley:

The distance between plane A corresponding to the hydraulic steering pulley and plane B corresponding to the alternator pulley must fall within the following tollerance: 3.8mm±2 (B-A).



Also check the flatness of the alternator pulley plane: maximum permitted variation 0.1mm

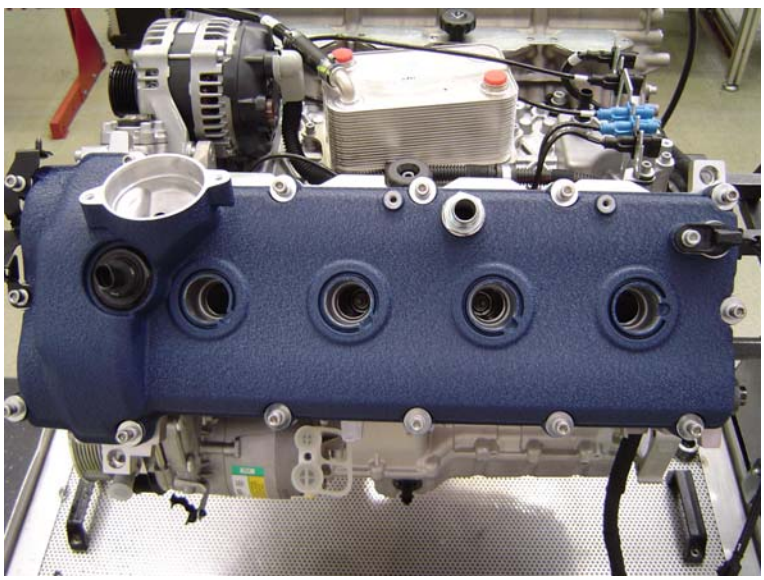


Fit the oil filter cap using screws TCEI M6x18 equipped with washer.

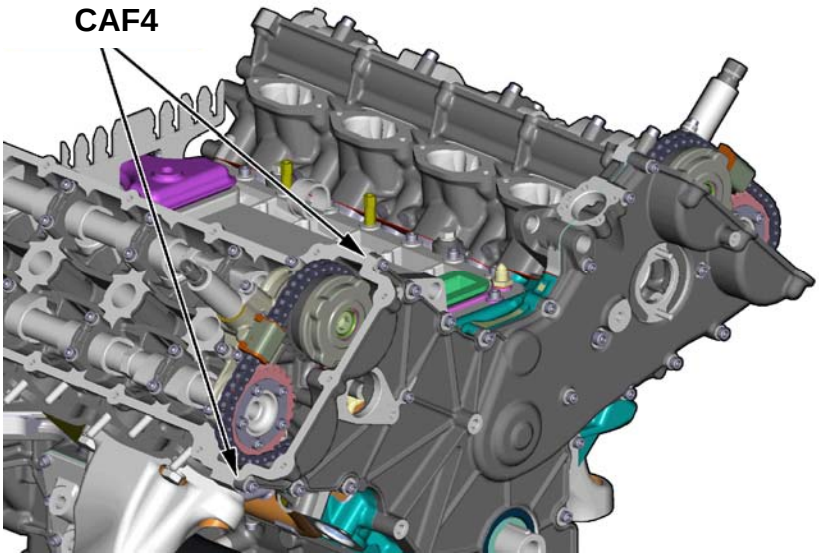
Tighten to the prescribed torque of 10 Nm.

Fit the oil filter and tighten to a torque of 30Nm.

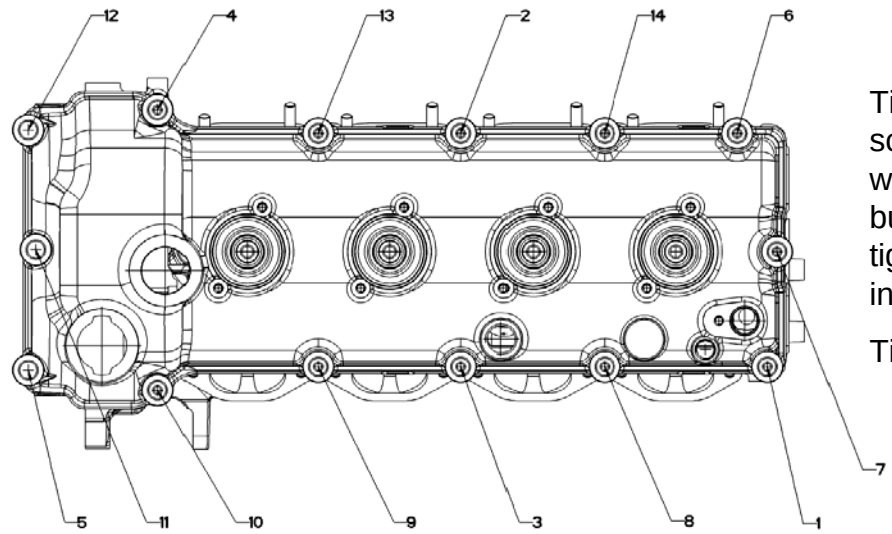
Fit the gaskets on the head covers



Fit the head covers on the engine.



Apply some CAF4 sealant in the joints between the tappet cover, the front head surface and the mating surface of the cover.



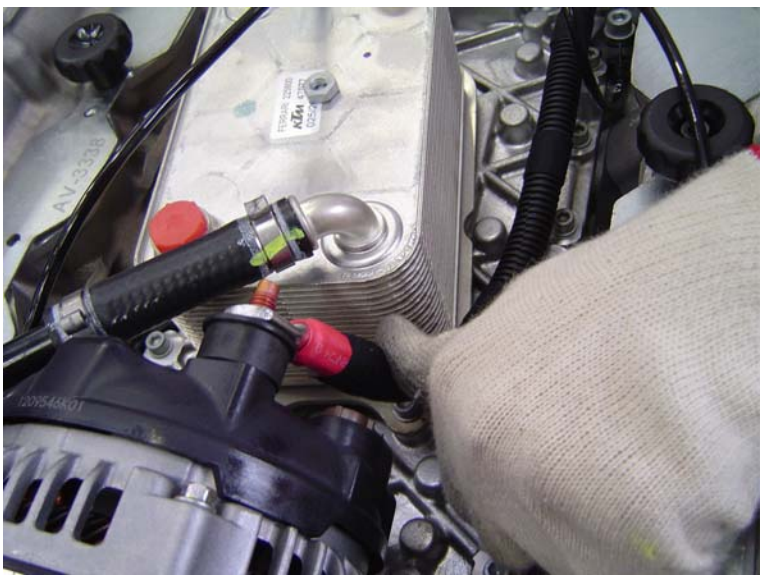
Tighten the M6x45 screws equipped with washer and rubber bushes, following the tightening sequence indicated in the figure.

Tightening torque: 10Nm

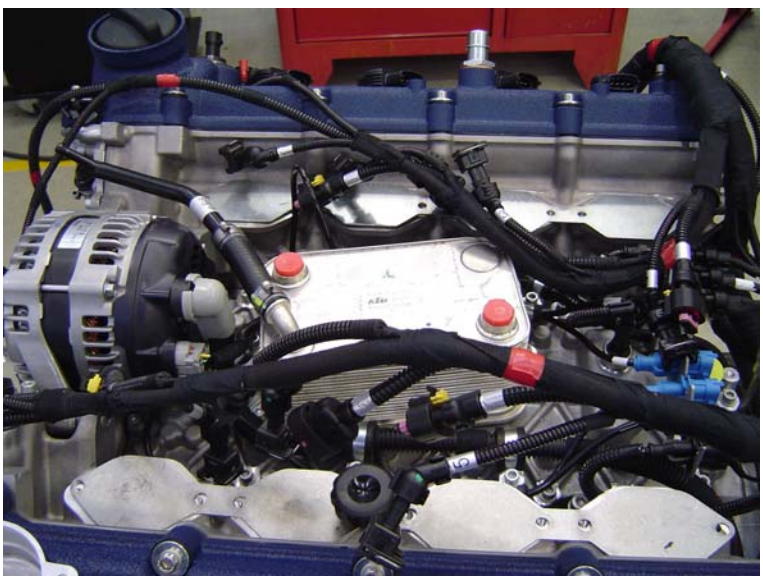
Connect up the engine wiring.

Fasten the cable sheath to the heat exchanger using grommet clamps and TCEI M6x12 screws.

