



# Repair Manual

**2.0 I 16 V engine**

**Letters: ABF**

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**26. Exhaust system: 2.0 I 16 V engine**

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**28. Ignition system: 2.0 I 16 V engine**

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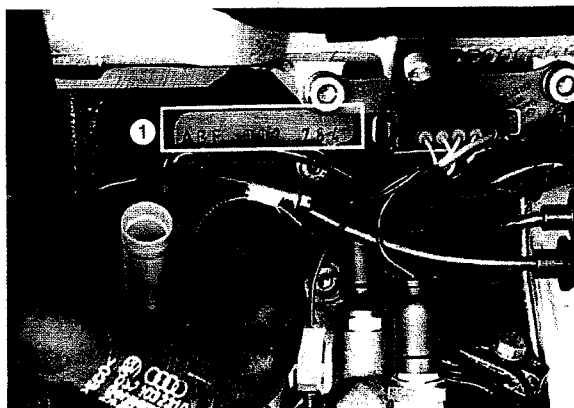
**List of tools: 2.0 I 16 V engine** ..... 1

**List of equipment: 2.0 I 16 V engine** ..... 1

# Engine

## Characteristics and data: 2.0 I 16 V engine

### IDENTIFICATION LETTER AND ENGINE NUMBER



01A024



01A025

- (1) The identification letters and the engine serial number are engraved on the cylinder block above the oil filter.  
 (2) There is also a sticker with the identification letters and serial number on the upper timing belt cover.

### ENGINE DATA

ENGINE CODE LETTERS		ABF
Cycle		OTTO/ATMOSPHERIC 4 stroke
Number of cylinders		4
Number of valves		16
Cylinder bore	mm	82.5
Stroke	mm	92.8
Swept volume	l	2.0
	cm <sup>3</sup>	1984
Compression ratio		10.5 : 1
Maximum horsepower	kW	110
	rpm	6000
Maximum torque	Nm	180
	rpm	4500

# Engine

## Characteristics and data: 2.0 I 16 V engine

### ENGINE DATA

ENGINE CODE LETTERS	ABF
RON minimum	95 N.O. Super lead-free
Injection	Digifant
Ignition	Digifant
Ignition order	1-3-4-2
Idling speed (not adjustable) <span style="float: right;">rpm</span>	820 ± 50
CO contents (not adjustable) Measured before the catalytic converter: Measured on final length of exhaust:	0.7 ± 0.4% < 0.5 %
Compression ratio (bars) <span style="float: right;">New Maximum allowable wear</span>	10 ÷ 13 7.5
Catalyst	Yes
Lambda adjustment	Yes
Pinking adjustment	Yes
Selfdiagnose	Yes
Distribution timing, at 1 mm valve stroke Intake opens Intake closes Exhaust opens Exhaust closes	1° before TDC 38° after BDC 39° before BDC 1° after TDC

# Engine

## Tightening torque: 2.0 I 16 V engine

PART	TIGHTENING TORQUE Nm
<b>ENGINE UNIT</b>	
Gearbox to engine fixing bolts M10	60
Gearbox to engine fixing bolts M12	80
Bolts fixing brackets to engine block or gearbox	45
Bolts fixing brackets to bodywork	50
Articulated half shafts to gearbox flange fixing bolts	45
Exhaust pipe to exhaust manifold attachment M10	40
<b>CRANKSHAFT ASSEMBLY</b>	
Timing belt cover attachment	10
Tension roller fixing nut	45
Intermediate shaft pinion fixing bolt	65
Crankshaft pinion fixing bolt	90 + 90°
Cylinder head cover fixing bolt	10
Bracket fixing bolt	45
Pinking sensor fixing bolt	20
Tension device fixing bolt	10
Air conditioning compressor support fixing nuts	30
Cooling liquid pump fixing bolt	20 + 90°
Bolt fixing engine speed transmitter	10
Oil sump fixing bolt	25
Engine flywheel fixing bolt	60 + 90°
Crankshaft oil seal holder fixing bolt, flywheel side	10
Intermediate shaft oil seal support fixing bolt	25
Crankshaft oil seal holder fixing bolt, distribution side M6	10
Crankshaft oil seal holder fixing bolt, distribution side M8	25
Crankshaft bearing cap fixing bolt	65
Bolt fixing toothed crown	10 + 90°
Connecting rod cap fixing nut	30 + 90°
Oil injector pressure valve	27

# Engine

## Tightening torque: 2.0 I 16 V engine

PART	TIGHTENING TORQUE Nm
<b>CYLINDER HEAD</b>	
Intake manifold fixing bolt	20
Manifold bracket fixing bolt	20
Cylinder head cover fixing bolt	10
Tension roller fixing nut	45
Cylinder head fixing bolt (see tightening instructions)	60 + 180°
Camshaft drive pinion fixing bolt	65
Camshaft bearing cap fixing nut	15
<b>LUBRICATION</b>	
Oil temperature transmitter	10
Oil pressure switch	25
Non-return valve	5
Oil filter support fixing bolt	25
Oil pump fixing bolt	20
Oil pump cover fixing bolt	10
Oil sump fixing bolt	20
Oil cooler fixing nut	25
Oil drain plug	40
Oil injector pressure valve	27
<b>COOLING</b>	
Fan control thermostitch	35
Cooling liquid pump fixing bolt	20 + 90°
Cooling liquid distributor fixing bolt	10
Coolant liquid temperature gauge transmitter	10
Cooling liquid pump pulley fixing bolt	20
Cooling liquid pump half housing fixing bolt	10
Thermostat cover fixing bolt	10
Air conditioning compressor support fixing nuts	30

# Engine

Tightening torque: 2.0 l 16 V engine

PART	TIGHTENING TORQUE Nm
<b>FUEL FEED</b>	
Fuel level transmitter/pump fixing nut	75
Fuel tank fixing bolt	25
Bolt fixing fuel filter bracket	3
Filling mouth fixing bolt	4
Electromagnetic valve fixing nut for activated carbon tank	10
<b>FUEL PREPARATION</b>	
Spark plugs	30
Inlet manifold fixing bolts (upper and lower parts)	20
Lambda probe	50
Fixing bolts for throttle valve manifold and idling stabilizer bracket	10
Idling switch and throttle valve potentiometer fixing bolts	10
Fuel distributor fixing bolts	10
<b>EXHAUST SYSTEM</b>	
Exhaust system supports M6	10
Exhaust system supports M8	25
Nut fixing exhaust pipe to manifold	40
<b>IGNITION SYSTEM</b>	
Pinking sensor fixing bolt	20
Bolt fixing engine speed transmitter	10

### ENGINE UNIT Removal and refitting

#### Removal

To remove the engine unit, the vehicle must be placed on a lifter.

Disconnect the battery negative lead.

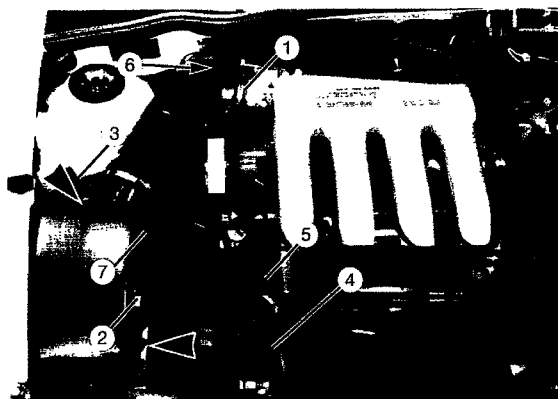


13D035

Raise the vehicle and remove the lower engine protection.

Remove the front panel as described in the Repair Group 51.

(In models with air conditioning, support the radiator-condenser assembly on brackets to avoid stretching or bending the tubes.)

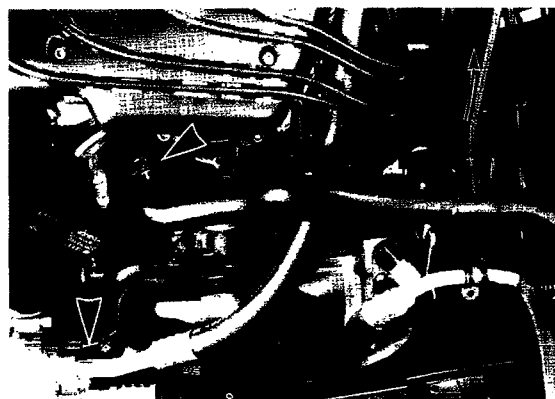


10B113

Remove the following items from the air filter/inlet tube assembly:

1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Intake air muffler bushing from housing to air filter assembly.

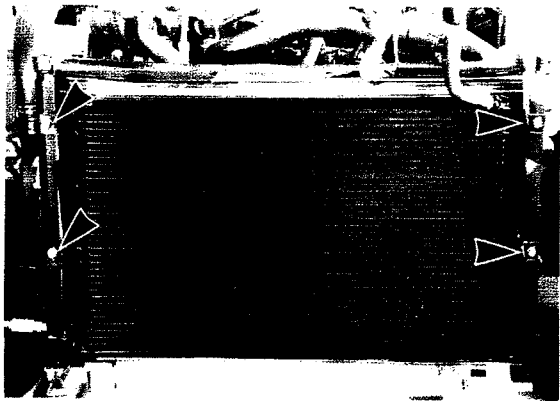
Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



10B114

Remove the cap from the coolant liquid tank and remove the radiator tubes from their fixings to the engine block and to the tank; then drain the coolant liquid.

Remove the electrical connections to the radiator and remove the radiator.



10B116

The following operations are necessary to remove the radiator on models with air conditioning:

- Remove the brackets holding the condenser to the radiator and to the front cross member.
- Remove the channels and the brackets holding the air conditioning system.

After removing the radiator, hold the condenser taking care not to bend or twist the pipes.

**Note**

Opening the air conditioning system to remove the engine unit is not necessary.

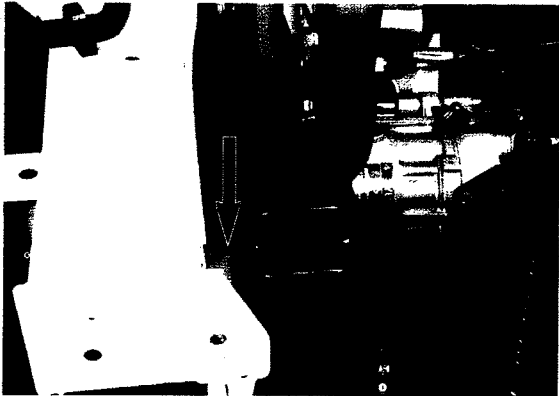
When removing the radiator from the vehicle, take care not to damage any air conditioning system part.



10B004

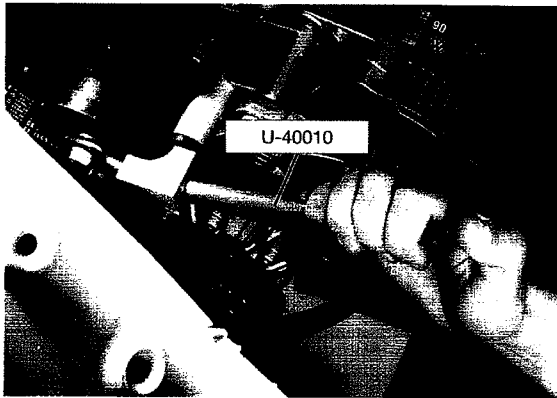
For vehicles with air conditioning, unhang the dehydrator filter.

ProCarManuals.com



10B127

Remove the air intake muffer tank, pressing the tank in the direction of the arrow.

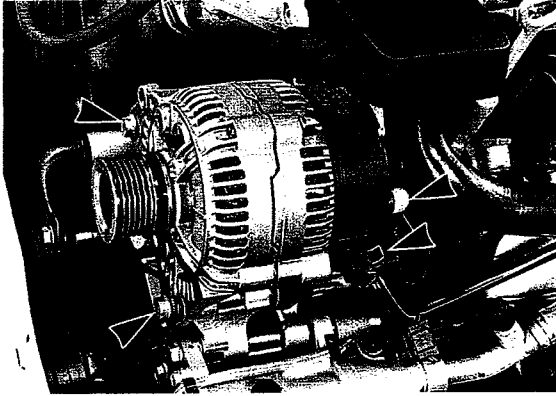


10B005

Remove the Poly-V belt using the appropriate tool:

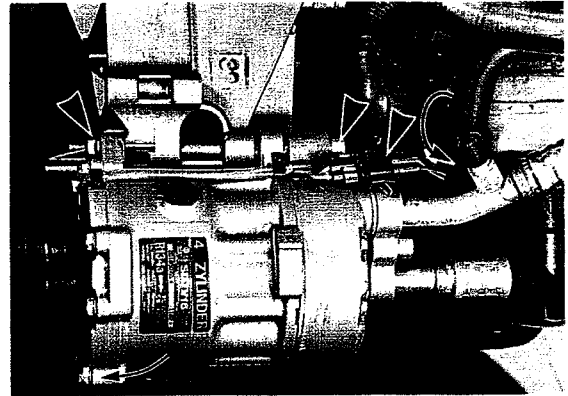
- Models with tensioning roller ..... **U-40010.**
- Models without tensioning roller ..... **U-40050.**

When removing the belt, mark the turning direction; this mark should be taken into account when re-assembling.



10B092

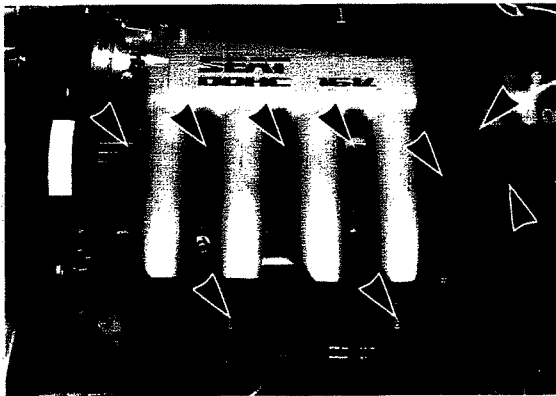
Remove the alternator's electrical connections and fixing bolts and remove the alternator.



10B079

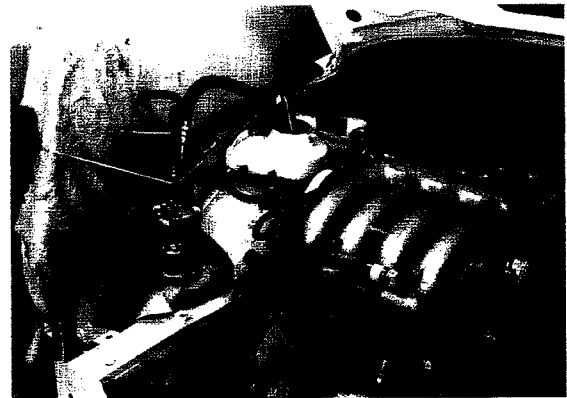
For vehicles with air conditioning, disconnect the electrical cables and remove the fixing bolts of the air conditioning compressor.

Remove the air conditioning compressor and place it where the air filter assembly was fitted (opening the system is not necessary).



10B117

Remove the spark plug cables shield together with the cables and the ignition distributor cap.



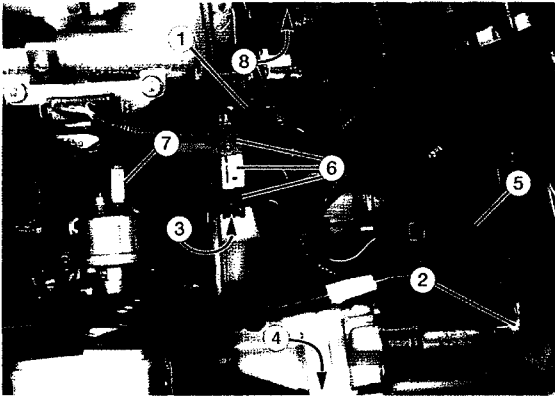
10B118

In models with air conditioning, position the condenser, compressor and tubes assembly on the right hand side and support it there (remove the fixing brackets).

Care must be taken to protect the components when carrying out this operation to prevent damage to the bodywork or to any of the air conditioning installation components.

# Engine 10

## Engine unit: removal and refitting. 2.0 I 16 V engine



10B119

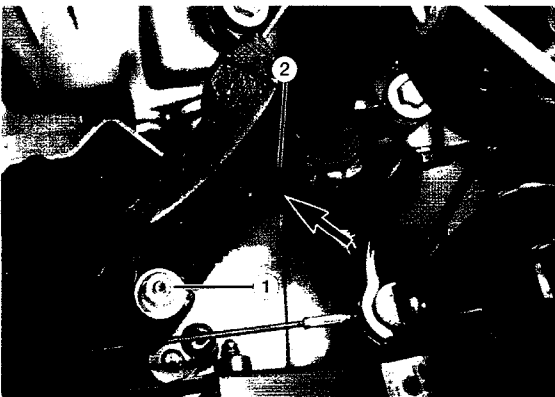
Disconnect:

1. The electrical system central connector.
2. The starter motor electrical cables.
3. The engine unit ground connection.
4. The support fixing the power steering pipe to the starter motor.
5. The reverse switch connector.
6. The engine speed transmitter connector and the pinking sensor connectors, located next to the central connector.

Take the colours of the sensors connectors into account when installing:

Sensor connect. **1 brown** - install. connect. **brown**.  
Sensor connect. **2 black** - install. connect. **white**.

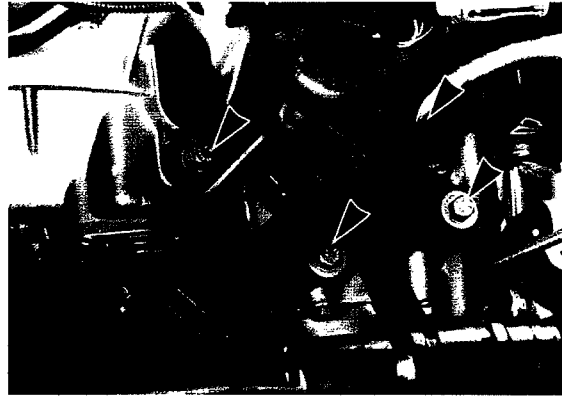
7. The contact connector G, in the oil pressure switch.
8. The control thermal switch for the 3rd electric fan speed, in the cooling liquid distributor pipe.



10B120

Remove the control and selector cables from their fixing point to the gearbox:

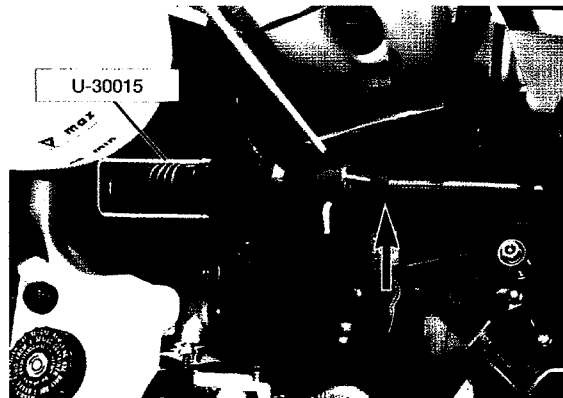
1. The bolt with collar must be removed in order to remove the control cable.
2. The lug marked with the arrow must be moved in order to remove the selector cable from its fixing to the drive element.



10B121

Remove the bracket holding the control and selector cables.

Detach the connector from the speedometer.

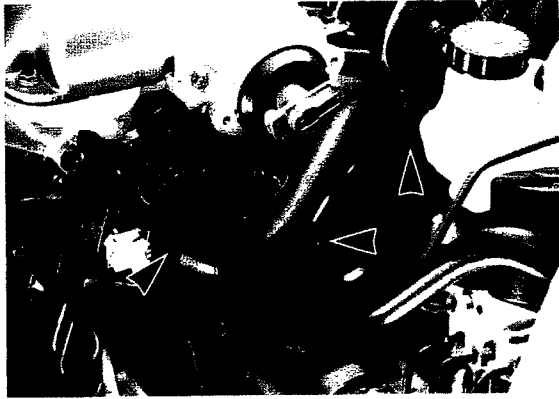


10B122

Detach the clutch control cable. If there is no holding strip on the cable, use tool **U-30015**. To place both the tool and the strip, the control cable must be compressed (refer to Volume II, Repair Group 30, for additional information).

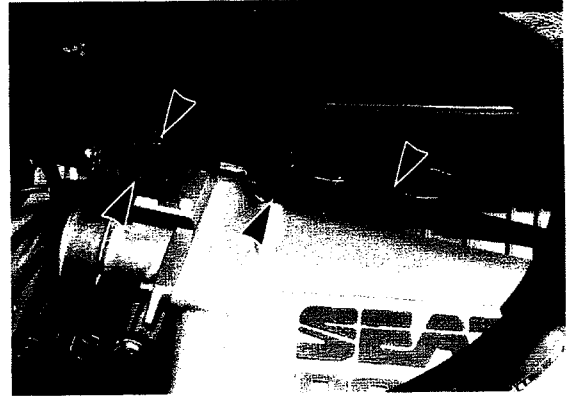
# Engine 10

## Engine unit: removal and refitting. 2.0 l 16 V engine



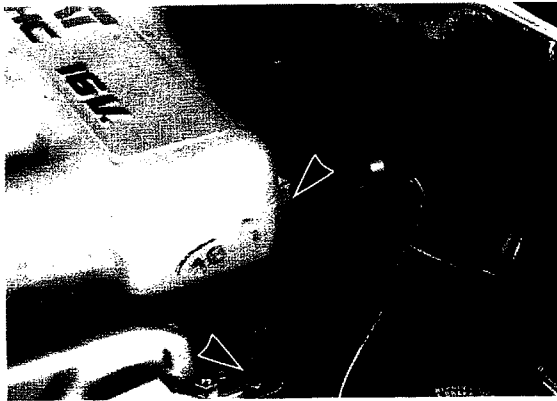
10B123

Detach the cooling liquid hoses to the heating system and to the expansion tank from the engine unit.



10B125

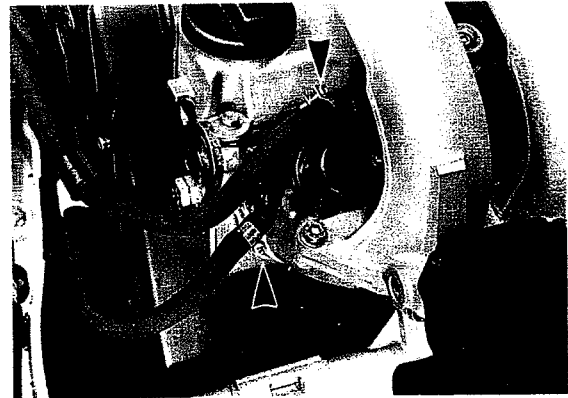
Detach the accelerator cable from the throttle valve assembly and from the support on the intake manifold (do not remove the fixing clamp).



10B124

Remove the suction take-off for the servo-assisted brakes from its fixing point on the inlet manifold.

Detach the earth connection from its fastening to the cylinder head.

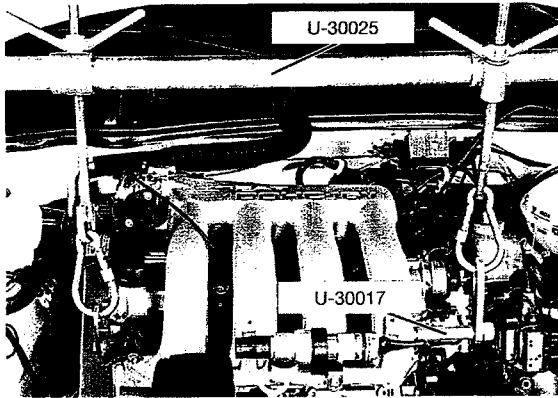


10B085

Disconnect the fuel inlet (black) and return (blue) pipes and plug properly the system.

# Engine 10

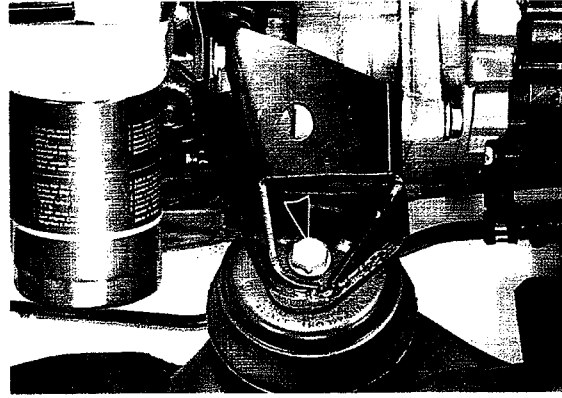
## Engine unit: removal and refitting. 2.0 I 16 V engine



10B086

Place the crossmember **U-30025** to hold the engine unit for the following operations.

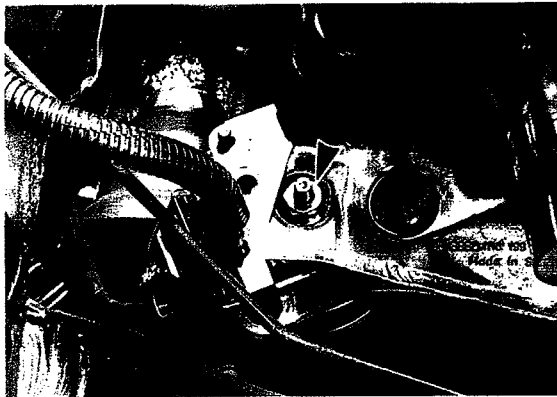
The **U-30017** adaptor tool must be used to place the cross member.



10A196

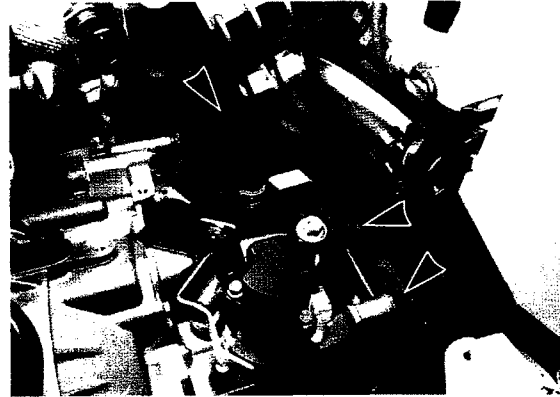
Remove front engine unit support fixing bolt.

Remove the power steering fluid tank support assembly without detaching the pipes and properly attach the assembly to the bodywork.



10A195

Remove the engine support bracket bolt at the rear of the engine; the fixing bracket must be removed with the lambda probe connector.



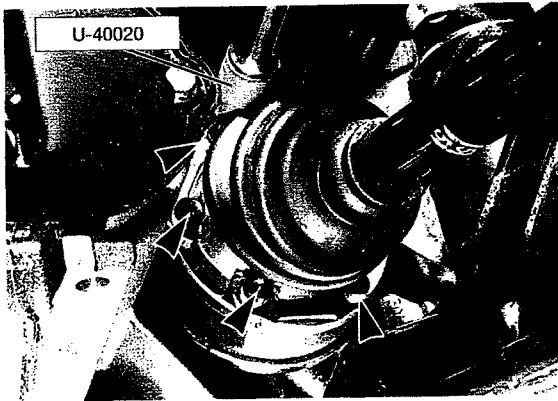
10B126

Remove the bolt fixing the rear engine unit support, gearbox side.

Remove the bolt fixing the gearbox holding flange and remove the flange.

# Engine 10

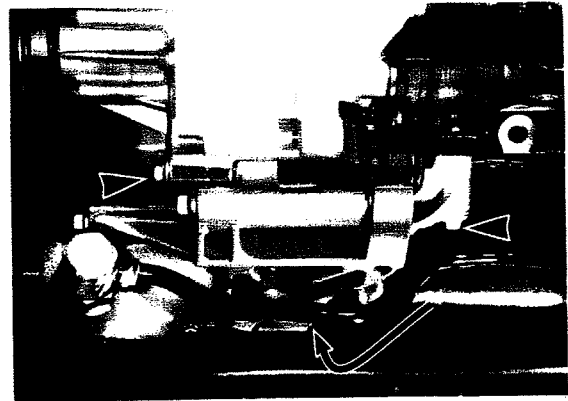
## Engine unit: removal and refitting. 2.0 I 16 V engine



10A198

Raise the vehicle and remove the swivel half shafts from their fixings to the gearbox, using the M8 socket of the **U-40020** tool.

Conveniently fix the half shafts to the bodywork so that they do not interfere with the following operations.

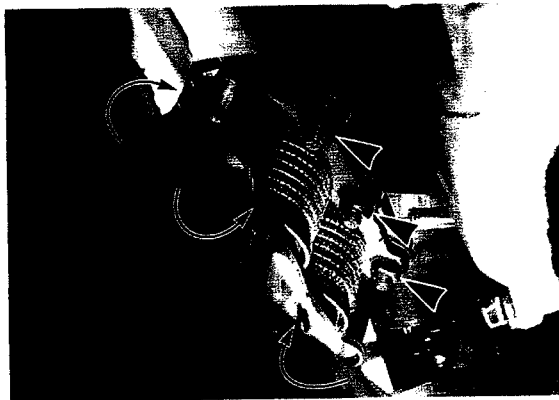


10D023

Remove the steering pump bracket and support it on the cross member, taking special care not to damage or bend the system's tubing.

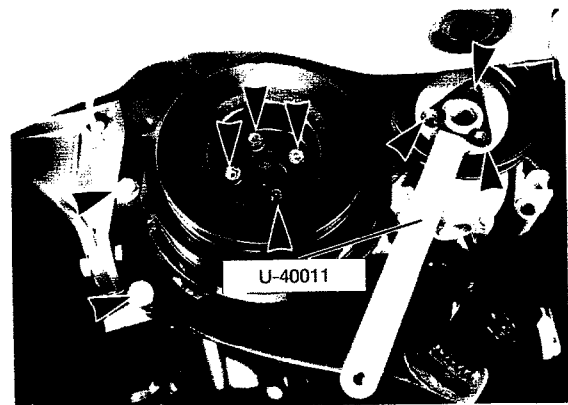
### Note

To carry this operation, do not open the power steering system.



10A086

Detach the exhaust pipe from the exhaust manifold.



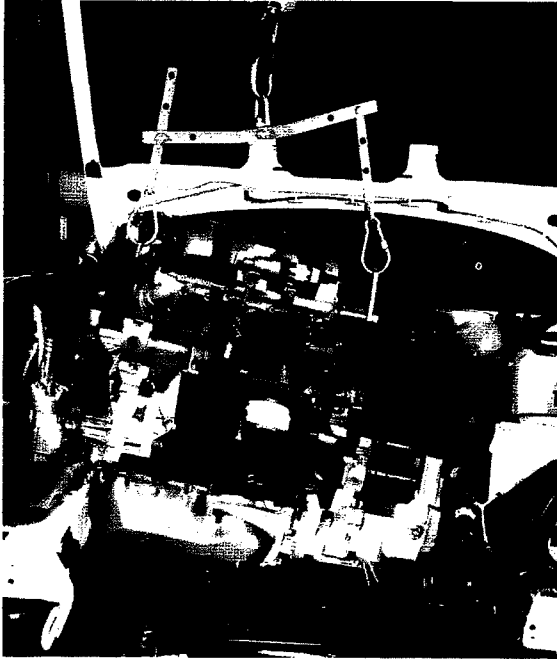
10D024

Remove the crankshaft drive pulleys and the cooling liquid pump. To carry out this operation, tool **U-40011** must be used.

Remove the power-assisted steering tension bracket.

# Engine 10

## Engine unit: removal and refitting. 2.0 l 16 V engine



10B115

Remove the **U-30025** cross member and apply the **U-30034** lifting hook together with the **U-30017** adaptor, as shown in the photograph.

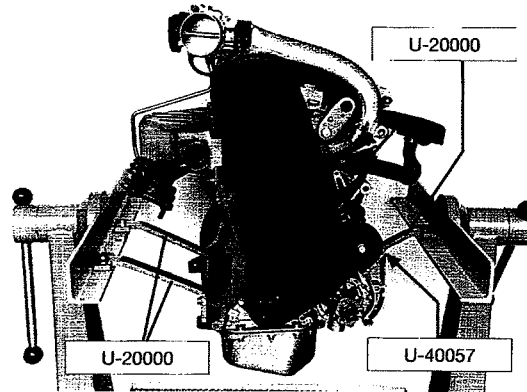
Raise and move the engine unit until it can be removed through the front of the vehicle, taking care not to damage the bodywork or the mechanical parts fixed to it.

### Note

When lifting the engine unit, check that the exhaust manifold is loose from the front part of the exhaust pipe and the gearbox cables are not damaged.

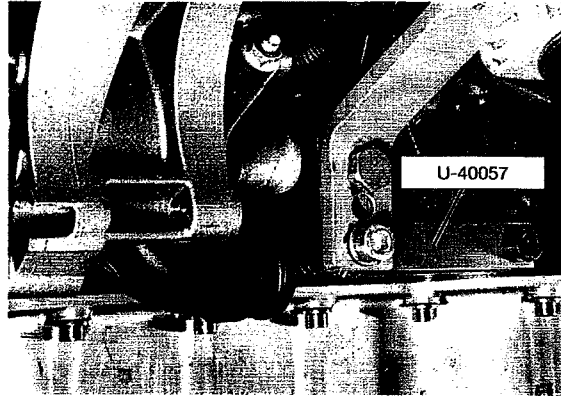
After removing the engine unit, if it is to be disassembled, fix the engine unit to an appropriate support and remove the following parts:

- Starter motor and front engine unit support.
- Rear engine unit support, engine side.
- Engine flywheel cover plates.
- The heat-resistant guard between the exhaust pipe and the engine block.
- The gearbox assembly.
- The rigid coolant tube, together with the flexible hoses joined to it.



10A204

To disassemble and reassemble the engine unit, it must be fitted to the rotary trestle **Ar-2204** or **Ar-2204 A** using the holding flanges **U-20000** and **U-40057**.



10A205

To support the engine on the oil filter side, the **U-40057** flange must be used; if necessary, remove the coolant pump hose.

### Refitting

To reassemble, reverse the above operations taking the following into account:

Check for excessive wear in the clutch assembly and replace it if necessary.  
Apply a light coat of grease around the clutch bearing and on the primary shaft splines.

Check that the centering bushings between the engine and the gearbox are in place and in good condition.

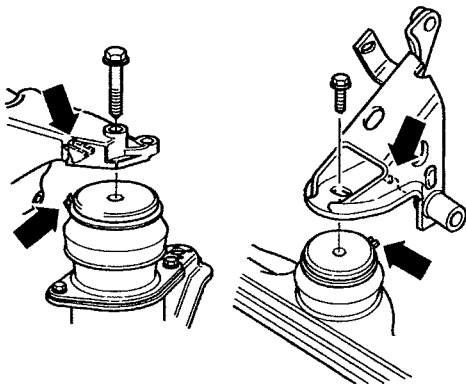
When lowering the engine unit, take special care not to damage the swivelled half shafts.

Check the ignition timing and idling speed (Repair group 24).

Check and, if necessary, adjust the headlamp alignment.

The tightening torques to be applied to the fasteners previously removed are the following:

- Gearbox to engine fixing bolts M10 ..... 60 Nm.
- Gearbox to engine fixing bolts M12 ..... 80 Nm.
- Bolts fixing brackets to engine block or gearbox ..... 45 Nm.
- Articulated half shafts to gearbox flange .. 45 Nm.
- Bolts fixing brackets to bodywork..... 50 Nm.
- Exhaust pipe to exhaust manifold M10..... 40 Nm.



10BD01

When refitting the engine unit into the vehicle, check that the grooves on the front and rear right engine supports match with the rubber-metal bushing pins.

Refit the engine unit fasteners so that they are not subject to any tension. Align the fasteners by shaking the engine unit.

Adjust the vane pump V belt tension (Running gear, Repair Group 48).

Fit the gearbox control and selector cables and adjust if necessary (02A gearbox, Repair Group 34).

Refill the cooling system with cooling liquid.

Adjust the accelerator cable (Repair Group 20).

