



BOTTOM ENGINE:

Description	Tightening torques
Heat exchanger connector	4.5
Oil filter unit bracket	4.5
Crankshaft bearing caps	2.7 + 47° ± 5°
Con rods	2 + 45° ± 6°
Pinking sensor	2
Oil level sensor	2.2
Oil pump	2.5
Engine oil sump	*
Water pump	1.1
Flywheel	5 - 5.5
Clutch mechanism	0.8
Crankshaft accessories pulley	2 + 130° ± 15°
Water pump inlet pipe	2
Multifunction support	4
Alternator	2.1
Power steering pump	2.1
Air conditioning compressor	2.1

* See tightening procedure.

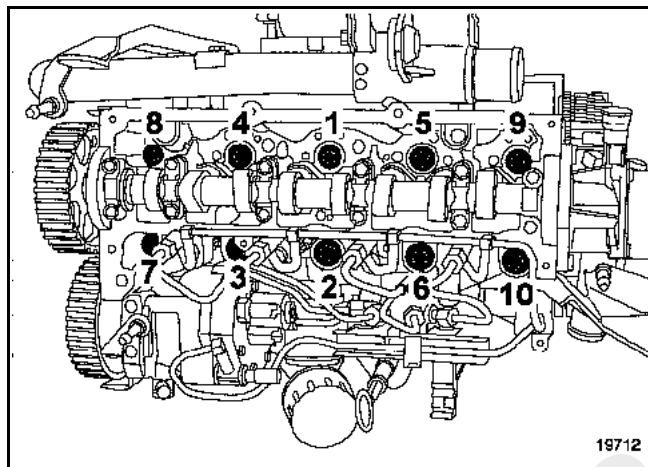
CYLINDER HEAD

Cylinder head tightening procedure

REMINDER: Use a syringe to remove any oil which may have entered the cylinder head mounting bolt holes to achieve correct tightening of the bolts.

**All bolts must always be changed after removal.
Do not oil the new bolts.**

Tighten all the bolts to a torque of **2.5 daN.m**.



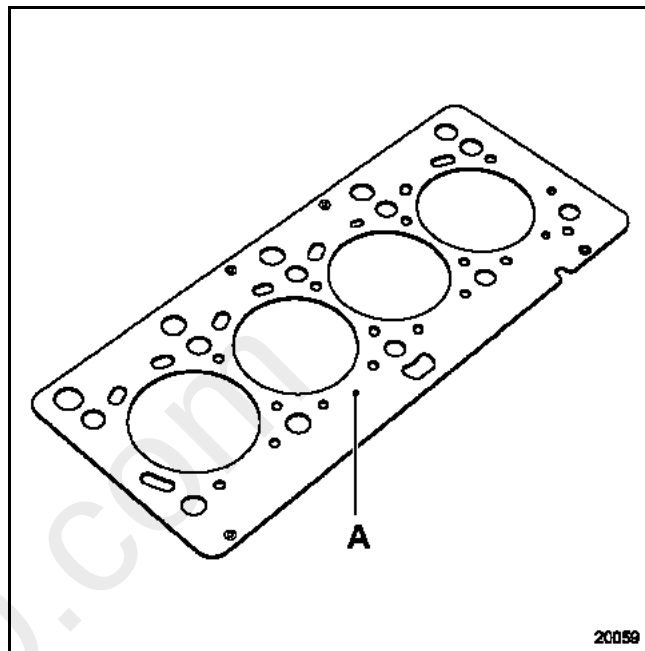
Check that all the bolts are correctly tightened to **2.5 daN.m** then tighten to an angle, **bolt by bolt**, of **255° ± 10°**.

Do not retighten the cylinder head bolts after performing this procedure.

Thickness of the cylinder head gasket

The thickness of the cylinder head gasket is measured at (A):

- thickness of the gasket when tightened:
0.78 ± 0.3 mm.



Checking piston protrusion

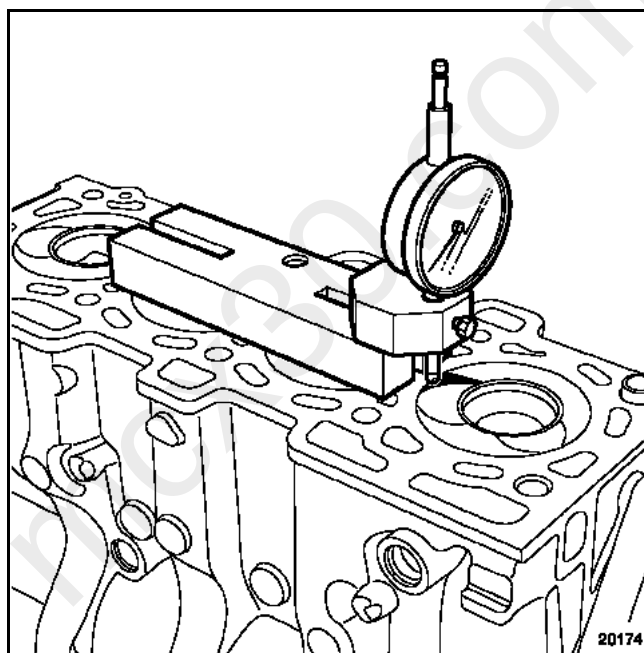
Clean the piston heads in order to eliminate any traces of deposits.

Turn the crankshaft one turn in its operating direction to bring piston no.1 close to **Top Dead Centre**.

Fit tool **Mot. 251-01** equipped with a gauge on its base plate **Mot. 252-01**, and find top dead centre of the piston.

N.B.: All measurements must be carried out along the longitudinal axis of the engine, in order to eliminate any errors due to tilting of the piston.

WARNING: the gauge follower must not be in the valve clearance.

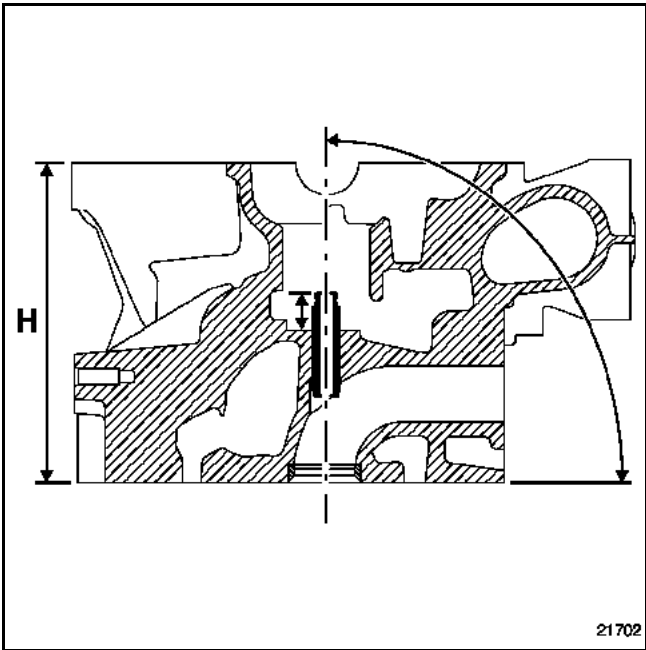


Measure the piston protrusion.