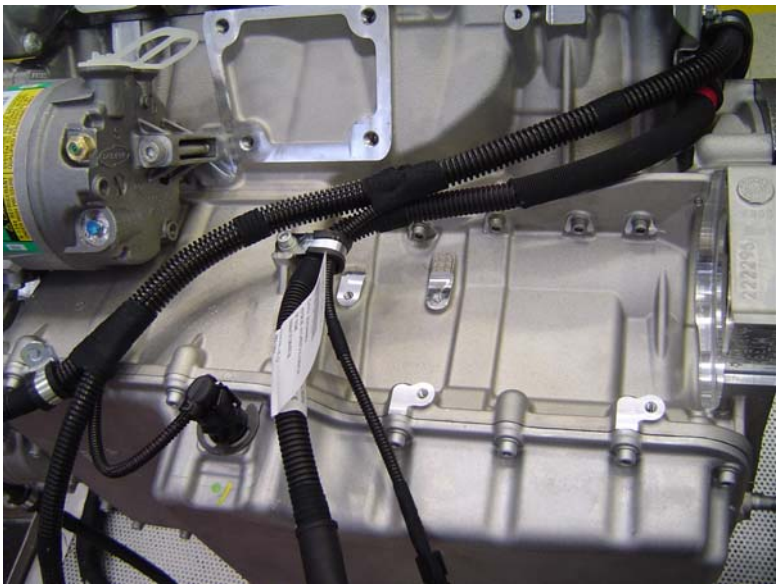
Tightening torque: 10 Nm.



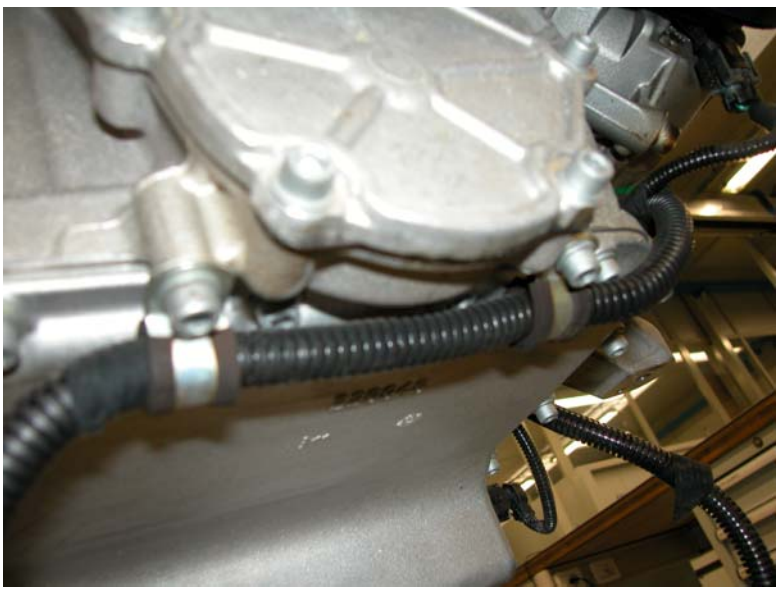
Fit the alternator cable



Distribute the cabling along the length of both engine banks.

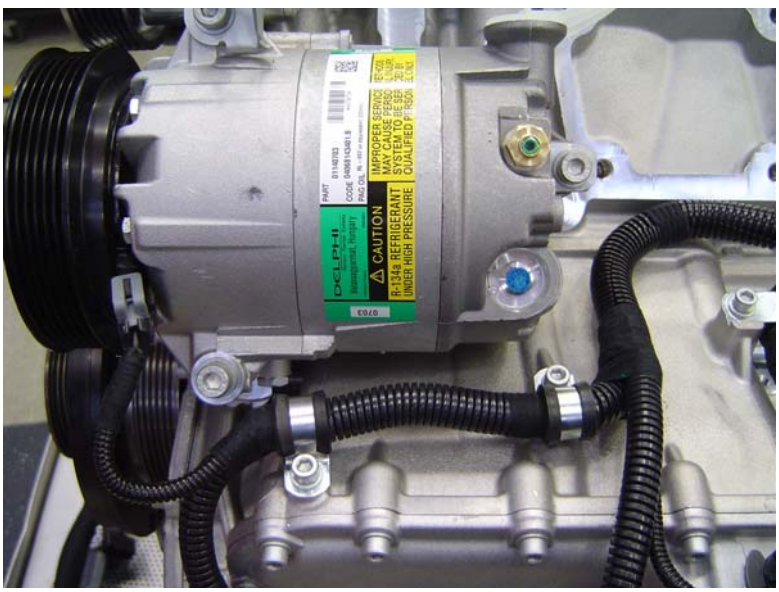


Fasten the section of cabling which connects to the starter motor, AC compressor and oil level sensor etc. on the left-hand bank side. Use clamp with sheath and screw TCEI M6x12. Tighten to the prescribed torque: 10Nm.



Fasten the cables under the timing cover using two clamps with sheath and screws TCEI M6x12

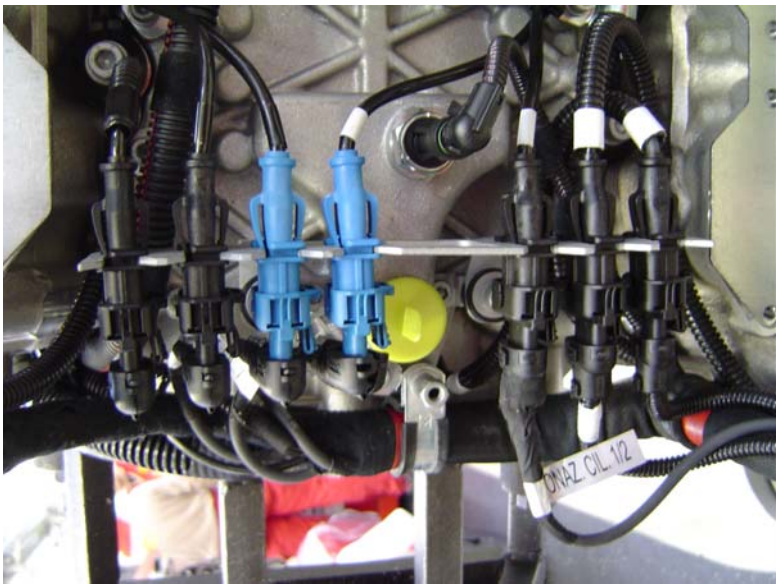
Tighten to a torque of 10Nm.



Fasten the cables in the area under the AC compressor using two clamps with sheath and screws TCEI M6x12

Tighten to a torque of 10Nm.

Attach the connector to the AC compressor.

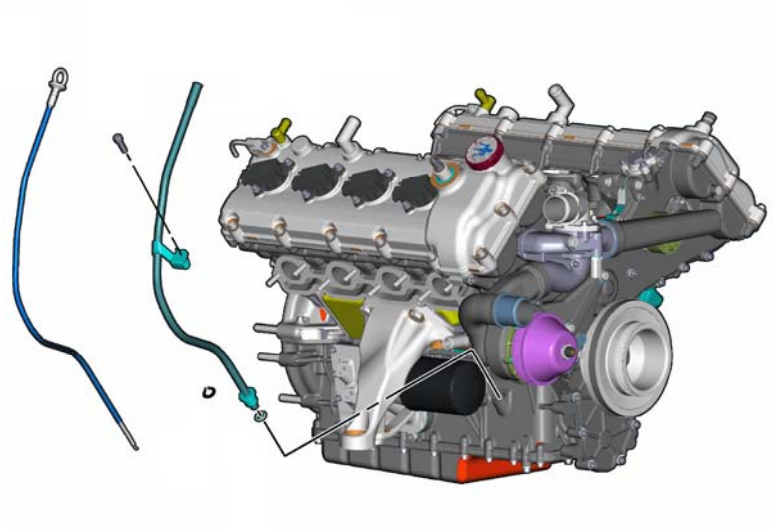


Attach the connectors for the oil sensor, knock sensors, timing sensors and RPM sensor.

Fit the oil pipes for the heat exchanger onto the crankcase

Fasten the inlet and outlet oil pipes with M16 unions equipped with washers ∅16-22x1

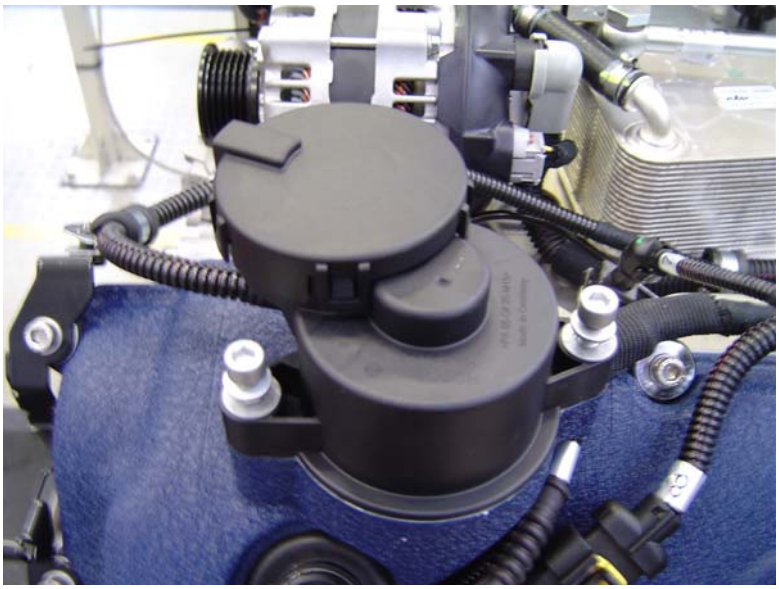
Tightening torque: 40Nm



Install oil dipstick holder with O-ring.