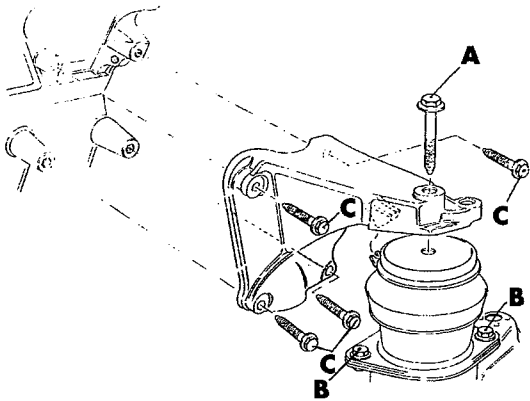
# Engine 10

## Engine unit: removal and refitting. 2.0 I 16 V engine

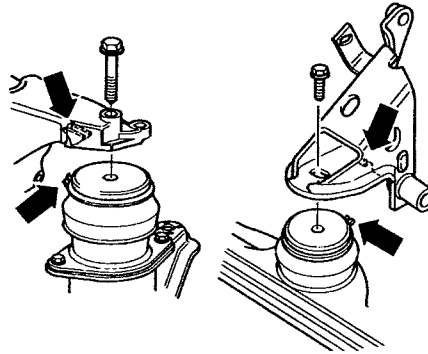
### RUBBER-METAL BUSHINGS Removal and refitting

To reassemble, reverse the above operations taking the following into account:

#### Rear rubber-metal bushing, engine side



10BD02



10BD01

- Fit the **U-30025** engine support cross-member, using the **U-30017** adaptor.
- Remove the bolt (A) fixing the engine support to the rubber-metal bushing by partially removing the intake pipe, if necessary.
- Remove the lambda probe fixing plate together with the connector.
- Loosen the fixing points for the rear gearbox and front engine side brackets to avoid tensions.
- Remove the bolts (B) fixing the rubber-metal bushing to the bodywork.
- Lift the engine using the crossmember **U-30025**.
- If the engine support is to be removed, remove first the bolts (C) fixing the support to the engine.
- Remove the elastic bushing through the vehicle underside.

- Check that the grooves on the front and rear right engine supports match with the rubber-metal bushing pins.
- Refit the engine unit fasteners so that they are not subject to any tension. Align the fasteners by shaking the engine unit.

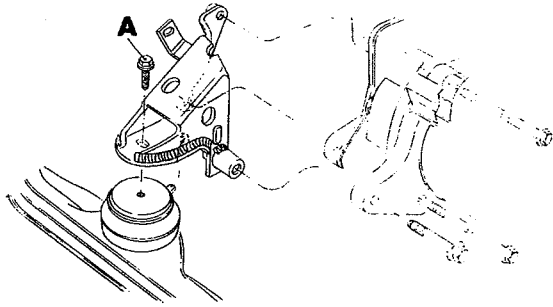
#### Tightening torque:

(A) .....	<b>60 Nm.</b>
(B) .....	<b>30 Nm.</b>
(C) .....	<b>25 Nm.</b>

# Engine 10

## Engine unit: removal and refitting. 2.0 I 16 V engine

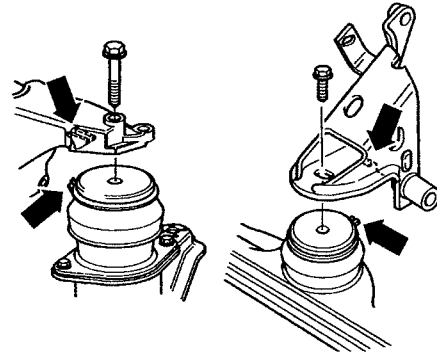
### Front rubber-metal bushing, engine side



10BD03

- Disconnect the battery negative lead.
- Remove the bolt (A) fixing the engine support to the rubber-metal bushing.
- Loosen the bolts fixing the engine rear supports, gearbox side and engine side, to avoid tensions.
- Remove the bolt holding the rigid anti-freeze liquid tube from the front engine support.
- Raise the vehicle and place a column jack under the engine unit (protect properly the contact area).
- Remove from the underside the bolt fixing the rubber-metal bushing to the front crossmember.
- Remove the bolts fixing the starter motor and hold the starter motor properly.
- Raise the vehicle using the jack and then remove the support and the rubber-metal bushing.

To reassemble, reverse the above operations taking the following into account:



10BD01

- Check that the grooves on the front and rear right engine supports match with the rubber-metal bushing pins.
- Refit the engine unit fasteners so that they are not subject to any tension. Align the fasteners by shaking the engine unit.

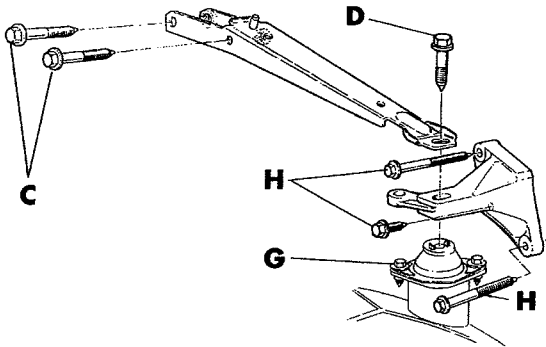
Tightening torque:

(A) ..... **60 Nm.**

# Engine 10

## Engine unit: removal and refitting. 2.0 I 16 V engine

### Rear rubber-metal bushing, gearbox side



10AD11

- Fit the **U-30025** engine support cross-member, using the **U-30017** adaptor.
- Remove the bolt (D) fixing the rear support, gearbox side, and loosen the bolts fixing the rear and front supports, engine side, to avoid tensions.
- Raise the engine unit using the crossmember **U-30025** and remove the bolts (H) fixing the support to the gearbox assembly.
- Remove the bolts (G) fixing the rubber-metal bushing to the bodywork and remove the bushing.

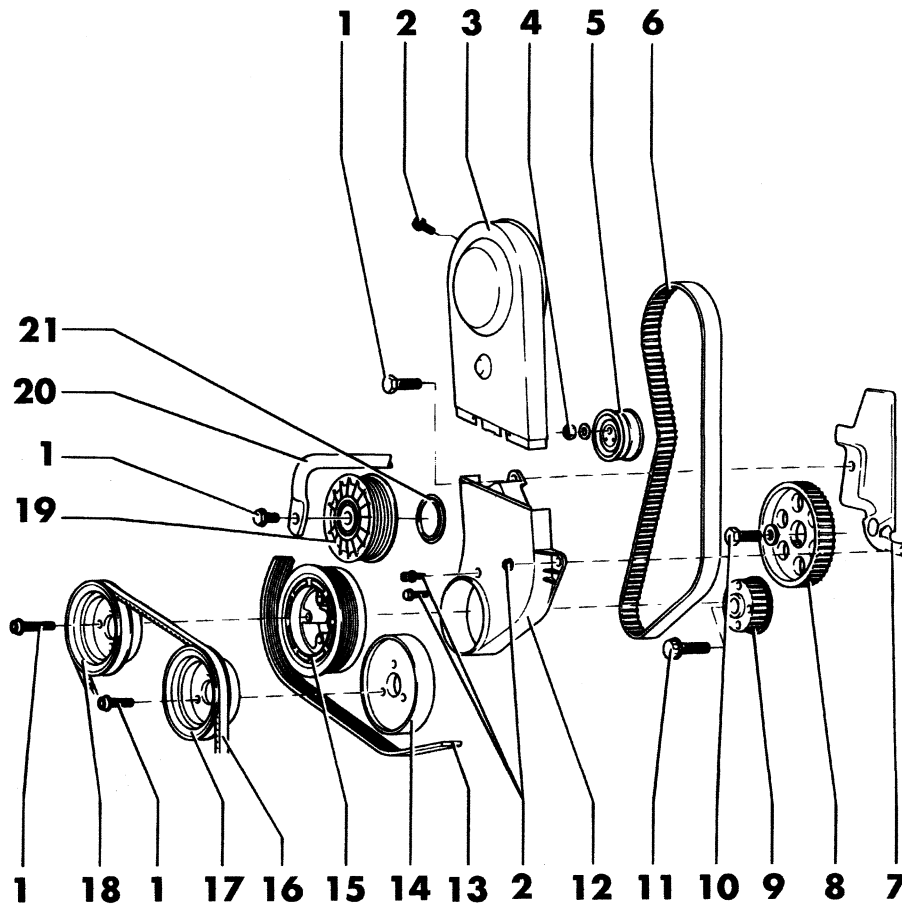
To reassemble, reverse the above operations taking the following into account:

- Refit the engine unit fasteners so that they are not subject to any tension. Align the fasteners by shaking the engine unit.

#### Tightening torque:

(C) .....	60 Nm.
(D) .....	60 Nm.
(G) .....	30 Nm.
(H) .....	35 Nm.

### ENGINE: EXPLODED VIEW



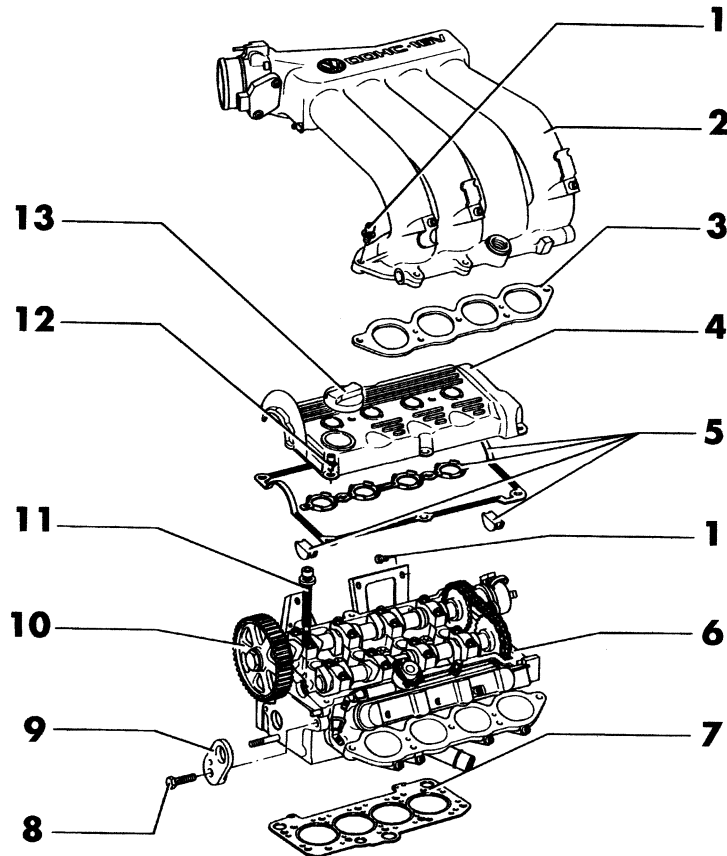
13BD17

- |   |  |
|---|--|
| <p>1. 20 Nm.</p> <p>2. Timing belt cover attachment. 10 Nm.</p> <p>3. Timing belt upper cover.</p> <p>4. Tension roller fixing nut. 45 Nm.</p> <p>5. Timing belt tension roller.</p> <p>6. Timing belt.<br/>Before disassembling, mark the direction of rotation.<br/>Do not bend.</p> <p>7. Inner cover.</p> <p>8. Intermediate shaft drive pinion.</p> <p>9. Crankshaft pinion.</p> <p>10. Intermediate shaft pinion fixing bolt. 65 Nm.</p> <p>11. Crankshaft pinion fixing bolt. 90 Nm + 90°.<br/>Remove and refit using tool U-30027.<br/>Replace the bolt and oil before fitting.</p> | <p>12. Timing belt lower cover.</p> <p>13. Poly-V belt.<br/>Remove and refit using tool U-40010.<br/>Mark the direction of rotation before removing it.</p> <p>14. Pulley for Poly-V belt.</p> <p>15. Vibration dampener.<br/>Note the mounting position.</p> <p>16. V belt.</p> <p>17. Pulley for V belt.</p> <p>18. Pulley.</p> <p>19. Poly-V belt tensioning pulley.</p> <p>20. Tensioning pulley bracket.</p> <p>21. Tensioning pulley rear lid.</p> |
|---|--|

# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### ENGINE: EXPLODED VIEW



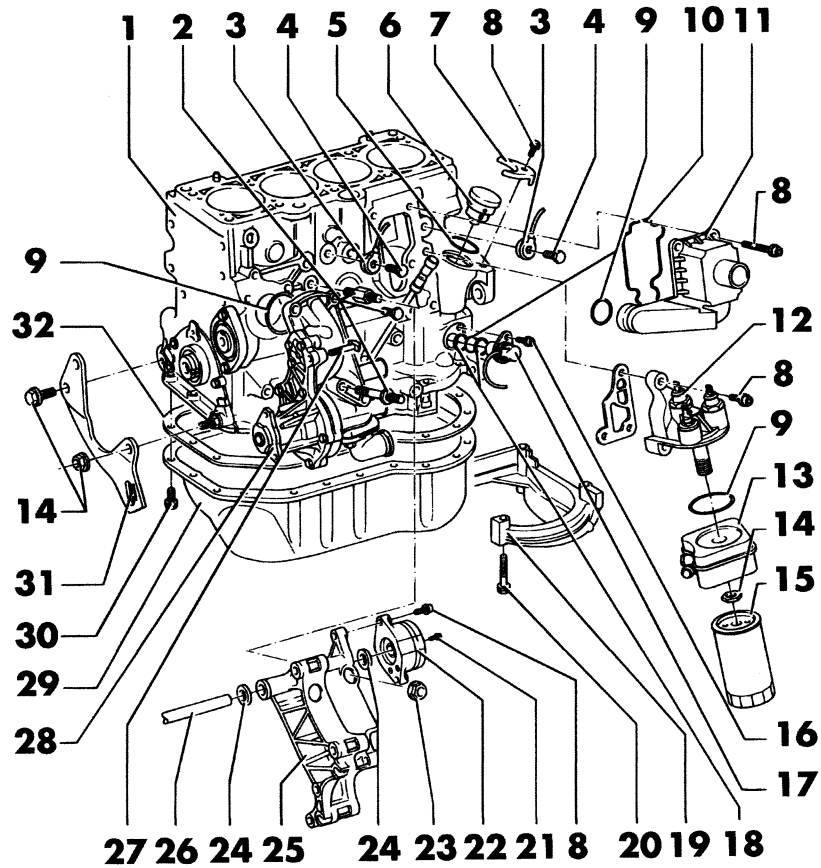
13BD18

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>1. Fixing bolt. 20 Nm.</li><li>2. Manifold intake, top.</li><li>3. Gasket.<br/>Replace.</li><li>4. Cylinder head cover.</li><li>5. Cylinder head cover gasket.<br/>Replace if damaged.</li><li>6. Cylinder head.<br/>Disassembly and reassembly (refer to Group 15).</li><li>7. Cylinder head gasket.<br/>Replace.</li></ul> | <ul style="list-style-type: none"><li>8. Bracket fixing bolt. 45 Nm.</li><li>9. Support.</li><li>10. Camshaft drive pinion.<br/>Note the position when assembling the timing belt.<br/>Remove and refit using the tool U-20002/1.</li><li>11. Cylinder head bolt.<br/>For removal and refitting, take into account the proper<br/>sequence (refer to Group 15).</li><li>12. Cylinder head cover fixing. 10 Nm.</li><li>13. Plug.</li></ul> |
|--|--|

# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### ENGINE: EXPLODED VIEW



13BD19

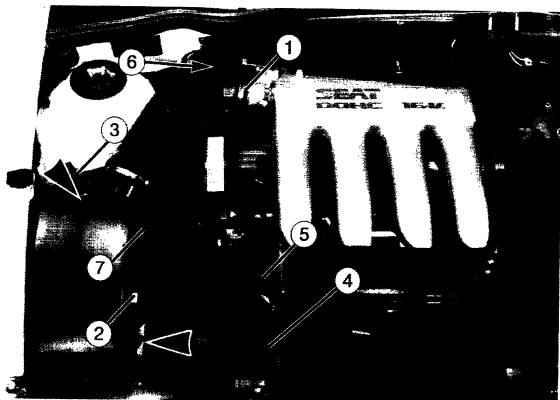
- |   |   |
|---|---|
| <p>1. <b>Cylinder block.</b></p> <p>2. <b>Cooling liquid pump fixing bolts.</b><br/>20 Nm + 90°.<br/>Replace.</p> <p>3. <b>Pinking sensor.</b></p> <p>4. <b>Pinking sensor fixing bolt.</b> 20 Nm.<br/>The tightening torque affects the sensor operation.</p> <p>5. <b>O-ring.</b><br/>Replace.</p> <p>6. <b>Plug.</b></p> <p>7. <b>Attachment flanges.</b></p> <p>8. <b>Fixing bolt.</b> 25 Nm.</p> <p>9. <b>O-ring.</b><br/>Replace.</p> <p>10. <b>Gasket.</b><br/>Replace if damaged.</p> <p>11. <b>Crankshaft sump vent.</b></p> <p>12. <b>Oil filter support.</b></p> <p>13. <b>Oil cooler.</b></p> <p>14. <b>25 Nm.</b></p> <p>15. <b>Oil filter.</b><br/>Detach using the tool <b>U-40078</b> or the universal filter remover.<br/>Tighten by hand.</p> | <p>16. <b>Fixing bolt.</b> 10 Nm.</p> <p>17. <b>Engine speed transmitter.</b></p> <p>18. <b>Support rings.</b></p> <p>19. <b>Support.</b></p> <p>20. <b>Fixing bolt.</b> 45 Nm.</p> <p>21. <b>Tension device fixing bolt.</b> 10 Nm.</p> <p>22. <b>Tensioner.</b></p> <p>23. <b>Support fixing nuts.</b> 30 Nm.</p> <p>24. <b>Oil seal.</b><br/>Replace if damaged.</p> <p>25. <b>Support.</b></p> <p>26. <b>Tensioning pulley bracket.</b></p> <p>27. <b>Hammer head bolt to fix the cooling liquid pump.</b></p> <p>28. <b>Cooling liquid pump.</b><br/>Disassembly and reassembly (refer to Group 19).</p> <p>29. <b>Oil sump.</b></p> <p>30. <b>Oil sump fixing bolt.</b> 25 Nm.<br/>Remove the bolts on the flywheel side with the corresponding spanner (see Repair Group 17).</p> <p>31. <b>Vane pump support.</b></p> <p>32. <b>Oil sump gasket.</b><br/>Do not stick the gasket, note the mounting position.</p> |
|---|---|

### DISTRIBUTION TIMING BELT DRIVE

#### Removal and refitting

The following operations can be carried out with the engine fitted into the vehicle or with the engine attached to a rotary trestle.

#### Disassembly

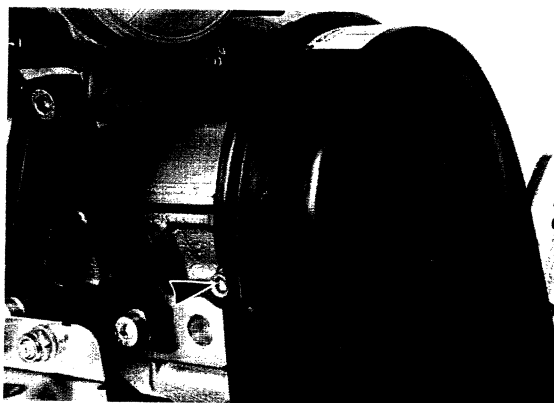


10B113

If the disassembly is carried out in the vehicle, disconnect the negative terminal on the battery and partially remove the air filter/inlet tube assembly, for which the following items must be removed:

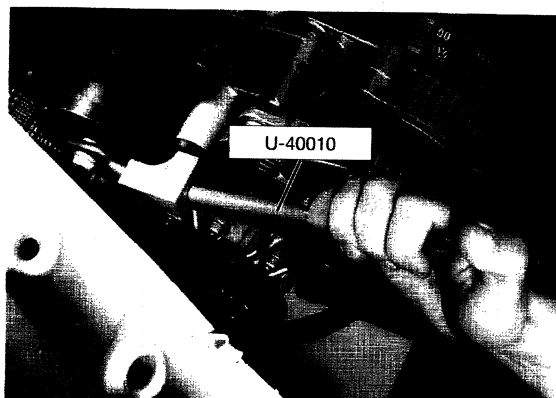
1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Air intake muffler bushing from its housing to the air filter assembly .

Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



13A102

Remove the upper cover after removing the fixing bolts.



10B005

#### IN VEHICLE

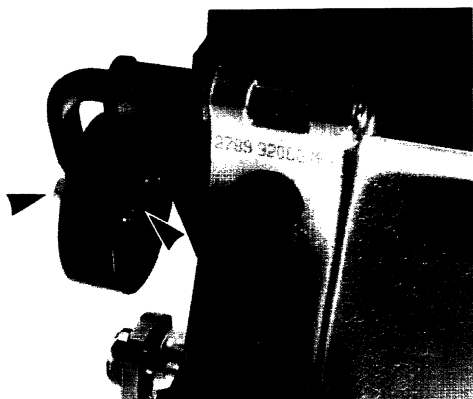
Remove the Poly-V belt using the appropriate tool:

- Models with tensioning roller ..... **U-40010**.
- Models without tensioning roller ..... **U-40050**.

When removing the belt, mark the turning direction; this mark should be taken into account when re-assembling.

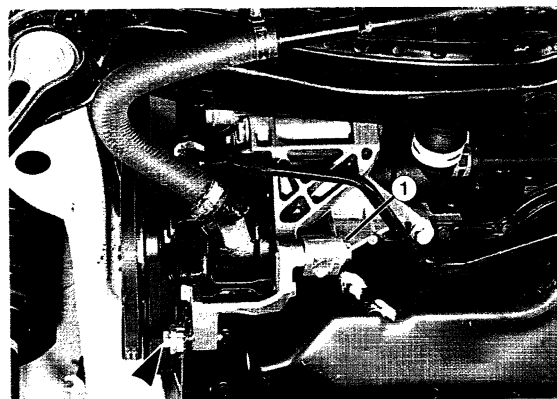
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine



13B002

**IN VEHICLE (models with Poly-V and tensioning roller)**  
Remove the bolt fixing the Poly-V belt tension roller; to hold the nut, the roller rear cover must be removed by prying with a screwdriver.



48B016

**IN VEHICLE**

Raise the vehicle and remove the lower engine protection.

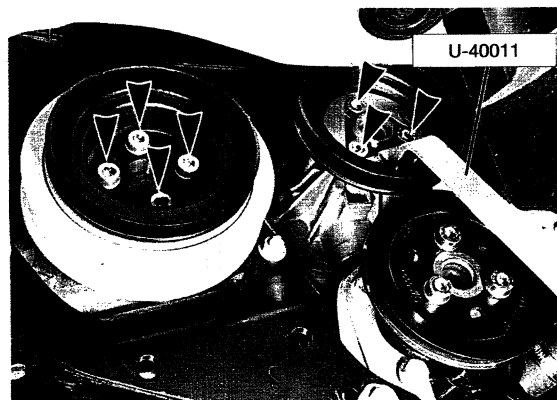
Remove the power steering drive pulley by loosening the fixing bolt 1 and the bolt of the tensioning nut.

Remove the Poly-V belt.



13A103

Remove the upper bolts or nuts which hold the lower cover.



13B071

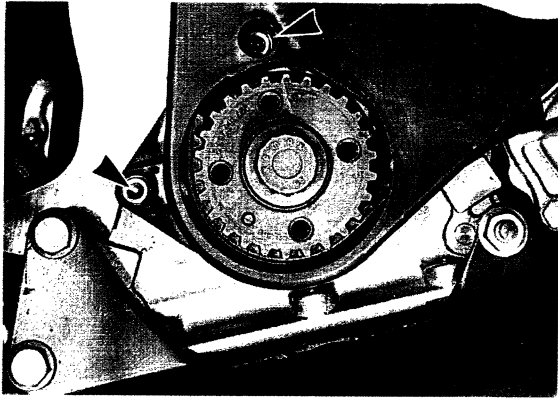
**IN VEHICLE**

Remove the crankshaft drive pulley together with the vibration damper.

If necessary to remove the lower guard, remove the cooling liquid pump pulley. To carry out this operation, tool **U-40011** must be used.

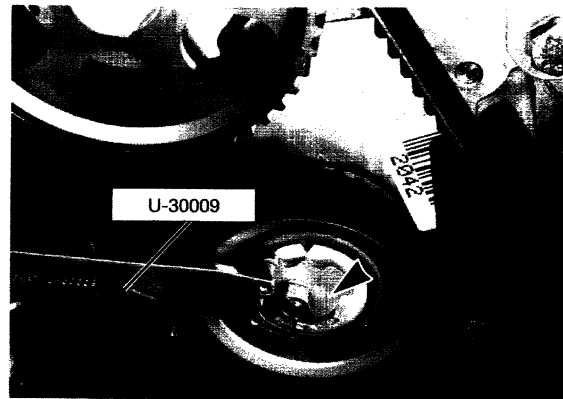
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine



13B072

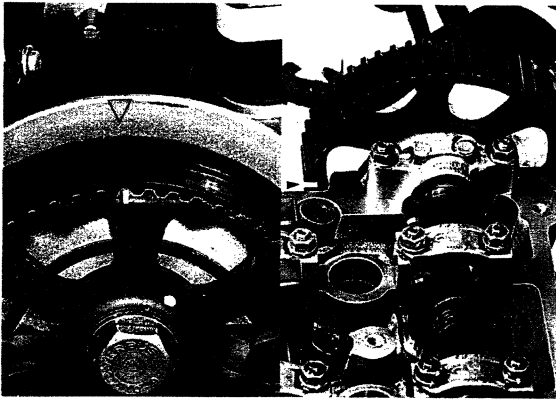
Remove the remaining bolts fixing the lower guard and remove the lower guard.



13B107

Loosen the timing belt by loosening the tension roller fixing nut and turning the roller counterclockwise using tool **U-30009**.

Remove the timing belt and mark the direction of movement if the belt is to be reused.

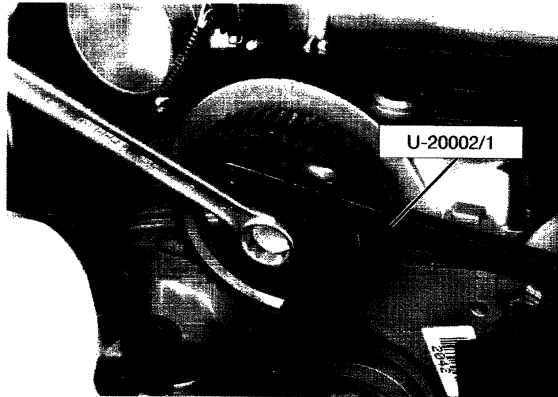


13B073

13B074

Align the mark on the distributor drive shaft pinion with the arrow on the cylinder head cover.

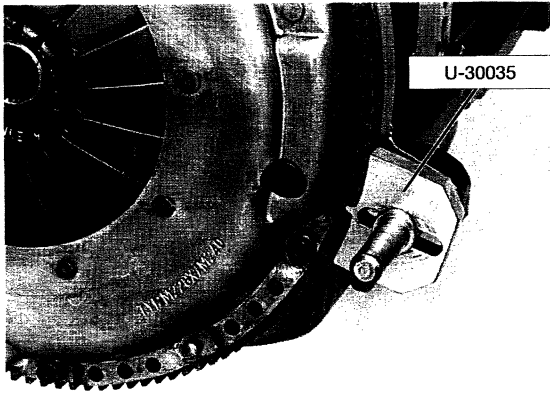
If the cylinder head cover has been removed, the mark on the back of the distributor drive shaft pinion must be flush with the cylinder head.



13B108

Remove the camshaft and the intermediate shaft drive gears using tool **U-20002/1**.

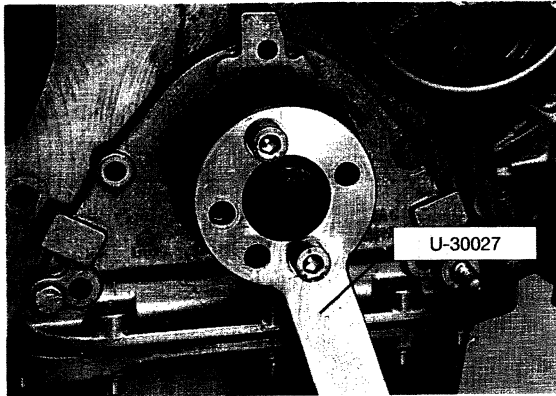
Remove the crankshaft pinion. To remove the fixing bolt, the crankshaft must be prevented from turning.



13A105

### ON THE WORK BENCH

With the engine attached to a rotary trestle, lock the flywheel using the tool **U-30035** to prevent the crankshaft from turning.



13A106

### ON THE VEHICLE

With the engine installed in the vehicle, use the **U-30027** spanner to prevent the engine from turning by fixing it to the pinion using suitable bolts.

The power-assisted steering tension support must be removed in order to fit the spanner.

### Reassembly

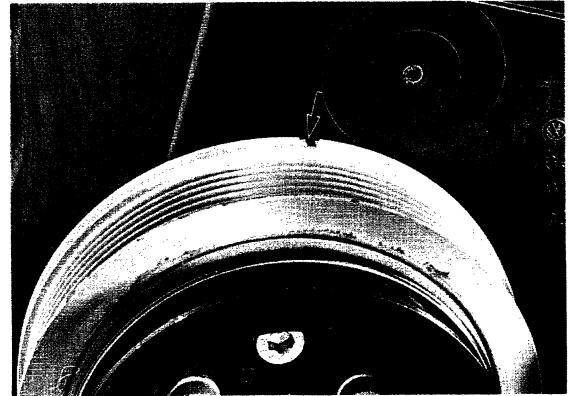
To reassemble, reverse the above operations taking the following into account:

Refit the crankshaft pinion and tighten the bolt to the specified torque.

Refit the camshaft and intermediate shaft drive pinions. To prevent the above shafts from turning, use tool **U-20002/1**.

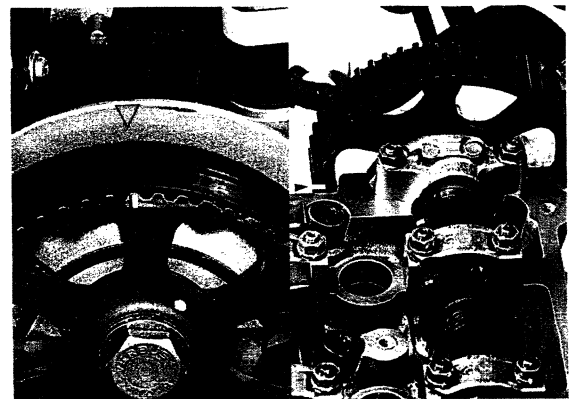
Fit the timing belt on the crankshaft pinion and on the intermediate shaft gear.

Fit the lower cover of the toothed belt.



13B076

Place the crankshaft drive pulley together with the vibration damper. The mark on the vibration damper must align with the mark on the lower cover of the toothed belt.



13B073

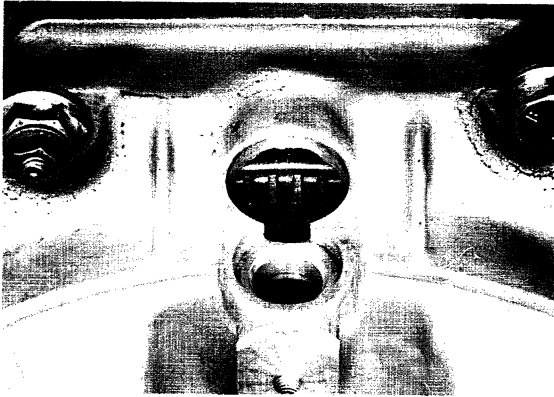
13B074

Align the mark on the distributor drive shaft pinion with the arrow on the cylinder head cover.

If the cylinder head cover has been removed, the mark on the back of the distributor drive shaft pinion must be flush with the cylinder head.

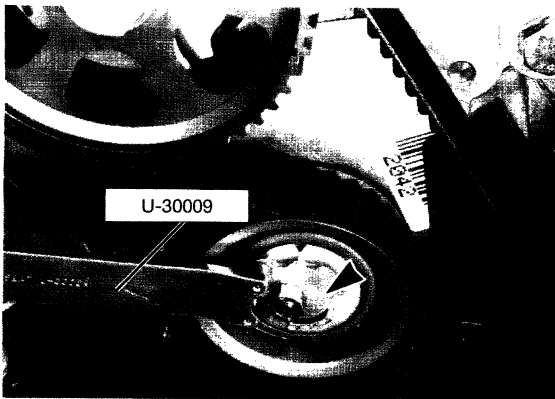
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine



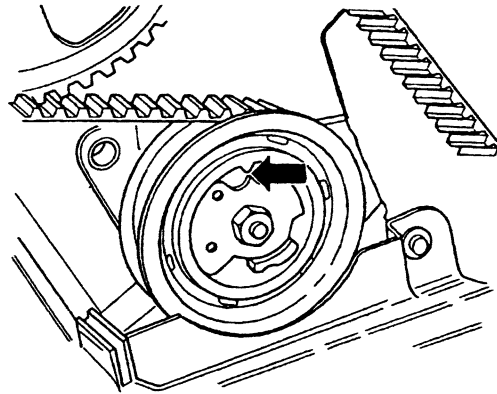
13A107

Check that the engine flywheel mark matches with the mark on the clutch housing.



13B107

After the distribution marks are matched, fit the timing belt and tighten the belt to the proper tension, by turning the tension roller clockwise using tool **U-30009** (the toothed belt must only be tensioned with the engine cold).



13BD23

Check that the tautness of the gear-tooth belt is correct matching the marks on the tension roller. If not, loosen the tension roller nut and, using the tool **U-30009**, turn the roller anticlockwise as far as it will go, then turn the roller anticlockwise until the marks match.

Tighten the tension roller with the fastening nut.

Turn the crankshaft two turns, until the marks are again on TDC and recheck the adjustment.

Fit the plug into the clutch housing.

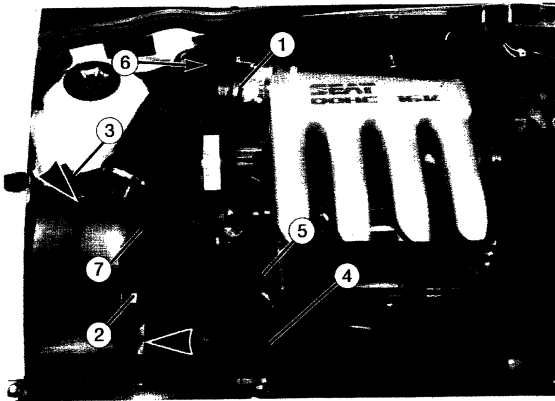
Place the upper cover, the Poly-V belt tensioning pulley and the belt. Pay attention to the direction indicating mark on the Poly-V belt.

Fit and tighten the power steering drive belt (Running gear, Group 48).

# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### TIMING BELT Tightening

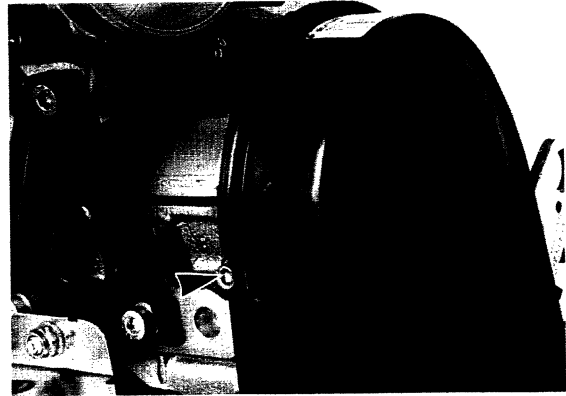


10B113

If tensioning is carried out in the vehicle, disconnect the negative cable of the battery and partially remove the air filter/inlet tube assembly, for which the following items must be removed:

1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Air intake muffler bushing from its housing to the air filter assembly.

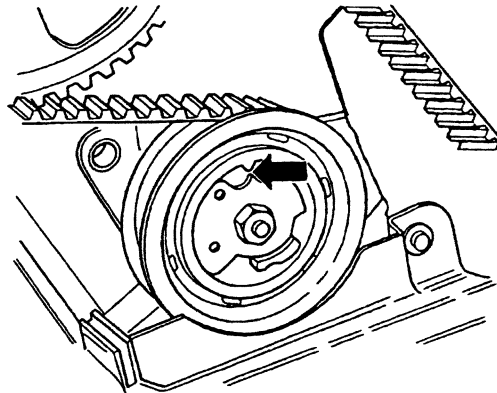
Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



13A102

Remove the upper cover after removing the fixing bolts.