The protrusion must be: **0.192 ± 0.093 mm.**

Height of the cylinder head (in mm)

H = 127



Gasket face bow (in mm):

Cylinder head	0.05
Cylinder block	0.03

NO REGRINDING IS AUTHORISED

Test the cylinder head to detect possible cracks using the cylinder head test tools (comprising a tray and a kit suited to the cylinder head, plug, sealing plate, blanking plate). The approval number of the cylinder head test container is **664 000**.

Valves

Stem diameter (in mm)

Inlet	5.977 ± 0.008
Exhaust	5.963 ± 0.008

Face angle

Inlet and exhaust:	90°
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Head diameter (in mm)

Inlet	33.5 ± 0.12
Exhaust	29 ± 0.12

Valve length (in mm)

Inlet	100.95 ± 0.22
Exhaust	100.75 ± 0.22

Max. valve lift (in mm)

Inlet	8.015
Exhaust:	8.595

Protrusion of valves in relation to the cylinder head gasket face (in mm)

Inlet and exhaust	0 ± 0.07
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Valve seats

Seat angle (α)

Inlet and exhaust: 89° 30'

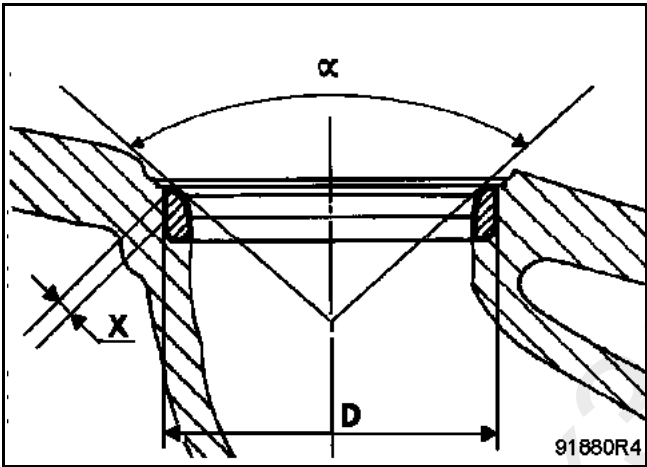
Mating surface width (X) (in mm)

Inlet and exhaust: 1.8

Seat external diameter (D) (in mm)

Inlet 34.542 ± 0.008

Exhaust 30.042 ± 0.008



Diameter of the housing in the cylinder head
(in mm)

Inlet 34.459 ± 0.015

Exhaust 29.97 ± 0.015

Valve guides

Length (in mm)

Inlet and exhaust: 40.5 ± 0.15

Guide external diameter (in mm)

Normal: 11 $\begin{smallmatrix} +0.062 \\ +0.044 \end{smallmatrix}$

Guide internal diameter (in mm)

Inlet and exhaust

Not machined 5.5 $\begin{smallmatrix} +0.12 \\ 0 \end{smallmatrix}$

Machined* 6.009 ± 0.009

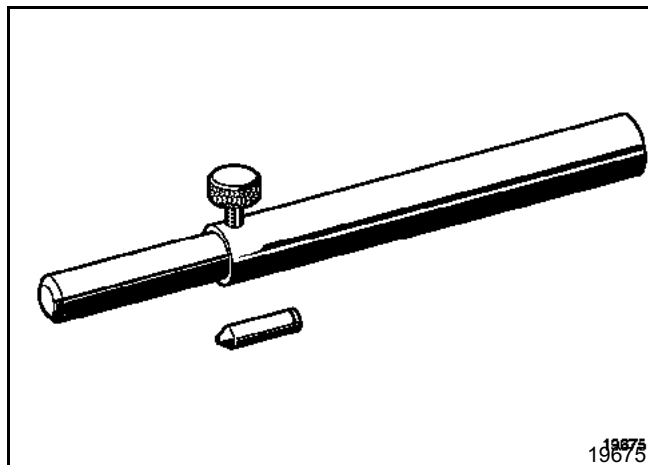
* This dimension is measured with the guide fitted in the cylinder head.

Diameter of the housing in the cylinder head
(in mm)

Normal 11 ± 0.0075

The inlet and exhaust guides have valve stem seals which must be changed each time the valves are removed.

It is imperative to fit the valve stem seals using tool Mot. 1511-01 or other suitable equipment.

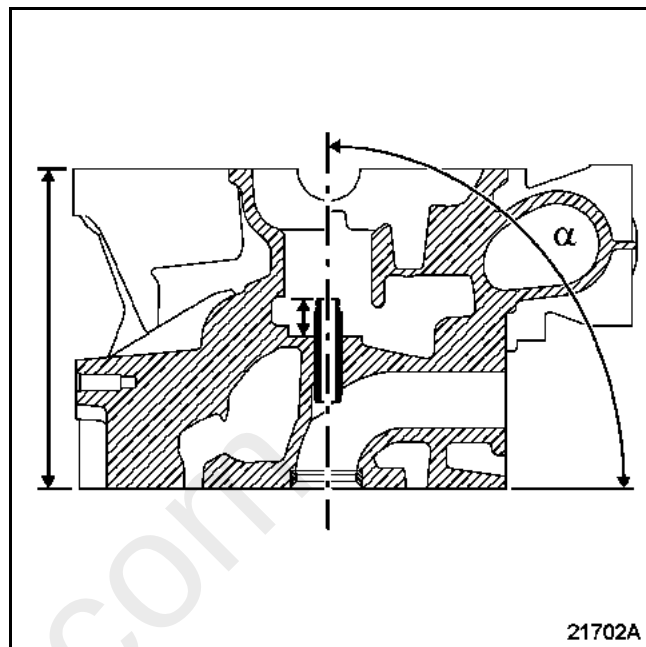


NOTE: do not lubricate the valve stem seals before fitting them.

Angle of the inlet and exhaust guides (in degrees)

Inlet and exhaust:

$\alpha = 90$



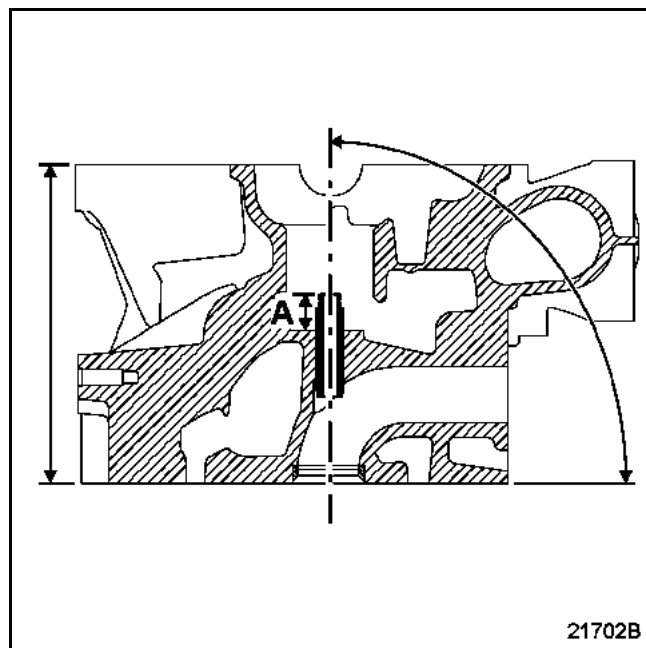
Position of the inlet and exhaust valve guides (in mm)

Inlet:

A = 14

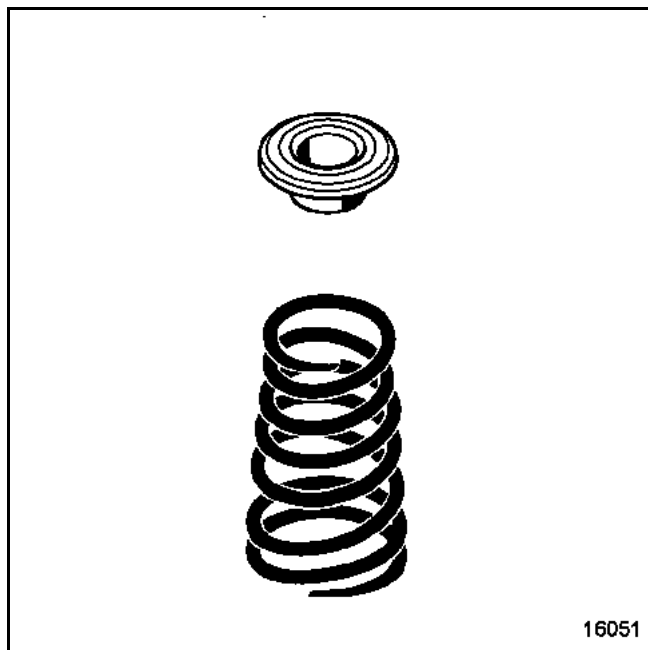
Exhaust

A = 14.2



Valve springs

The valve springs are **tapered** (ensure the correct direction of fitting).



Free length (in mm)	43.31
Length under a load of (in mm)	
23 daN	33.80
50 daN	24.80
Joined spires (in mm):	23.40
Wire diameter (in mm)	3.45
Internal diameter (in mm)	
Bottom	18.80 ± 0.2
Top	14.10 ± 0.2
External diameter (in mm):	
Bottom	25.70 ± 0.2
Top	21 ± 0.2

WARNING: THIS ENGINE DOES NOT HAVE ANY VALVE SPRING LOWER WASHERS.

Pistons

Piston external diameter (in mm)

 34.975 ± 0.01

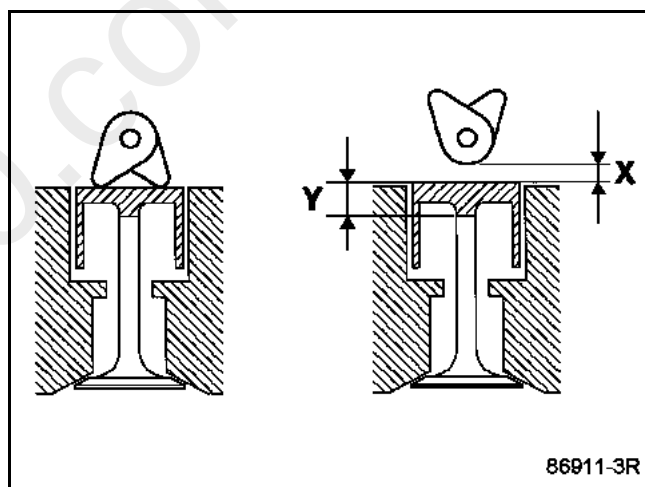
Diameter of the housing in the cylinder head (in mm)

 35.02 ± 0.02

Checking the valve clearance

Place the valves of the cylinder concerned at the "end of exhaust - beginning of inlet" position and check the clearance (X).

NOTE: dimension (Y) corresponds to the tappet thickness class (there are 25 classes at the Parts Store).



1	4
3	2
4	1
2	3

Compare the values recorded with the values specified, then replace the tappets which are not within tolerance.

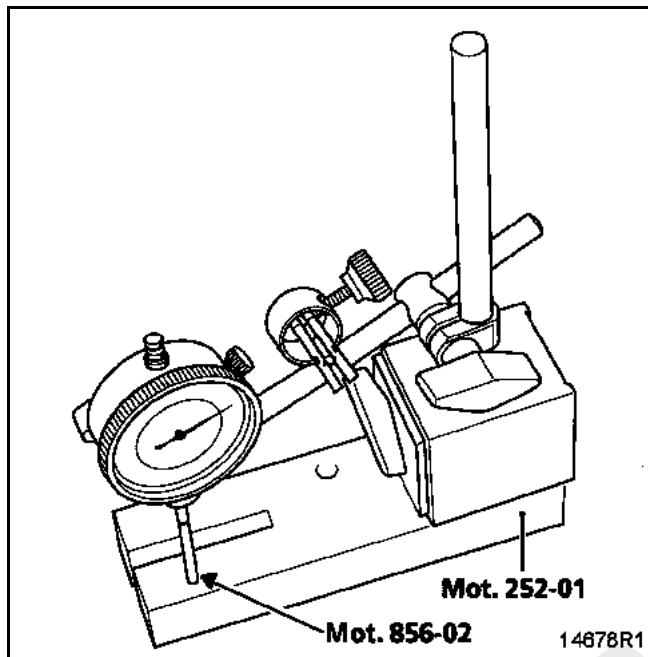
Clearance (in mm), when the engine is cold:

Inlet	0.20	$+0.05$ -0.075
Exhaust:	0.40	$+0.05$ -0.075

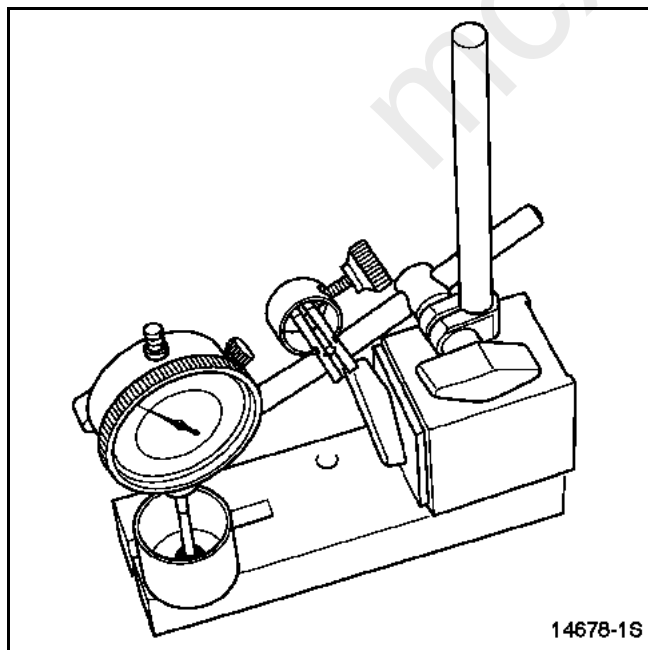
The camshaft must be removed to replace the tappets.

Determining dimension "Y".

Set up the following assembly using **Mot. 252-01** and **Mot. 856-02**, then calibrate the gauge.



Raise the gauge extension (**without modifying the position of the magnetic support/gauge assembly**), then slide in the tappet to be measured.



Note dimension (Y) and repeat the operation for the tappets where the valve clearance is not within tolerance.

Refer to the Replacement Parts Catalogue for the vehicle concerned to select the various thicknesses of the tappet(s). The Parts Stores supplies 25 classes of single-piece tappets.