Lock in place using Seeger ring and screw TCEI M6x14.

Tightening torque: 10Nm

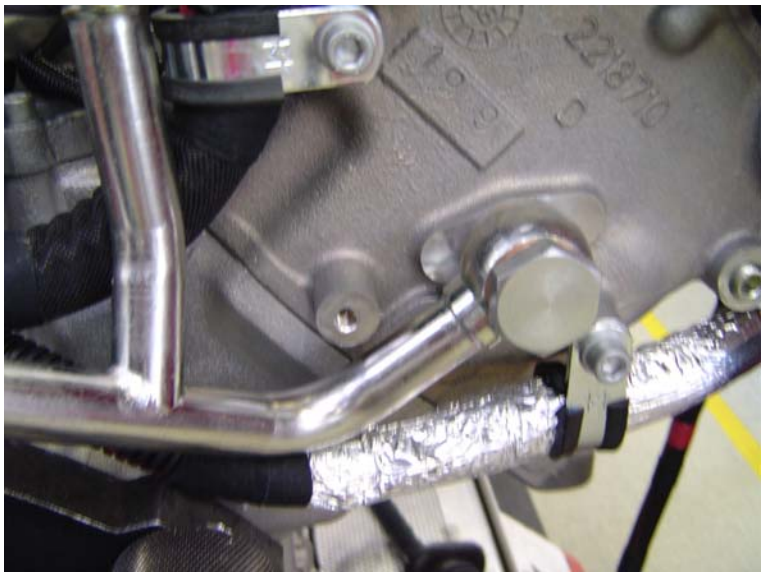


Place the oil vapour separator on the left-hand engine head. Fasten using screws TCEI M6x30 equipped with washer.

Tighten to the prescribed torque of 10Nm.

Install the water outlet pipe for the passenger compartment by means of unions.

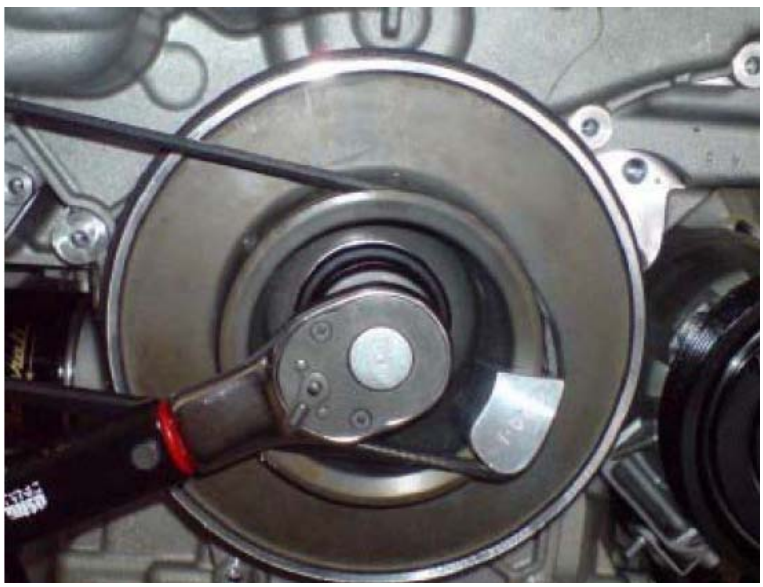
Tightening torque: 40Nm



Attach the connector for the water temperature sensor and fit the poly-V belt

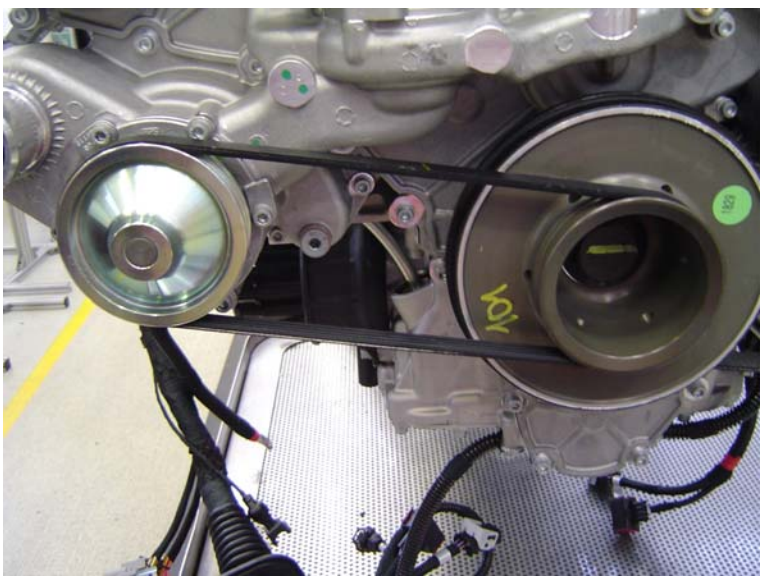
Ensure that the belt does not come into contact with oil or solvents which may impair the elasticity of the rubber and therefore lead to reduced grip. Fit the new belt on the pulley of the water pump using the appropriate tool.

Position tool **900027671** on the crankshaft drive pulley and fit the water pump drive belt onto the pulley.

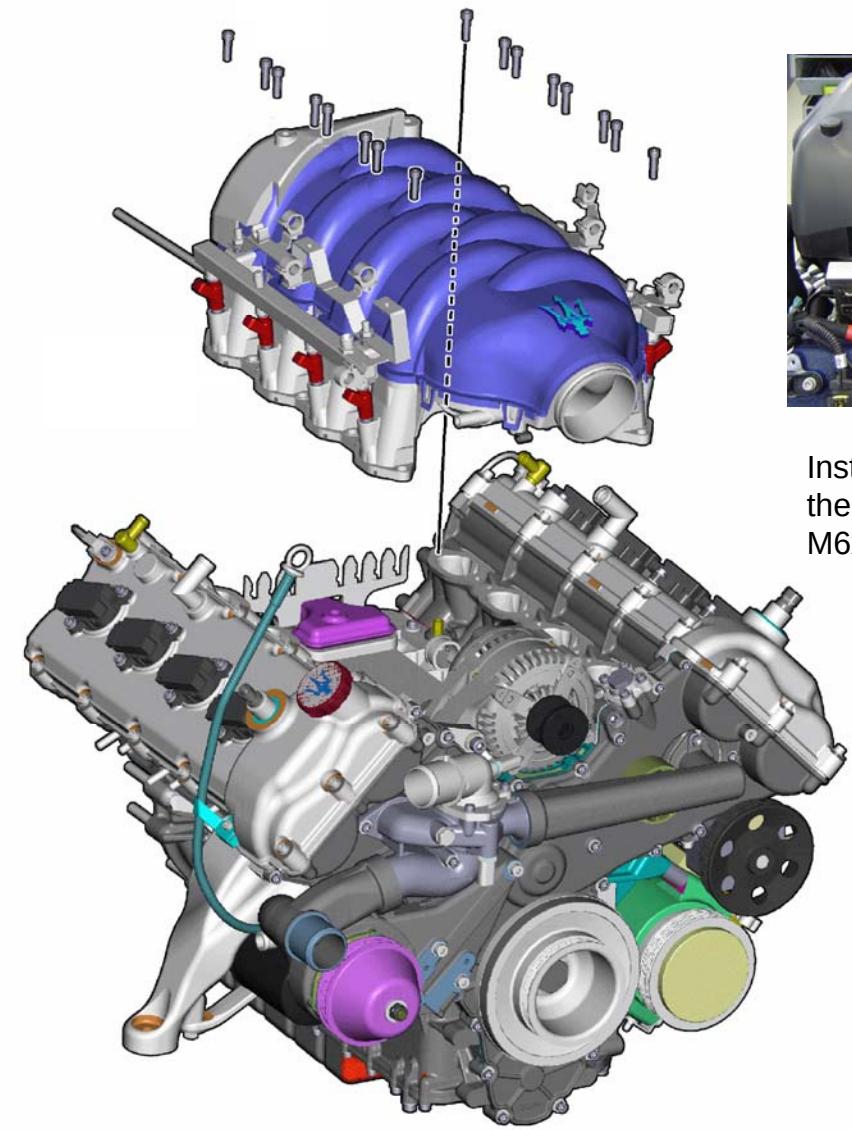


Rotate the crankshaft drive pulley in the engine's normal direction of rotation, and fit the belt into the pulley groove.
The belt tension does not need to be checked, but the belt must be replaced at regular intervals as indicated in the scheduled maintenance plan (see corresponding section of the manual).

Remove tool **900027671**.