Match the distributor marks and, when they are in the TDC position, check the tautness of the gear-tooth belt (this can only be tensioned with the engine cold).



13BD23

Check that the marks on the tension roller match. If not, loosen the tension roller nut and, using the tool **U-30009**, turn the tension roller anticlockwise as far as it will go and then turn the roller clockwise until the marks match.

Tighten the tension roller with the fastening nut.

Turn the crankshaft two turns, until the marks are again on TDC and recheck the adjustment.

Strongly press the timing belt with the index finger; the marks on the tensioner should move apart. Release the pressure on the belt; the tensioner roller should return to its original position (the marks on the tensioner should realign).

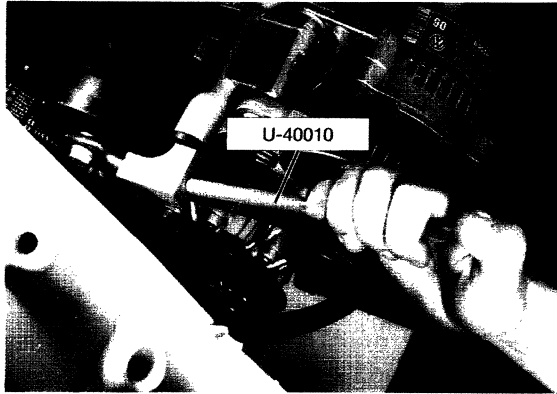
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### POLY-V BELT Removal and refitting

#### Removal

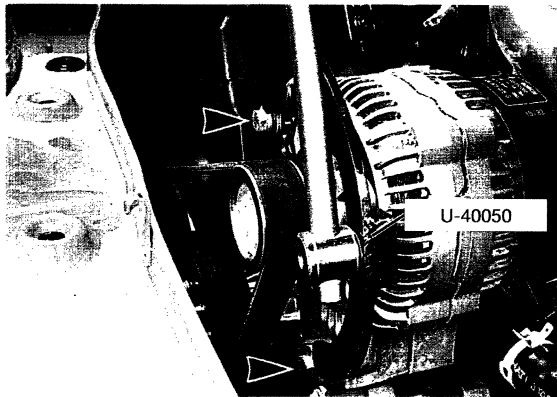
If the belt is to be reused, the direction of rotation must be marked before removing the belt; the mark must be taken into account when refitting.



10B005

#### VERSION WITH POLY-V BELT AND TENSIONING ROLLER

Detach the Poly-V belt from the alternator pulley using tool **U-40010**.



27B026

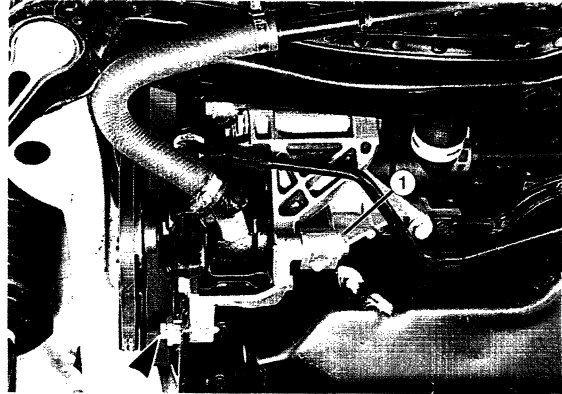
#### VERSION WITH POLY-V BELT, WITHOUT TENSIONING ROLLER

Remove the Poly-V belt.

Remove the belt by loosening the bolts holding the alternator bracket.

Place the **U-40050** tool as shown in the photograph and use a spanner to move the tool until the tensioning spring is overcome.

Once detensioned, remove the Poly-V belt from its fixing to the engine (the cooling liquid pump pulley should be removed first).



48B016

Raise the vehicle and remove the power steering drive belt. To do this, the fixing bolt 1 and the tensioning nut bolt must be loosened.

Remove the Poly-V belt.

#### Refitting

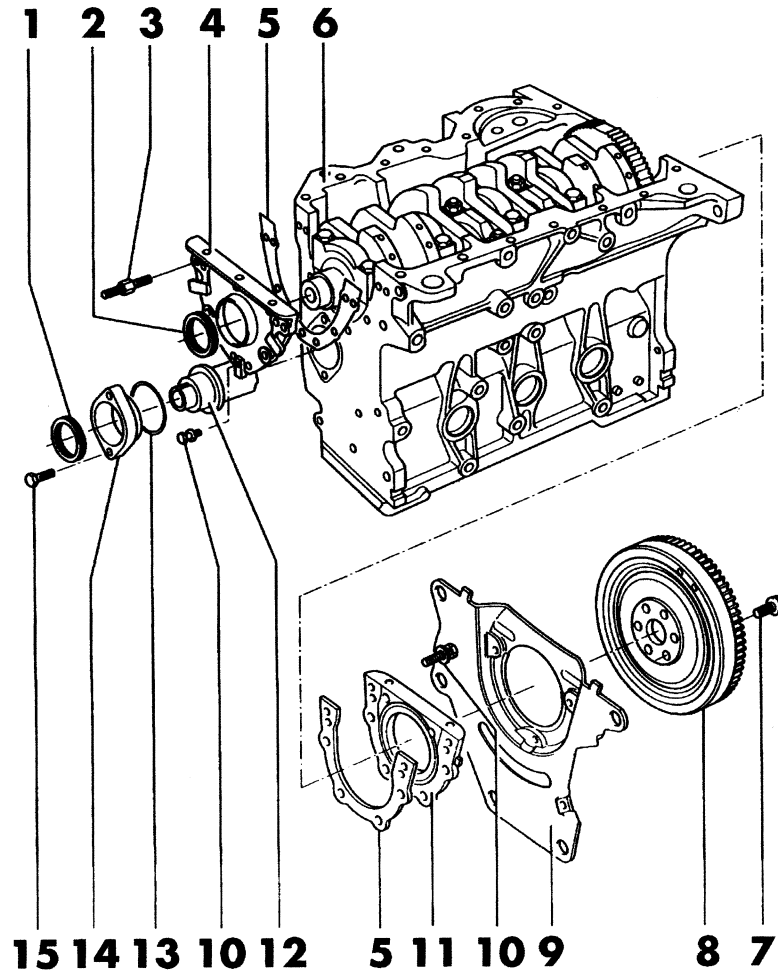
To reassemble, reverse the above operations taking the following into account:

When refitting the Poly-V belt (only if it is being reused), take into account the direction of rotation mark.

n models with a Poly-V belt without tensioning roller, once the belt is refitted and before the alternator securing bolts are tightened, the engine must be run at idling speed (approx. 10 seconds); the alternator fixing bolts must then be tightened (starting with the lower bolt).

Fit and tighten the power steering drive belt (Running gear, Group 48).

### CYLINDER BLOCK, SEALS AND ENGINE FLYWHEEL: EXPLODED VIEW

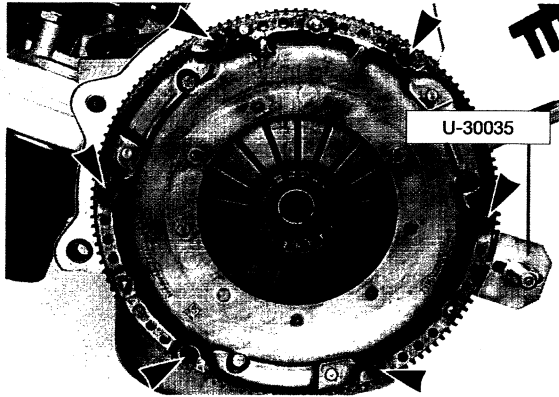


13AD22

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li><b>1. Intermediate shaft oil seal.</b><br/>Remove using the tool U-10080 and refit using the tool U-30002.</li> <li><b>2. Crankshaft oil seal.</b><br/>Remove using tool U-10080 and refit using tool U-20019.</li> <li><b>3. Cover fixing bolt. 25 Nm.</b></li> <li><b>4. Front cover.</b></li> <li><b>5. Gasket.</b><br/>Replace.</li> <li><b>6. Cylinder block.</b><br/>Check the cylinder bores.</li> <li><b>7. Engine flywheel fixing bolt. 60 Nm + 90°.</b><br/>Replace. The additional tightening by 90°, can be carried out in several stages.</li> <li><b>8. Engine flywheel.</b><br/>Use the U-30035 retainer tool to remove and install.</li> </ol> | <ol style="list-style-type: none"> <li><b>9. Intermediate plate.</b><br/>Check that there is a proper seat on the centering bushings.</li> <li><b>10. Cover fixing bolt. 10 Nm.</b></li> <li><b>11. Rear cover with seal.</b><br/>Removal and replacement.</li> <li><b>12. Intermediate shaft.</b><br/>Removal and refitting. Check the axial play.</li> <li><b>13. O-ring.</b><br/>Replace if damaged.</li> <li><b>14. Oil seal holding cover.</b></li> <li><b>15. Intermediate shaft oil seal holder fixing bolt. 25 Nm.</b></li> </ol> |
|---|---|

### CRANKSHAFT OIL SEAL, FLYWHEEL SIDE Replacement

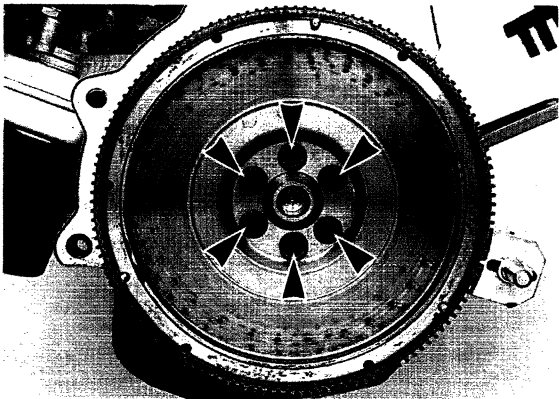
To replace the oil seal, it is necessary to remove first the gearbox-differential assembly.



13A109

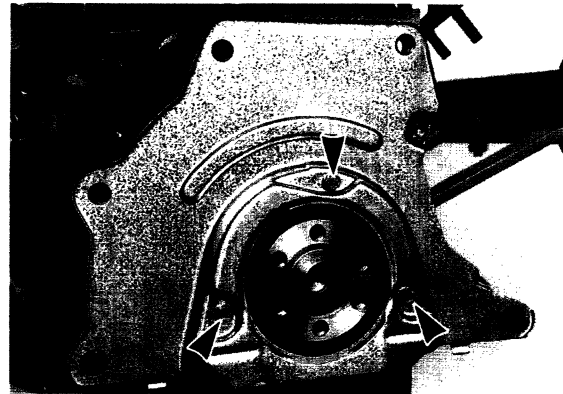
Remove the pressure assembly fixing bolts; block rotation with the **U-30035** tool.

Remove the pressure assembly together with the clutch plate.



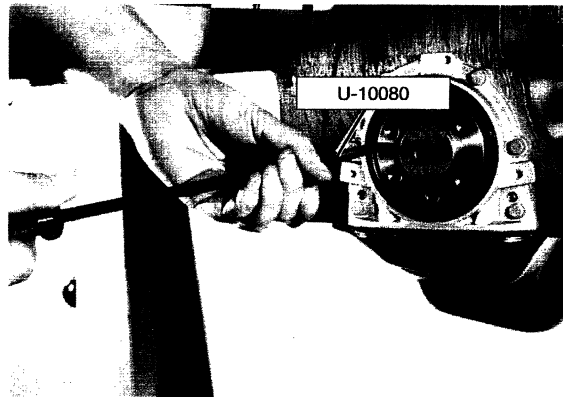
13A110

Remove the bolts fixing the engine flywheel and remove the flywheel.



13B013

Remove the intermediate plate fixing bolts and remove the intermediate plate.



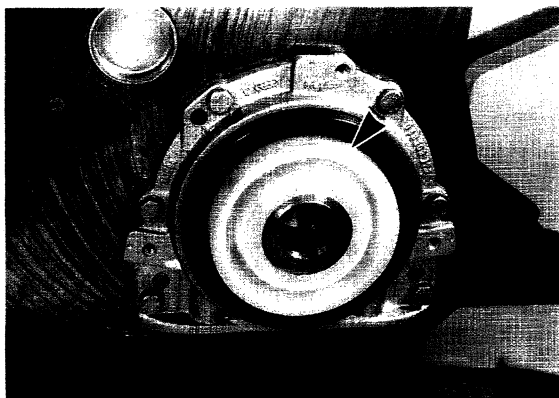
13B038

Push out the oil seal using the percussion tool **U-10080**.

Operate on different of the oil seal until pushing it out. Be very careful throughout the operation.

# Engine 13

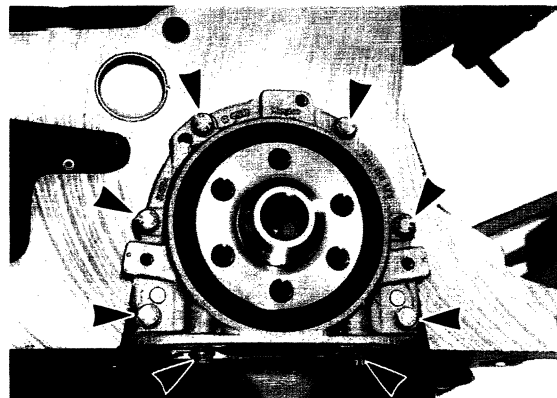
## Crankshaft assembly: 2.0 I 16 V engine



13B021

The spare oil seal is fitted with a bushing to make the fitting easier and to allow the oil seal lip slide over the crankshaft without getting damaged.

Place the bushing on the crankshaft and slide the retainer onto it.

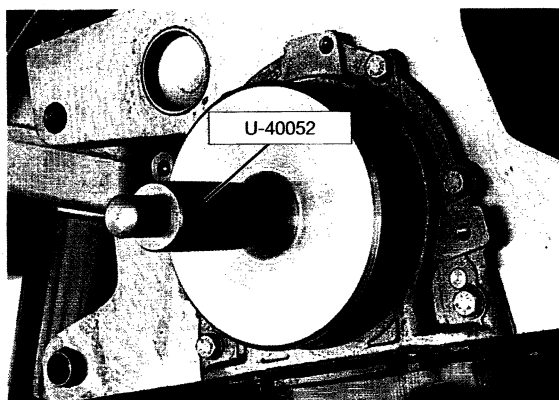


13B010

If necessary, replace the entire cover and seal assembly and tighten the bolts to the specified torque.

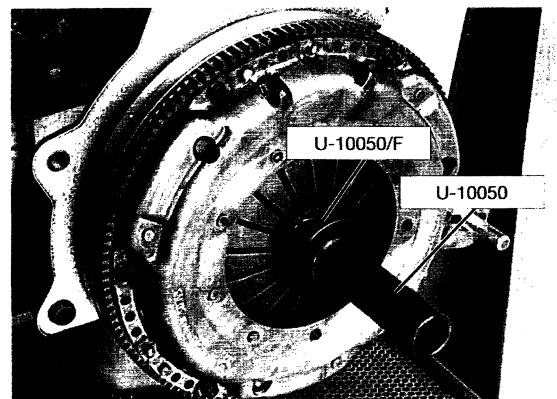
To refit, reverse the above operations taking the following into account:

The engine flywheel bolts must be replaced and fitted with a sealant; tighten the bolts crosswise to the specified torque.



13B090

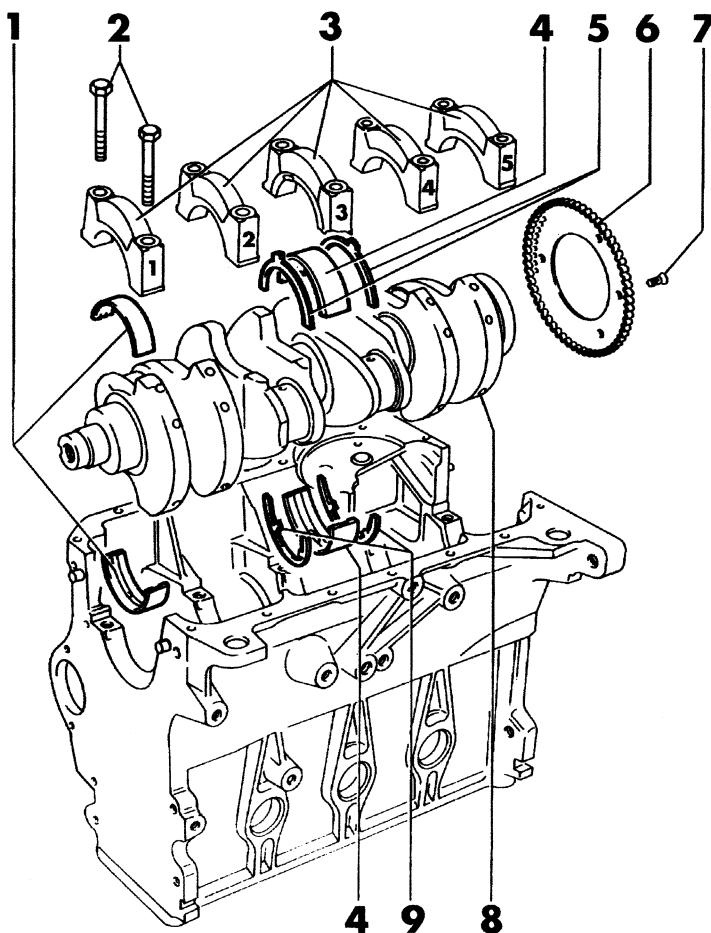
Fully insert the retainer with the **U-40052** tool.



13A111

Centre the clutch plate using the **U-10050** tool and the **U-10050/F** adaptor; cross-tighten the pressure assembly fixing bolts to the specified torque.

### CRANKSHAFT ASSEMBLY: EXPLODED VIEW



13AD23

**1. Half bearings number 1, 2, 4 and 5.**

Do not interchange used half bearings.  
The half bearing number 4 with lubrication groove.

**2. Cap fixing bolt. 65 Nm.**

**3. Crankshaft caps.**

Follow the assembly sequence.  
Cap number 1 is located on the distribution side.  
Cap number 3 with grooves for friction washers.  
The half bearing projections must be superimposed.

**4. Central half bearing number 3.**

The cylinder block side half bearing with lubrication groove.  
The cap side half bearing without lubrication groove.

**5. Axial half bearing.**

For number 3 crankshaft cap.  
Note the mounting position.

**6. Toothed crown.**

For the engine speed transmitter.

**7. Bolt fixing toothed crown. 10 Nm + 90°.**

**8. Crankshaft.**

Check dimensions and radial and axial plays.

**9. Axial half bearing.**

For cylinder block cap number 3.  
Note the mounting position.

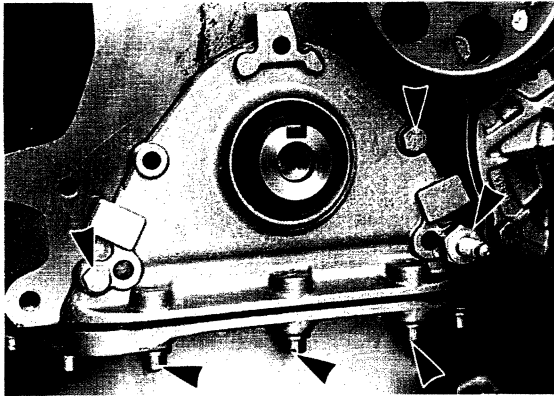
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### CRANKSHAFT OIL SEAL, DISTRIBUTION SIDE Replacement

To replace the crankshaft oil seal, proceed as follows:

Remove the crankshaft pinion; the procedure is like the one described for the operation "timing belt drive, removal and refitting" but removing the camshaft and intermediate shaft drive pinions is not required.

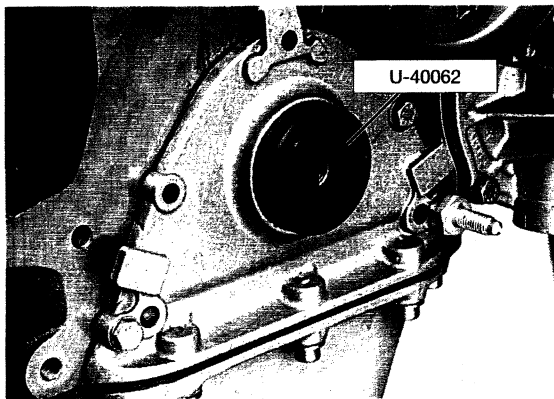


13A112

Remove the power-assisted steering tension bracket.

Remove the cover and seal and use a punch to remove the seal.

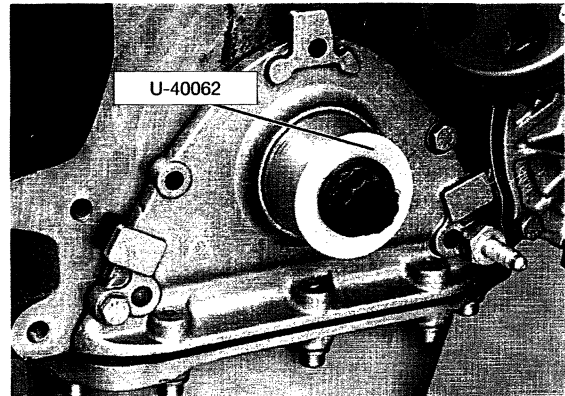
Once the seal has been removed, re-fit the cover to the block.



13A113

Place the centring part of the tool **U-40062** on the crankshaft and slide the oil seal over the centring part.

Lightly oil the oil seal lip and outer edge before fitting.



13A114

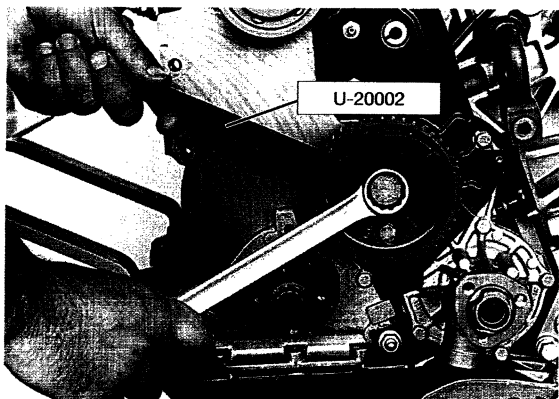
Place the pusher of the tool **U-40062** and acting on the pinion fixing bolt insert the oil seal until it stops.

After fitting the oil seal, proceed with the reassembly by reversing the procedure for disassembling.

### INTERMEDIATE SHAFT OIL SEAL Replacement

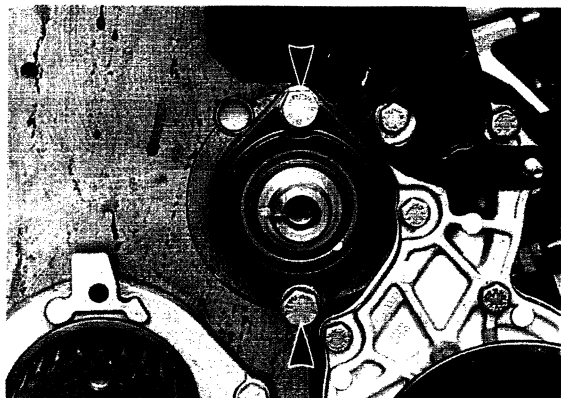
To replace the intermediate shaft oil seal, proceed as follows:

Remove the intermediate shaft pinion; the procedure is like the one described for the operation "timing belt drive, removal and refitting" but removing the camshaft and crankshaft drive pinions is not required.



13B081

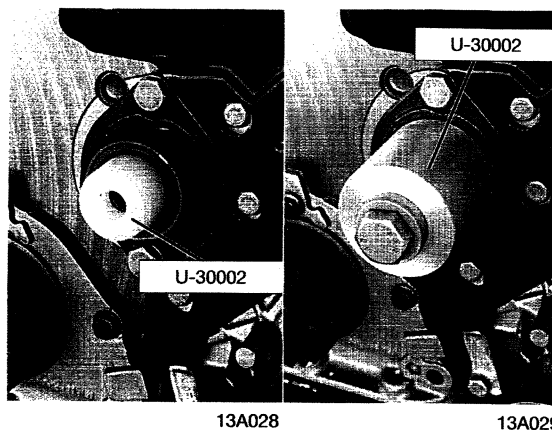
Disassemble the intermediate shaft drive pinion using the tool **U-20002/1**.



13A115

Remove the oil seal holding cover and push the seal out of the cover using a drive head.

Once the seal has been removed, refit the cover to the block.



13A028

13A029

Lightly oil the oil seal lip and outer edge.

Fit the oil seal on the centring ring of tool **U-30002**.

Insert the oil seal using the tool pusher; for pushing, a proper bolt must be used.

After fitting the oil seal, proceed with the reassembly by reversing the procedure for disassembling.

# Engine 13

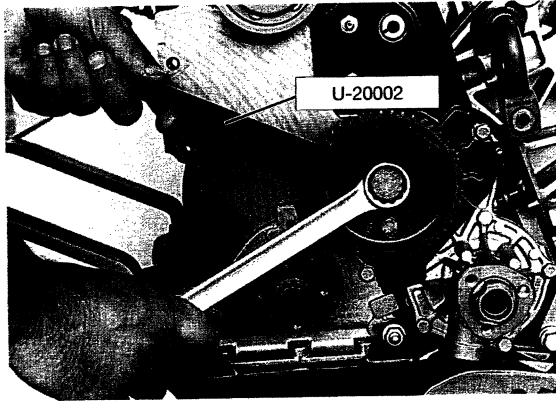
## Crankshaft assembly: 2.0 I 16 V engine

### INTERMEDIATE SHAFT Removal and replacement

#### Removal

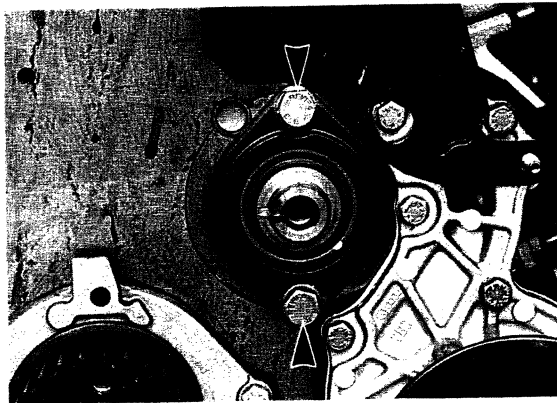
To replace the oil seal the engine must be removed from the vehicle.

Remove the timing belt.



13B081

Disassemble the intermediate shaft drive pinion using the tool **U-20002/1**.



13A115

Remove the oil seal holding cover and, if the oil seal is to be replaced, remove the oil seal from the cover.

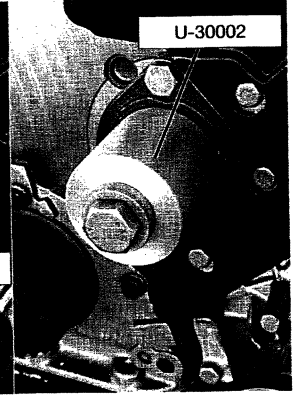
Remove the intermediate shaft.

To reassemble, reverse the above operations taking the following into account:

Refit the intermediate shaft and refit the oil seal holding cover.



13A028



13A029

If the seal has been replaced, lightly oil the sealing lip and its outer edge.

Fit the oil seal on the centring ring of tool **U-30002**.

Insert the oil seal using the tool pusher; to push the tool, a proper bolt must be used.

Before refitting the intermediate shaft drive pinion, check using a dial gauge that the shaft axial play does not exceed **0.25 mm**.

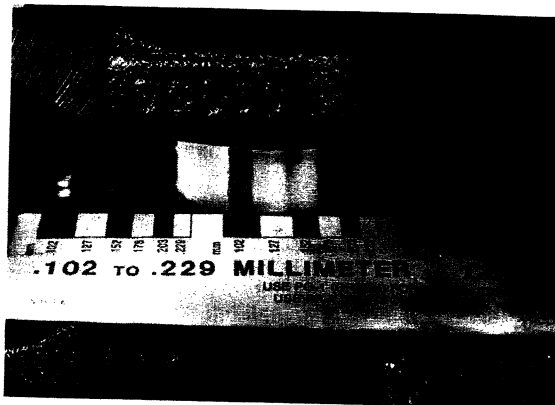
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### CRANKSHAFT: Dimensions (mm)

Dimensions for grinding	Main bearing crankshaft pins Ø mm	Main bearing connecting rod pins Ø mm
<b>Basic dimension</b>	- 0.022 54.00 - 0.042	- 0.022 47.80 - 0.042
<b>I Class</b>	- 0.022 53.75 - 0.042	- 0.022 47.55 - 0.042
<b>II Class</b>	- 0.022 53.50 - 0.042	- 0.022 47.30 - 0.042
<b>III Class</b>	- 0.022 53.25 - 0.042	- 0.022 47.05 - 0.042

### CRANKSHAFT RADIAL PLAY Checking



13A032

To check the radial play with the engine assembled, use Plastigage and proceed as follows:

Remove the crankshaft bearing cap.

Carefully clean the half bearing and the crankshaft journal.

Place a Plastigage strip in axial direction over the crankshaft journal.

Refit the cap and tighten to a torque **65 Nm**.

#### Note

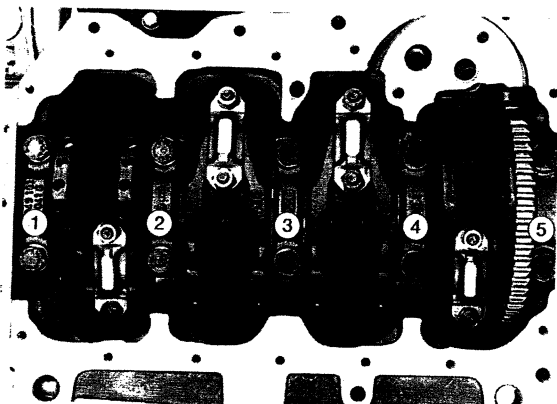
Do not turn the crankshaft while checking the radial play.

Remove the cap and check the width of the Plastigage strip with the measurement scale.

The value measured must be within the following range:

New engine ..... **0.02 to 0.06 mm**.  
LMaximum allowable wear ..... **0.17 mm**.

### Crankshaft bearing cap fitting and tightening



13A117

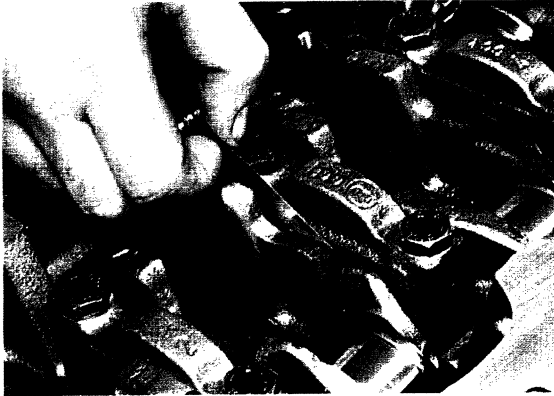
Fit the caps with the corresponding half bearings, according to the order marked on them.

Cap No. 1 is fitted on the distribution side.

Relief the caps taking into account that the half bearing projections must be superimposed.

Tighten the bolts to a torque of **65 Nm**.

**CRANKSHAFT AXIAL PLAY**  
**Ckecking**



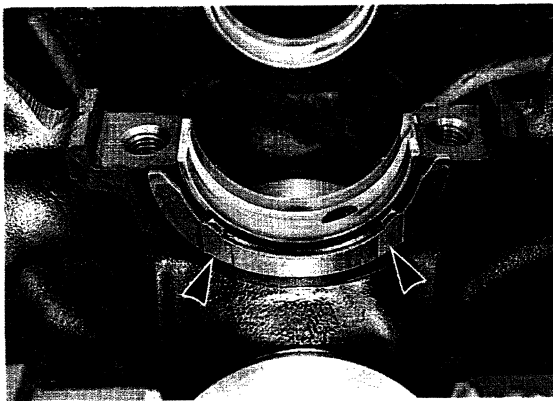
13A118

Check the bearing number 3 (adjustment bearing) axial play using a feeler gauge.

The axial play measurement must be:

New engine ..... **0,07 to 0,17 mm.**  
Maximum allowable wear ..... **0,25 mm.**

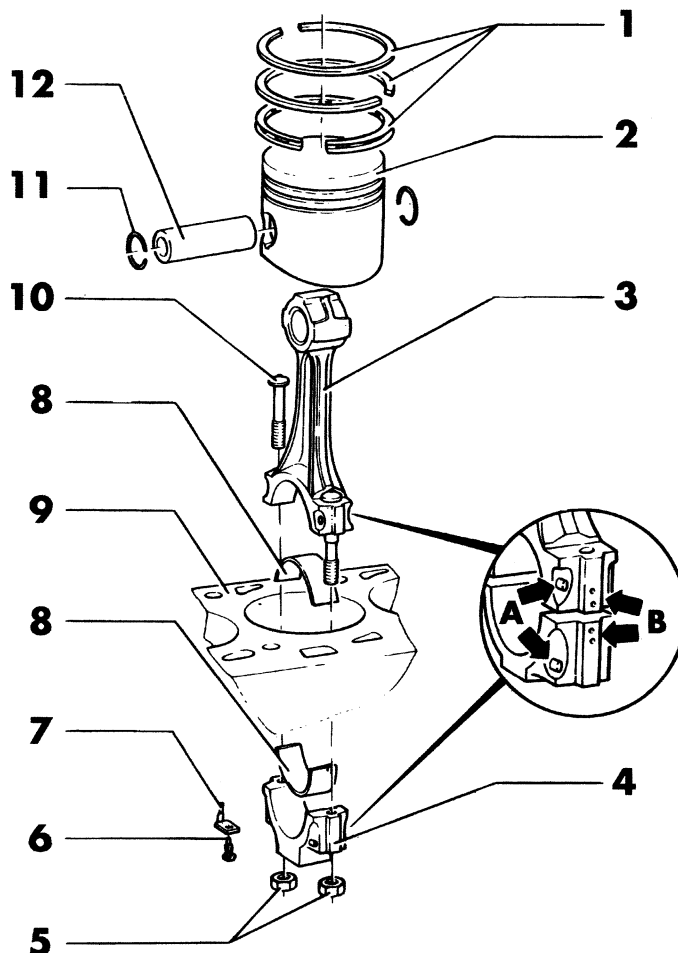
**AXIAL HALF BEARINGS**  
**Reassembly**



13A033

Note the mounting position; the grooves on one of the half bearing sides must be directed towards the crankshaft.

**CONNECTING ROD, PISTONS AND PISTON PINS: EXPLODED VIEW**



13BD05

- |   |   |
|---|---|
| <p><b>1. Piston rings.</b><br/>Remove and refit using special tweezers.<br/>Stagger the piston ring ends by 120°.<br/>Check the play.<br/>The mark "TOP" must be directed towards the piston head.</p> <p><b>2. Piston.</b><br/>Check.<br/>Mark the mounting position and the cylinder to which it belongs.</p> <p><b>3. Connecting rod.</b><br/>It includes a drilling to lubricate the piston pin.<br/>Replace as complete sets only.<br/>Mark the correspondence with the cylinder "B".<br/>The marks "A" must be directed towards the distribution side.</p> <p><b>4. Connecting rod cap.</b><br/>The marks "A" must be directed towards the distribution side.</p> | <p><b>5. Connecting rod cap fixing nut. 30 Nm + 90°.</b><br/>Oil the contact surfaces.</p> <p><b>6. Pressure valve. 27 Nm.</b><br/>Opening pressure: 2.5 ÷ 3.2 bar.</p> <p><b>7. Oil injector.</b></p> <p><b>8. Connecting rod big end half bearing.</b><br/>It includes a drilling to lubricate the piston pin.<br/>Note the mounting position.<br/>Do not interchange used half bearings.<br/>Make sure that the retaining projections are properly seated.</p> <p><b>9. Cylinder block.</b><br/>Check the cylinder bores.</p> <p><b>10. Connecting rod bolt.</b></p> <p><b>11. Circlip.</b></p> <p><b>12. Piston pin.</b><br/>Remove and refit using the tool <b>U-20008</b>.<br/>If necessary to facilitate reassembly, heat the piston to 60 °C.</p> |
|---|---|

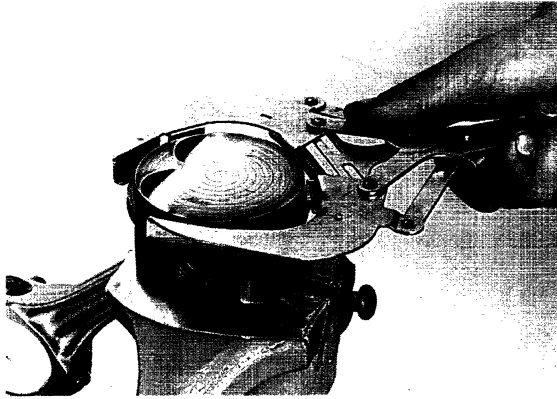
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### PISTON-PISTON PIN-CONNECTING ROD ASSEMBLY

Disassembly, checking and reassembly

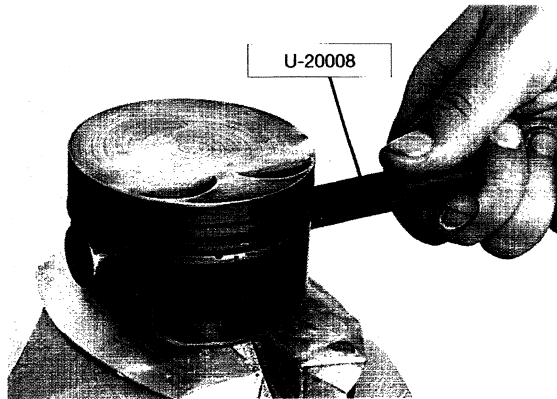
#### Disassembly



13A125

Hold the connecting rod-piston pin-piston assembly on a bench vise using guards on the jaws.