Camshaft

End play (in mm) **0.08 to 0.178**

Number of bearings **6**

Diameter of the camshaft bearings (in mm)

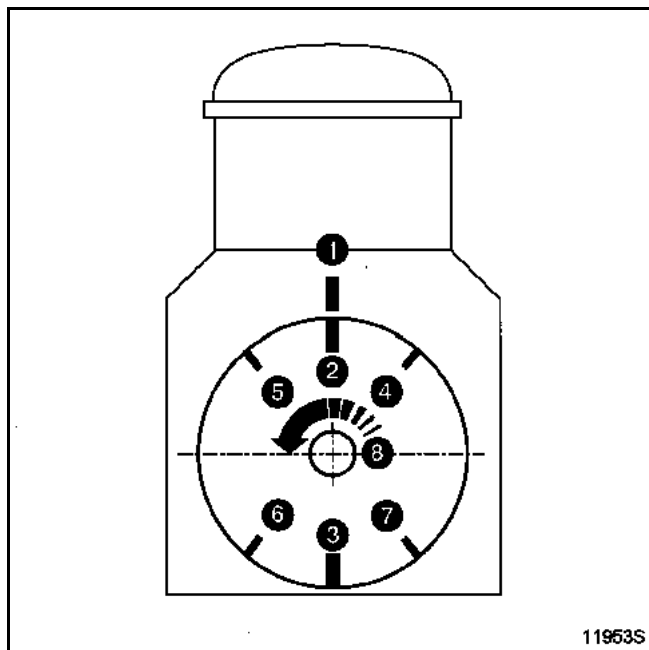
- on the camshaft:
 - bearings 1, 2, 3, 4, 5 **24.989 ± 0.01**
 - bearing 6 **27.989 ± 0.01**
- on the cylinder head:
 - bearings 1, 2, 3, 4, 5 **25.05 ± 0.01**
 - bearing 6 **28.05 ± 0.01**

Timing diagram

- Inlet opening retard * **-9**
- Inlet closing retard **20**
- Exhaust opening advance **27**
- Exhaust closing advance ** **-7**

* **As the inlet opening retard** is negative, the valve is opened after Top Dead Centre.

** **As the exhaust closing advance** is negative, the valve is closed before Top Dead Centre.



- 1 Cylinder block top dead centre fixed mark
- 2 Flywheel top dead centre moving mark
- 3 Flywheel bottom dead centre moving mark
- 4 Inlet Opening Retard
- 5 Exhaust Closing Advance
- 6 Inlet Closing Retard
- 7 Exhaust Opening Advance
- 8 Direction of engine rotation (flywheel end).

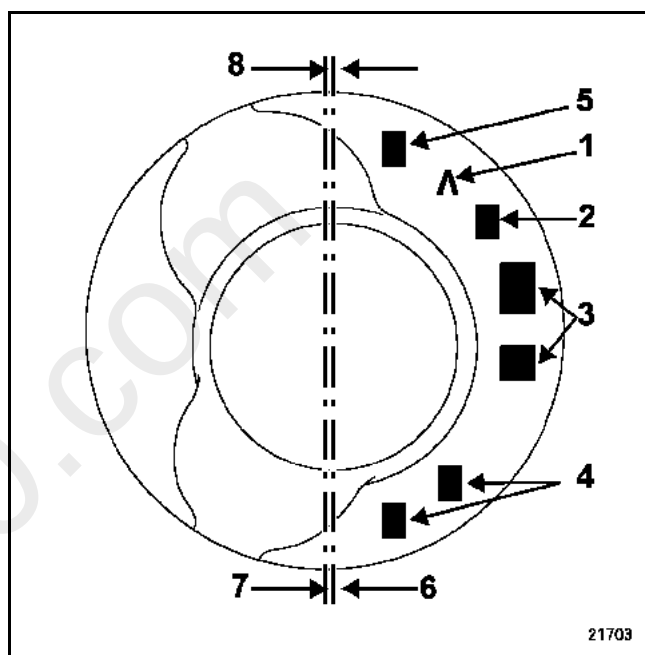
PISTONS

Fitting the gudgeon pin in the con rod and in the piston.

The gudgeon pin is retained by circlips.

These engines are fitted with **FEDERAL MOGUL pistons**.

Piston marking



- 1 Direction of fitting of the piston towards the flywheel
- 2 Height between the gudgeon pin and the top of the piston (see table below).
- 3 Used by the supplier only
- 4 Used by the supplier only
- 5 Used by the supplier only
- 6 Piston axis of symmetry
- 7 Gudgeon pin hole axis
- 8 Offset between the hole axis (7) and the piston's axis of symmetry (6) is **0.3 mm**

Table of gudgeon pin heights

* Mark on piston	Pin height (mm)
K	41.667
L	41.709
M	41.751
N	41.793
P	41.835

The tolerance on the pin heights is ± 0.02 mm.

* The different gudgeon pin heights are exclusively reserved for the engine assembly plant.

The Parts Stores will only supply piston classes (height) L, M, N.

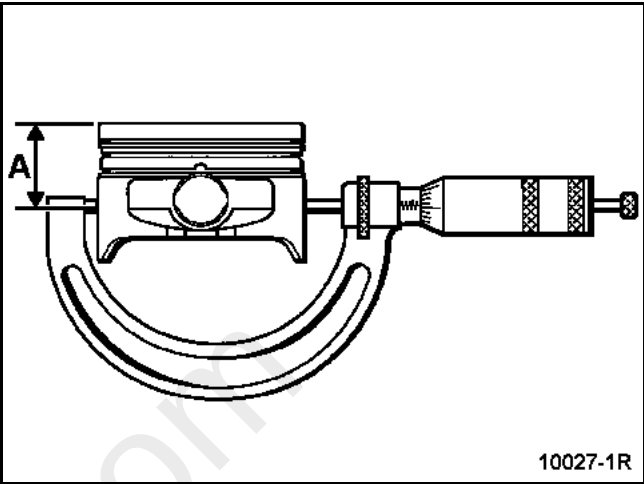
NOTE:

- if the engine is fitted with a K class piston, an L class piston must be fitted as a replacement.
- if the engine is fitted with a P class piston, an N class piston must be fitted as a replacement,

Measuring the piston diameter

The piston diameter must be measured at height **A = 56 mm**.

Piston diameter (in mm): **75.94 $\pm$ 0.007**



Gudgeon pin (in mm)

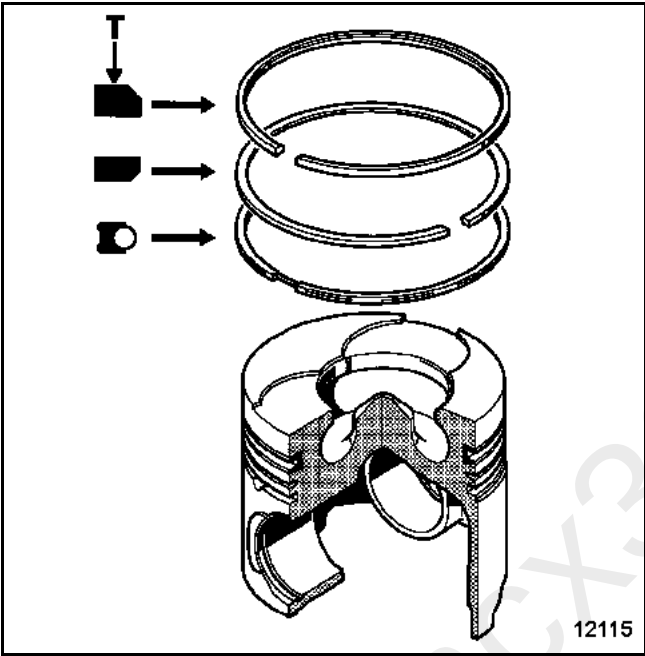
Length	59.7 - 60.3
External diameter	24.8 - 25.2
Internal diameter:	13.55 - 13.95

Rings

Three rings (thickness in mm):

Compression	2	-0.01 -0.03
Sealing	2	-0.01 -0.03
Scraper	2.5	-0.01 -0.03

The rings are supplied ready adjusted.