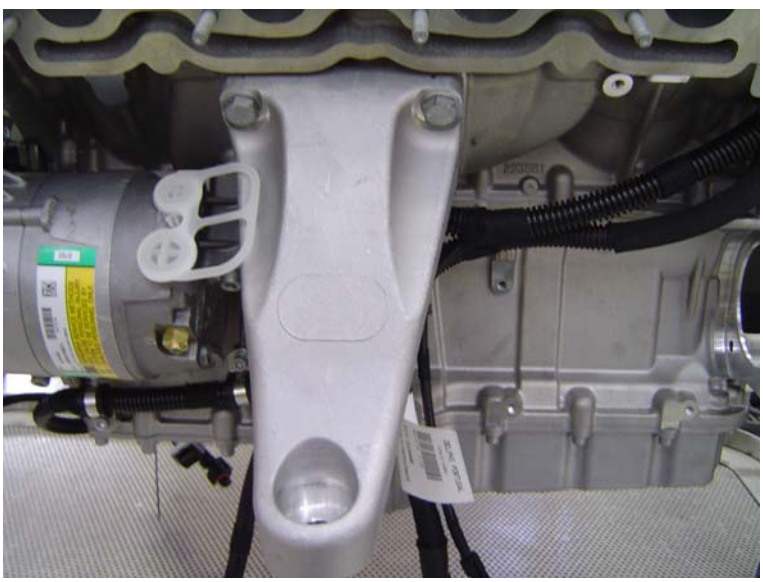
Attach the cable connectors for the coils on the left and right-hand banks.



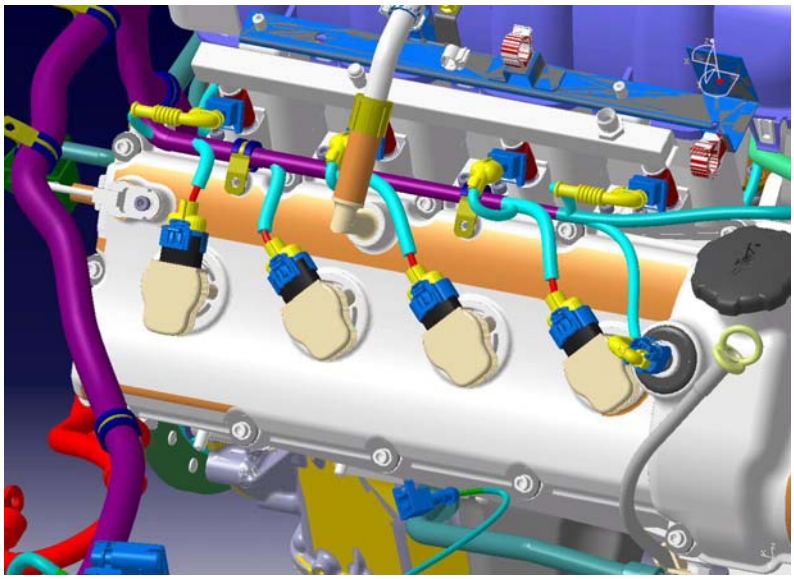
Install the plenum chamber. Fit the fastening screws TCEI M6x25

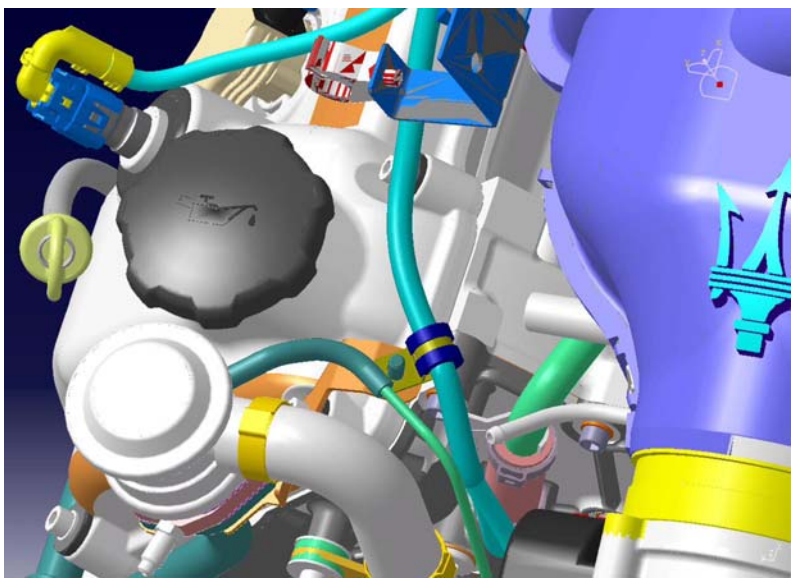
Fit the pipe linking the separator to the plenum chamber using fastening clamps.

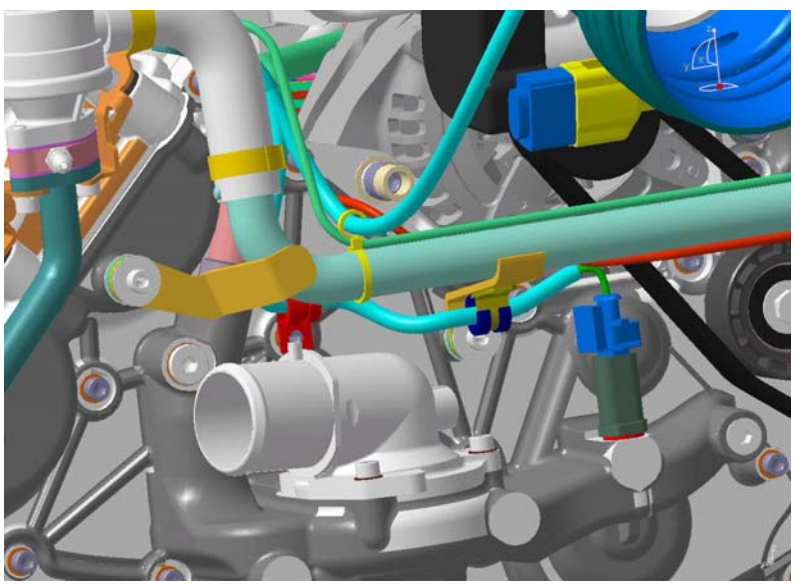
Fit the oil vapour communication pipe, connecting it to the head covers.

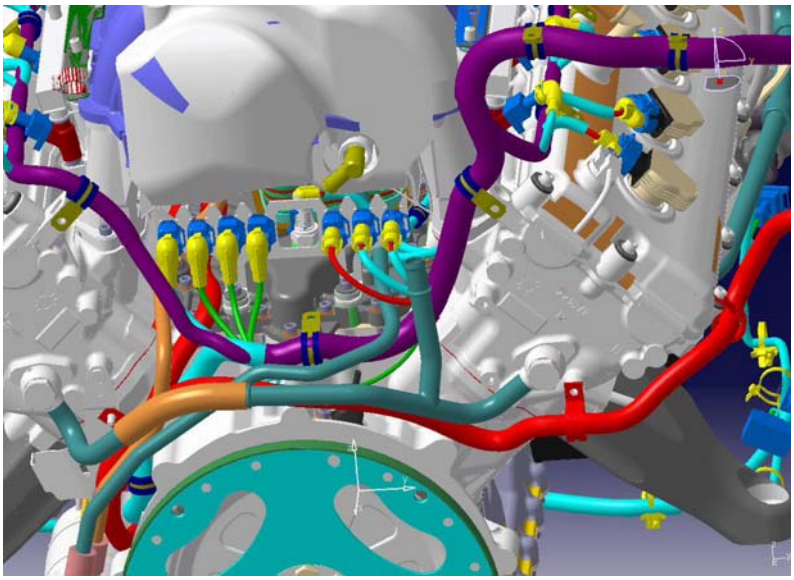


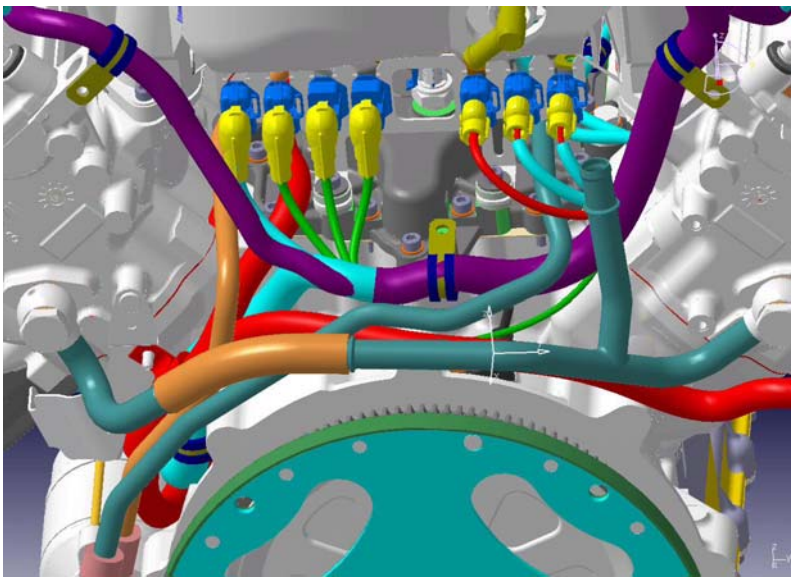
Fit the engine support legs. Fasten using screws TCEI M10x30 equipped with washers ∅10.5-20x2.3 Tighten to the prescribed torque: 45 Nm