Remove the piston rings using special tweezers.



13A120

Remove the circlips and remove the piston pin by pushing it out using the tool **U-20008**.

Mark the mounting position and the cylinder to which it belongs.



13A036

If the condition on the parts is good, the parts may be reused.

The connecting rods must be replaced by complete sets only.

Mark the correspondence between the assemblies and the cylinders and note mounting position.

#### Checking the pistons



13A037

Take the measurements at about 10 mm from the lower edge and at 90° with the piston pin axis. The maximum allowable tolerance with regard to the rated dimension is **0.04 mm**.

#### Note

Whenever a repair is carried out, only pistons and piston rings of the same class will be fitted as well as only pistons of the same weight.

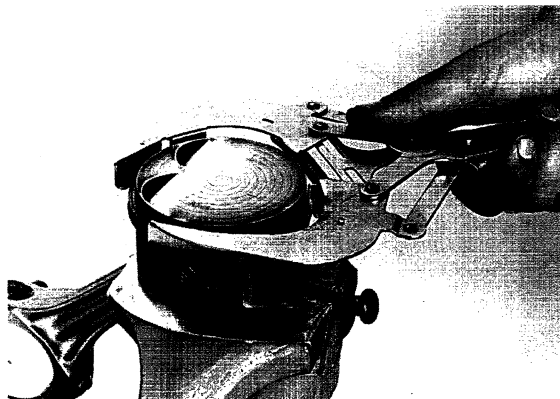
# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### PISTON-PISTON PIN-CONNECTING ROD ASSEMBLY

Disassembly, checking and reassembly

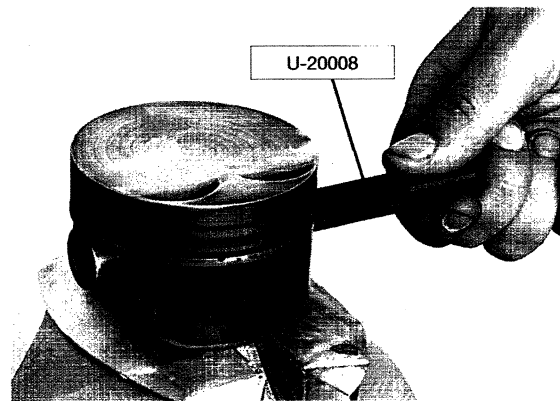
#### Disassembly



13A125

Hold the connecting rod-piston pin-piston assembly on a bench vise using guards on the jaws.

Remove the piston rings using special tweezers.



13A120

Remove the circlips and remove the piston pin by pushing it out using the tool **U-20008**.

Mark the mounting position and the cylinder to which it belongs.



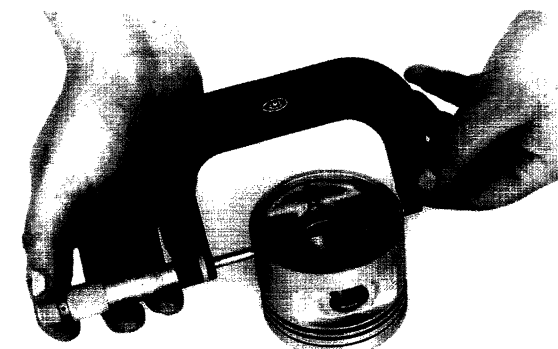
13A036

If the condition on the parts is good, the parts may be reused.

The connecting rods must be replaced by complete sets only.

Mark the correspondence between the assemblies and the cylinders and note mounting position.

#### Checking the pistons



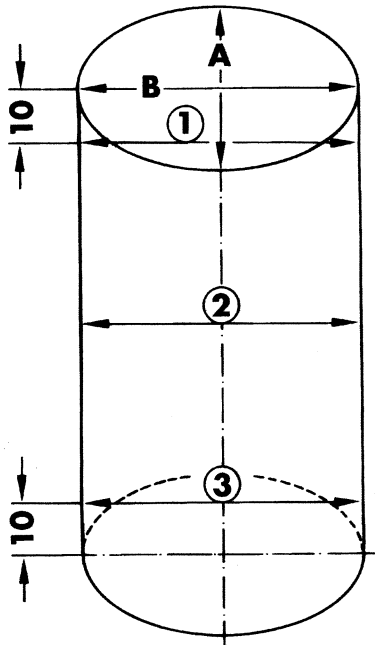
13A037

Take the measurements at about 10 mm from the lower edge and at 90° with the piston pin axis. The maximum allowable tolerance with regard to the rated dimension is **0.04 mm**.

#### Note

Whenever a repair is carried out, only pistons and piston rings of the same class will be fitted as well as only pistons of the same weight.

### Checking the cylinder bore



13AD08

Using a precision inside caliper (50-100 mm), measure at three different points both crosswise **A** and lengthwise **B**.

Maximum allowable difference with regard to the rated dimension: **0.08 mm**.

### Piston and cylinder bore dimensions

Values (in mm)

Measurement after grinding	Ø piston	Ø cylinder bore
Basic dimension	82.485	82.51
Class I	82.735	82.76
Class II	82.985	83.01

For greater values, the cylinder bore must be ground up to the allowable oversize in accordance with the scale for oversized pistons.

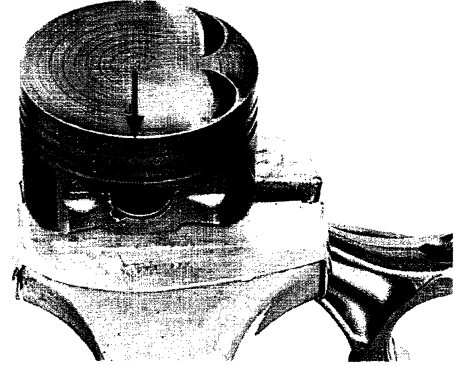
After grinding, wash and dry the cylinder bores and clean any particle from the walls using a viscous oil.

### Note

The calibration must not be carried out with the cylinder block attached to the rotary trestle, as due to the stresses the measurements could be incorrect.

### Reassembly

Before refitting the connecting rod-piston pin-piston assembly, carry out all the measurements and checkings required.



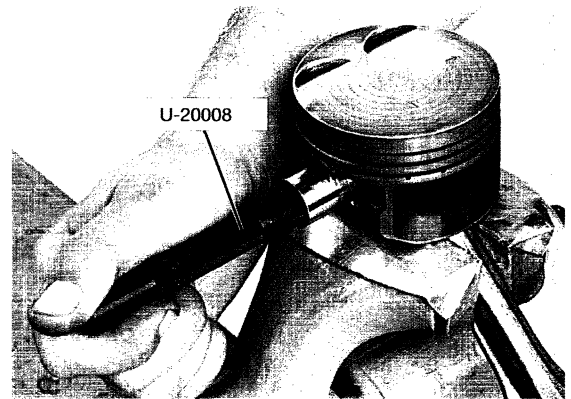
13A123

Hold the connecting rod on a bench vise using proper guards on the jaws.

Refit the piston-piston pin-connecting rod assembly.

Note the mounting position of the connecting rod with regard to the piston; the arrow engraved on the piston head must be pointing to the cast pegs on the connecting rod small end.

Check that the connecting rod and the piston belong to the same cylinder.



13A124

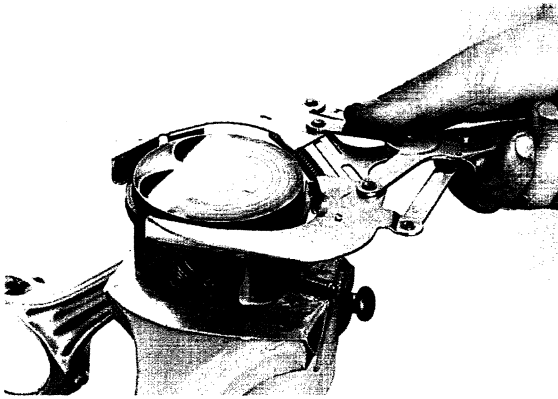
Fit the piston pin using tool **U-20008**.

If the piston pin is difficult to insert, heat the piston to about 60 °C.

Fit the circlips.

# Engine 13

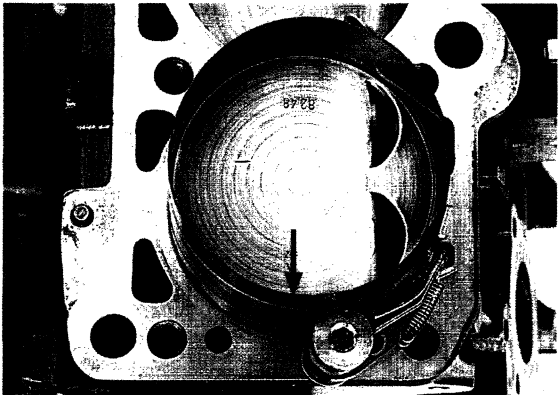
## Crankshaft assembly: 2.0 I 16 V engine



13A125

Fit the piston rings on the piston using special tweezers for piston rings.

Position the piston ring ends staggered by 120° and taking into account that the mark "TOP" must be directed towards the piston head.



13A126

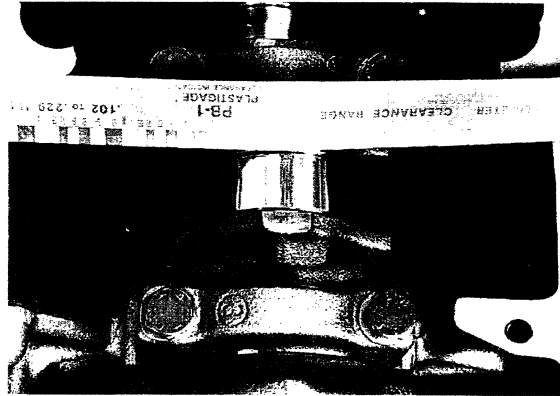
When refitting the connecting rod-piston pin-piston assembly into the cylinder block, make sure that the numbers of the assemblies match those of the cylinders.

Before refitting, lubricate the contact and friction surfaces using engine oil.

The arrows engraved on the pistons must be pointing to the distribution side.

For refitting, use an adjustable clamp.

### CONNECTING ROD RADIAL PLAY CHECKING



13A045

With the engine assembled, the play checking can be carried out using Plastigage.

Remove the connecting rod cap.

Clean thoroughly the half bearing and the crankshaft pin.

Place either on the crankshaft pin or on the half bearing a Plastigage strip in axial direction.

Refit the connecting rod cap and tighten the bolts to a torque of **30 Nm**; do not turn the crankshaft during the measurement.

Remove the connecting rod cap.

Check the Plastigage strip width using the measurement scale.

The radial play must be:

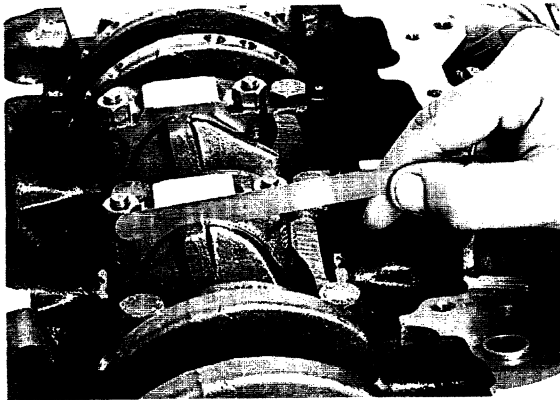
New .....	<b>0.01 to 0.06 mm.</b>
Maximum allowable wear .....	<b>0.12 mm.</b>

After checking the play, refit the connecting rod caps and tighten the bolts to the specified torque.

# Engine 13

## Crankshaft assembly: 2.0 I 16 V engine

### CONNECTING ROD AXIAL PLAY CHECKING



13B088

Measure with a feeler gauge.

The axial play must be:

New ..... 0.05 to 0.31 mm.  
Maximum allowable wear ..... 0.37 mm.

### COMPRESSION RATIO

#### Test conditions

- Engine oil temperature: minimum 30 °C.
- Throttle valve fully open.
- Engine speed transmitter connector (next to the central connector), disconnected.
- Battery in good condition.
- Spark plugs removed.

#### Checking



13B109

Fit the **VAG 1381** or **VAG 1763** pressure meter into the spark plug hole.

Operate the starter motor until the pressure recorder does not show any further increase in pressure.

The compression ratio must be within the following ranges:

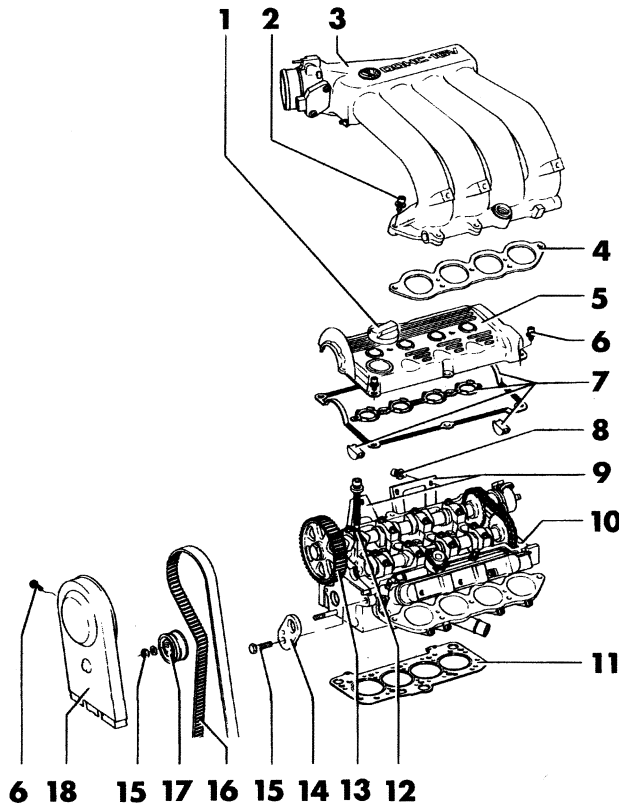
Engine	New (bars)	Maximum allowable wear (bars)
ABF	10 ÷ 13	7.5

The maximum allowable difference between any two cylinders must not exceed 3 bar.

### CYLINDER HEAD: EXPLODED VIEW

When using a spare cylinder head, after fitting to the engine, the contact areas between the hydraulic tappets and the camshaft cams must be lubricated.

The plastic bases supplied to protect the valves must be taken out immediately before fitting the cylinder head. Whenever the cylinder head is removed, the cooling liquid must be changed.



15BD14

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. <b>Plug.</b><br/>Replace the gasket if damaged.</li> <li>2. <b>Intake manifold attachment. 20 Nm.</b></li> <li>3. <b>Manifold intake, top.</b></li> <li>4. <b>Manifold intake.</b> Replace.</li> <li>5. <b>Cylinder head cover.</b></li> <li>6. <b>10 Nm.</b></li> <li>7. <b>Cylinder head cover gaskets.</b><br/>Replace if damaged.</li> <li>8. <b>Support fixing bolt. 20 Nm.</b></li> <li>9. <b>Support.</b></li> <li>10. <b>Cylinder head.</b><br/>Check the cylinder head for distortion or knocks.<br/>Removal and refitting.</li> <li>11. <b>Cylinder head gasket.</b><br/>Note the mounting position.</li> </ol> | <ol style="list-style-type: none"> <li>12. <b>Cylinder head fixing bolt.</b><br/>Follow the mounting instructions as well as the sequence for tightening and removing.<br/>Check correspondence between screw and type of cylinder head gasket.</li> <li>13. <b>Camshaft pinion.</b><br/>Note the position when assembling the timing belt.<br/>Remove and refit using the tool <b>U-20002/1</b>.</li> <li>14. <b>Support.</b></li> <li>15. <b>45 Nm.</b></li> <li>16. <b>Timing belt.</b><br/>Before disassembling, mark the direction of rotation.<br/>Do not bend.<br/>Replacement and tightening (refer to Group 13).</li> <li>17. <b>Distribution belt tensioning roller.</b></li> <li>18. <b>Timing belt upper cover.</b></li> </ol> |
|---|--|

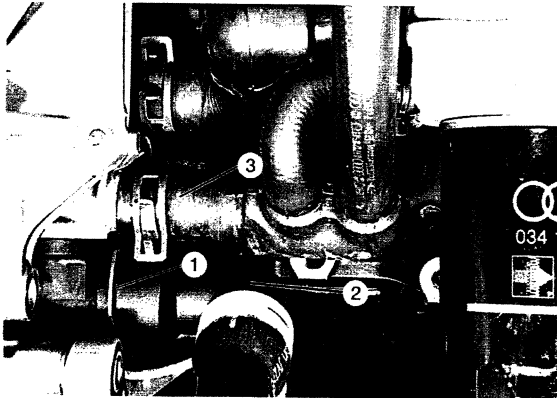
### CYLINDER HEAD

#### Removal and refitting (on the vehicle)

#### Removal

To remove the cylinder head, with the engine fitted into the vehicle, carry out the following operations:

Disconnect the battery ground lead.

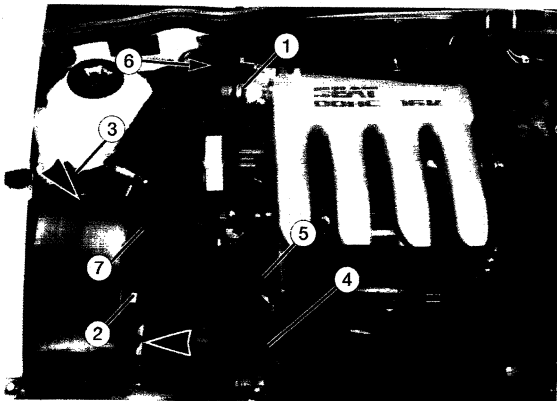


19B020

Remove the expansion tank cap.

Drain the coolant liquid by removing the safety clip "1", removing the hose "2" and the flexible tube "3", use the **U-10095** tool to remove the clamps.

(Raise the vehicle and separate the lower protector from the engine unit.)

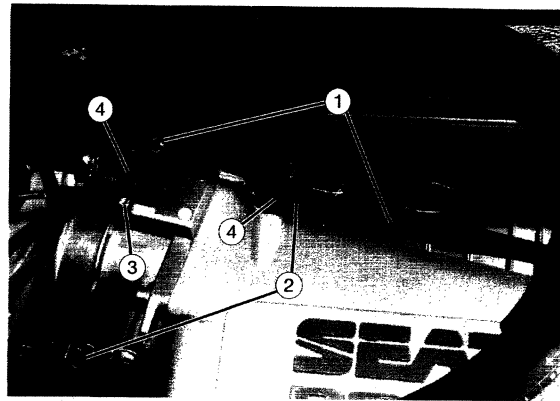


10B113

Remove the following items from the air filter/inlet tube assembly:

1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Tube for inlet air silencer from its fixture to the air filter set.

Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



15B105

1. Detach the accelerator cable from the throttle valve assembly and from the support on the intake manifold (do not remove the fixing clamp).
2. Remove the throttle valve and the idling switch connectors.
3. Remove the pressure regulator suction take-off from its fixing point on the inlet manifold.
4. Remove the suction tubes and the gas inlet tube from the active coal deposit from its fixture to the throttle set.

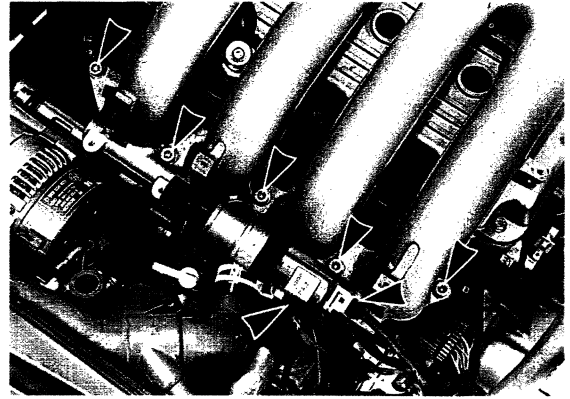
# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine



10B124

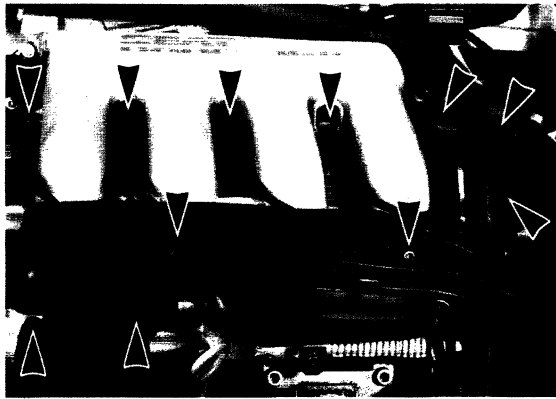
Disconnect the brake servo vacuum connection from the intake manifold.



15B061

Remove the connectors from the stabilizing valve and the fuel distributor.

Remove the bolts which hold together the upper and lower parts of the inlet manifold.

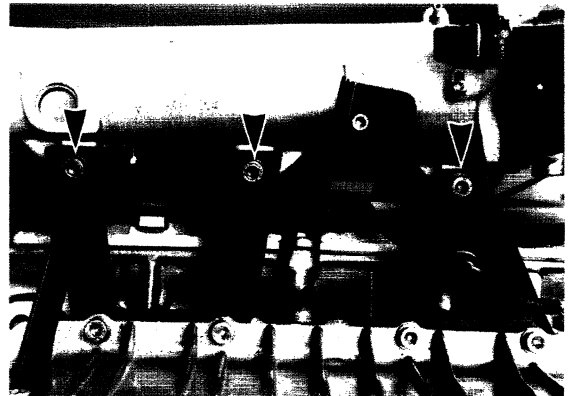


15B107

Partially remove the following items:

The spark plug cables cover, together with the cables and the distributor cap.

The sump gasses pressure regulating valve (it is not necessary to remove the gas outlet tube).



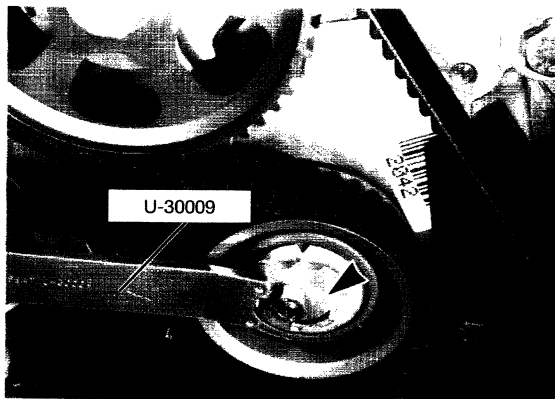
15B108

Remove the bolts holding the rear support brackets to the upper part of the inlet manifold.

Remove the upper part of the inlet manifold, removing the electrical installation fixtures from it.

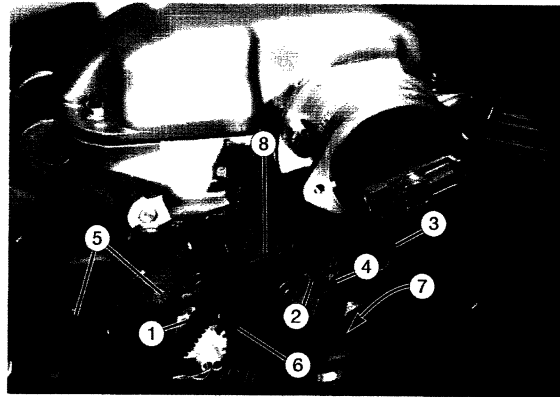
# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine



13B107

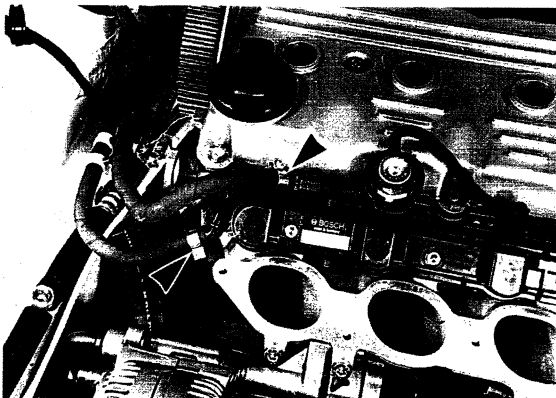
Remove the upper distribution cover, align the distribution marks, slacken the belt and remove the distributor shaft drive pinion from its fixing (for more information, see Repair Group 13).



15B106

Detach from the cylinder head the following items:

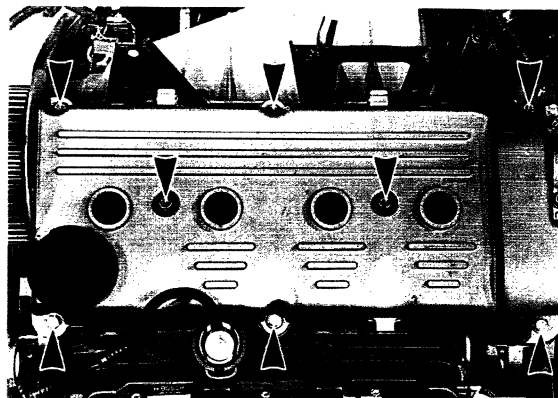
1. Temperature transmitter connector.
2. Instrument panel temperature transmitter connector.
3. Hall transmitter connector.
4. Earth strap.
5. Central connector bracket.
6. Coolant hose.
7. Coolant liquid rigid tube fixing bolt.
8. Connector from the control thermostat for 3rd. electric fan speed (versions with air conditioning only).



15B063

Disconnect the fuel inlet (black) and return (blue) pipes and plug properly the system.

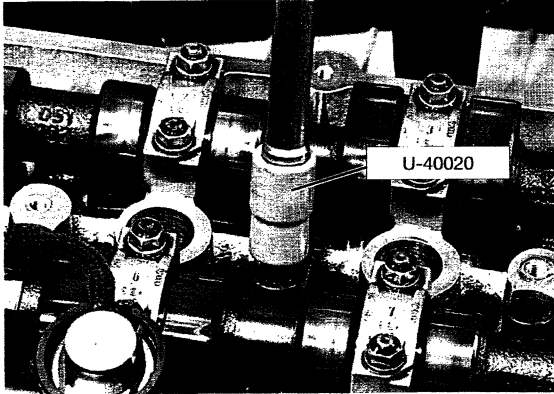
Remove the nuts holding the exhaust pipe to the manifold.



15B065

Remove the cylinder head cover.

Remove the tubes from their fixings on the coolant liquid distributor; use the **U-10095** tool to remove the clips.



15B067

Remove the cylinder head cover fixing bolts using the wrench **U-30022** or **U-40020**.

The sequence to loosen the bolts is the opposite for tightening.

Remove the cylinder head assembly.

If the cylinder head parts are to be disassembled and checked, the following must be removed:

- The fuel distributor together with the inlet manifold.
- Spark plugs.
- Ignition distributor.
- Exhaust manifold, together with the support brackets.
- Coolant liquid distributor tube.
- Distribution belt tensioning roller.
- The supports or part which may interfere with the positioning on the base-tool **U-10073/1**.

### Metal cylinder head gasket

Engines come equipped with cylinder head gaskets made either of soft material or metal.

Where the cylinder head gasket is made of soft materials (standard), it can be substituted afterwards with a metal gasket.

# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine

### Refitting

To reassemble, reverse the above operations taking the following into account:

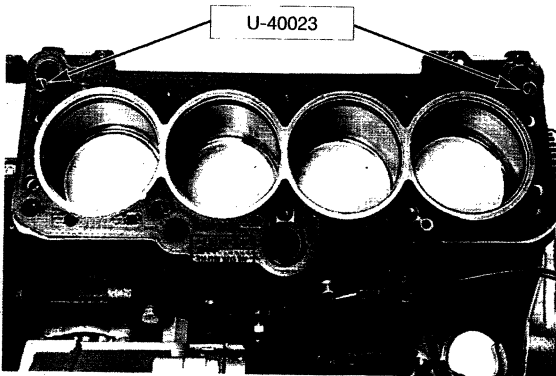
The engine must be cold when installing it.

Ensure that no pieces of the old gasket remain on the cylinder head and engine block; remove any pieces with great care from both parts, ensuring that no large scratches are produced in the process. If abrasive paper is used, this should not be coarser than 100 grade.

Carefully clean the cylinder head and the block of any particles of sand or emery.

The new cylinder head gasket must only be removed from its packaging just before it is fitted into place. Handle the gasket very carefully. If the silicone coating or the edges are damaged, the seal may be lost.

Position the pistons at about half the stroke to prevent any possible interference with the valves.



15B074

Install the new cylinder head gasket, "oben" brand or the existing number of replacements in it must face the cylinder head, bear in mind the centering studs in the block (if the block does not have these studs, use tool **U-20004** together with **U-40023** guide bolts for centering, screw the bolts to the drillings indicated in the diagram).

Fit the cylinder head and thread by hand the bolts fixing it into the eight holes that remain free.

### Note

Always replace the cylinder head fixing bolts.

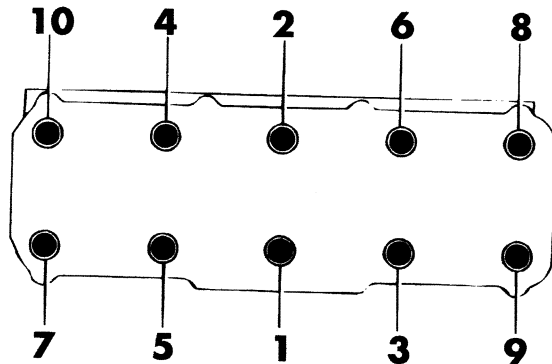
Remove the guide studs by turning counterclockwise the handle of the tool **U-20004** until the studs are removed.

Refit the two remaining cylinder head, fixing bolts and tighten all of them; remember the directions for tightening the cylinder head fixing bolts.

To refit and tighten the timing belt, refer to the Repair Group 13.

Refill the cooling system with fresh cooling liquid.

### Notes for tightening the cylinder head bolts



15AD09

The tightening of the cylinder head bolts must be carried out in four stages, following the order indicated above.

Tighten using a torque wrench, the engine being cold.

First stage ..... **40 Nm**  
 Second stage ..... **60 Nm**

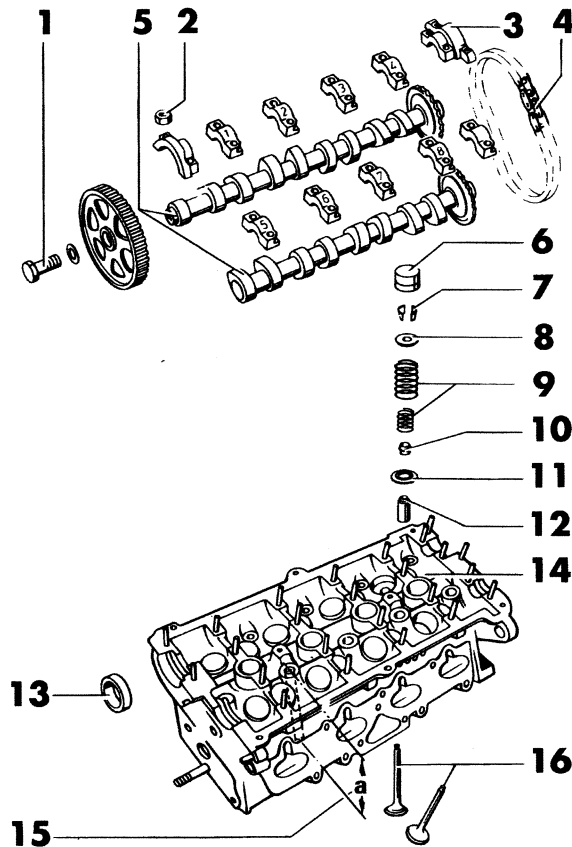
Tighten using a fixed wrench.

Third stage ..... **90°**  
 Fourth stage ..... **90°**

The cylinder head fixing bolts need not be retightened after the repair.

### VALVE OPERATION: EXPLODED VIEW

The cylinder heads showing cracks between valve seats or between a valve seat ring and the spark plug housing thread, can be used without any effects on the duration, provided the cracks do not exceed a maximum width of 0.5 mm or only the first threads are cracked.



15AD13

- |   |  |
|---|--|
| <p><b>1. Camshaft pinion fixing bolt.</b> 65 Nm.</p> <p><b>2. Camshaft fixing bolt cap.</b> 15 Nm.</p> <p><b>3. Cap.</b><br/>Observe position and order of assembly and removal.</p> <p><b>4. Drive chain.</b><br/>Mark direction of turn with a painted line before removal.</p> <p><b>5. Camshaft seals.</b><br/>Check the axial and radial plays.<br/>Maximum eccentricity: 0.01 mm.<br/>Note the camshaft code letters.<br/>Distribution timing.</p> <p><b>6. Hydraulic tappets.</b><br/>Dot not interchange.<br/>Checking.<br/>Before refitting the cup tappets, check the camshaft axial play.</p> <p><b>7. Half cones.</b></p> <p><b>8. Top valve spring seat.</b></p> | <p><b>9. Valve springs.</b><br/>Remove and refit using the tool <b>U-10073/1</b> and the base plate <b>U-30033</b>.</p> <p><b>10. Valve springs.</b><br/>Remove using the tool <b>U-10070</b>. Refit using the tool <b>U-30007</b>.</p> <p><b>11. Bottom valve spring seat.</b></p> <p><b>12. Valve guide.</b><br/>Spare valve guides are supplied with collar.<br/>Check.<br/>Remove and refit using the tool <b>U-30006</b>.</p> <p><b>13. Camshaft oil seal.</b><br/>Lightly oil the oil seal lip and outer edge.<br/>Remove using tool <b>U-10080</b>, refit using tool <b>U-30002</b>.</p> <p><b>14. Cylinder head.</b><br/>Valve seat grinding.</p> <p><b>15. "a" Cylinder head grinding dimension.</b><br/>Minimum height = 118.1 mm.</p> <p><b>16. Valve.</b><br/>Cannot be grinded, only polished with emery cloth.</p> |
|---|--|

# Engine 15

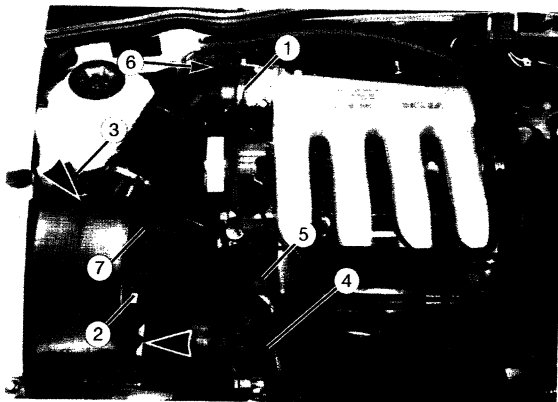
## Cylinder head: valve operation. 2.0 I 16 V engine

### CAMSHAFT OIL SEAL

Replacement (cylinder head fitted into the vehicle)

To replace the camshaft oil seal, with the cylinder fitted into the vehicle, proceed as follows:

Disconnect the battery negative lead.