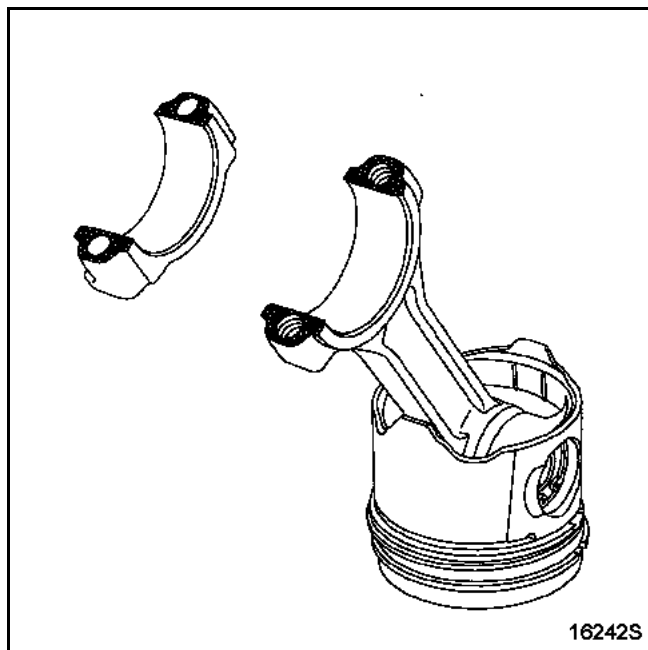
T = Top

Clearance at the gap

Rings	Clearance at the gap (in mm)
Compression	0.2 to 0.35
Sealing	0.7 to 0.9
Scraper	0.25 to 0.5

CON RODS

The connecting rods are of the "DETACHABLE CAP" type.

**WARNING:**

- The bolts must be coated with engine oil under the heads and on the threads when the con rods are fitted in the engine.
- The big end caps are positioned on the con rod by irregularities on the parting line.
- The occurrence of impacts or a foreign body between the body - cap mating surfaces will lead to rapid rupture of the con rod.

Lateral big end play (in mm) 0.205 to 0.467

Diametrical big end play (in mm) 0.035 to 0.045

Centre distance between the big end and small end (in mm) 133.75

Diameter of the big end (in mm) 47.619 ± 0.009

Diameter of the small end (in mm)
(without ring) 27.25 ± 0.010

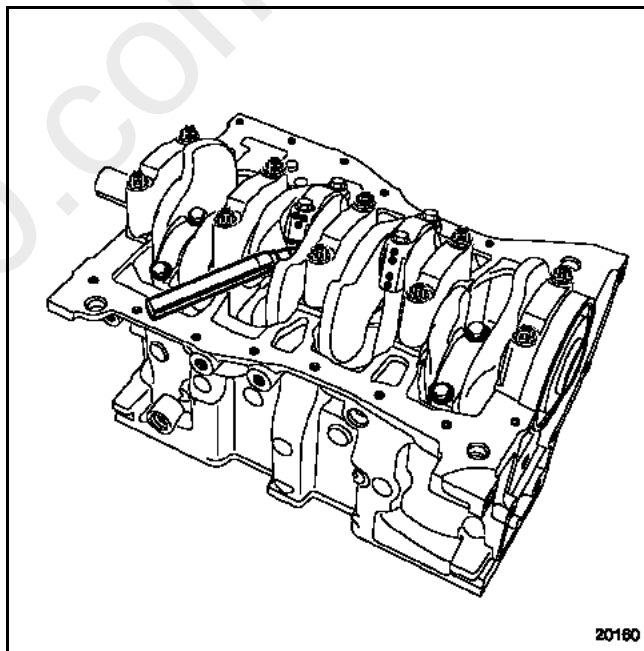
(with ring) 25.019 ± 0.006

NOTE: the con rod small end rings cannot be replaced.

The maximum weight difference for the con rod, piston and gudgeon pin assemblies for the same engine must be **25 grams**.

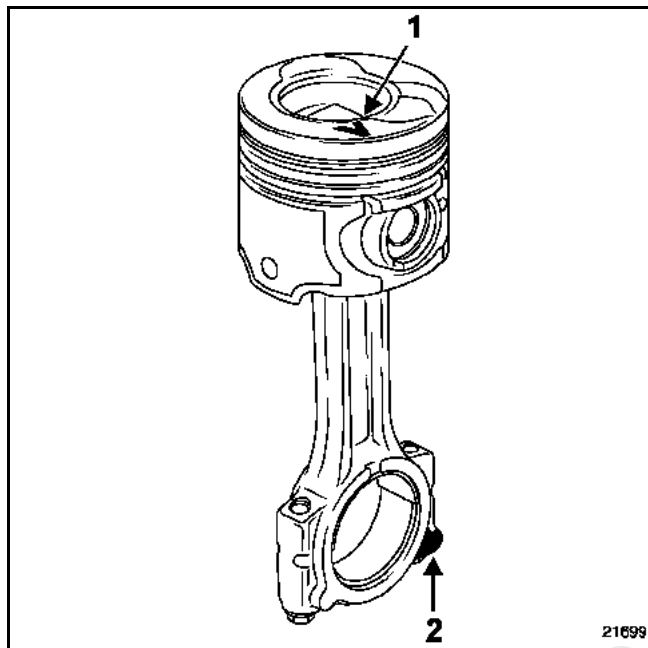
WARNING: do not use a sharp point to mark the big end caps in relation to their con rod, to avoid initiating a crack in the rod.

Use a permanent marker pen.

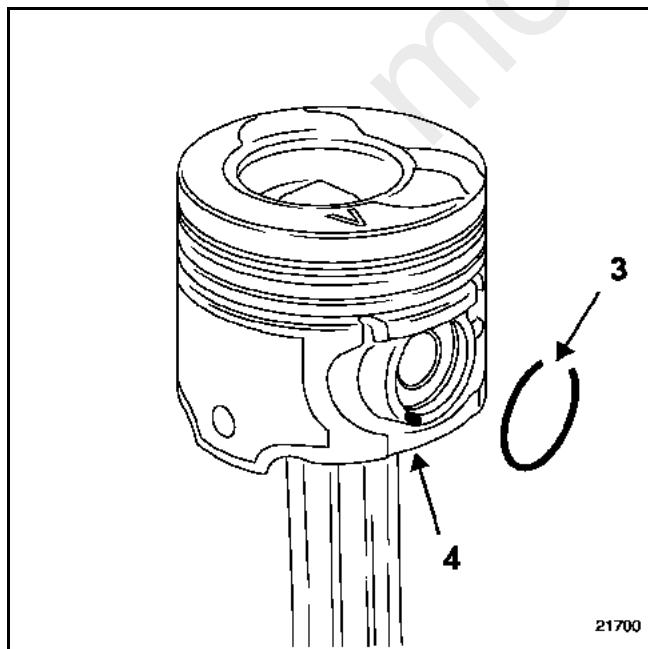


Direction of fitting of the con rod in relation to the piston

Point the "A" (1) engraved on the top of the piston downwards and the machined flat (2) of the big end as shown on the diagram below.