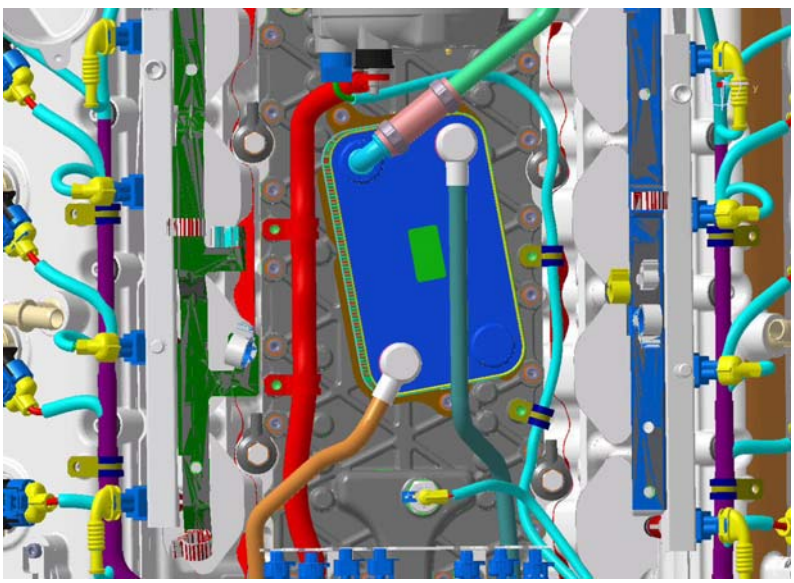


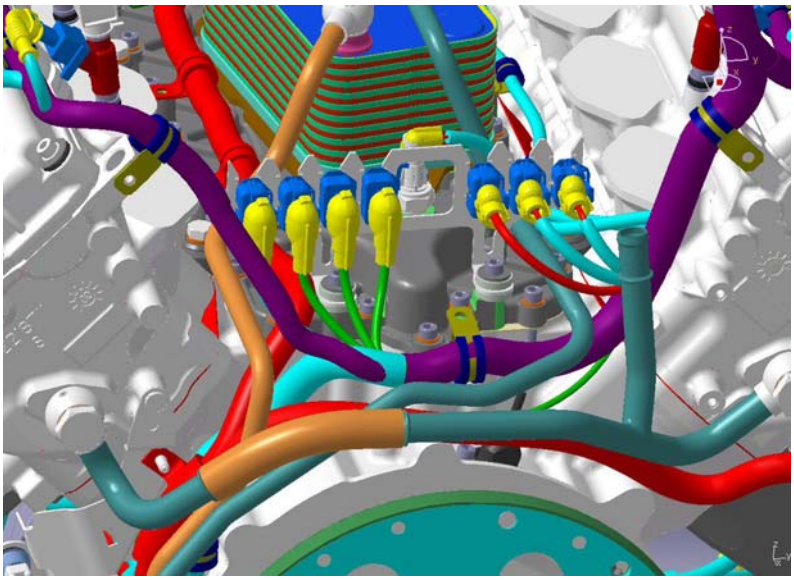


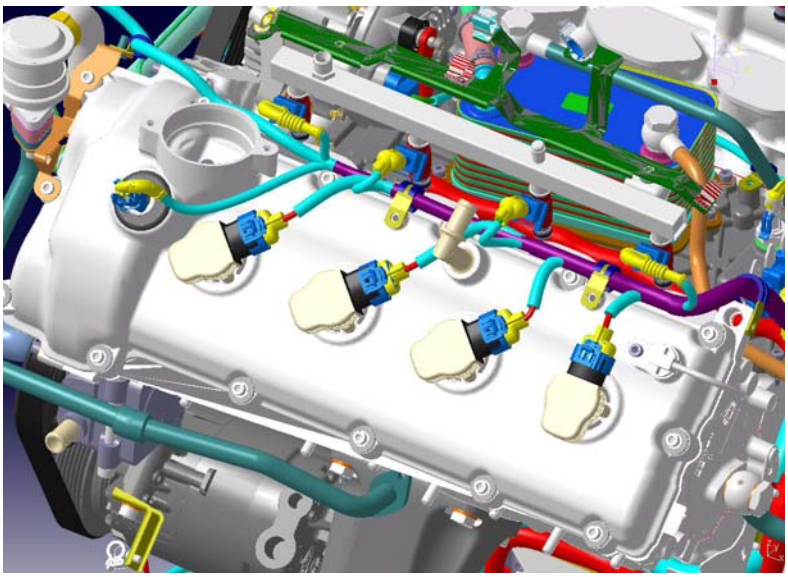


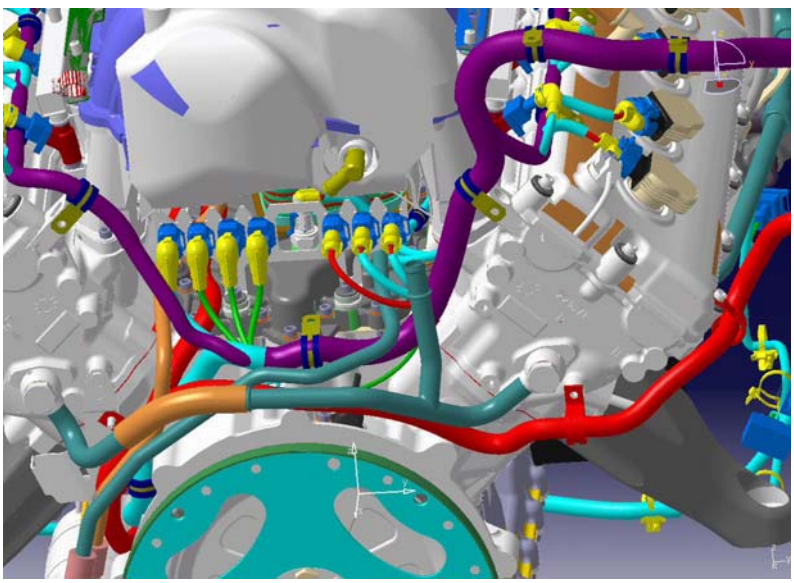


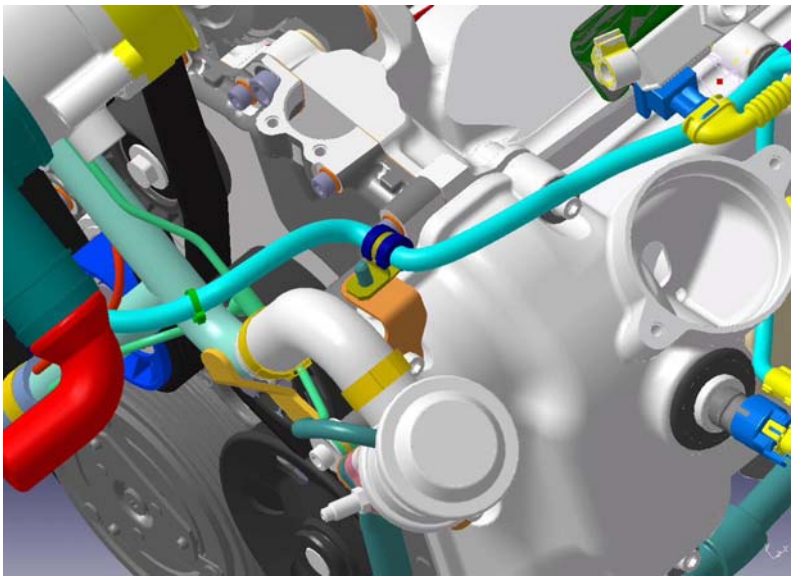


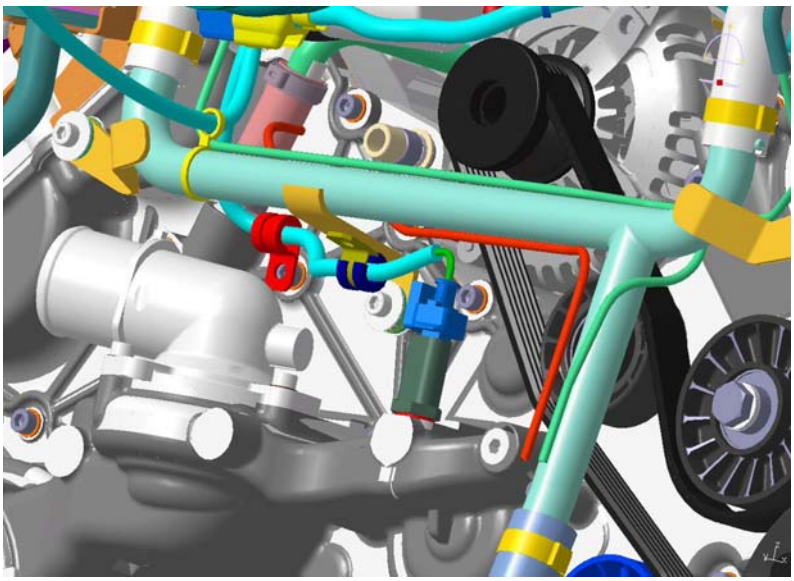


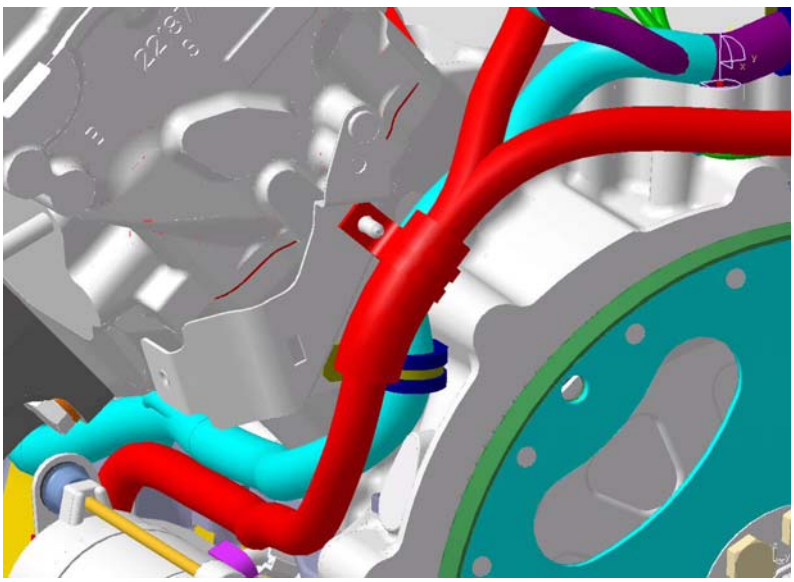


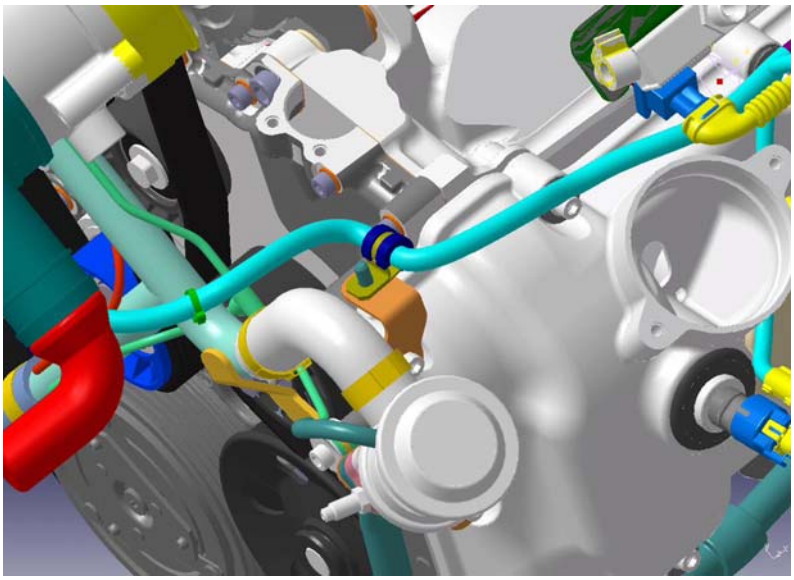


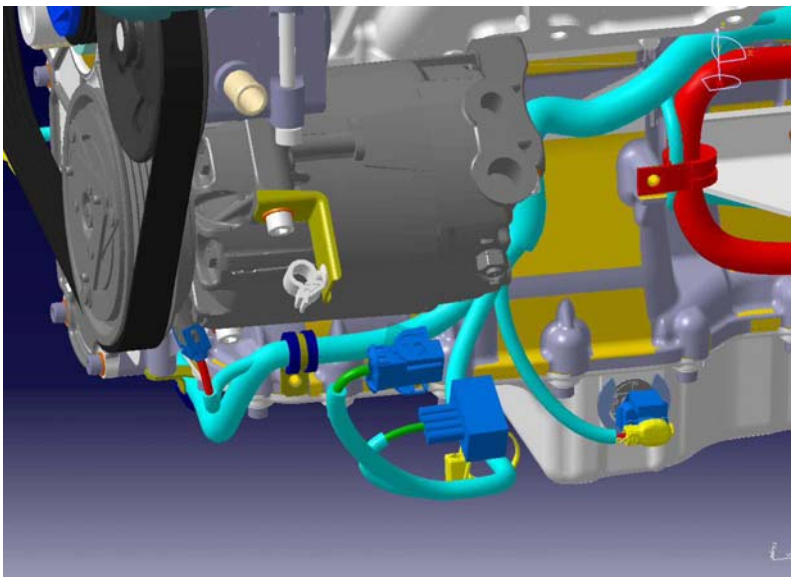


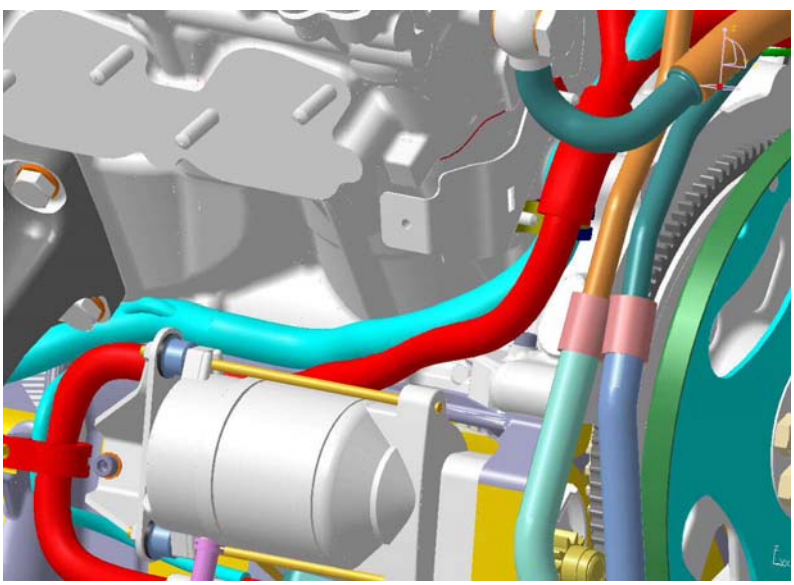


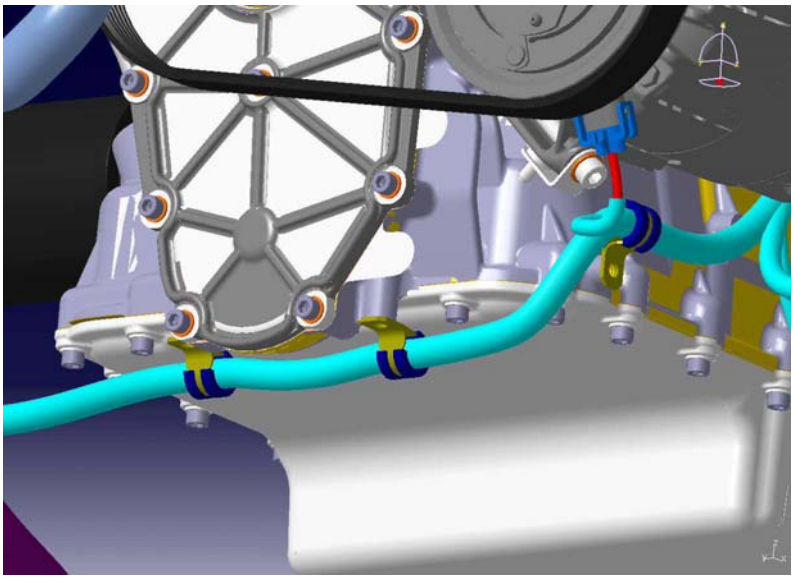












TIGHTENING TORQUES

					SERRAGGIO			
N°	PARTICOLARE	TABELLA NORMALE MATRICOLA DISEGNO	FILETTATURA	MATERIALE	CLASSE	COPPIA NOMINALE (N.m)	COPPIE DI SERRAGGIO INTESE CON LUBRIFICAZIONE	SERRAGGIO DA RIPRISTINARE DOPO SALA PROVA
A	BASAMENTO MOTORE							
1	DADO "E" M10x1.25 X SERRAGGIO BANCATE A SOTTOBASAMENTO	133988	10x1.25	Acc.10.9 R 100	A▽	○	Grasso Molycote 1000	
2	VITE "TCEI" M4x0.7 FISS. UGELLI RAFFREDDAMENTO PISTONI	Tab. 10356 1/43029/21	4x0.7	Acc. 8.8 R80	B	3	109673 Loctite 242	
3	VITE "TCEI" M6x1 FISS.SOTTOBASAM-BASAMENTO	V.D.B.	6x1	Acc.8.8 R 80	B	10		
4	TAPPO FIL. CILINDRICA M22x1.5 CONDOTTO OLIO LATO VOLANO SU BASAMENTO	V.D.B.	22x1.5	Acc.5.8 Tab. 52605/01	A	60	-	
5	VITE "TE" M8x1.25 FISS.SENSORE DI DETONAZIONE	V.D.B.	8x1.25	Acc.10.9 R 100	B	20	Specifiche Bosch 20±5 Nm	
6	VITE "TCEI" M8x1.25 FISSAGGIO RACCORDO A BASAMENTO	Tab. 10356 1/43064/24	8x1.25	Acc. 8.8 R 80	B	25		
7	VITE "TCEI" M6x1 FISSAGGIO PARATIA A SOTTOBASAMENTO	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
8	TAPPI FIL. CONICA M22x1.5 FORI ANIMA CONDOTTO ACQUA OLIO	V.D.B.	22x1.5	OTTONE R=380 N/mm²	B	34	109673 Loctite 242	
9	RACCORDO FILETTATO M25x1.5 SU SOTTOBASAMENTO X FISS. FILTRO OLIO	V.D.B.	25x1.5	9 SMnPb 28	B	60		

B	COPPA OLIO							
1	VITE "TCEI" M6x1 FISS. COPPA OLIO A SOTTO BASAMENTO	V.D.B.	6x1	Acc.8.8 R 80	B	10		
2	VITE M6x1 FISS. SENSORE LIVELLO OLIO	V.D.B.	6x1	Acc.8 R 50	A	8		
3	TAPPO MAGNETICO M22x1.5 PER SCARICO OLIO DALLA COPPA	104280	22x1.5	Comm.	B	60		
4	VITE "TCEI" M6x1 X STAFFA FISS. CABLAGGIO	V.D.B.	6x1	Acc. 8 R 50	B	8		