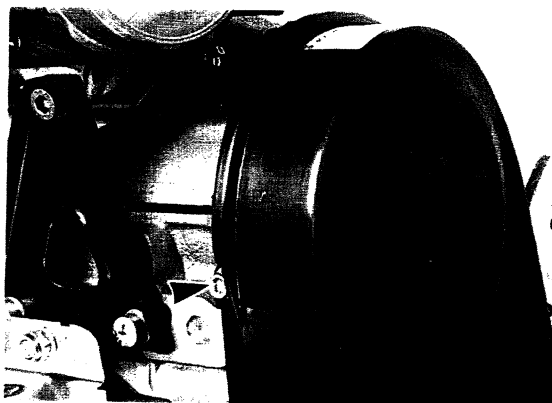


10B113

If the disassembly is carried out in the vehicle, disconnect the negative terminal on the battery and partially remove the air filter/inlet tube assembly, for which the following items must be removed:

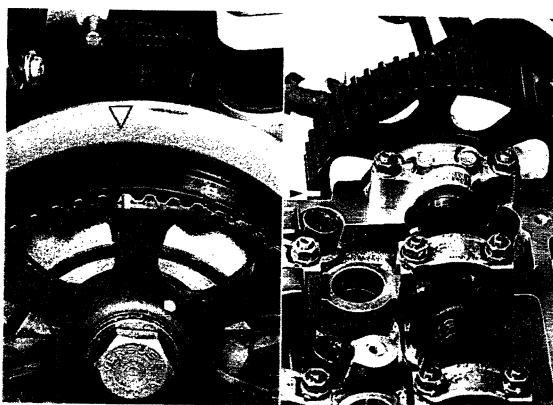
1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Tube for inlet air silencer from its fixture to the air filter set.

Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



13A102

Remove the upper cover after removing the fixing bolts.



13B073

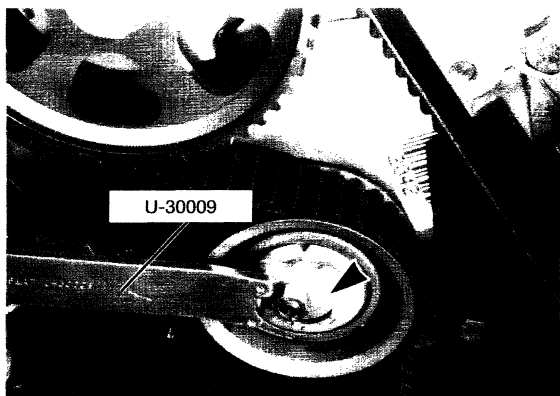
13B074

Align the mark on the distributor drive shaft pinion with the arrow on the cylinder head cover.

If the cylinder head cover has been removed, the mark on the back of the distributor drive shaft pinion must be flush with the cylinder head.

# Engine 15

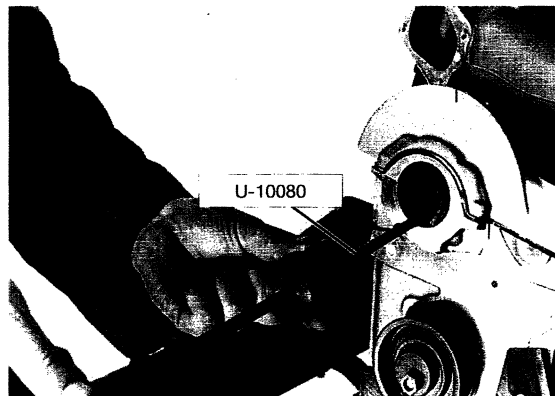
## Cylinder head: valve operation. 2.0 I 16 V engine



13B107

Loosen the timing belt by loosening the tension roller fixing nut and turning the roller counterclockwise using the tool **U-30009**.

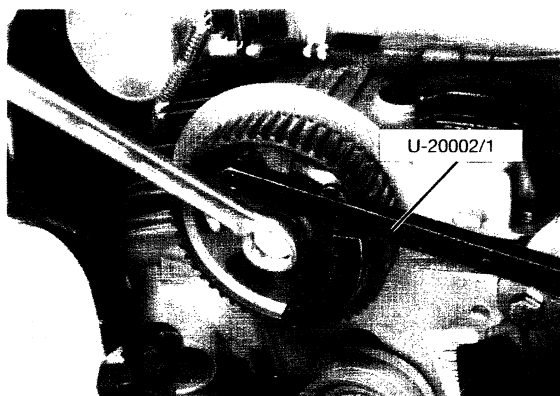
Remove the timing belt and mark the direction of movement if the belt is to be reused.



15A039

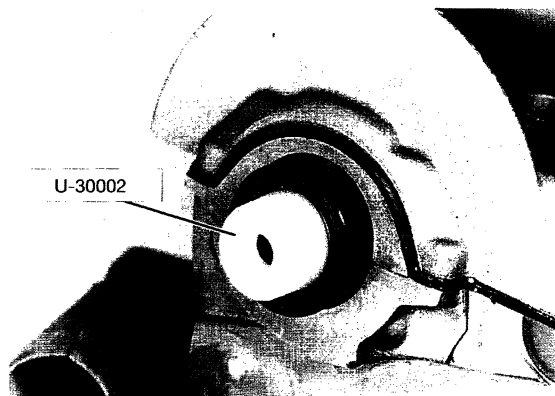
Remove the retainer using the special tool **U-10080**.

To refit, reverse the above operations taking the following into account:



13B108

Remove the camshaft drive pinion using the tool **U-20002/1**.



15A040

Lightly oil the oil seal lip and outer edge.

Position the centring part of the tool **U-30002** and slide the oil seal up to its position.

# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine

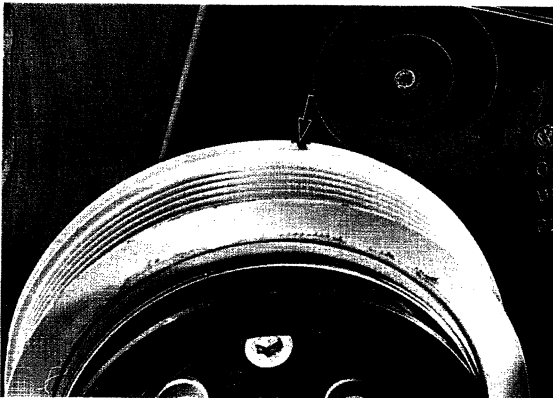
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15A041

Insert the oil seal using the tool pusher, until the oil seal is flush with the cylinder head.

Then refit the camshaft drive pinion, so that the mark on the pinion matches the mark on the cylinder head cover.



13B076

Check that the mark on the vibration damper aligns with the mark on the lower cover of the toothed belt.

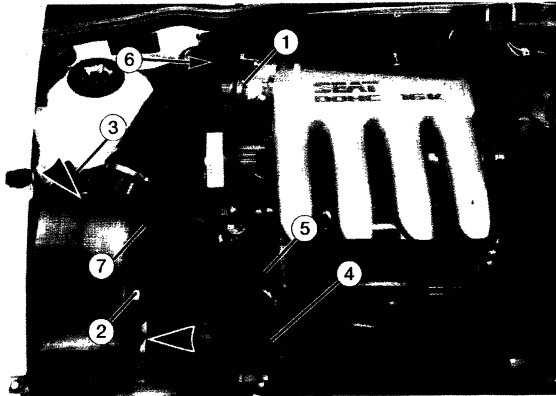
Refit and tighten the timing belt as described in Group 13.

### DISTRIBUTOR SHAFTS Removal and refitting

#### Removal

The following operations must be carried out to remove the distributor shafts:

Disconnect the battery negative lead.

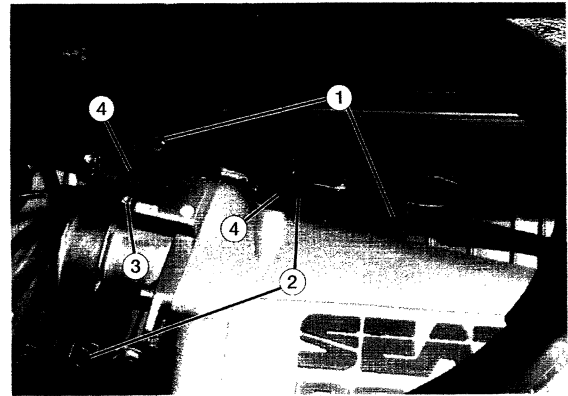


10B113

If the disassembly is carried out in the vehicle, disconnect the negative terminal on the battery and partially remove the air filter/inlet tube assembly, for which the following items must be removed:

1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Tube for inlet air silencer from its fixture to the air filter set.

Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



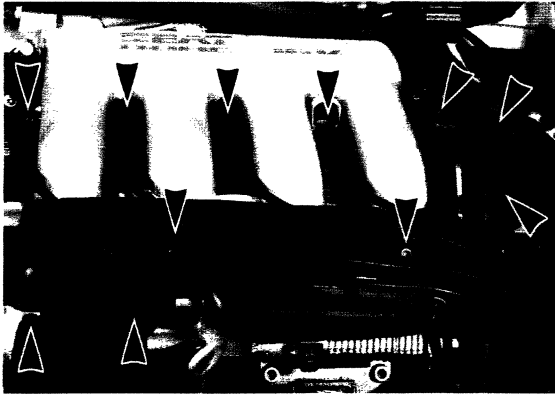
15B105

1. Detach the accelerator cable from the throttle valve assembly and from the support on the intake manifold (do not remove the fixing clamp).
2. Remove the throttle valve and the idling switch connectors.
3. Remove the pressure regulator suction take-off from its fixing point on the inlet manifold.
4. Remove the suction tube and the active carbon tank gases tube from their fixing on the throttle valve assembly.



10B124

Disconnect the brake servo vacuum connection from the intake manifold.

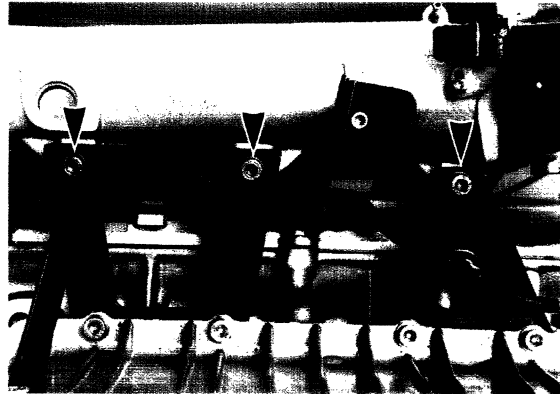


15B107

Partially remove the following items:

The spark plug cables cover, together with the cables and the distributor cap.

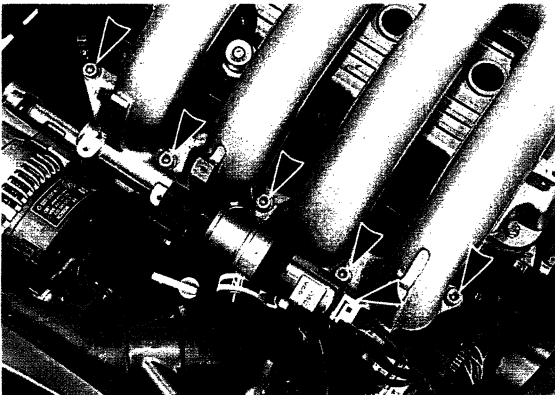
The sump gasses pressure regulating valve (it is not necessary to remove the gas outlet tube).



15B108

Remove the bolts holding the rear support brackets to the upper part of the inlet manifold.

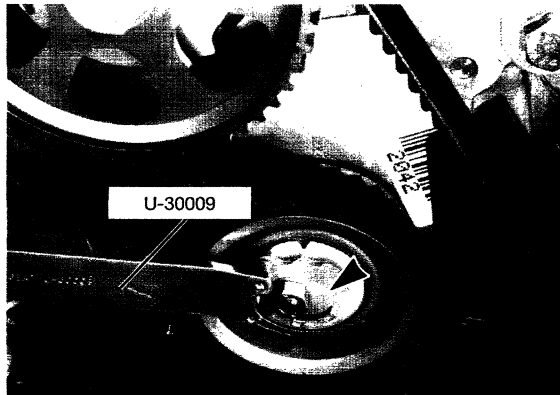
Remove the upper part of the inlet manifold, removing the electrical installation fixtures from it.



15B076

Remove the stabilizing valve connector.

Remove the bolts which hold together the upper and lower parts of the inlet manifold.

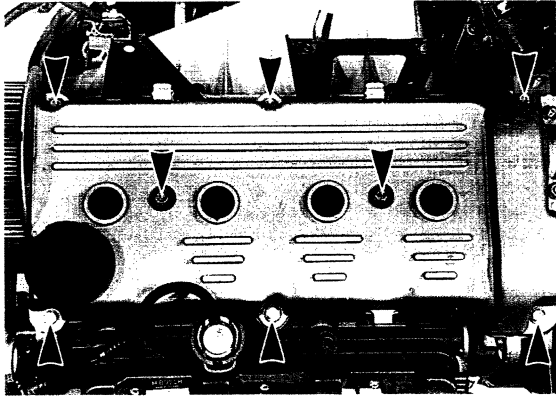


13B107

Remove the upper distribution cover, align the distribution marks, slacken the belt and remove the distributor shaft drive pinion from its fixing (for more information, see Repair Group 13).

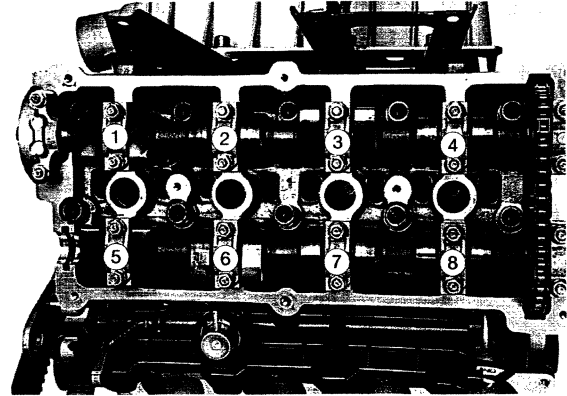
## Engine 15

### Cylinder head: valve operation. 2.0 I 16 V engine



15B065

Remove the cylinder head cover.



15B069

Then remove the caps, in the following order:

— **Inlet shaft.**

Remove caps 5, 7 and the cap at the chain end.

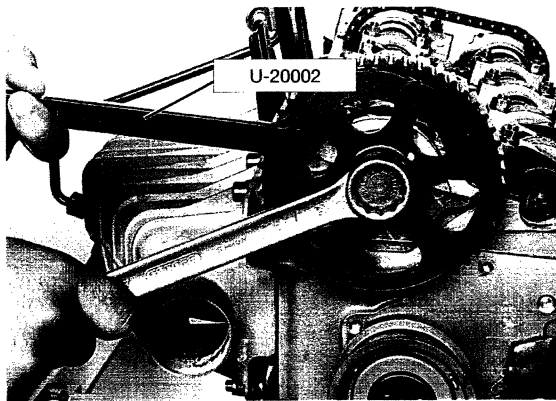
Cross-loosen caps 6 and 8.

— **Exhaust shaft.**

Remove caps 1, 3 and the caps at the ends.

Cross-loosen caps 2 and 4.

Remove both shafts together with the drive chain. If the chain can be re-used, mark its direction of rotation with a dab of paint.



15B068

Remove the camshaft drive pinion using the tool **U-20002/1**.

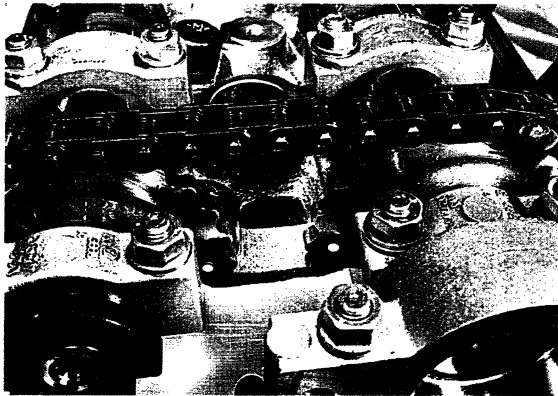
Remove the ignition distributor.

# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine

### Refitting

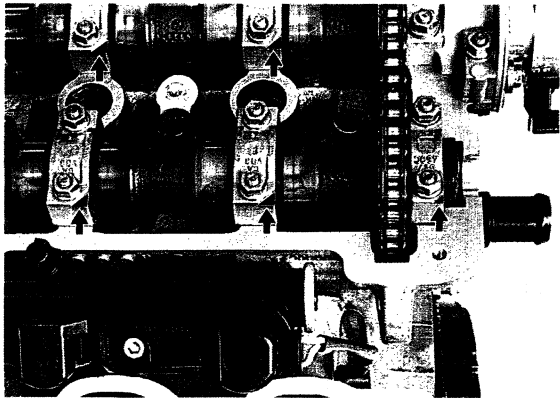
To reassemble, reverse the above operations taking the following into account:



15B070

Position camshafts with chain in such a manner that pinion marks coincide as indicated in figure.

(Take the mark made on the chain into account if it has been re-used.)



15B071

Cap cover grooves should face side of manifold intake.

Refit caps in the following order:  
Tightening torque of caps: **15 Nm**.

#### — Inlet shaft.

Tighten caps 6 and 8.

Refit and tighten remaining caps.

#### — Exhaust shaft.

Tighten caps 2 and 4.

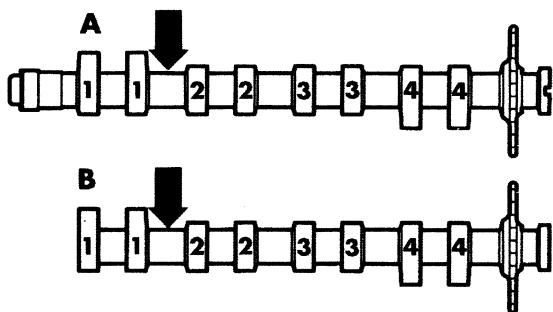
Refit and tighten remaining caps.

Mount the drive pinion and tension the toothed distribution belt as described in group 13.

# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine

### Camshaft code



15BD15

The shafts are identified by a series of numbers or letters stamped between the cam pairs for cylinders 1 and 2 (arrow).

Exhaust shaft -A-: 051 102

Inlet shaft -B-: 051 101 o 051 101 A

### Distribution timing, at 1 mm valve stroke

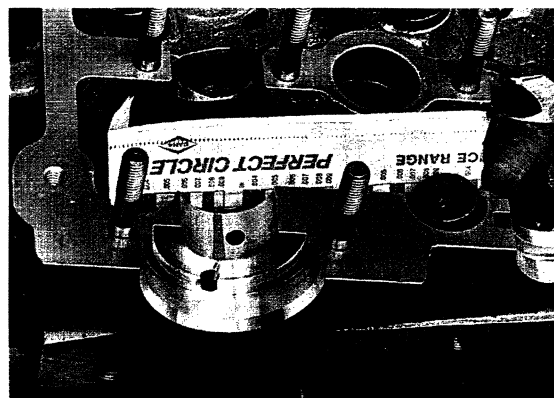
Engine code letters	ABF
Intake opens	1° before the TDC
Intake closes	38° after the BDC
Exhaust opens	39° before the BDC
Exhaust closes	1° after the TDC

### CAMSHAFT RADIAL PLAY Checking

Remove the camshaft and the hydraulic tappets.

Clean the camshaft and bearing cap seats.

Refit the camshaft on the cylinder head so that the cams are not in contact with the valves.



15B072

Place a Plastigage strip, according to bearing width, on the camshaft seat in axial direction.

Fit the cap and tighten to the specified torque.

While making the measurement do not turn the camshaft.

Remove the bearing cap.

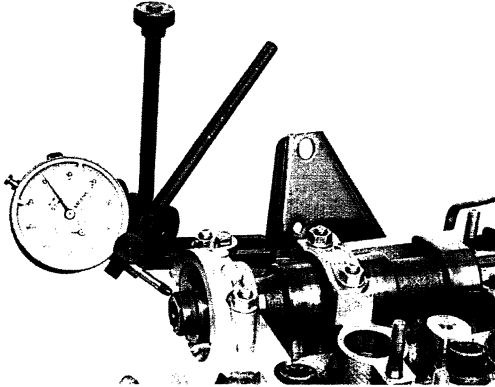
Check the width of the Plastigage strip using the measurement scale.

Maximum allowable wear: **0.1 mm**.

If this limit is exceeded, check the play with a new camshaft.

If the limit is exceeded again, the cylinder head must be replaced.

## CAMSHAFT AXIAL PLAY Checking



15B077

Carry out measurements with a dial gauge on end of camshaft on pinion side.

First remove hydraulic tappets and refit caps No. 1 and 5.

Tolerance limit is **0.15 mm**.

**HYDRAULIC TAPPETS**  
**Removal, checking and refitting**

**Checking**

A slight valve noise during the starting up is normal.

To carry out the checking, proceed as follows:

Start up the engine and keep it running until the radiator fan starts to operate.

Increase the engine speed up to about 2500 rpm for a couple of minutes.

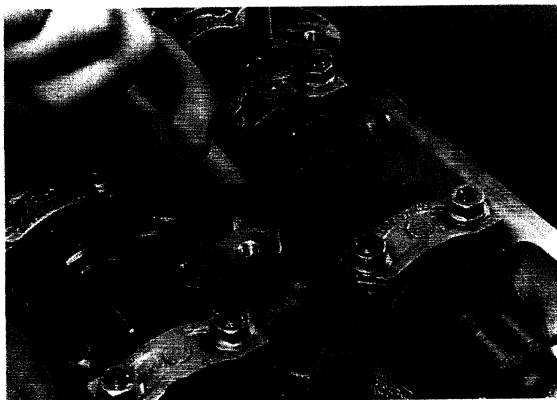
If the tappets are still noisy, proceed as follows to locate the faulty tappet:

Remove upper part of manifold intake and the cylinder head cover.

Turn the crankshaft clockwise (when viewed from the pinion) until the rocker arms of the tappets to be checked are upward.

Then measure the free play between the rocker arms and the pushrods:

- If the measurement obtained is greater than **0.1 mm**, replace the pushrod.
- If the measurement obtained is less than **0.1 mm**, continue with the check.



15A048

Press down the tappet using a plastic or wooden wedge. If there is a free run in excess of **0.1 mm** until the valve starts to open, replace the tappet.

The tappets must be replaced as complete parts and cannot be repaired or adjusted.

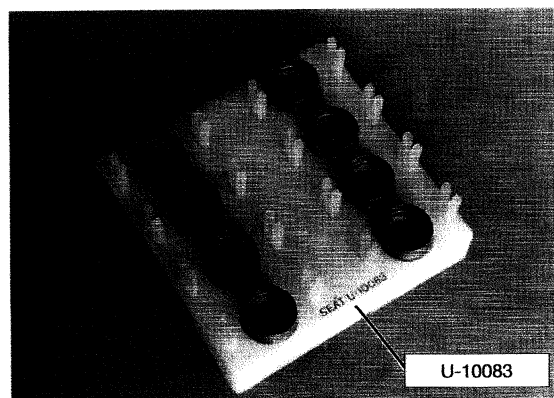
**Removal**



15B073

Remove camshafts.

Remove the tappets using the tool **U-10014**.



15A011

To prevent the switching of the tappets before they are replaced, place them in order on the **U-10083** base.

Place them with cams sliding surface downwards.

Replace the tappets in their original order, if they are re-usable.

Shorten friction surface.

**Note**

When new tappets have been fitted, engine should not be started until after approximately 30 minutes (valves may rest on piston).

# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine

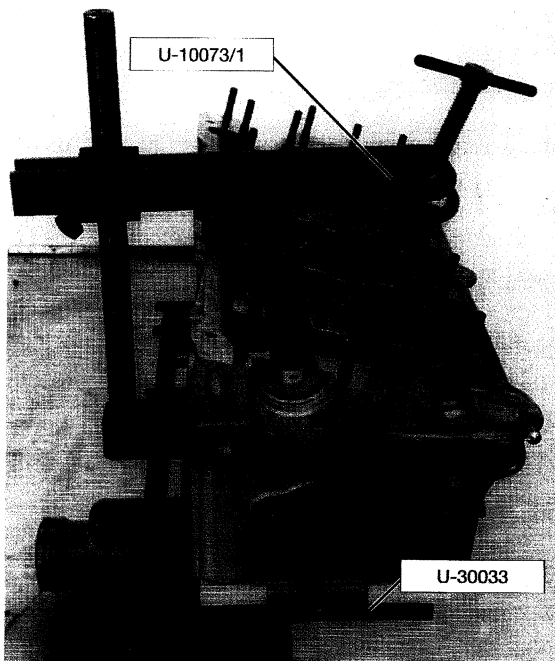
### CYLINDER HEAD

#### Removal, checking and refitting

##### Disassembly

With the cylinder head removed from the vehicle, proceed as follows:

Remove the manifolds, the coolant liquid distributor, the spark plugs, the ignition distributor, the inlet and exhaust camshafts and the hydraulic tappets (take care not to mix them up).



##### Note

Never use a magnetized object to remove the half cones as this could impair the proper operation of the hydraulic tappets.

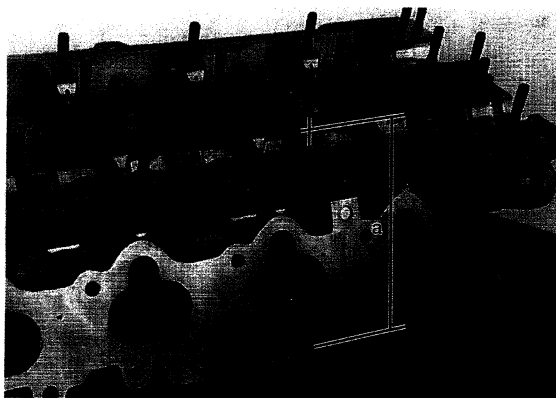
After removing the half cones, remove the spring upper discs and the valve springs.

Remove the valve fixing base **U-30033** and remove the valves through the cylinder head underside.

In order not to interchange parts during the reassembly, place orderly all parts on the base **U-10083**.

##### Checking

##### Cylinder head dimensions after grinding



Measure across fixing bolt housing "a".

Minimum height for grinding should be **118.1 mm**.

Fix the cylinder head on a bench vise using the fixing tool **U-10073/1**; the tool is fixed to the vise through the central rib.

Place the rule **U-30033** on the fixing tool base.

Position the pusher-support of tool **U-10073/1** over the cylinder head; the pusher-support must be positioned so that it operates properly on the upper disc of the valve spring which is to be compressed

Operate the tool until the valve spring is compressed and remove the half cones.

### Checking the distortion



15A053

With cylinder head removed check that maximum warping on cylinder head surface is 0.05 mm.

Use for checking a rule and a feeler gauge.

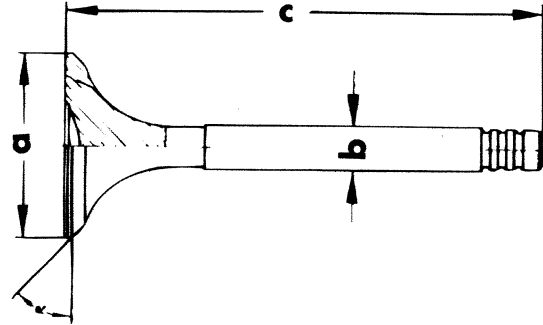
### Reassembly

To refit, carry out the operations described for disassembling reversing the order.

### VALVES

#### Testing and measuring

Valve grinding is not permitted, although polishing is.



15AD04

#### Valve dimensions (mm)

Dimensions (mm)	Intake valve	Exhaust valve
a	Ø 32.00	Ø 27.00
b	Ø 6.97	Ø 6.94
c	95.50	98.00
α	45°	45°

# Engine 15

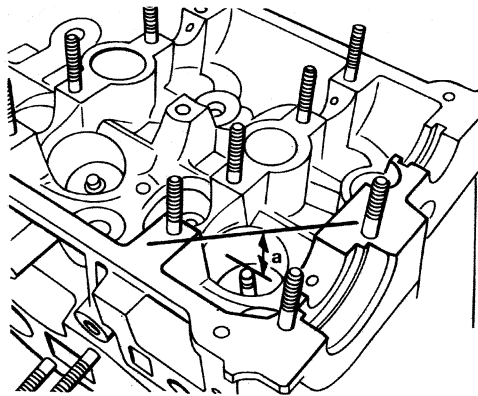
## Cylinder head: valve operation. 2.0 I 16 V engine

### VALVE SEATS Grinding

Grind the valve seats just up to the point a perfect valve contact surface is achieved.

When repairing leaking valves, it is important to check for wear in the valve guides apart from grinding or replacing the valve seats and valves.

Before grinding, the maximum allowable dimension after grinding must be calculated. If this dimensions is exceeded, the proper valve play compensation cannot be guaranteed and the cylinder head must be replaced.



15AD14

To calculate the maximum allowable dimension after grinding, insert the valve and press it firmly against the seat. (If the valves is replaced during the repair work, use a new valve for measuring.)

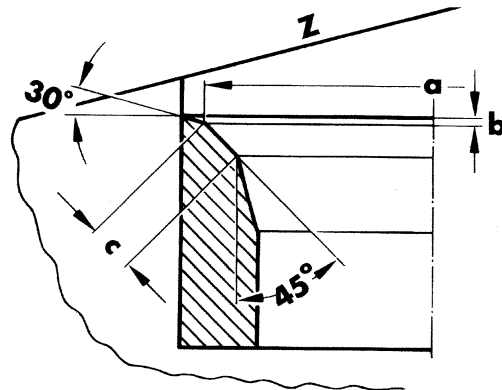
Measure gap "a" between end of stem and top edge of cylinder head.

The maximum allowable dimension after grinding is the result of subtracting to the value "a" the minimum dimension indicated in the following table:

Minimum dimension:

Intake valve .....	<b>34.4 mm.</b>
Exhaust valve .....	<b>34.7 mm.</b>

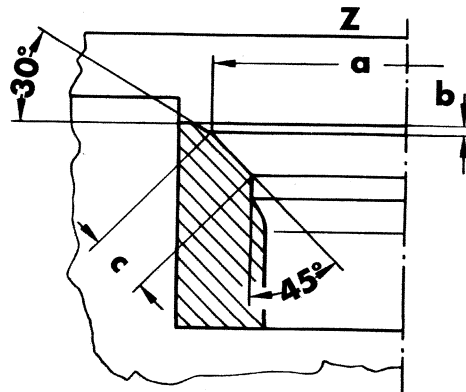
### Intake valve seat grinding



15AD15

- a** = Ø 31.2 mm.
- b** = Maximum allowable dimension after grinding.
- c** = 1.5 ÷ 1.8 mm, if necessary grind valve seat on a correction mill of 75°.
- z** = Lower edge of cylinder head.
- 30°** = Top angle of correction.
- 45°** = Valve seat angle.

### Exhaust valve seat grinding



15AD16

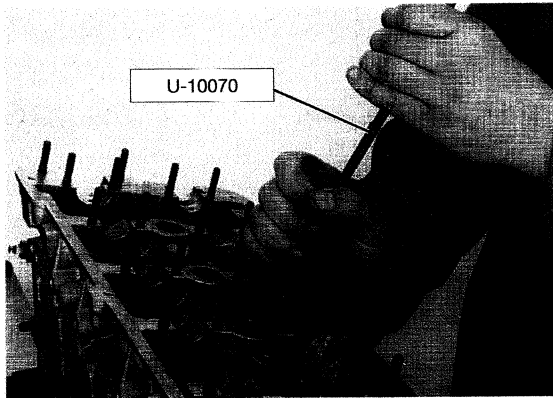
- a** = Ø 26.6 mm.
- b** = Maximum allowable dimension after grinding.
- c** = Approximately 1.8 mm.
- z** = Lower edge of cylinder head.
- 30°** = Top angle of correction.
- 45°** = Valve seat angle.

### VALVE GUIDE OIL SEALS Replacement

Carry out operation with cylinder head removed and fixed to support **U-10073/1** and base **U-30033**.

Remove the camshaft and the tappets.

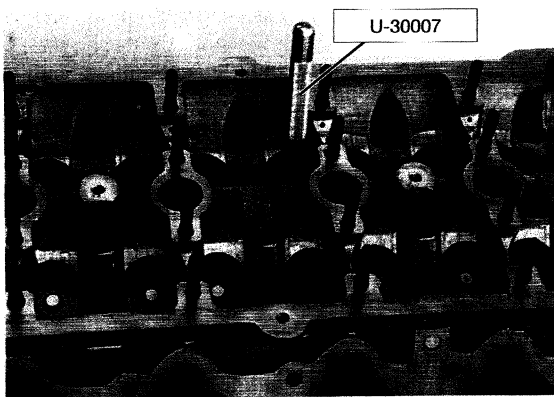
Remove half cones and valve springs with pusher of tool **U-10073/1**.



15A054

Remove the valve guide seal using the tool **U-10070**.

The oil seals are fitted with tool **U-30007** (oil the oil seals before fitting them).



15A055

Position the plastic bushing (supplied with the spare part) and slide the oil seal.

Insert the oil seal into position using tool **U-30007**.

### VALVE GUIDES

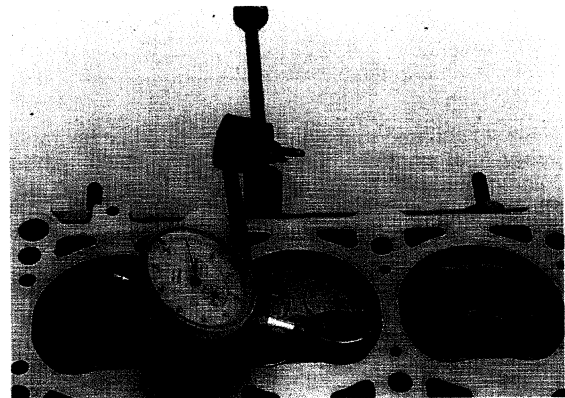
#### Checking the play between valve and guide

When the valve play is to be checked or to determine the faulty parts to be replaced, proceed as follows:

Insert the valve in its guide; the valve stem end must be flush with the guide.

Because the valve stem diameters are different, use the intake valve for the intake guide only and the exhaust valve for the exhaust guide only.

First of all, clean thoroughly the parts to be checked.



15A056

Measure the play using a dial gauge.

The maximum allowable wear is:

Intake valve guides ..... **1.0 mm.**  
Exhaust valve guides ..... **1.3 mm.**

If the values measured are greater than the above values, replace the valve guides.

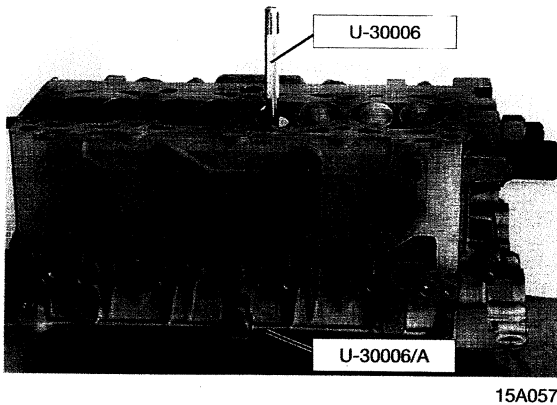
#### Valve guide replacement

Before carrying out the operation, take into account that the cylinder heads with valve seats not allowing additional grinding or the cylinder heads already grinded up to the allowable limit, are not suitable to replace the valve guides.

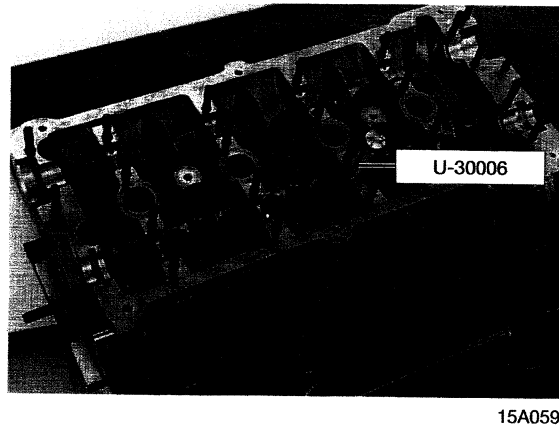
# Engine 15

## Cylinder head: valve operation. 2.0 I 16 V engine

### Disassembly



Remove valve guides with tool **U-30006** in a hydraulic press from combustion chamber side. Rest cylinder head on base **U-30006/A**.