**Direction for fitting the circlips on the piston**

Position the opening (3) of the spring rings opposite the removal and fitting channel (4).

**CRANKSHAFT**

Number of main journals **5**

Crankshaft lateral clearance (in mm):

- without wear on lateral shims: **0.045 - 0.252**
- with wear on the lateral shims: **0.045 - 0.852**

Crankshaft diametrical clearance (in mm):

- journals **0.027 - 0.054**
- crankpins **0.035 - 0.045**

Journal diameter (in mm):

48 ± 0.01

Crankpin diameter (in mm):

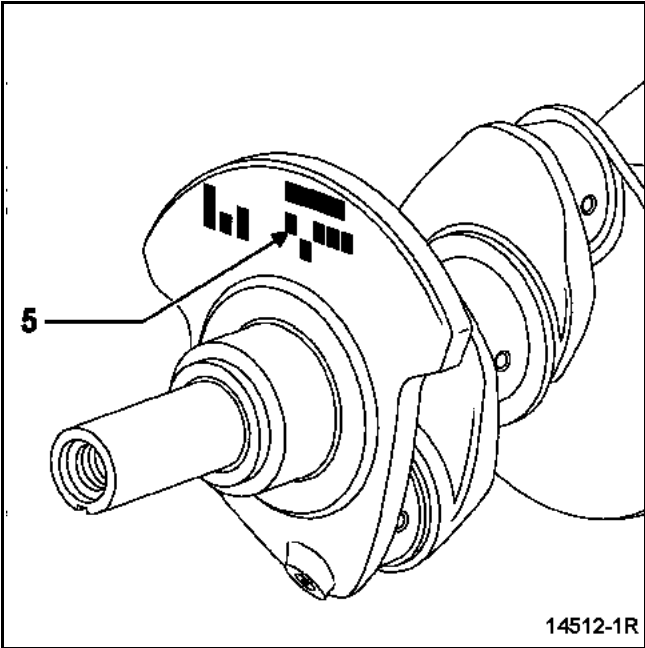
43.97 ± 0.01

The lateral shims are located on bearing N° 3.

NO RECTIFICATIONS ARE ALLOWED.

Working out the class of crankshaft bearing shells
(Original fitment)

Marking (5) on the crankshaft



Detail of the marking (5):

Number of journals

1*	2	3	4	5
B	B	C	C	B

Classes of journal
diameters

- A = D1
- B = D2
- C = D3

* Flywheel end.

Table of journal diameter classes

Journal class mark on the crankshaft	Journal diameter (in mm)
A = D1	47.990 to 47.996
B = D2	47.997 to 48.003
C = D3	48.004 to 48.010

CYLINDER BLOCK

The diameters of the bearings (6) of the cylinder block are marked by a hole on the block (7) located above the oil filter.

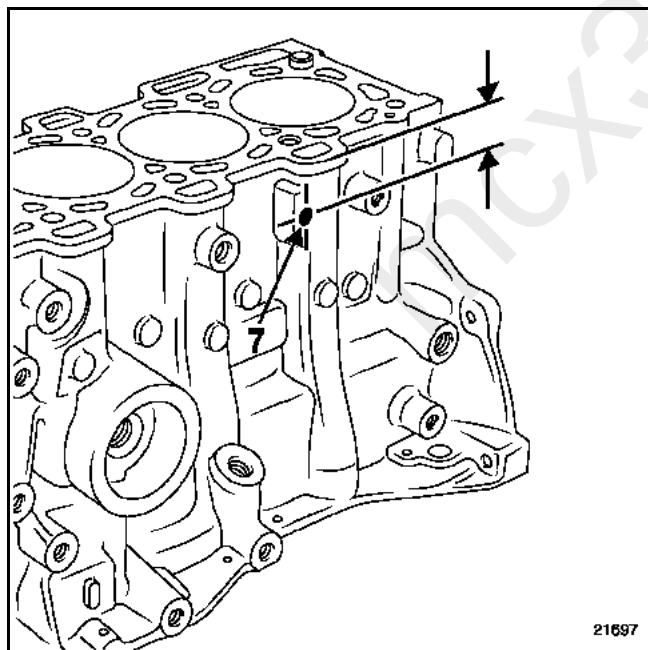
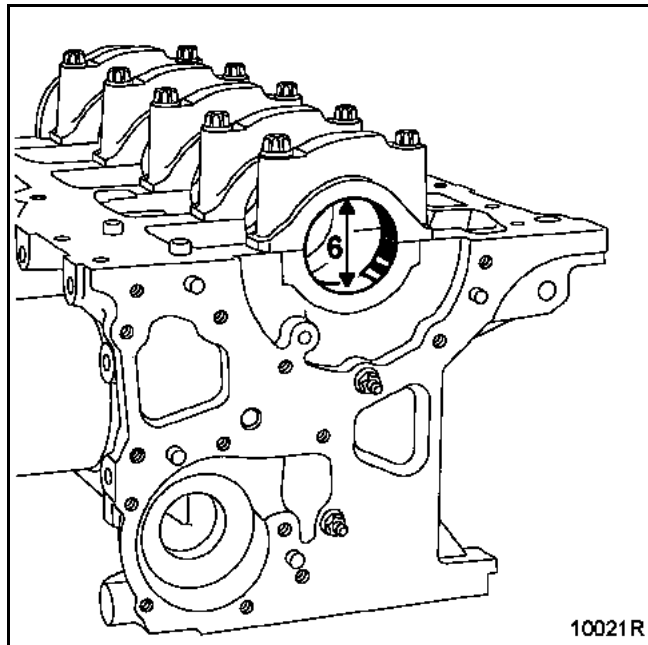


Table of cylinder block bearing diameters

Hole position (7)	Class reference	Cylinder block bearing diameter (in mm)
A = 33 mm	1 or blue	51.936 - 51.942 exclusive
B = 43 mm	2 or red	51.942 inclusive - 51.949

NOTE: the marking zone includes:

– A - B gives the diameter class of bearings 1 or 2.