N°	PARTICOLARE	TABELLA NORMALE MATRICOLA DISEGNO	FILETTATURA	MATERIALE	CLASSE	COPPIA NOMINALE (N.m)	COPPIE DI SERRAGGIO INTESE CON LUBRIFICAZIONE	SERRAGGIO DA RIPRISTINARE DOPO SALA PROVA
C	SCAMBIATORE DI CALORE							
1	VITE "TCEI" M6x1 FISS. SCAMBIATORE AL BASAMENTO	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
2	TAPPO M14x1.5 X FORO SENSORE PROVA PRESSIONE OLIO	V.D.B.	14x1.5	OT.58	B	16		
3	RACCORDO BOCCHETT. M16x1.5 FISS. TUBAZIONI OLIO A SCAMBIATORE	V.D.B.	16x1.5	9 SMnPb 35	A	35		
4	TAPPO M10x1 SU SCAMBIATORE PER SFIATO VAPORI	Tab. 14530 V.D.B.	10x1	Acc. 5.8	B	12		
5	VITE "VTCEI" M6x1 C/RND FISS. SCAMB. OLIO CAMBIO SU SCAMB. AKG	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
6	VITE "TCEI" M6x1 FISS. STAFFA CONNETTORI	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
7	VITE "TCEI" M6x1 FISS. TUBO USCITA ACQUA SCAMBIATORE	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
8	VITE "TCEI" M6x1 FISS. FASCETTA PER TUBO OLIO CAMBIO	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
D	COPERCHI SCATOLE RIPORTATE							
1	VITI "TCEI" M6x1 FISS. COPERCHIO ANTERIORE A BASAMENTO E TESTE	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
2	VITI "TCEI" M6x1 FISS. COPERCHIO TERMOPRESSOSTATO	V.D.B.	6x1	Acc. 8.8 R 80	☐	☐		
3	SENSORE M12x1.5 TEMP. H2O CON CONTATTI DORATI	180137	12X1.5	Comm.	☐	☐		
4	VITE "TE" M10x1.25 FISS. PULEGGIA X CINGHIA ACESSORI	Tab. 10312 V.D.B.	10x1.25	Acc. 8.8 R 80	☐	☐		
5	TAPPO M14x1.5 (CONICO) X FORO SOSTEGNO ANIMA	Tab. 14552 V.D.B.	14x1.5	OTTONE	☐	☐		
6	VITE "TCEI" M6x1 FISSAGGIO POMPA ACQUA CPL	V.D.B.	6x1	Acc. 8.8	☐	☐		
7	TAPPO M12x1.25 X SPURGO VAPORE BANCATA SX E DX E SPURGO ACQUA	V.D.B.	12x1.25	Acc. 8.8	☐	☐		
8	VITE "TE" M8x1.25 FISS. IDLER X CINGHIA ACESSORI	Tab. 10312 V.D.B.	8x1.25	Acc. 8.8	☐	☐		
9	RACCORDO FILETT/CALZ M20x1.5	V.D.B.	20x1.5	9 SMnPb 35	☐	☐		
10	RACCORDO M16x1.5 COLLEG. TUBO USCITA ACQUA DA SCAMBIATORE	V.D.B.	16x1.5	Alloy 11S (Duralluminio)	☐	☐		
E	SFIATATOI							