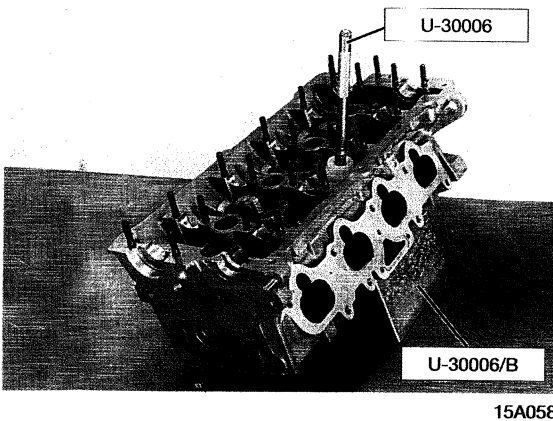
#### ● Exhaust valves:

Insert new guides with tool **U-30006** to flange in a hydraulic press from camshaft side.

Position plastic sliding bushing guide to carry out this operation.

### Reassembly

Oil new guides before refitting.



#### ● Intake valves:

Insert new guides with tool **U-30006** to flange in a hydraulic press from camshaft side.

Place cylinder head beforehand on base **U-30006/B** and work at right angles to guide. To carry out this operation it is necessary to position plastic centerer of tool.

#### Note

Once valve guide flange is in position, do not increase clamp pressure to more than 1 ton as this may break the flange.

- Ream by hand the valve guides, making sure to use water soluble cooling oil.
- Grind the valve seats.
- Polish the valves if they are not to be replaced.

### LUBRICATION SYSTEM: EXPLODED VIEW

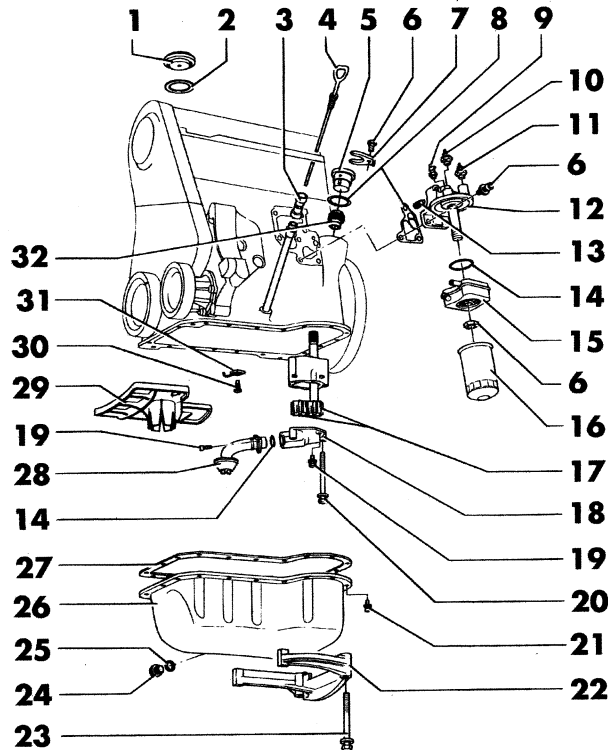
All components can be removed and refitted the engine fitted into the vehicle.

Replace all O-rings.

The oil level must never exceed the mark "MAX" on the dipstick as this could lead to damages to the catalyst.

If, when repairing the engine, metal chips are noticed, the oil cooler should be replaced and the lubrication system conduits thoroughly cleaned to prevent further damage.

The oil pump cannot be repaired; it must be replaced completely.



17BD09

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| <p><b>1. Plug.</b></p> <p><b>2. Gasket.</b> Replace if damaged.</p> <p><b>3. Nozzle.</b> Withdraw to suck the oil.</p> <p><b>4. Dipstick.</b><br/>The oil level must not exceed the "MAX" mark.</p> <p><b>5. Closing cover.</b><br/>With free play compensation.</p> <p><b>6. 25 Nm.</b></p> <p><b>7. Attachment flanges.</b></p> <p><b>8. Gasket.</b> Replace.</p> <p><b>9. Oil temperature transmitter. 10 Nm.</b><br/>For oil temperature indicator.</p> <p><b>10. Oil pressure switch, 1.8 bar. 25 Nm.</b><br/>White.<br/>Check with the equipment VAG 1342.<br/>The original gasket cannot be removed for later reuse.<br/>In case of leaks, break the gasket down and fit a new one.</p> | <p><b>11. Oil-pressure indicating pressure gauge. 25 Nm.</b><br/>Check.<br/>Incorporates a 0.3 bar oil-pressure break switch inside.<br/>The original gasket cannot be removed for later reuse.<br/>In case of leaks, break the gasket down and fit a new one.</p> <p><b>12. Oil filter support.</b></p> <p><b>13. Non-return valve. 5 Nm.</b></p> <p><b>14. Gasket.</b> Replace.</p> <p><b>15. Oil cooler.</b><br/>Note the position, relatively far from any other component.</p> <p><b>16. Oil filter.</b><br/>Remove using the U-40078 tool or with a universal filter extractor.<br/>Tighten by hand.</p> |
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# Engine 17

## Lubrication: 2.0 I 16 V engine

### LUBRICATION SYSTEM: EXPLODED VIEW

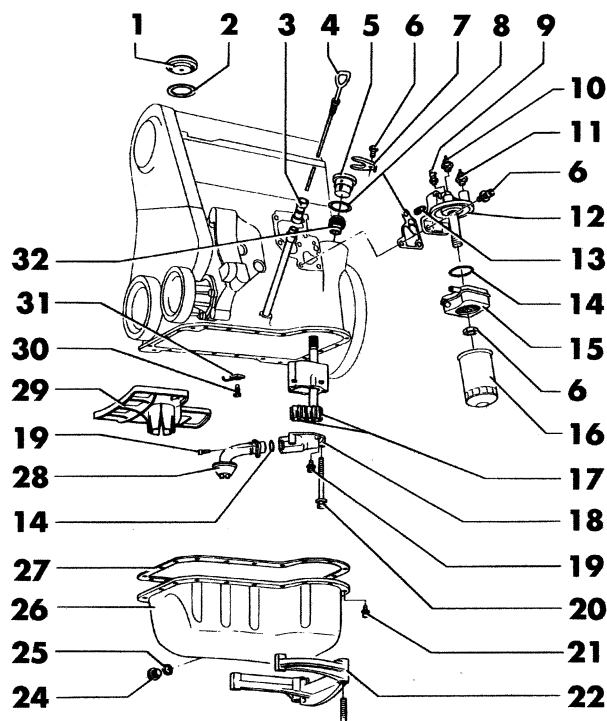
All components can be removed and refitted the engine fitted into the vehicle.

Replace all O-rings.

The oil level must never exceed the mark "MAX" on the dipstick as this could damage the catalyst.

If, when repairing the engine, metal chips are noticed, the oil cooler should be replaced and the lubrication system conduits thoroughly cleaned to prevent further damage.

The oil pump cannot be repaired; it must be replaced completely.



17BD09

- |  |   |
|--|---|
| <p><b>17. Oil pump gears.</b><br/>Check the backlash and the axial play.</p> <p><b>18. Oil pump cover.</b><br/>The pressure regulating valve is built in the cover.<br/>Valve opening pressure: 5.7 ÷ 6.7 bar.</p> <p><b>19. Fixing bolt. 10 Nm.</b></p> <p><b>20. Fixing bolt. 20 Nm.</b></p> <p><b>21. Oil sump fixing bolt. 20 Nm.</b><br/>Use the following tool to remove the bolts on the steering wheel side of the engine:<br/>Allen head bolt: <b>U-40051</b>.<br/>Torx bolts: <b>U-40051/1</b>.<br/>Hex head bolt: <b>U-40051/2</b>.</p> <p><b>22. Support</b> (according to the version).</p> <p><b>23. Fixing bolt. 45 Nm.</b></p> | <p><b>24. Oil drain plug. 30 Nm.</b></p> <p><b>25. Gasket. Replace.</b></p> <p><b>26. Oil sump.</b></p> <p><b>27. Oil sump gasket.</b><br/>Replace.<br/>Note the proper mounting position.</p> <p><b>28. Suction pipe.</b><br/>Clean the grill if it is dirty.</p> <p><b>29. Anti-splash plate.</b><br/>Fit with the oil pump disassembled only.</p> <p><b>30. Oil injector pressure valve. 27 Nm.</b><br/>Valve opening pressure: 2.5 ÷ 3.2 bar.</p> <p><b>31. Oil injector for piston cooling.</b></p> <p><b>32. Oil pump drive pinion.</b></p> |
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# Engine 17

## Lubrication: 2.0 I 16 V engine

### ENGINE OIL SPECIFICATIONS

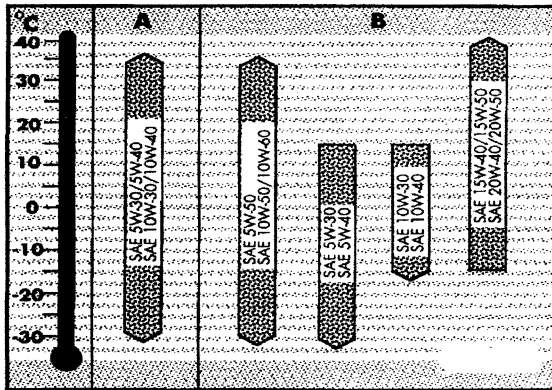
Only use the oil classes listed below:

- Multigrade oils according to the **VW 501 01** standard.
- High performance oils (synthetic multi-grade) as per **VW 500 00** standard.

In exceptional cases only:

- Multigrade oils according to **API-SF** or **SG**.

### Temperature range



17BD10

- A** = Synthetic multigrade oils.
- B** = Multigrade oils.

### Lubrication system: capacity

- When the oil filter is changed ..... 4.0 l.
- When the oil filter is not changed ..... 3.5 l.

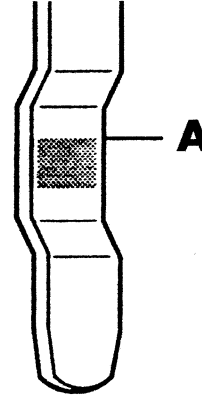
### Checking the oil level

The following operations must be carried out to check the oil level:

The vehicle must be on a horizontal surface.

If the engine has been running, it is necessary to wait a few minutes (minimum 3 minutes) so that the oil drains into the sump.

Remove the dip stick, clean it and reinsert it fully.



17AD08

Remove the dip stick and check the level:

The oil level must be within the area marked on the dip stick; it must never exceed the upper mark "A" as this could damage the catalytic converter.

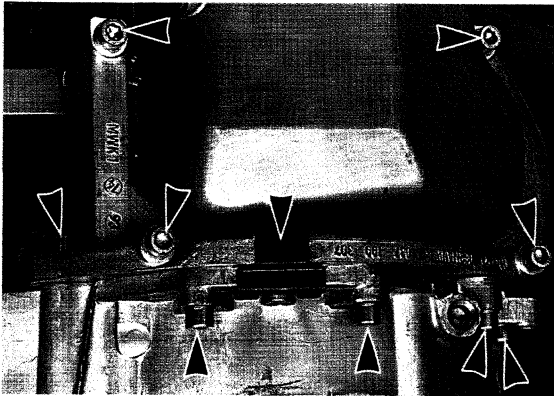
# Engine 17

## Lubrication: 2.0 I 16 V engine

### OIL PUMP Removal and refitting

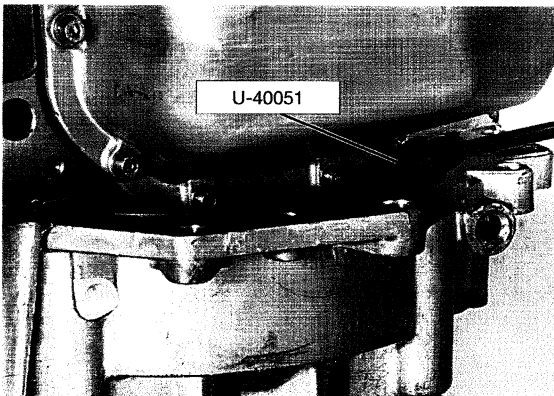
#### Removal

Raise the vehicle.  
Drain the oil sump.



17A021

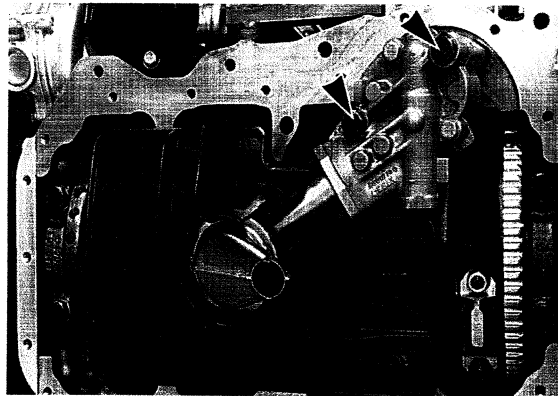
Remove the inertia flywheel cover by removing the bolts fixing it to the engine block and gearbox.



17A022

Remove the oil sump fixing bolts. Use the corresponding spanner to loosen the fixing bolts on the steering wheel side of the engine if necessary:

Allen head bolt: **U-40051**.  
Torx bolts: **U-40051/1**.  
Hex head bolt: **U-40051/2**.



17A023

Remove the bolts fixing the oil pump and remove the pump together with the suction tube.

#### Note

The oil pump assembly cannot be repaired; in the case of a fault, it must be replaced completely.

#### Refitting

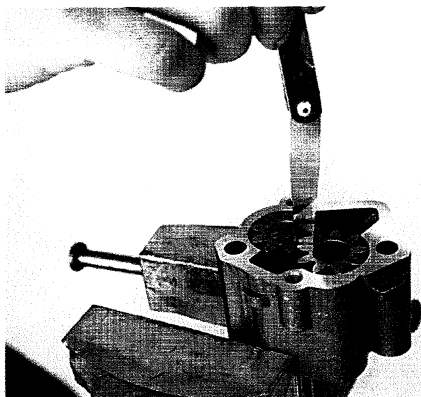
To refit, reverse the above operations taking the following into account:

Replace the oil sump gasket.

Refill the lubrication system with oil.

**BACKLASH**  
**Checking**

To check the oil pump backlash, the oil pump must be removed from the engine.



17A003

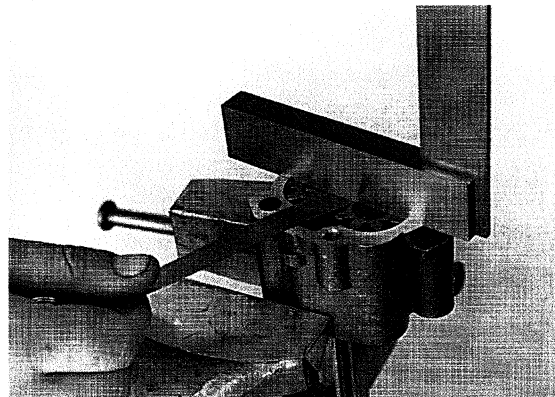
Remove the bolts fixing the pump cover to the pump housing.

Check the gear backlash using a feeler gauge:

New pump ..... **0.05 mm.**  
Maximum allowable wear ..... **0.20 mm.**

**AXIAL PLAY**  
**Checking**

To check the oil pump axial play, the pump must be removed from the engine.



17A004

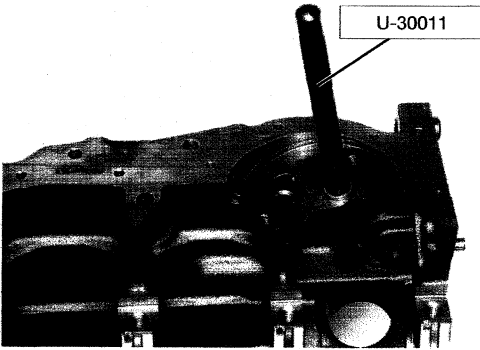
Remove the bolts fixing the pump cover to the pump housing.

Check the axial play using a feeler gauge and a precision rule.

Check that the axial play does not exceed **0.15 mm.**

### OIL PUMP DRIVE SHAFT BUSHINGS Replacement

(It is not necessary to remove the crankshaft in order to carry out this operation; it is shown removed in the photograph for better visibility.)



17A024

Remove and refit the oil pump shaft bushings which are located in the cylinder block, using tool **U-30011**.

The oil pump side bushing is removed from the oil pump side.

The intermediate shaft side bushing is removed through the upper part.

When refitting, make sure that the lubrication holes in the bushings match the holes in the cylinder block.

### OIL COOLER Replacement

Coolant flows through the oil cooler and maintains the oil temperature within the specified limits.

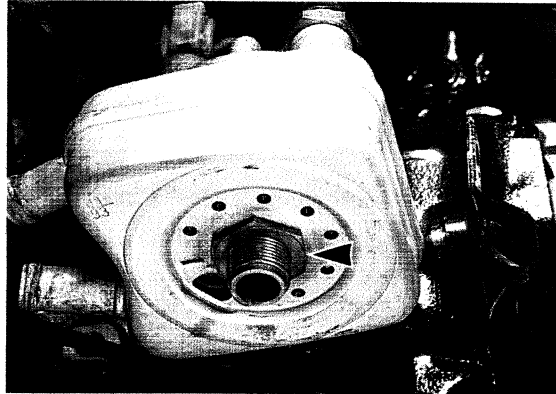
The oil cooler is attached to the oil filter support.

If metal chips are noticed in the engine oil, the oil cooler should be replaced.

To replace the oil cooler, carry out the following operations:

Remove the oil filter with the **U-40078** tool or an universal filter extractor.

Remove the oil cooler, the two coolant liquid hoses (to avoid draining the liquid, it is recommended that the hoses be clamped with the **U-30042** tool).



17A025

Remove the oil cooler fixing nut and remove the oil cooler.

To refit the oil cooler, reverse the above operations taking the following into account:

Apply a proper sealant to the areas in contact with the filter support, to the gasket outside.

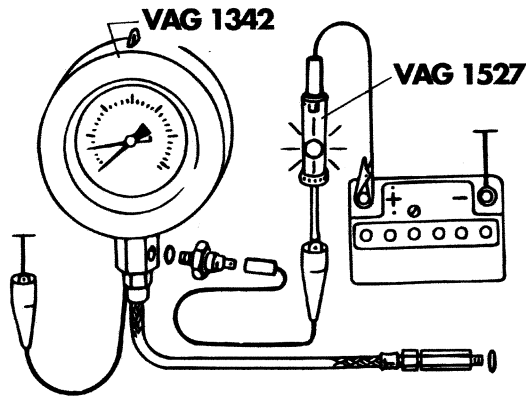
Check the cooling liquid level.

Refill the lubrication system with oil.

### OIL PRESSURE SWITCH Checking

In order to check the 1.8 bar switch, it is necessary to use checking apparatus **VAG 1342**, following the steps indicated below:

To make the connections, the measurement cable auxiliary kit **VAG 1594** may be used.



17AD03

Remove the 1.8 bar switch (white insulation) and screw it in the checking equipment.

Screw the adaptor pipe in the 1.8 bar switch housing to apply pressure to the equipment.

Connect to ground the checking equipment brown cable.

Connect diode lamp **VAG 1527** from the positive terminal on the battery to the 1.8 bar pressure switch terminal (white insulation), the diode should not light up.

Start up the engine and slowly increase the speed.

When the checking equipment **VAG 1342** shows a reading between **1.6** and **2.0 bar**, the LED lamp must turn on; otherwise, replace the 1.8 bar switch.

### ENGINE OIL PRESSURE Checking

The test equipment **VAG 1342** must be used to check the pressure and the following operations are required:

Remove the **1.8 bar** switch (white insulation) and screw it in the checking equipment.

Screw the adaptor pipe in the **1.8 bar** switch housing to apply pressure to the equipment.

Start up the engine and increase the speed; at 2000 rpm and with the oil at 80 °C, the oil pressure must be **2.0 bar** minimum.

When increasing the speed, the oil pressure must not exceed **7.0 bar**; otherwise, replace the oil pump cover with the pressure regulating valve.

### OIL FILTER Replacement

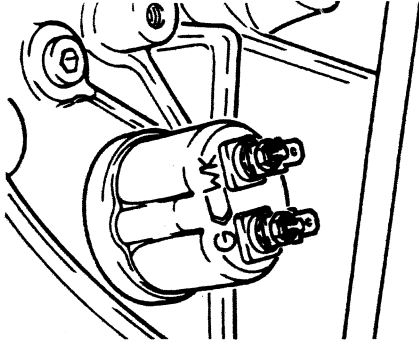
Remove using the **U-40078** tool or a universal filter extractor.

For refitting, note the instructions on the filter.

Tighten the filter by hand.

**OIL-PRESSURE GAUGE**  
**Checking**

In order to carry out this check, the oil level must be in order and the oil temperature must be at least 80 °C.



17BD14

Disconnect **contact** cable **G** from the pressure gauge and connect digital multimeter **VAG 1526** from **contact G** on the pressure gauge to the engine ground.

To make the connections, the measurement cable auxiliary kit **VAG 1594** may be used.

Select measuring range **200 Ω** on the multimeter **VAG 1526**, with the ignition off it should read from **5 to 13 Ω**.

Start the engine and gradually increase the revolutions. The resistance should go up to a **maximum of 210 Ω**.

Next, disconnect **contact** cable **WK** from the pressure gauge and connect digital multimeter **VAG 1526** from **contact WK** on the pressure gauge to the engine ground.

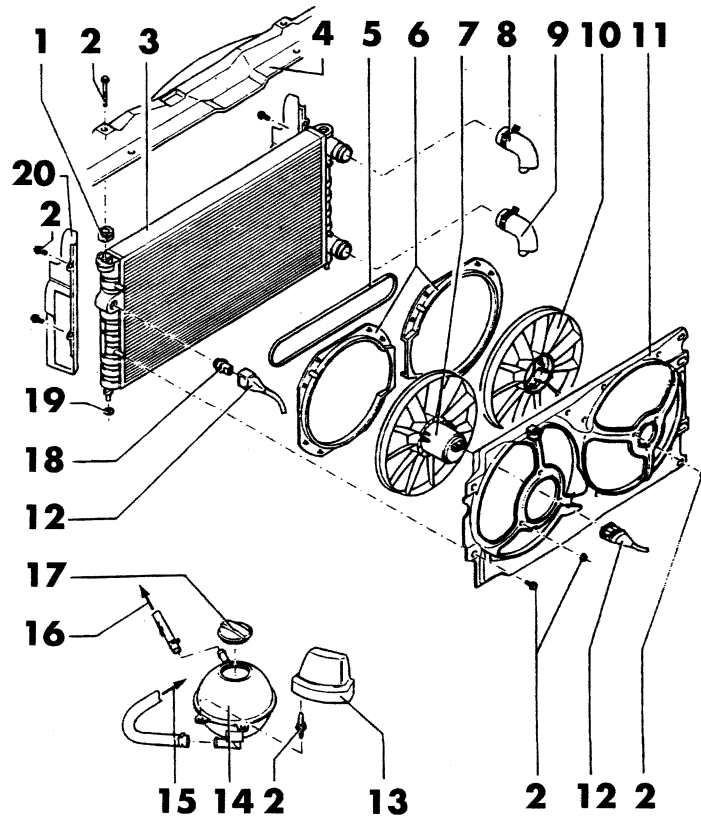
With the engine ticking over the value obtained should be  $\infty \Omega$ .

Following this, turn off the ignition, the value should read from **0 to 0.5 Ω**.

If the values indicated above are not reached, replace the pressure gauge.

## COOLING SYSTEM: EXPLODED VIEW

In case of repair, the steel strip clamps may be replaced with bolt clamps.  
For fitting the steel strip clamps, the tool **U-10095** is recommended.  
Replace gaskets and O-rings.

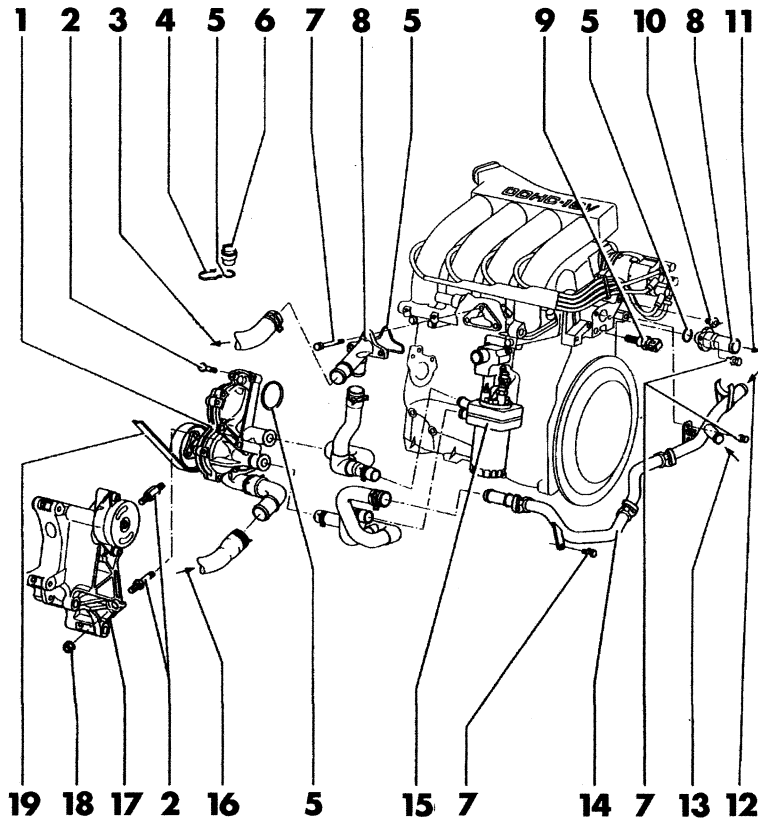


19BD17

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| <p><b>1. Fixing block.</b></p> <p><b>2. 10 Nm.</b></p> <p><b>3. Radiator.</b><br/>Removal and replacement.</p> <p><b>4. Lock holder crossmember.</b></p> <p><b>5. V belt.</b><br/>According to model.</p> <p><b>6. Fan ring.</b><br/>Note the mounting position.</p> <p><b>7. Fan.</b></p> <p><b>8. Upper hose.</b><br/>To the cooling liquid distributor.</p> <p><b>9. Lower hose.</b><br/>o the cooling liquid pump.</p> <p><b>10. Additional fan.</b><br/>According to model.</p> | <p><b>11. Fan baffle.</b></p> <p><b>12. Connector.</b></p> <p><b>13. Cover.</b></p> <p><b>14. Expansion tank.</b><br/>Check watertightness with the equipment <b>VAG 1274</b> and the adaptor <b>VAG 1274/3</b>.</p> <p><b>15. To the cooling liquid pipe.</b></p> <p><b>16. To the radiator upper hose.</b></p> <p><b>17. Expansion tank cap.</b><br/>Check the valve using the equipment <b>VAG 1274</b> and the adaptor <b>VAG 1274/4</b>.</p> <p><b>18. Fan control thermostat. 35 Nm.</b><br/>Check.</p> <p><b>19. Rubber gasket.</b></p> <p><b>20. Fan.</b></p> |
|--|---|

## COOLING SYSTEM: EXPLODED VIEW

In case of repair, the steel strip clamps may be replaced with bolt clamps.  
For fitting the steel strip clamps, the tool **U-10095** is recommended.  
Replace gaskets and O-rings.

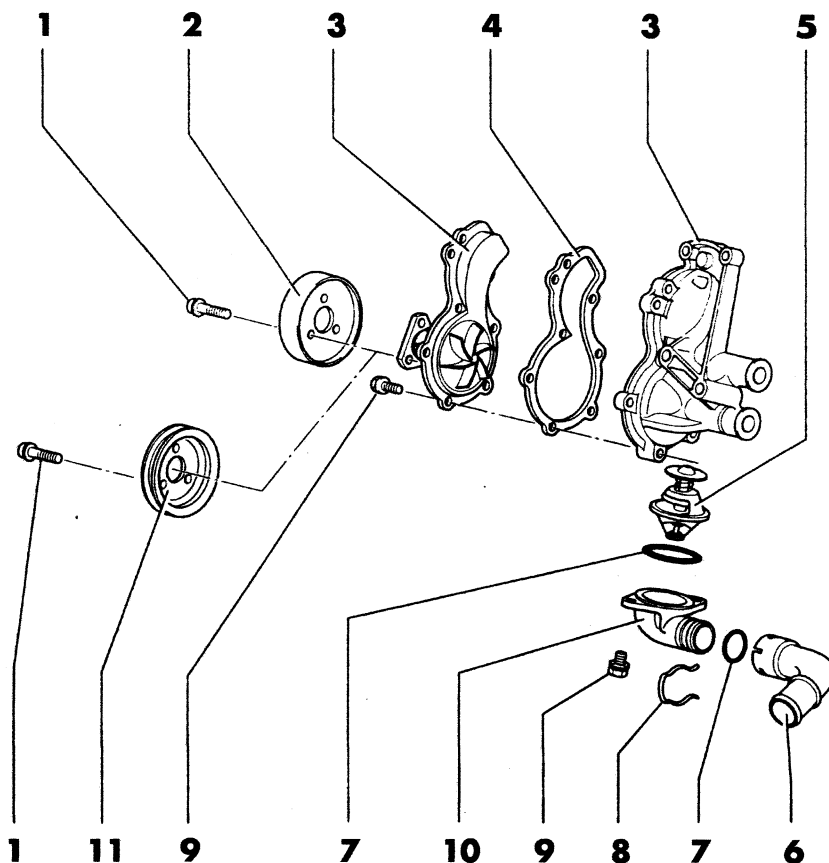


19AD12

- |  |  |
|--|--|
| <p><b>1. Cooling liquid pump.</b><br/>Check that the operation is smooth.<br/>Cannot be repaired.</p> <p><b>2. 20 Nm + 90°.</b><br/>Replace.</p> <p><b>3. To the radiator upper hose.</b></p> <p><b>4. Fixing clamp.</b></p> <p><b>5. O-ring.</b><br/>Replace.</p> <p><b>6. Thermo-switch for controlling third speed of electric fan.</b><br/>Models with air conditioning only.<br/>The thermal switch is located in the coolant distributor (pos. 8).</p> | <p><b>7. 10 Nm.</b></p> <p><b>8. Cooling liquid distributor.</b></p> <p><b>9. Cooling liquid temperature transmitter. 10 Nm.</b></p> <p><b>10. Transmitter for coolant liquid temperature gauge. 10 Nm.</b></p> <p><b>11. To the heater.</b></p> <p><b>12. To the heater.</b></p> <p><b>13. To the expansion tank.</b></p> <p><b>14. Cooling liquid pipe.</b></p> <p><b>15. Oil cooler.</b></p> <p><b>16. To the radiator lower hose.</b></p> <p><b>17. Support.</b></p> <p><b>18. 30 Nm.</b></p> <p><b>19. Trapezoid and Poly-V belt.</b></p> |
|--|--|

## COOLING SYSTEM PUMP: EXPLODED VIEW

In case of repair, the steel strip clamps may be replaced with bolt clamps.  
For fitting the steel strip clamps, the tool **U-10095** is recommended.  
Replace gaskets and O-rings.



19BD11

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1. 20 Nm.</li> <li>2. <b>Cooling liquid pump pulley.</b><br/>Version with Poly-V belt.</li> <li>3. <b>Cooling liquid pump.</b><br/>Check that the operation is smooth.<br/>Cannot be repaired.</li> <li>4. <b>Gasket.</b><br/>Replace.</li> <li>5. <b>Thermostat.</b><br/>Check.</li> </ul> | <ul style="list-style-type: none"> <li>6. <b>Cooling liquid hose.</b></li> <li>7. <b>O-ring.</b><br/>Replace.</li> <li>8. <b>Fixing clamp.</b></li> <li>9. 10 Nm.</li> <li>10. <b>Thermostat cover.</b></li> <li>11. <b>Cooling liquid pump pulley.</b><br/>Models with trapezoidal belt.</li> </ul> |
|--|--|

### COOLING LIQUID

#### Draining and refilling

The cooling system is supplied with a mixture of water and the anti-freeze and rustproof product **G11** or **G12**.

This product, along with the anti-freeze additives with the indication:

- “according to **TL-VW 774 B**” in the case of the **G11**.
- “according to **TL-VW 774 D**” in the case of the **G12**.

#### Note

Bear in mind the indications in the section “operations to be performed depending on the type of vehicle-equipped anti-freeze additive” (see table of contents).

The above additives prevent deterioration due to freezing, rust or lime sediments, as well as raising the boiling temperature of the coolant.

Because of that, the cooling system must at all moments be filled with the specified mixture of anti-freezing and anti-rust compound.

In particular, in tropical climate countries, the anti-freezing compound, because of the high boiling point it gives to the mixture, helps to guarantee a reliable operation when the engine is under high loads.

#### Recommended mixture ratio

Cover	Anti-freeze additive	Water
- 25 °C	40 %	60 %
- 35 °C	50 %	50 %

The refilling amount for the cooling system is 5.5 l approximately, but may vary according to the car equipment.

The antifreezing ratio must not exceed 60 %, higher ratios result in a decrease in the cooling power and anti-freeze protection.

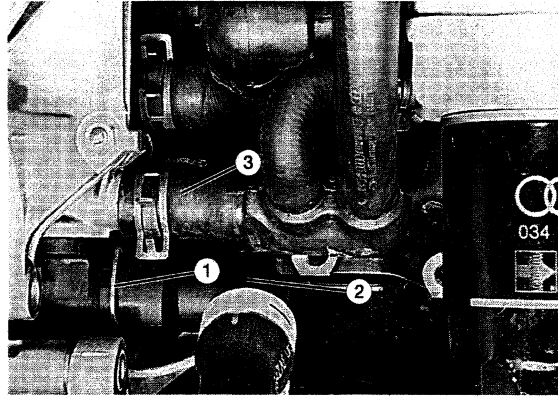
The cooling liquid must be changed whenever the cylinder head, cylinder head gasket, radiator or the complete engine are replaced.

#### Note

The cooling system is under pressure when the engine is hot. Before attempting any repair to the system, let the pressure to come down.

#### Draining

Remove the expansion tank cap.



19B020

Drain the coolant liquid by removing the safety clip “1”, removing the hose “2” and the flexible tube “3”; use the **U-10095** tool to remove the clips. (Raise the vehicle and separate the lower engine unit if necessary.)

#### Refilling

Slowly fill the cooling system with coolant liquid up to the “MAX” mark on the expansion reservoir.

Run the engine for 2 minutes at about 1500 rpm, while adding coolant liquid until the level reaches the overflow hole in the expansion reservoir.

Mount the cap and start up the engine, keeping it running until the radiator fan is started.

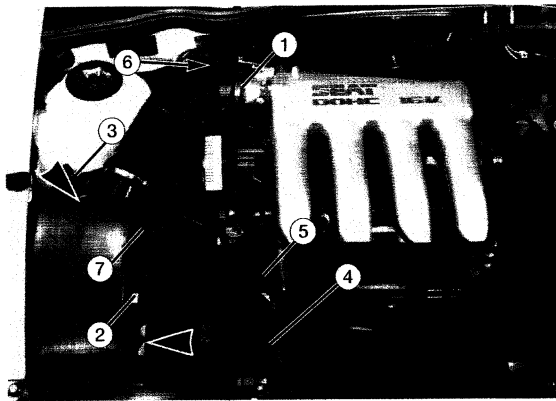
Check the coolant liquid level and top up if necessary once the pressure has dropped.

With the engine at the working temperature, the liquid level must be slightly above the mark “MAX”.

When the engine is cold, the liquid level must be between the marks “MIN” and “MAX”.