Matching the crankshaft bearing shells

Journal diameter class			
	D1	D2	D3
1 *	C1	C2	C3
	1.949 to 1.955 yellow	1.946 to 1.952 blue	1.943 to 1.949 black
2 *	C4	C1	C2
	1.953 to 1.959 red	1.949 to 1.955 yellow	1.946 to 1.952 blue
Bearing shell thickness and class			

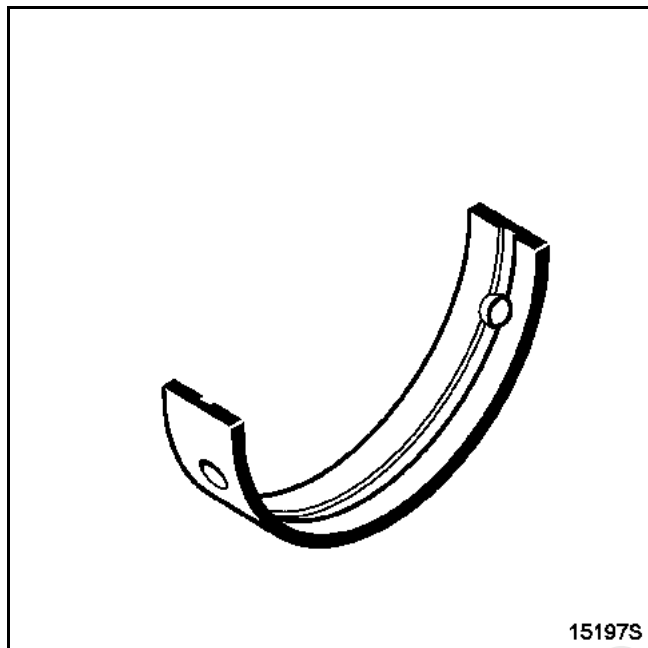
* Cylinder block crankshaft bearing diameter class.

NOTE: the parts stores will only supply class **C2** (blue).

BEARING SHELLS

Crankshaft bearing shells

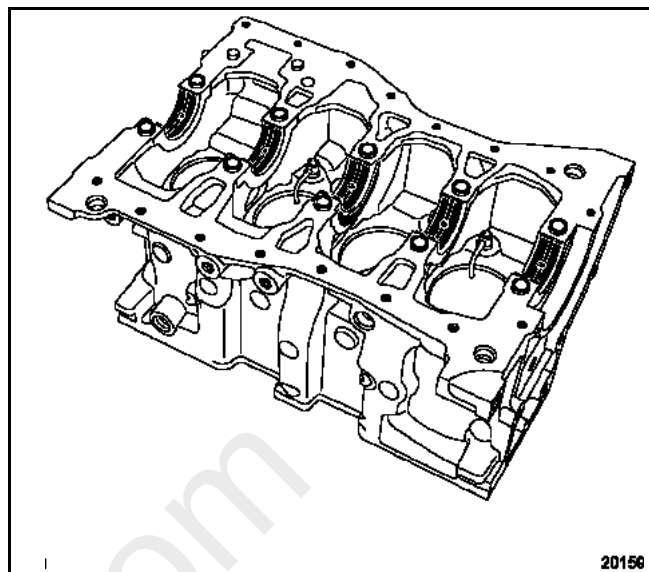
The engine is fitted with bearing shells without a locator notch.



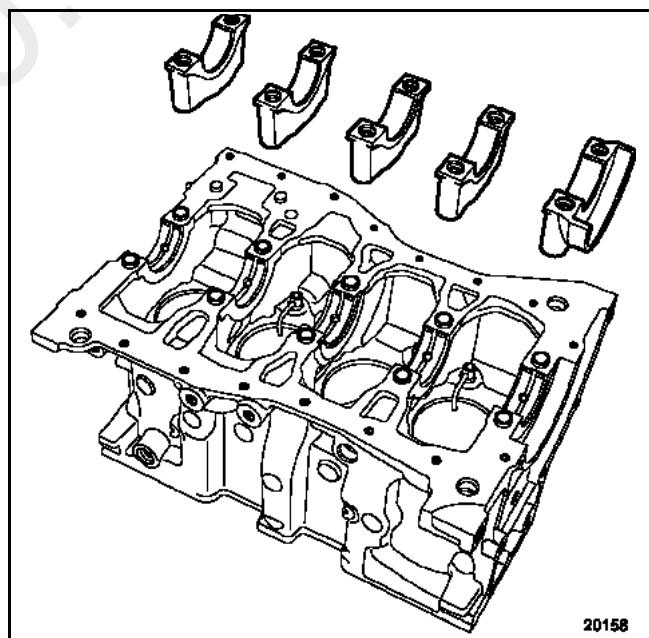
The crankshaft bearing shells are fitted on the cylinder block and on the bearings using **Mot. 1493-01**.

Direction of fitting:

- on the **cylinder block**, fit **grooved** bearing shells on all the bearings,

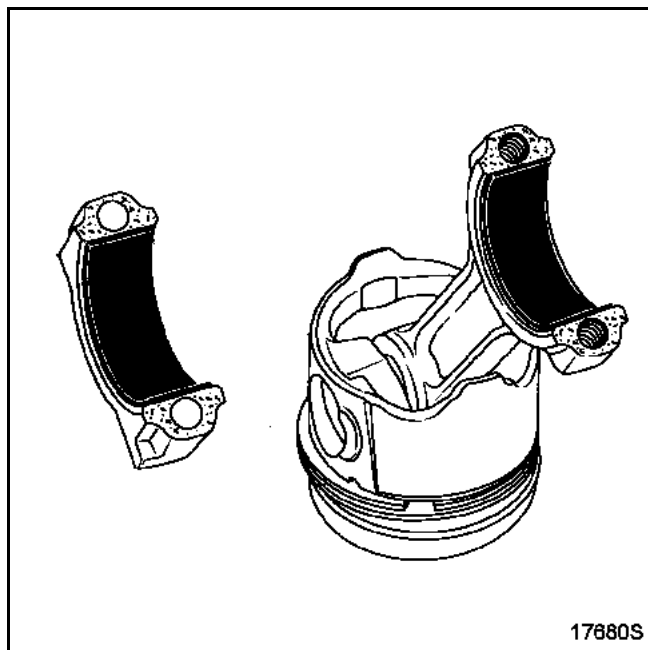


- on the **bearing caps**, fit **non grooved** bearing shells.



Con rod bearing shells

The engine is fitted with bearing shells without a locator notch.

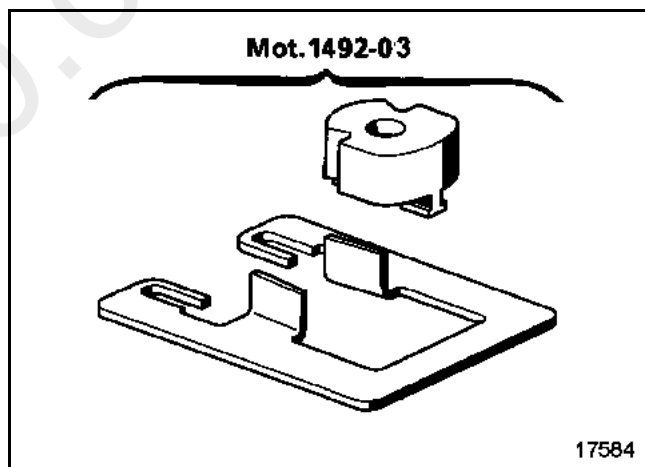
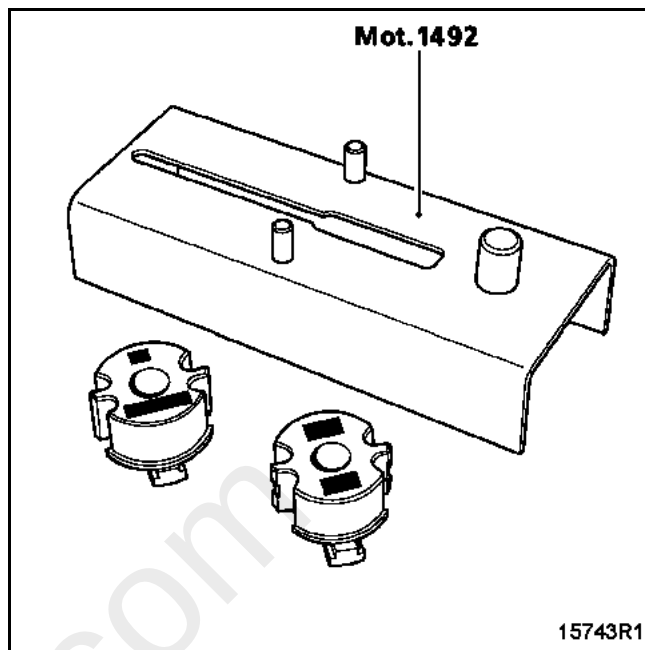


NOTE: the upper and lower con rod bearing shells are not the same width.