1	VITE "TCEI" M6x1 FISS. SEPARATORE VAPORI OLIO	V.D.B.	6x1	Acc. 8.8 R 80	B	10		

N°	PARTICOLARE	TABELLA NORMALE MATRICOLA DISEGNO	FILETTATURA	MATERIALE	CLASSE	COPPIA NOMINALE (N.m)	COPPIE DI SERRAGGIO INTESE CON LUBRIFICAZIONE	SERRAGGIO DA RIPRISTINARE DOPO SALA PROVA
G	TESTE CILINDRI							
1	DADO "E" BORD. M11x1 FISS. TESTA CILINDRI AL BASAMENTO	183524	11x1	23 NMB4	A	☆	107287 Grasso speciale Molycote BR2	
2	VITE "TCEI" M6x1 FISS. CAPPELLINI ANTERIORE E PATTINO FISS SUP.	V.D.B.	6x1	Acc. 8.8 R 80	A	☆		
3	VITE "TCEI" M6x1 FISS. CAPPELLINI INTERMEDI	V.D.B.	6x1	Acc. 8.8 R 80	A	☆		
4	TAPPO FILET. CONICA M6x1 X FORI ACQUA LATO ASPIR. E FORI CIRCUITO OLIO	199760	6x1	Acc. 5.8	B	5	109673 Loctite 242	
5	TAPPO FILET. CONICA M18x1.5 PER FORI SOSTEGNO ANIME	V.D.B.	18x1.5	OTTONE	B	28	109673 Loctite 242	
6	TAPPO FILET. CONICA M10x1.25 PER FORI CIRCUITO OLIO	Tab. 14545 1/43260/01	10x1.25	Acc. 4.8	B	10	109673 Loctite 242	
7	VITE "TCEI" M6x1 FISS. COPERCHI TESTE	V.D.B.	6x1	Acc. inox UNI 5931 A4 R70	B	☆		
8	-	-	-	-	-	-		
9	VITE "TCEI" M14x1.5 FISS. VARIATORI DI FASE	V.D.B.	14x1.5	Acciaio	A	-	Olio su filetto 50Nm+85°di angolo (range di coppia 180-200Nm)	
10	-	-	-	-	-	-		
11	VITE "TCEI" M5x16 FISS. ELETTROVALV. SU CAPPELLO ANT.	V.D.B.	5x0.8	Acc. 8.8 R 80	B	6		
12	RACCORDO M22x1.5 SU COPERCHI TESTE X TUBO COLLEG. TESTE	V.D.B.	22x1.5	9 SMnPb 28	B	60		
13	VITE "TCEI" M6x1 FISS. STAFFA SUPP. MUFFOLA	V.D.B.	6x1	Acc. 8.8	B	10		
H	CONDOTTO D'ASPIRAZIONE							
1	VITE "TCEI" M6x1 FISS COLLETTORE ASP. A TESTE CILINDRI	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
I	ALBERO A GOMITI							
1	TAPPO FIL.CONICA M28x1.5 PER CHIUSURA FORO POST. SUI BANCHI	Vedi dis. albero motore	28x1.5	OTTONE	B	-	Vedi dis. albero motore	
L	BIELLA E STANTUFFI							
1	VITE SERRAGGIO BIELLA	V.D.B.	MJ10x1	P503	A	◎	Vedi dis. biella completa	
M	VOLANO MOTORE							
1	VITE"TE"AUTOBLOC.M10x1.25 FISSAGGIO VOLANO AD ALBERO MOTORE	V.D.B.	10x1.25	Acc. 12R R 120/140	A	91	Consigliata da RICARDO con analisi DP 00/2016	