### COOLING LIQUID PUMP Removal and refitting

#### Removal

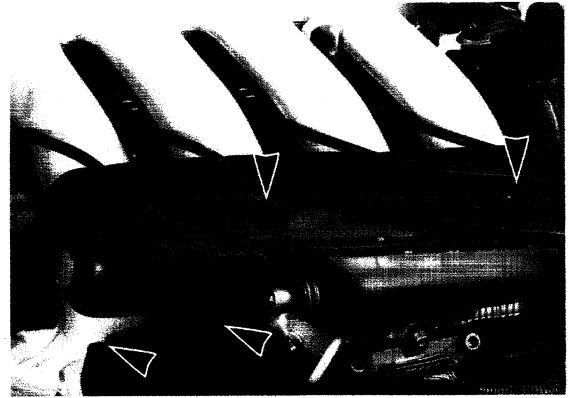


10B113

Remove the following items from the air filter/inlet tube assembly:

1. Junction clip between inlet tube and inlet manifold.
2. Suction take-off from its fixing to the inlet air thermo-regulator.
3. Inlet air temperature transmitter connector.
4. Sump gasses ventilation tube from its fixing to the pressure regulating valve.
5. Idling stabilizer valve tube from its fixing to the valve.
6. Hot air tube from its fixing to the exhaust manifold heat shield.
7. Tube for inlet air silencer from its fixture to the air filter set.

Remove the O-rings which connect the air filter assembly to the bodywork and remove the filter.



19B032

Remove the spark plug cable cover fixing bolts and partially remove the cover until the pressure regulating valve bolts can be removed. Move the valve to one side without disconnecting the sump gasses outlet tube.



10B005

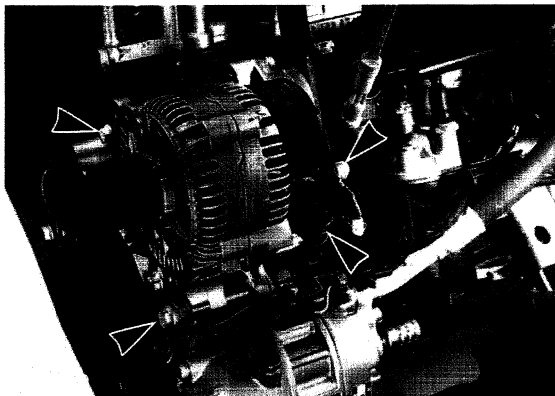
Separate belt Poly-V using the corresponding tool:

- Models with tensioning roller ..... **U-40010**.
- Models without tensioning roller ..... **U-40050**.

Mark the direction of rotation on the belt, before removing it; the mark must be taken into account when refitting.

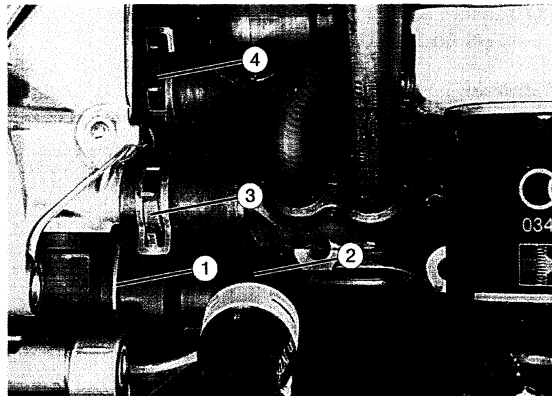
# Engine 19

## Cooling: 2.0 I 16 V engine



10B006

Remove the bolts fixing the alternator to the support. Partially detach the alternator; to do this, disconnecting the electrical cables is not required.

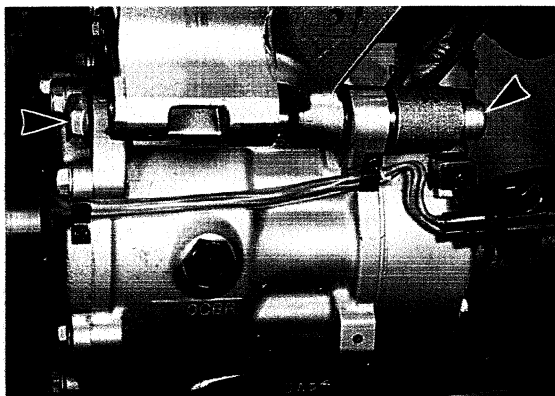


19B024

Remove the expansion tank cap.

Raise the vehicle and drain the coolant liquid by removing the safety clip "1" and the hose "2", then remove the flexible tubes "3" and "4", using the **U-10095** tool to remove the clips.

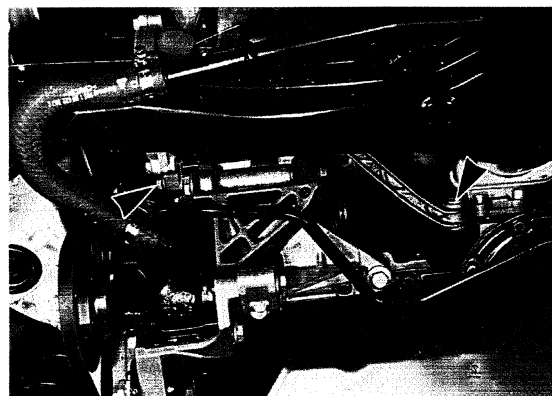
Separate lower protector from the propulsion engine set if necessary.



19B023

(Versions fitted with air conditioning.)

Remove the bolts which hold the air conditioning compressor to the brackets.



19B025

(Versions fitted with air conditioning.)

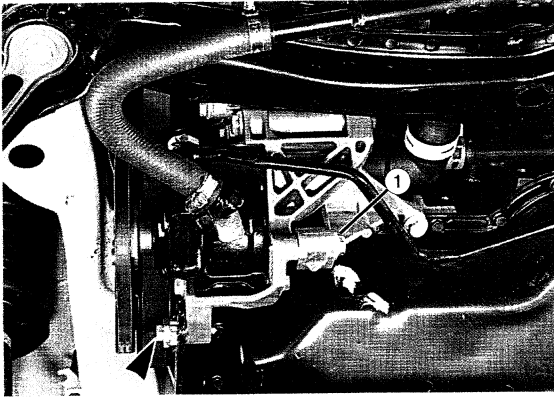
Remove the bolts fixing the air conditioning compressor to the support and partially detach the compressor without stressing the pipes.

### Note

Opening the air conditioning system is not required.

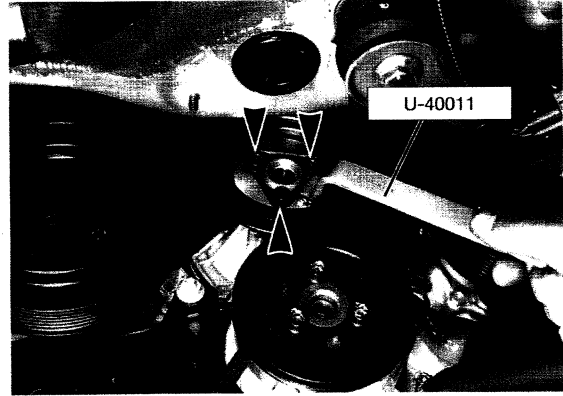
# Engine 19

## Cooling: 2.0 l 16 V engine



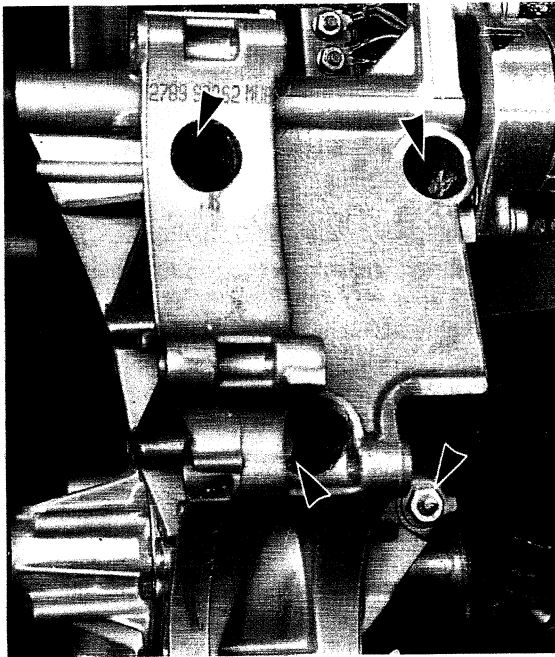
48B016

Raise the vehicle and remove the power steering drive belt. To do this, the fixing bolt "1" and the tensioning nut bolt must be loosened.



19B028

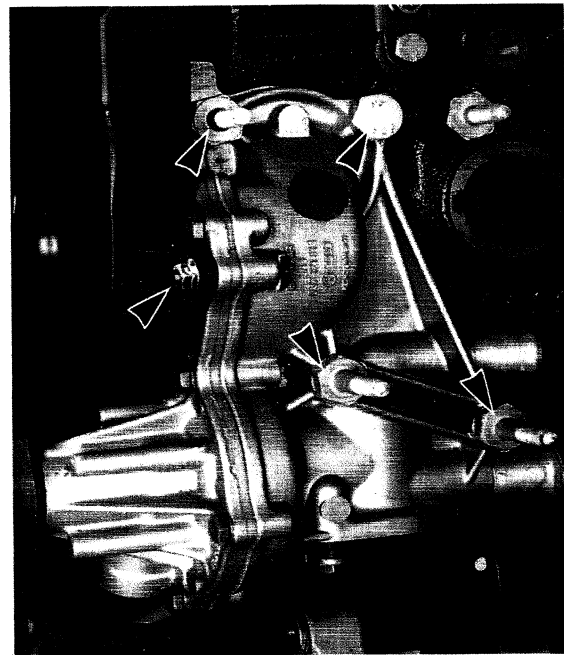
Only when the pump is to be replaced, remove the pulley mounted on the engine using the U-40011 tool.



19B001

Remove the support fixing bolts and nuts and remove the support.

(A bolt on the underside of the bracket must be removed; this is not shown in the photograph.)

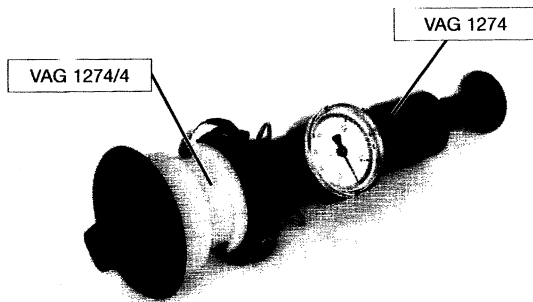


19B002

Remove the threaded studs for fixing the pump to the cylinder block and the hammer head bolt fixing the pump to the guard.

Remove the cooling liquid pump.

**EXPANSION TANK CAP**  
**Checking**



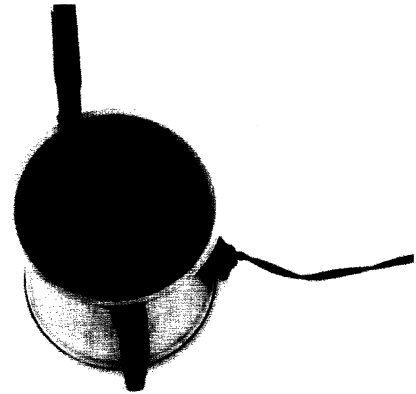
19A006

Place the cap on the equipment **VAG 1274** using the adaptor **VAG 1274/4** and operate the equipment manual pump until the pressure reaches **1.4 ÷ 1.6 bar**.

When the pressure reaches the above value, the cap safety valve must open.

Otherwise, replace the cap.

**THERMOSTAT**  
**Checking**



19A007

Heat the thermostat by dipping it into a container with hot cooling liquid and control the water temperature with a thermometer.

The valve must start opening when the temperature is about **85 °C**.

Continue heating the liquid and check that the valve is fully open (minimum stroke **7 mm**) when the liquid temperature is about **105 °C**.

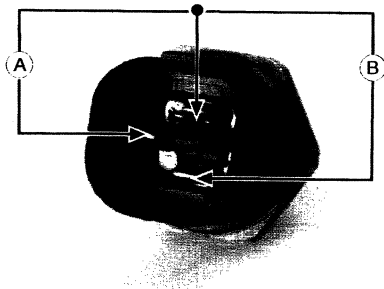
The thermostat is located at the bottom of the cooling liquid pump.

### FAN CONTROL THERMOSWITCH Checking

Dip the thermoswitch heat sensitive area in a container with cooling liquid.

Heat the cooling liquid and, using a thermometer, check the cut-in/cut-off temperatures for the electrical fan 1st and 2nd speeds.

This checking may be carried out using the digital tester **VAG 1526** (continuity checking model) and the auxiliary cables **VAG 1594 A**.



19D006

Connect the tester to the contacts marked "A" on the drawing (1st speed) and check that when the temperature reaches  $92 \div 97 \text{ }^\circ\text{C}$ , the circuit closes and when the temperature comes down below  $91 \div 84 \text{ }^\circ\text{C}$ , the circuit opens again.

Then connect the tester to the contacts marked "B" on the drawing (2nd speed) and check that when the temperature reaches  $99 \div 105 \text{ }^\circ\text{C}$ , the circuit closes and when the temperature comes down below  $98 \div 91 \text{ }^\circ\text{C}$ , the circuit opens again.

Otherwise, replace the thermoswitch.

### ELECTRIC FAN 3rd SPEED THERMAL CONTROL SWITCH Checking

(Models with air conditioning only)

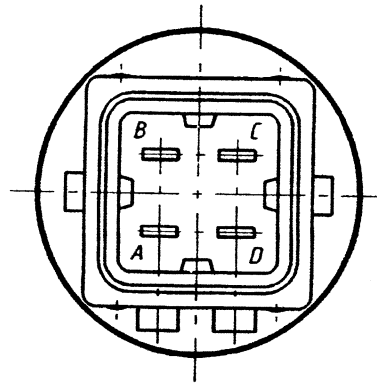
The thermal switch controlling the third speed of the electric fan is located in the cylinder head coolant distributor tube.

Remove the thermal switch from the vehicle.

Dip the thermoswitch heat sensitive area in a container with cooling liquid.

Heat the cooling liquid and, using a thermometer, check the cut-in/cut-off temperatures for the electrical fan 3rd speed.

This checking may be carried out using the digital tester **VAG 1526** (continuity checking model) and the auxiliary cables **VAG 1594 A**.



19AD11

Connect a multi-meter between contacts "A" and "C" and check that when a temperature of  $110 \div 115 \text{ }^\circ\text{C}$  is reached the circuit closes (switches on) and when the temperature drops below  $105 \div 110 \text{ }^\circ\text{C}$  the circuit re-opens (switches off).

Otherwise, replace the thermoswitch.

### ELECTRICAL FAN-RADIATOR ASSEMBLY Removal and refitting

#### Removal (versions without air conditioning)

To remove the electrical fan-radiator assembly, the following is required:

- Disconnect the battery negative lead.
- Remove the cooling liquid tank cap.
- Partially remove the cover from the spark plug cable and the sump gases pressure regulating valve (it is not necessary to remove the gases vent tube).
- Disconnect the hoses from the radiator. (Raise the vehicle and separate the lower guard from the motor-propulsion assembly if necessary.)
- Remove the bolts fixing the fan baffle to the radiator and remove the baffle together with the fan.
- Loosen the two radiator fixing bolts on the lock holding crossmember.
- Remove the radiator from the vehicle.

#### Refitting

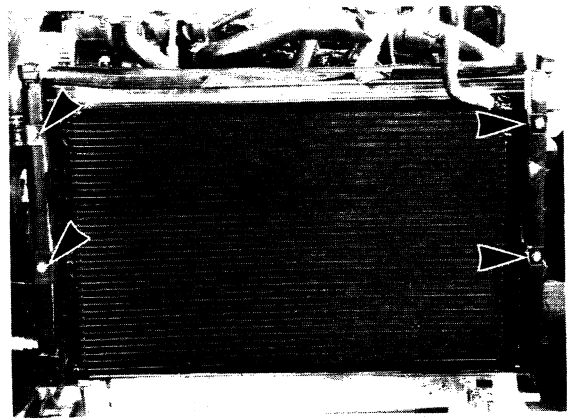
To reassemble, reverse the above operations taking the following into account:

Refill the cooling system with cooling liquid. Bear in mind the indications in the section "**operations to be performed depending on the type of vehicle-equipped anti-freeze additive**".

#### Removal (versions with air conditioning)

To remove the electrical fan-radiator assembly, the following is required:

- Disconnect the battery negative lead.
- Remove the cooling liquid tank cap.
- Disconnect the hoses from the radiator. (Raise the vehicle and separate the lower guard from the motor-propulsion assembly if necessary.)
- Remove the front panel as described in the Repair Group 51.



10B116

Remove electrical connections from the electrical fan-radiator assembly.

Detach the radiator from the condenser and remove the electrical fan-radiator assembly from the vehicle.

After removing the radiator, fix the condenser without stressing or bending the air conditioning system pipes.

#### Refitting

To reassemble, reverse the above operations taking the following into account:

Refill the cooling system with cooling liquid. Bear in mind the indications in the section "**operations to be performed depending on the type of vehicle-equipped anti-freeze additive**".

Check and, if necessary, adjust the headlamp alignment.

**ELECTRICAL FAN-RADIATOR ASSEMBLY**  
**Removal and refitting**

**Removal** (versions without air conditioning)

To remove the electrical fan-radiator assembly, the following is required:

- Disconnect the battery negative lead.
- Remove the cooling liquid tank cap.
- Partially remove the cover from the spark plug cable and the sump gases pressure regulating valve (it is not necessary to remove the gases vent tube).
- Disconnect the hoses from the radiator. (Raise the vehicle and separate the lower guard from the motor-propulsion assembly if necessary.)
- Remove the bolts fixing the fan baffle to the radiator and remove the baffle together with the fan.
- Loosen the two radiator fixing bolts on the lock holding crossmember.
- Remove the radiator from the vehicle.

**Refitting**

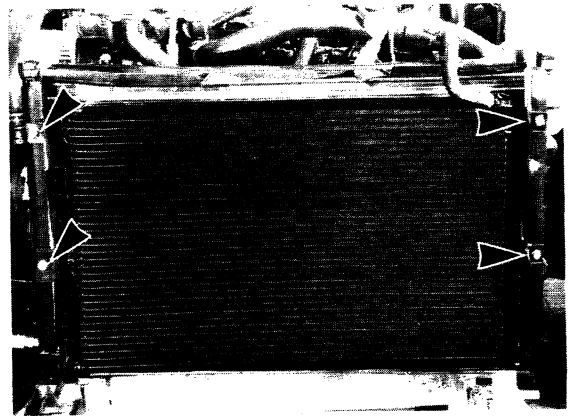
To reassemble, reverse the above operations taking the following into account:

Refill the cooling system with cooling liquid. Bear in mind the indications in the section **"operations to be performed depending on the type of vehicle-equipped anti-freeze additive"**.

**Removal** (versions with air conditioning)

To remove the electrical fan-radiator assembly, the following is required:

- Disconnect the battery negative lead.
- Remove the cooling liquid tank cap.
- Disconnect the hoses from the radiator. (Raise the vehicle and separate the lower guard from the motor-propulsion assembly if necessary.)
- Remove the front panel as described in the Repair Group 51.



10B116

Remove electrical connections from the electrical fan-radiator assembly.

Detach the radiator from the condenser and remove the electrical fan-radiator assembly from the vehicle.

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**Refitting**

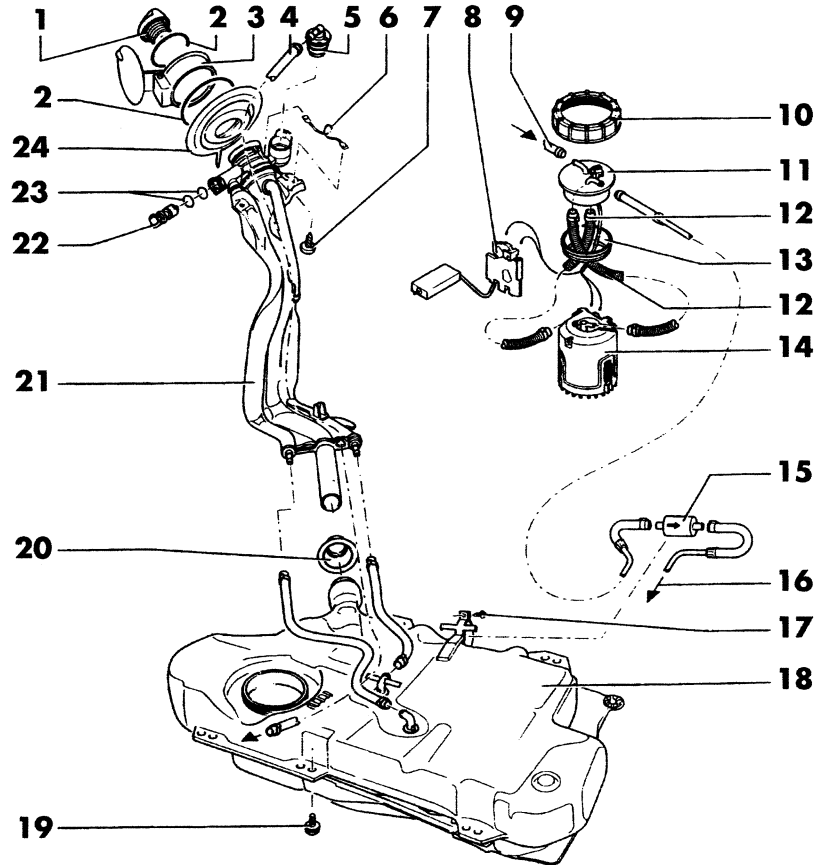
To reassemble, reverse the above operations taking the following into account:

Refill the cooling system with cooling liquid. Bear in mind the indications in the section **"operations to be performed depending on the type of vehicle-equipped anti-freeze additive"**.

Check and, if necessary, adjust the headlamp alignment.

FUEL FEED SYSTEM: EXPLODED VIEW

The hoses are fixed to the connections by means of clamps, either steel strip clamps or bolt clamps. Only strip clamps must be used to fix the flexible fuel tubes to the engine.



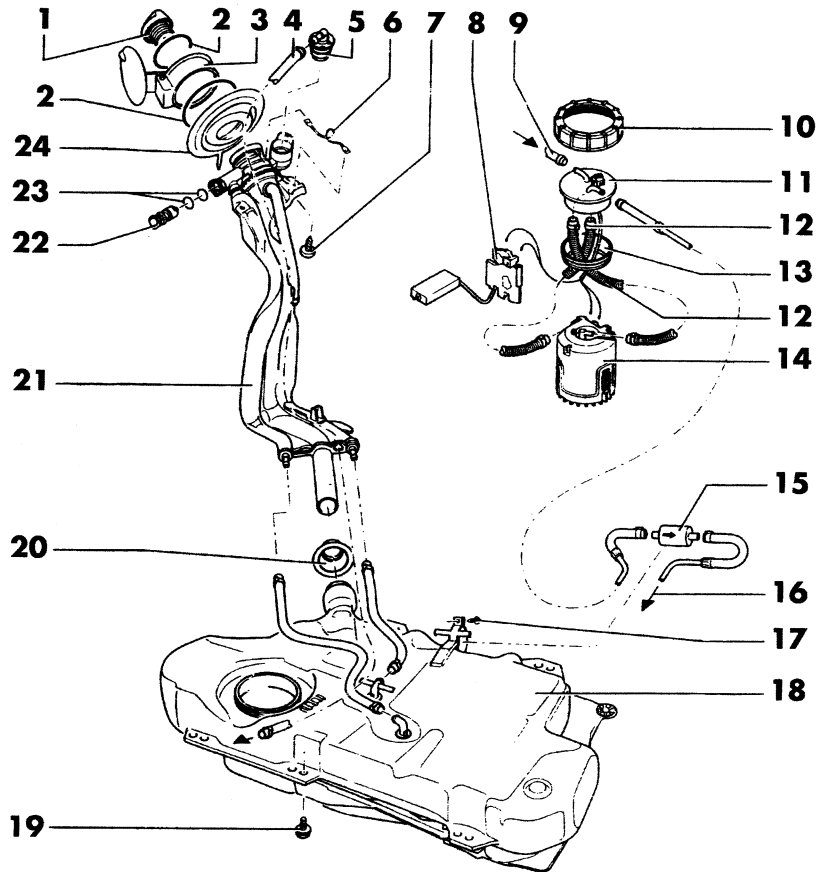
20BD20

1. Plug.
2. Attachment circlip.
3. Filling cap/pipe assembly.
4. Vent pipe.  
To active carbon tank.
5. Gravity valve.  
Checking.
6. Earth connection.
7. 4 Nm.
8. Fuel level sender unit.
9. Fuel return tube.  
Blue, from injection unit.

10. Fuel pump-fuel level sender unit assembly fixing nut. 75 Nm.  
Remove and refit using the tool U-40055.
11. Fuel level sender unit and fuel pump cover.  
Note the mounting position.
12. Corrugated tube.  
When carrying out operations with the pump/level transmitter assembly, these tubes must not touch the fuel tank, in order to prevent noise transmission.

### FUEL FEED SYSTEM: EXPLODED VIEW

The hoses are fixed to the connections by means of clamps, either steel strip clamps or bolt clamps. Only strip clamps must be used to fix the flexible fuel tubes to the engine.



20BD20

- |  |  |
|--|--|
| <p><b>13. Gasket.</b><br/>Replace if damaged.<br/>Wet with fuel when fitting.</p> <p><b>14. Fuel pump.</b><br/>Remove and refit using the tool <b>U-40073</b>.<br/>Checking.</p> <p><b>15. Fuel filter.</b><br/>The arrow on the fuel filter shows the fuel flow direction.</p> <p><b>16. Feed pipe.</b><br/>Black, to injection unit.</p> <p><b>17. 3 Nm.</b></p> | <p><b>18. Fuel tank.</b><br/>Removal and replacement.</p> <p><b>19. 25 Nm.</b></p> <p><b>20. Dust boot.</b></p> <p><b>21. Filling mouth.</b></p> <p><b>22. Vent valve.</b><br/>Checking.</p> <p><b>23. O-ring.</b><br/>Replace if damaged.</p> <p><b>24. Dust boot.</b><br/>The waste tube must be located underneath.</p> |
|--|--|

**CLEANING AND SAFETY PRECAUTIONS**

When removing and refitting fuel level sender units-fuel pumps, if the tanks are full or partially full, the following safety measures must be observed:

- Before starting any fitting work, a gas suction equipment must be placed close to the fuel tank, so that the fuel vapours released when the fuel level sender unit cover is removed, are sucked immediately.

If no vapour suction equipment is available, a fan (motor out of the air flow) with a capacity higher than 15 m<sup>3</sup>/h can be used.

- Avoid any contact with the fuel using fuel resistant gloves.

When working on the fuel feed/injection system, the following rules regarding cleanliness must be observed:

- Before disconnecting any joint, carefully clean the connection and the surroundings.
- The parts removed must be placed on a clean surface and then must be covered. As a cover use plastic or paper sheets, never use clothes which may release fibers.
- Carefully cover or plug the parts removed if the repair is not to be completed immediately.
- Fit clean parts only; do not use, therefore, parts which are not properly packaged.
- Unpack the parts immediately before fitting them only.
- With the fuel feed system open, neither use compressed air nor move the vehicle.

**FUEL TANK**

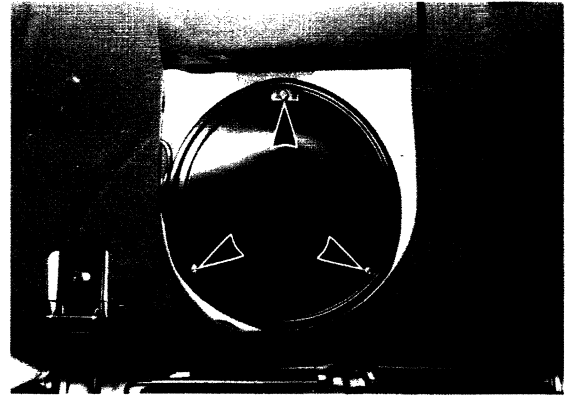
**Removal and replacement**

**Removal**

Place the vehicle on a bridge filter.

Disconnect the battery ground lead.

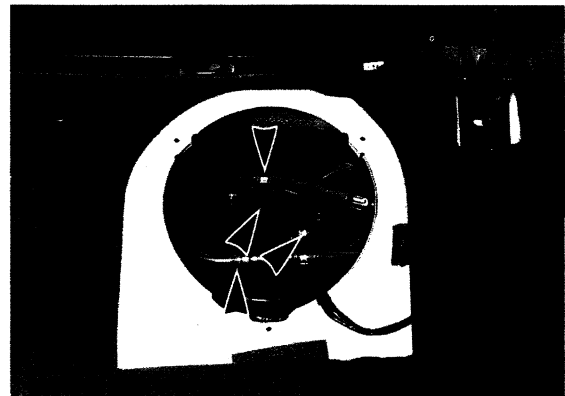
Drain the fuel tank.



20D001

Tilt forward the back seat.

Remove the fuel level sender unit-fuel pump assembly cover.



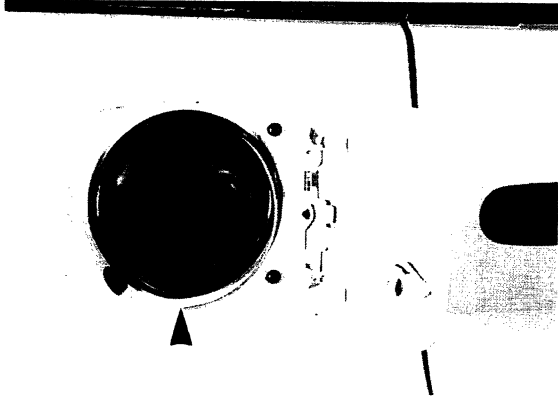
20D002

Disconnect the fuel feed and return pipes.

Unplug the connector from the fuel level sender unit-fuel pump assembly.

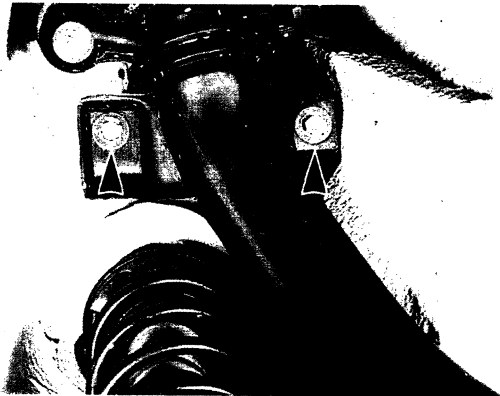
Disconnect the vapour pipes from the fuel tank to the activated carbon filter (according to the version).

Remove the right rear wheel and mark the mounting position with regard to the wheel hub; the mark must be taken into account when refitting.



20B003

Remove the circlip fixing the filling mouth protection cap.



20B004

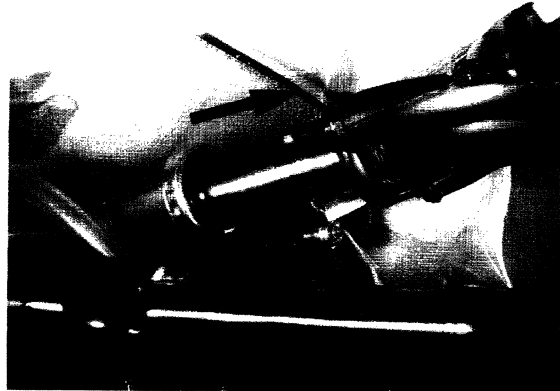
Raise the vehicle.

Remove the bolts fixing the filling mouth to the bodywork.  
(In some versions the existing protection on the wheel arch has to be detached.)

Remove and partially separate the final section of the exhaust installation from its attachment to the two rear rubber supports.

Place a jack with platform to support the fuel tank while removing it.

Separate the screws attaching the tank to the bodywork and partially remove the fuel tank unit, together with the antithermal plate.



20B043

Then extract the filler hole from its attachment to the fuel tank, for which purpose it is necessary to separate the dustguard and the fuel pipes.  
When separating the filler hole take special care so as not to damage the internal retainers in the tank.

Once the filler hole has been detached, proceed to remove the tank.

#### **Refitting**

To reassemble, reverse the above operations taking the following into account:

To facilitate the placement of the filler hole in the tank apply a light coat of Vaseline to the bottom of the filler hole and to the internal retainers in the tank.

When fitting the fuel or deaeration pipes make sure that they are not bent or have no leaks.

The fuel pipes should be fixed with screw clamps.

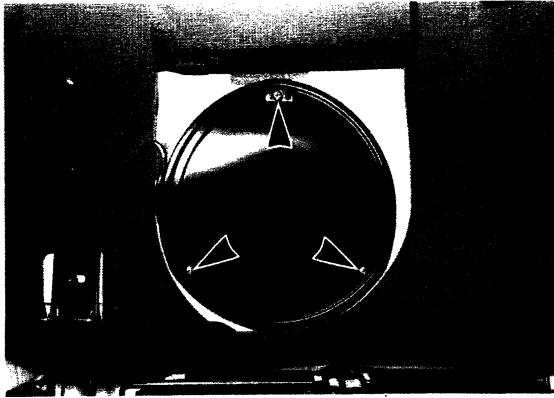
Do not swap the fuel pipes (supply pipes black and return pipes are blue, or blue mark).

When filling the tank with fuel make sure there are no leaks through the area where the filler hole is joined to the tank.

**FUEL LEVEL SENDER UNIT AND FUEL PUMP**  
Removal and replacement

**Removal**

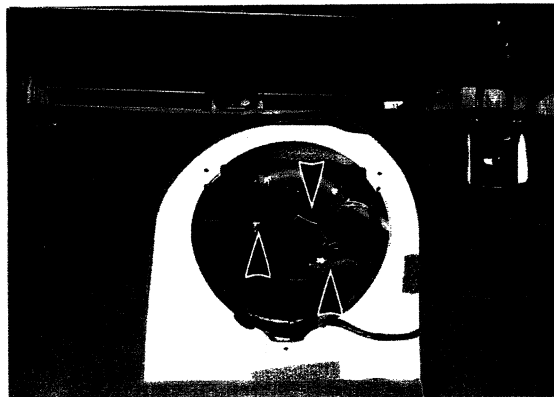
Disconnect the battery ground lead.



20D001

Tilt forward the back seat.

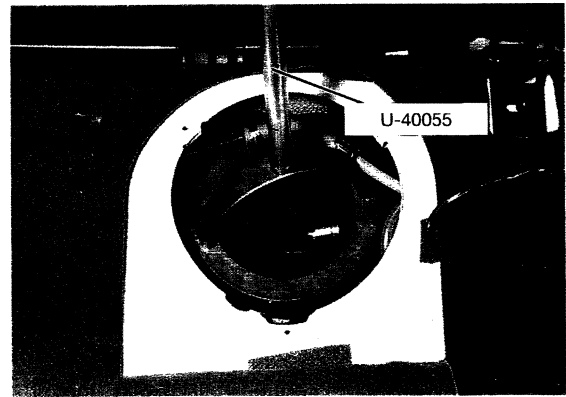
Remove the fuel level sender unit-fuel pump assembly cover.



20D007

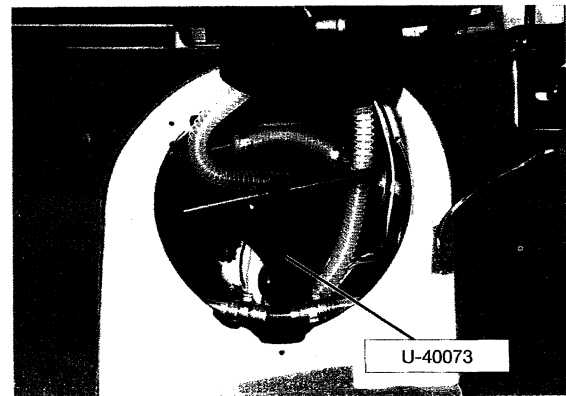
Disconnect the fuel feed and return pipes.

Unplug the connector from the fuel level sender unit-fuel pump assembly.



20D008

Remove the nut fixing the fuel level sender unit-fuel pump assembly using tool **U-40055**.



20D014

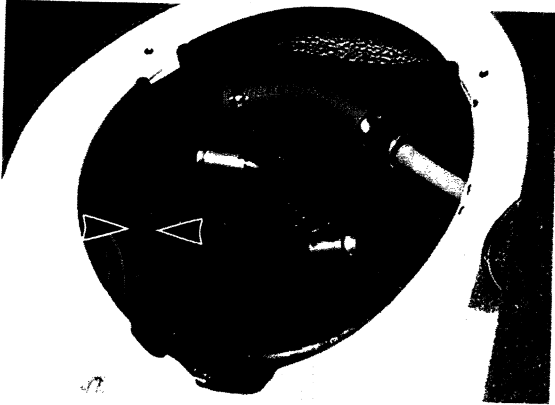
Remove the fuel level sender unit-fuel pump assembly by turning it counterclockwise until the assembly is released from the inside attachment (bayonet type). Use the tool **U-40073** to carry out this operation.