Bearing shell width (in mm):

- upper 20.625
- lower 17.625

The bearing shells are fitted using **Mot. 1492** and **Mot. 1492-03**.



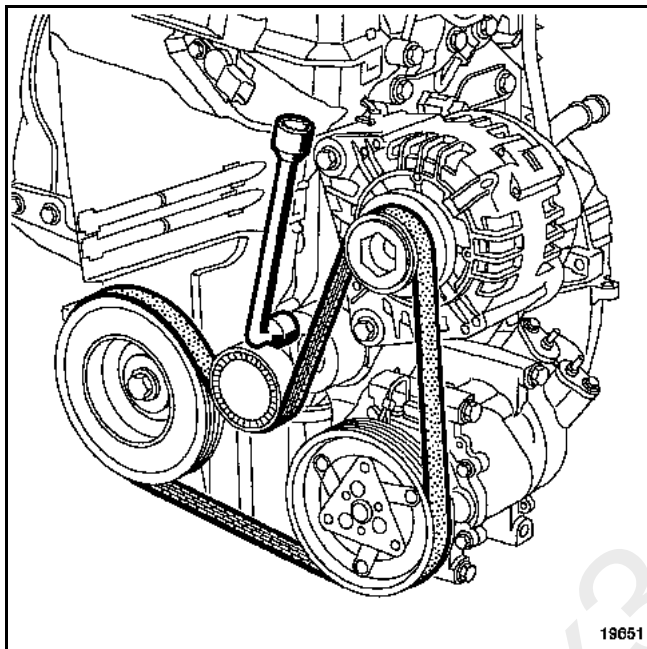
PREPARING THE ENGINE TO BE SET ON THE STAND

Before the engine is mounted on the stand

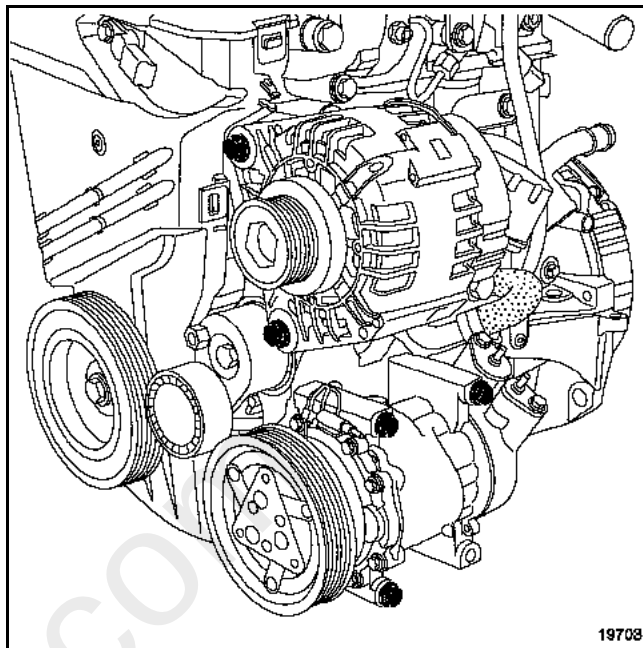
Mot. 792-03, the engine's electrical harness must be removed and the engine oil drained.

Remove:

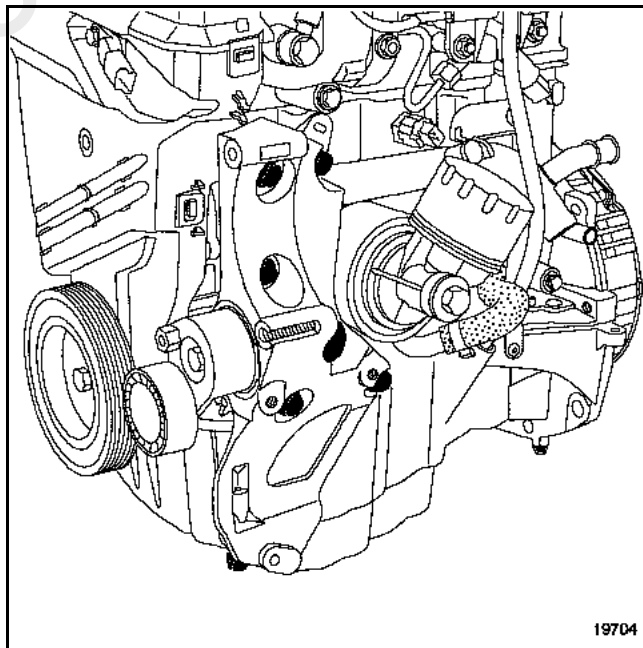
- the accessories belt,



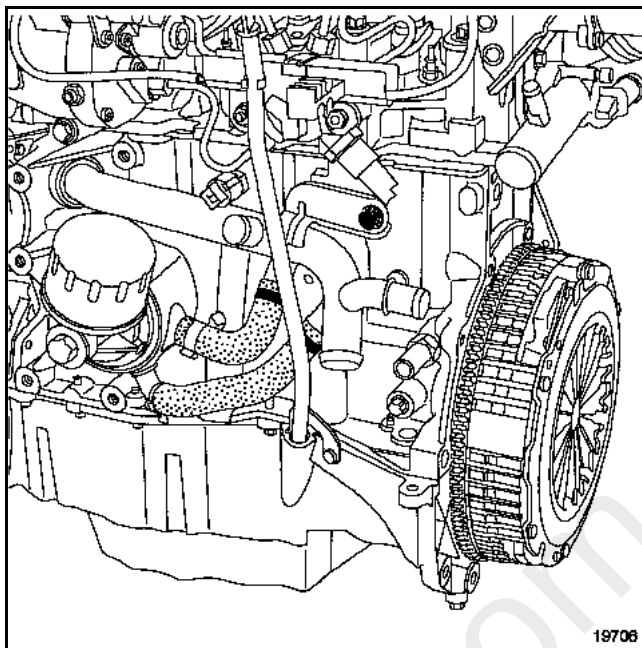
- the alternator,
- the air conditioning compressor or the power-assisted steering pump,



- the multifunction support,



- the coolant inlet pipe on the water pump.



Place the rods (A), (X), (Y) of **Mot. 1378** on the cylinder block so that they fit into the holes (20, 32, 33) on the plate of **Mot. 792-03**.