N°	PARTICOLARE	TABELLA NORMALE MATRICOLA DISEGNO	FILETTATURA	MATERIALE	CLASSE	COPPIA NOMINALE (N.m)	COPPIE DI SERRAGGIO INTESE CON LUBRIFICAZIONE	SERRAGGIO DA RIPRISTINARE DOPO SALA PROVA
N	SMORZATORE TORSIONALE							
1	VITE "TE" M20x1.5 FISS.SMORZATORE TORS. AD ALBERO MOTORE	V.D.B.	20x1.5	Acc. 12R R 120/140	A ▽	450	109673 Loctite 242	
O	RUOTISMI COMANDO DISTRIBUZIONE							
1	VITE "TE" M8x1.25 FISS. SPALLAMENTO AL SUPPORTO RINVIO	Tab.10312 1/60431/24	8x1.25	Acc.8.8 R 80	B	25		
2	VITE M5x0.8 FISS.PERNO SUPPORTO INGRANAGGIO	V.D.B.	5x0.8	Acc.8.8 R 80	B	6	109673 Loctite 242	
3	VITE "TCEI" M6x1 FISS.PATTINO FISSO SU RINVIO	V.D.B.	6x1	Acc.8.8 R 80	B	10		
4	VITE "TCEI" M6x1 FISS.PATTINO MOBILE	V.D.B.	6x1	Acc.8.8 R 80	B	10		
5	VITE "TCEI" M8x1.25 FISS.PATT.MOBILE DISTRIB.	Tab.10356 1/43064/24	8x1.25	Acc.8.8 R 80	B	25		
6	VITE "TCEI" M6x1 FISS. BOCCOLA TENDIT. T.SX	V.D.B.	6x1	Acc.8.8 R 80	B	10		
7	VITE "TCEI" M8x1.25 FISS.PATT.FISSO COM.DISTRIB.	V.D.B.	8x1.25	Acc.8.8 R 80	B	25		
8	VITE "TCEI" M6x1 FISS. PATTINO FISSO SUPERIORE	V.D.B.	6x1	Acc.10.9 R 100	B	☆		
10	VITE "TCEI" M6x1 FISS. INGR. SU ASSE SCARICO	V.D.B.	6x1	Acc.12.9 R 120	B	5+50 ° 30-15	109673 Loctite 242	
11	TENDITORE CATENA DISTRIBUZIONE M22x1.5 COMANDO ASSI CAMME	V.D.B.	22x1.5	Comm.	B	40		
P	REGOLAZIONE INIEZIONE							
1	SONDA LAMBDA ANTERIORE	V.D.B.	18x1.5	Comm.	B	50		
2	SONDA LAMBDA POSTERIORE	V.D.B.	18x1.5	Comm.	B	50		
3	VITE "TCEI" M6X1 FISS. FARFALLA MOTORIZZATA	Tab. 10356 1/43059/24	6x1	Acc. 8.8	B	10		
Q	TUBAZIONI PER INIETTORI							
1	DADO "E" M8 FISSAGGIO TUBI BENZINA	Tab.10114 1/61023/14	8x1.25	Acc. 04 R 50	B	15		
2	DADO "E" M8 FISS. STAFFA SU FLAUTI BENZ.	V.D.B.	8x1.25	R 50	B	15		

N°	PARTICOLARE	TABELLA NORMALE MATRICOLA DISEGNO	FILETTATURA	MATERIALE	CLASSE	COPPIA NOMINALE (N.m)	COPPIE DI SERRAGGIO INTESE CON LUBRIFICAZIONE	SERRAGGIO DA RIPRISTINARE DOPO SALA PROVA
R	DISTRIBUT.-BOBINA ACCENSIONE							
1	VITE "TCEI" M6x1 FISS. SENSORE VEL.ANGOLARE	V.D.B.	6x1	Acc.8.8 R 80	B	8	Specifiche Bosch 8±2 Nm	
2	VITE "TCEI" M6x1 FISS.SENSORE DI FASE ASP. AI COPERCHI	V.D.B.	6x1	Acc.8.8 R 80	B	8	Specifiche Bosch 8±2 Nm	
S	CAVI CANDELE ANTID.RADIO							
1	CANDELA DI ACCENSIONE NGK	VDB	10x1	Comm.	A	11		
T	POMPE OLIO							
1	VITE "TECEI" M8x1.25 FISSAGGIO POMPA OLIO AL SOTTOBASAMENTO	V.D.B.	8x1.25	Acc.8.8 R 80	B	25		
2	VITE "TCEI" M6x1 FISS. TUBO MANDATA OLIO AL SOTTOB.	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
U	FILTRI X LUBRIFICAZIONE							
1	VITE "TCEI" ROND. M6X1	V.D.B.	6X1	Acc. 8.8 R 80	B	10		
2	CARTUCCIA FILTRO OLIO	V.D.B.	1"12UNF2B	Comm.	B	30	Con olio motore su guarnizione	
V	REGOLATORI TEMPERAT./PRESSIONE							
1	TRASMETTITORE ELETTRICO DI PRESSIONE OLIO	201672	14x1.5	Comm.	B	32		
Z	MOTORE ELETTRICO X AVVIAMENTO							
1	DADO "E" AUTOBLOCC. M5x0.8 FISS. STAFFA A MOT. AVVIAMENTO	160472	5x0.8	35CrMo4	B	6		
2	VITE "TCEI" M6x1 FISS. STAFFA AL SOTTOBASAMENTO	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
W	COMPRESSORE X CONDIZIONATORE							
1	VITE "TCEI" M8x1.25 FISS. COMPRESSORE A BASAMENTO	V.D.B.	8x1.25	Acc. 8.8/10.9 R 80/100	B	25		
Y	GENERATORE ELETTRICO							
1	DADO "E" M8x1.25 FISS.CAVO DA ALTERNATORE A MOT. AVV.	Tab.10114 1/61023/14	8x1.25	Acc. 05 Tab. 52605/01	B	14		
J	ATTACCHI X GENERATORE							
1	VITE "TCEI" M10x1.25 FISS.GENERATORE A TESTE	V.D.B.	10x1.25	Acc.8.8 R 80	B	49		

N°	PARTICOLARE	TABELLA NORMALE MATRICOLA DISEGNO	FILETTATURA	MATERIALE	CLASSE	COPPIA NOMINALE (N.m)	COPPIE DI SERRAGGIO INTESE CON LUBRIFICAZIONE	SERRAGGIO DA RIPRISTINARE DOPO SALA PROVA
X	COMANDI GENERATORE ELETTRICO							
1	VITE "TE" M8x1.25 FISS. TENDICINGHIA A BASAMENTO	Tab. 10312 1/60444/31	8x1.25	Acc.10.9 R 100	B	25		
K	POMPA X SERVOSTERZO							
1	VITE "TCEI" M8x1.25 FISS.POMPA IDROGUIDA	V.D.B.	8x1.25	Acc.8.8/10.9 R 80/100	B	25		
2	-	-	-	-	-	-		
3	VITE "TCEI" M6x1 FISS.STAFFA DI SUPPORTO AL MOTORE	V.D.B.	6x1	Acc.12.9 R 120	B	10		
AA	IMPIANTO ELETTRICO MOTORE							
1	VITE "TCEI" M8x1.25x16 FISS.MASSA ELETTRICA MOTORE	V.D.B.	8x1.25	Acc. 8.8 R 80	B	25		
2	DADO "E" M6 FISS.CAVO MOT.AVV.SU STAFFA X MUFFOLA	V.D.B.	6x1	Classe 10	B	10		
3	VITE TCEI ROND. M6x1x12 FISS. STAFFETTE CAVI ELETTR.	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
AB	COLLETTORI DI SCARICO							
1	DADO "E" INT. STOP M8x1.25 FISS. COLLETTORI SCARICO	138392	8x1.25	18 SMnPb10 R 70/75	B	25	Montato in Maserati	
2	TERMOCOPPIA PER IMPIANTO SCARICO	168824	10x1	Comm	B	10		
3	FASCETTA TORCA PER IMPIANTO DI SCARICO	185307	10x1.5	Acciaio Inox	B	54	Con avvitatore Max 400 rpm	
AC	INTEGRANTI MOTORE							
1	TUBI SU POMPA BENZ. COLLEG. E TUBI PORTATA BENZ A INIETTORI	V.D.B.	14x1.5	Acc.	A▽	34		
AD	TUBAZIONI INDIC. LIVELLO OLIO							
1	VITE "TCEI" M6x1 FISS. TUBO ASTA OLIO A TESTA CILINDRI	V.D.B.	6x1	Acc. 8.8 R 80	B	10		
AE	TUBAZIONI X RAFFREDDAMENTO							
1	BOCCHET. M18x1.5 X RACC. ORIENT. FISS. TUBI A TESTE	V.D.B.	18x1.5	9 SMnPb 28	B	40		
AF	TUBAZ.VALVOLE ANTINQUIN.							
1	VITE TCEI ROND. M6x1x12 FISSAGGIO TUBI ARIA SECONDARIA	V.D.B.	6x1	Acc. 8.8 R 80	B	10		

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