**Note**

If the assembly is still filled with fuel, drain the contents before replacing the assembly.

**Refitting**

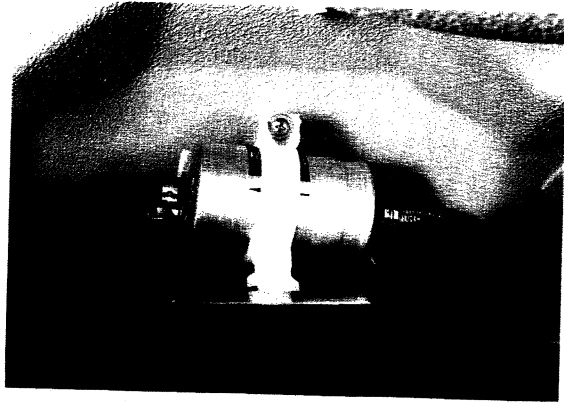
For refitting, note the proper mounting.



20D009

The mark (arrow) on the fuel level sender unit cover must match the mark on the fuel tank.

**FUEL FILTER  
Replacement**



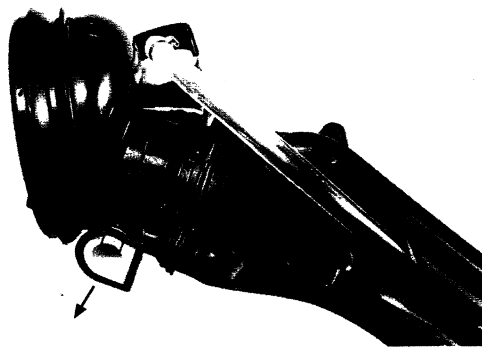
20B011

The fuel filter is located at the rear of the fuel tank, attached by means of a clamp.

To replace the filter, note that the arrow on the filter housing must be pointing in the fuel flow direction.

**VENT VALVE**  
**Checking**

To remove the vent valve, removing the fuel tank is not required.



20B009

Remove the valve from the filling mouth. To do this, detach the fixing tab and pull out the valve.

**GRAVITY VALVE**  
**Checking**

To remove the gravity valve, removing the fuel tank is not required.



20B008

Disconnect the pipe and remove the valve from the filling mouth. To do this, detach the fixing tab and pull the valve upwards.

To check the valve, connect an auxiliary flexible pipe to the pump connection and blow through the pipe.

With the valve in vertical position, the air must pass through.

When the valve is tilted 45°, the air flow must stop.

Otherwise, replace the gravity valve.



20B010

To check the valve, blow through the valve hole.

With the lever at the rest position, the air must not pass through the valve. When the lever is moved in the direction of the arrow, the air must pass through the valve.

Otherwise, replace the vent valve.

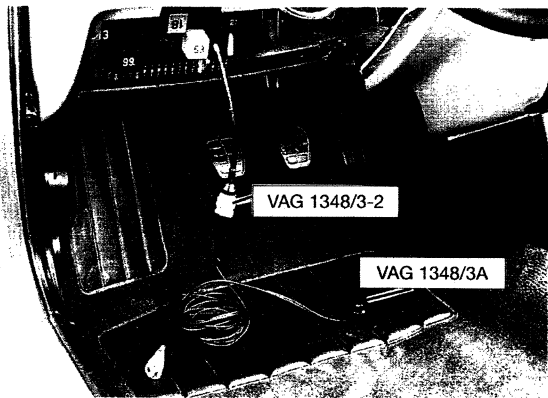
### FUEL PUMP

#### Checking the power supply

Check that the No. 18 fuse is in good condition and the battery voltage is correct.

Turn the ignition on and listen to the fuel pump noise; the pump must run for about 1 second (to hear the pump noise, being as close as possible to the fuel tank is required, as the fuel pump is located inside the fuel tank).

— If the fuel pump does not run:



Remove the fuel pump relay (R17) from relay board (relay position 12).

Connect the remote control **VAG 1348/3A** together with the adaptor cable **VAG 1348/3-2** to the contact number 4 on the relay board and to the battery positive terminal.

By operating the remote control **VAG 1348/3A**, the fuel pump must start running.

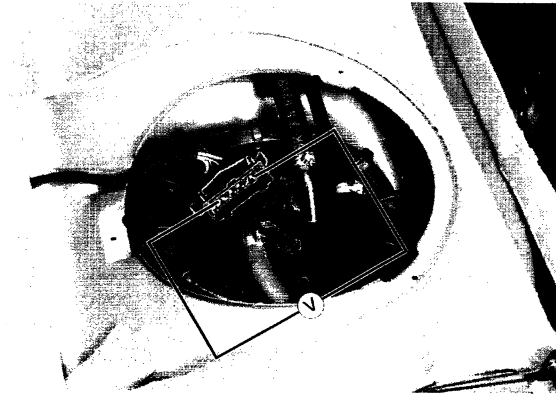
— If the fuel pump runs:

Check the operation of the fuel pump relay, as described in the Repair Group 24.

— If the fuel pump does not run:

Tilt forward the back seat. Remove the fuel level sender unit-fuel pump assembly cover.

Unplug the fuel level sender unit-fuel pump assembly connector.



Connect the **VAG 1526** digital multimeter to the outer contacts of the connector using the **VAG 1594** auxiliary cables.

Set the multimeter's selector to the voltage measurement position.

Operate the **VAG 1348/3A** remote control. The reading on the voltmeter should be:

Power supply voltage: **approx. battery voltage.**

— If the power supply voltage is not reached:

Check the electrical system with the help of the wiring diagram to locate and fix the discontinuity.

— If the power supply voltage is reached:

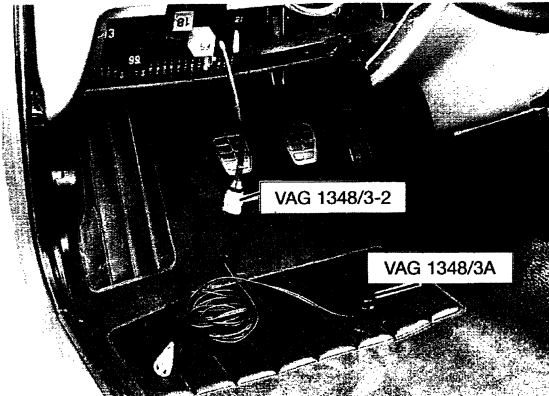
Remove the fuel level sender unit-fuel pump assembly fixing nut using the tool **U-40055**.

Check that the wiring between the cover and the pump is correct.

If the cables do not show any discontinuity, replace the pump.

## Checking the fuel flow

The battery voltage must be correct.

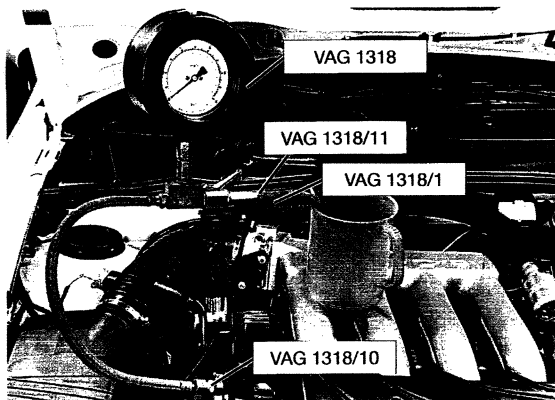


24B014

Remove the fuel pump relay (R17) from relay board (relay position 12).

Connect the remote control **VAG 1348/3A** together with the adaptor cable **VAG 1348/3-2** to the contact number 4 on the relay board and to the battery positive terminal.

Remove the fuel filling mouth cover.



20B035

Disconnect the supply pipe from its attachment to the fuel distributor.

Connect the pressure gauge equipment **VAG 1318** together with the adaptor **VAG 1318/10** to the feed pipe previously disconnected.

Connect the flexible pipe **VAG 1318/1** to the adaptor **VAG 1318/11** of the pressure gauge equipment. Place the flexible pipe end inside a graduated container.

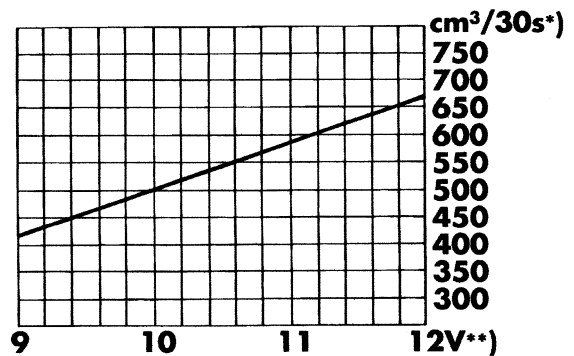
Open the pressure gauge equipment valve (handle in the flow direction).

Operate the remote control **VAG 1348/3A**, slowly close the pressure gauge equipment valve until the pressure reading is 3 bar.

Do not change the valve position.

Drain the fuel from the graduated container. Operate the remote control **VAG 1348/3A** for 30 seconds.

Compare the amount of fuel supplied with the value shown in the graph.



20BD03

\*) Minimum volume in cm<sup>3</sup> for 30 seconds.

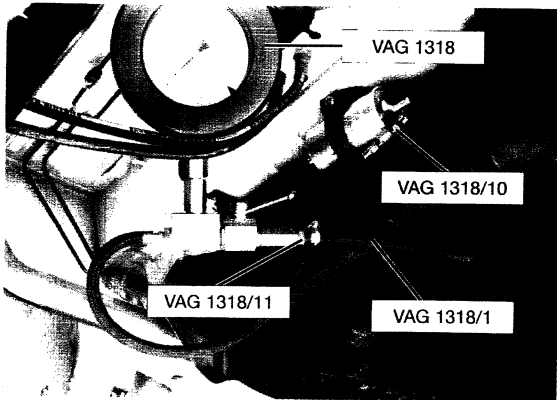
\*\*) Voltage at the fuel pump with the engine stopped and the pump running (about 2 volts below the battery voltage).

If the above minimum volume is not reached, the following are some of the possible reasons:

- Fuel pipe bent or plugged.
- Fuel filter clogged.
- Faulty fuel pump; replace the pump.

Carry out the following tests to determine the exact cause of the fault:

Check that the fuel pipes are free from dents, pinching or blockages.



20D016

Remove the fuel inlet tube to the filter and connect the **VAG 1318** manometer with the **1318/10** adapter to the feed pipe disconnected previously.

Re-check the fuel flow and if it is correct, replace the fuel filter.

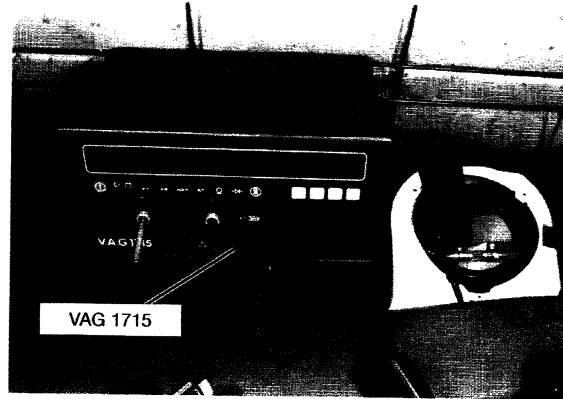
If the minimum flow is still not reached, remove the fuel pump assembly and check for faults in the pipes or dirt in the filter.

If no fault is found after carrying out these checks, replace the fuel pump.

**Note**

If the minimum fuel flow is obtained but a fault exists (for example, a sporadic failure in the fuel supply) check the electrical functioning of the fuel pump.

In order to do this, re-connect all the pipes previously disconnected.



20D017

Check the fuel pump power supply by connecting the **VAG 1715** tester to the red/yellow cable in the system.

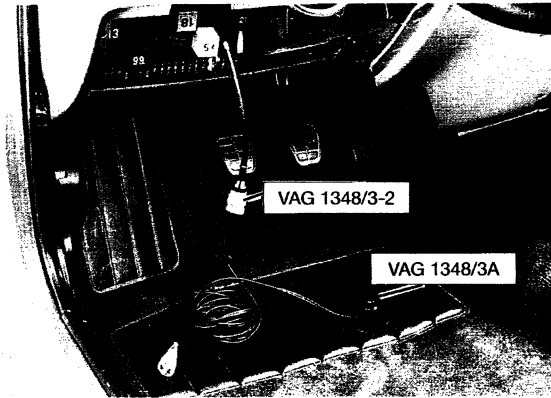
Start up the engine and let it run at the idle speed.

Measure the power consumption, which should not exceed **8 A**. If the value is higher, replace the fuel pump.

If the fault is sporadic, the test may be carried out during a test run, in which case the help of a second person will be required.

**FUEL PUMP NON-RETURN VALVE**  
**Checking**

The following checking also allows to check that the fuel feed pipes from the injection central unit to the connecting point to pressure gauge equipment **VAG 1318**, are leakproof.

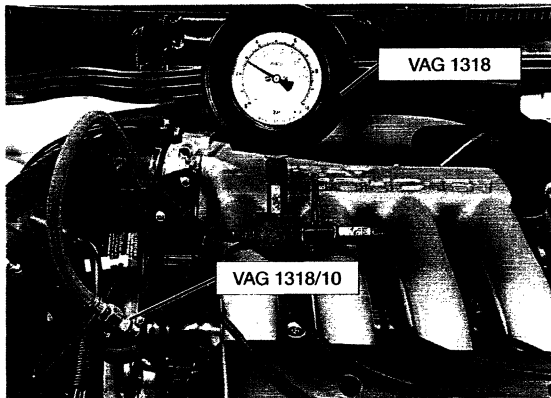


24B014

Remove the fuel pump relay (R17) from relay board (relay position 12).

Connect the remote control **VAG 1348/3A** together with the adaptor cable **VAG 1348/3-2** to the contact number 4 on the relay board and to the battery positive terminal.

Connect the **VAG 1318** pressure gauge as follows:



20B036

Disconnect the supply pipe from its attachment to the fuel distributor.

Connect the pressure gauge equipment **VAG 1318** together with the adaptor **VAG 1318/10** to the feed pipe previously disconnected.

Close the pressure gauge equipment valve by placing the handle perpendicular to the flow direction.

Operate the remote control **VAG 1348/3A** during short time intervals until the pressure reading is approximately 3 bar.

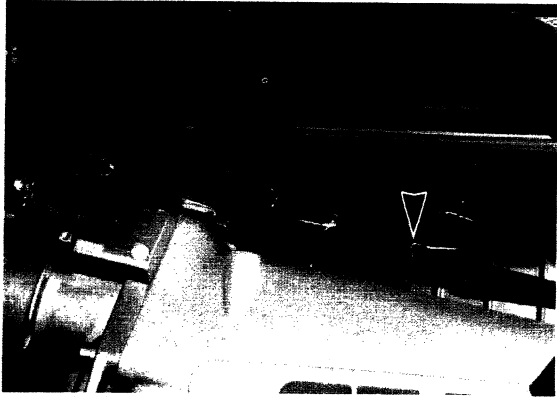
Release the excess pressure by carefully opening the valve. Placing a container or a cloth on the pressure gauge equipment free connection is recommended, as there may be fuel splashing when opening the valve.

Note the pressure drop. During a 10 minute period the pressure must not come down below 2 bar.

If the pressure drop is higher, check the fuel feed pipes for leaks and if the pipes are correct replace the fuel pump.

**ACCELERATOR CABLE ADJUSTMENT**

To check the accelerator cable proper adjustment, the accelerator pedal must be fully depressed; in this position the throttle valve must be fully open.

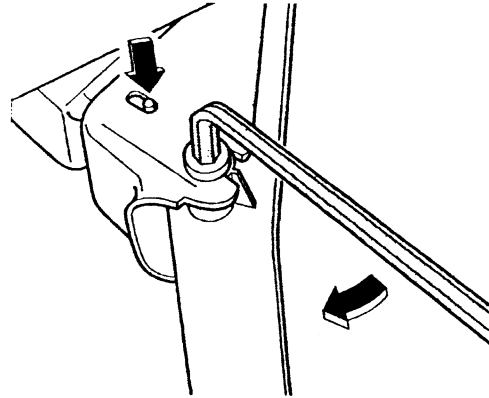


20B044

To adjust the accelerator cable, remove the clamp on the cable sheath, change the cable sheath position on the support and refit the fixing clamp.

**ACCELERATOR PEDAL**  
**Removal and replacement**

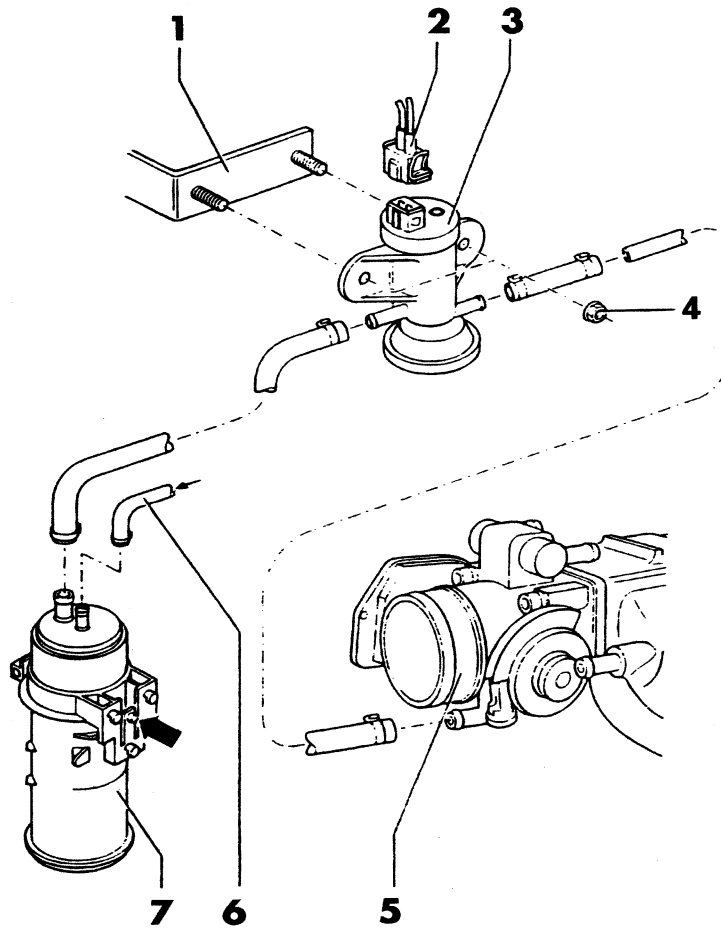
To remove the accelerator pedal the parcel tray and the pedals protector must be removed.



20DD04

Carefully push the pedal fastener and remove the shaft with an Allen key.

ACTIVATED CARBON TANK SYSTEM: EXPLODED VIEW



20BD17

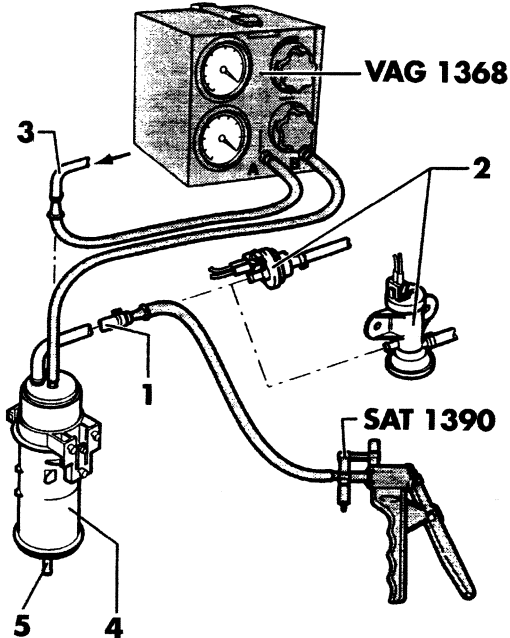
1. Support.
2. Connector.
3. Electromagnetic valve for the active carbon tank (N80).  
The valve is driven by the control unit with the engine running.  
Checking. (Refer to Repair Group 24.)
4. 10 Nm.

5. Damper unit.
6. Vapour pipe from the fuel tank (comes from the gravity valve).  
In some vehicles you may find a safety valve inserted next to the active carbon tank.
7. Activated carbon tank.  
It is located in the right front wheel arch.  
For removing, partially remove the wheel arch guard and press the safety tab in the direction shown by the arrow.

**BLEEDING THE FUEL SYSTEM**  
**Checking**

These checks should be made with the ignition off.

**Checking the active carbon tank**



20BD18

Separate the flexible deaeration pipe "1" which goes from the active carbon tank to the electromagnetic valve "2", from its attachment to the latter. Then place the SAT 1390 vacuum gun to the pipe which was previously disconnected.

Detach flexible deaeration pipe "3" which comes from the fuel tank to the active carbon tank "4" from its attachment to the latter, and connect it to inlet "A" of the VAG 1368 depression verifier.

Connect inlet "B" of the VAG 1368 depression verifier to the active carbon tank which is free and set the verifier key to position -B-.

Operate the SAT 1390 vacuum pump several times; no suction should be created.

- If suction is created:

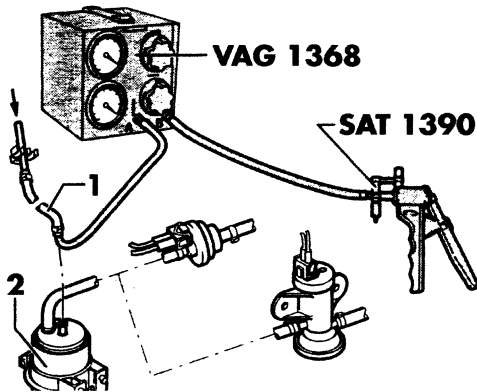
Check that the deaeration pipe at the bottom of active carbon tank "5", is not blocked. Clean if necessary.

- If no suction is created:

Cover the deaeration pipe at the bottom of the active carbon tank (to do so use a suitable top such as the ones delivered with the vacuum pump SAT 1390).

Act upon the vacuum gun several times, to create depression. If there is none, locate the watertightness problem in the active carbon tank or in the installation section being checked.

### Checking the fuel tank and filling top



20BD19

Detach flexible deaeration pipe "1" which comes from the fuel tank to the active carbon tank "2" from its attachment to the latter, and connect it to inlet "A" of the VAG 1368 depression verifier.

#### Note

In vehicles fitted with safety valve, flexible deaeration pipe "1", must be detached from its attachment to the safety valve, it cannot remain in the section of pipe being checked.

Connect the SAT 1390 suction pistol to the "B" connection of the VAG 1368 tester and set the tester's key to the A/B position.

Unscrew the fuel filler cap.

Operate the SAT 1390 vacuum pump several times; no suction should be created.

- If suction is created:

Verify that the safety valve is not in the section of pipe being checked.

Check the gravity valve, as described elsewhere in this group.

Check that the tube between the gravity valve and the active carbon tank is not obstructed.

- If no suction is created:

Fit the fuel filling cap, and act upon the vacuum pump SAT 1390 several times, there should be no depression.

- If suction is created:

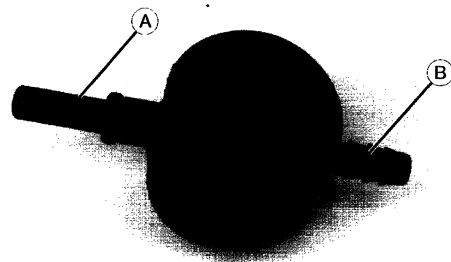
Replace the fuel filler cap.

#### Note

When the fuel level in the tank is low, the SAT 1390 must be operated approximately 25 times when carrying out these tests.

### Checking the safety valve and assembly position

(Only vehicles with safety valve fitted on the outside of the active carbon tank.)



20B045

To check the safety valve, it must be detached from the vehicle.

Connect vacuum gun SAT 1390 to the "A" connection of the valve.

- Create pressure, there must be an air flow.
- Create depression, the depression should be maintained.

Then connect the gun to the "B" connection of the valve.

- Create pressure, there must be an air flow.
- Create depression, the depression is not maintained.

If the result of the checks was not as indicated, replace the valve.

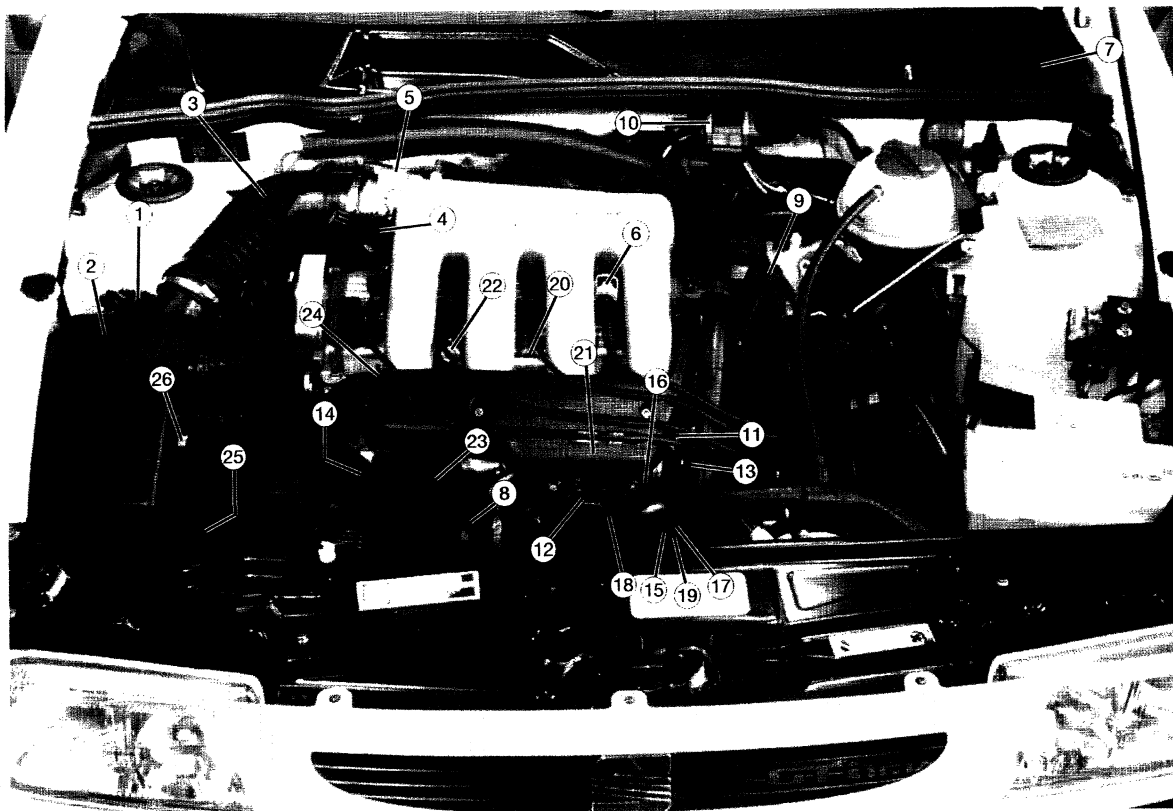
#### ● Mounting position

When fitting the valve to the vehicle, remember that the connection "A" should be positioned in the direction of the active carbon tank.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

### DIGIFANT 2.0 I 16 V INJECTION SYSTEM: COMPONENTS LOCATION



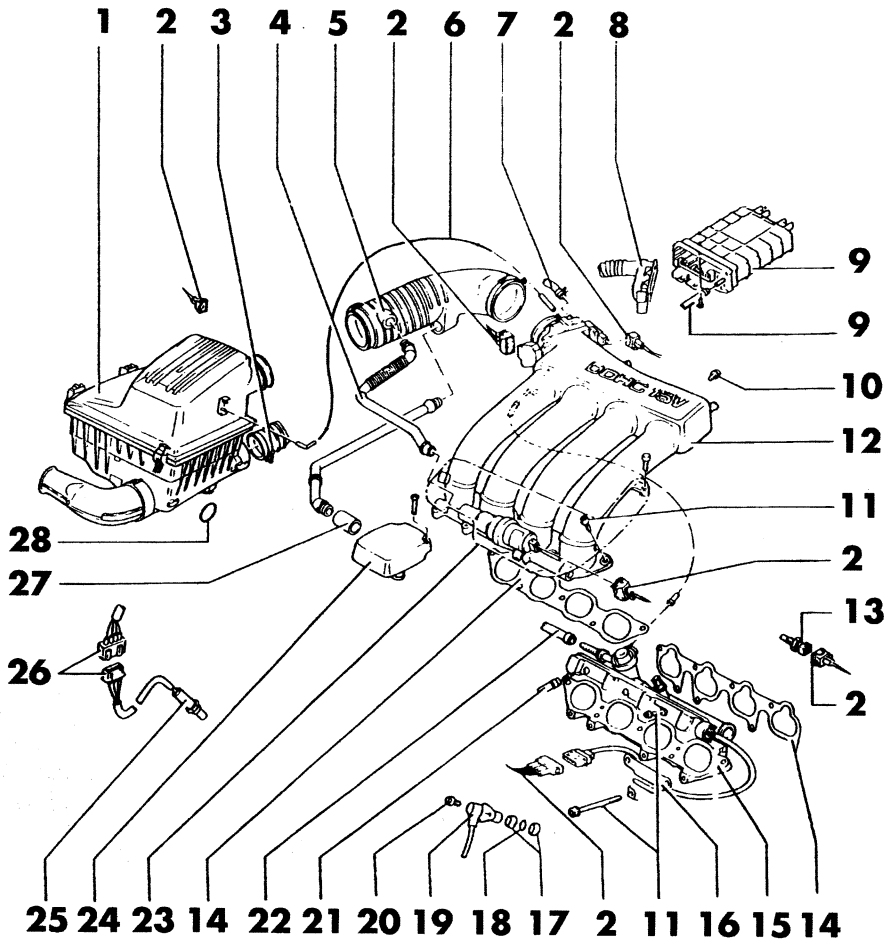
24B100

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Intake air temperature transmitter.</li> <li>2. Active carbon tank magnetic valve.</li> <li>3. Lambda probe connector.</li> <li>4. Throttle valve potentiometer.</li> <li>5. Idle speed switch.</li> <li>6. Spark plugs. 20 Nm.</li> <li>7. Digifant injection and ignition system control unit.</li> <li>8. Earth connection.</li> <li>9. Ignition distributor.</li> <li>10. Ignition transformer.</li> <li>11. Cooling liquid temperature transmitter.</li> <li>12. Injector power supply connection.</li> <li>13. Central connector.</li> <li>*14. Pinking sensor 1.</li> <li>15. Three-pin connector for pinking sensor 1. <ul style="list-style-type: none"> <li>● Brown.</li> <li>● On top of bracket.</li> </ul> </li> </ol> | <ol style="list-style-type: none"> <li>*16. Pinking sensor 2.</li> <li>17. Three-pin connector for pinking sensor 2. <ul style="list-style-type: none"> <li>● Black.</li> <li>● On centre of bracket.</li> </ul> </li> <li>*18. Engine speed transmitter.</li> <li>19. Three-pin connector for engine speed transmitter. <ul style="list-style-type: none"> <li>● At bottom of bracket.</li> </ul> </li> <li>20. Fuel pressure measurement take-off.</li> <li>21. Idle speed stabilization valve.</li> <li>22. Fuel pressure regulator.</li> <li>23. Sump gases pressure regulator valve.</li> <li>24. Fuel distributor with injectors.</li> <li>25. Activated carbon tank.</li> <li>26. Inlet air pre-heating temperature regulator.</li> </ol> <p>* Observe positioning in Group 28.</p> |
|---|--|

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

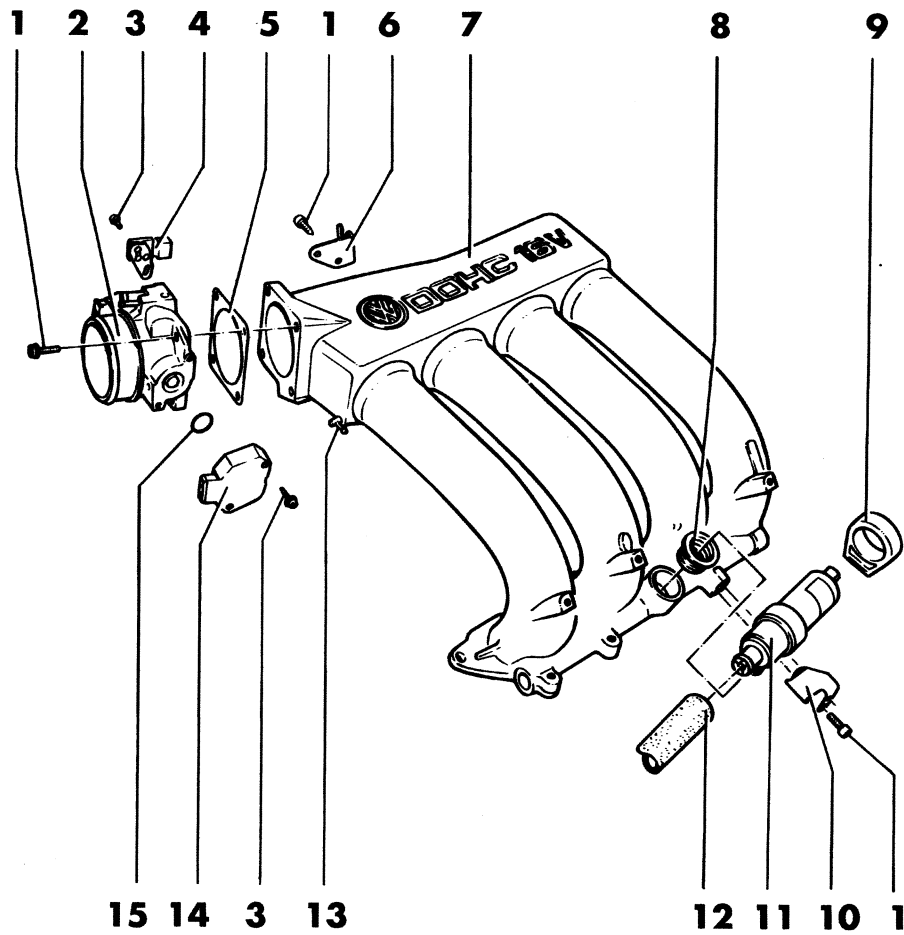
### DIGIFANT 2.0 I 16 V INJECTION SYSTEM: REMOVAL



24AD21

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Air filter assembly.</li> <li>2. Connector</li> <li>3. Hot air inlet.</li> <li>4. Joining tube.</li> <li>5. Flexible inlet tube.</li> <li>6. Vacuum pipe.</li> <li>7. To active carbon magnetic valve.</li> <li>8. Control unit connector.</li> <li>9. Digifant control unit. <ul style="list-style-type: none"> <li>• For injection system, lambda regulation, pinking regulation, engine revs limiting, ignition and self-diagnosis.</li> <li>• With inlet manifold pressure transmitter.</li> <li>• If replaced, check the idling speed.</li> </ul> </li> <li>10. Flexible suction tube to inlet manifold.</li> <li>11. Bolt. 10 Nm.</li> <li>12. Manifold intake, top. <ul style="list-style-type: none"> <li>Fix the lower part first and then fix it to the brackets.</li> </ul> </li> <li>13. Cooling liquid temperature transmitter.</li> </ol> | <ol style="list-style-type: none"> <li>14. Gasket.</li> <li>15. Manifold intake, bottom.</li> <li>16. Support.</li> <li>17. Support rings.</li> <li>18. O-ring.</li> <li>19. Engine speed transmitter.</li> <li>20. Bolt. 10 Nm.</li> <li>21. Fuel feed pipe.</li> <li>22. Fuel return pipe.</li> <li>23. Cover.</li> <li>24. Sump gases vent pressure regulating valve.</li> <li>25. Lambda probe. 50 Nm. <ul style="list-style-type: none"> <li>• Grease the thread with "G5" only; do not allow it to reach the slots in the probe body.</li> <li>• Power supply to lambda probe heating, via probe heating relay.</li> </ul> </li> <li>26. Connector for lambda probe and probe heating.</li> <li>27. Joining tube.</li> <li>28. Drive ring.</li> </ol> |
|---|---|

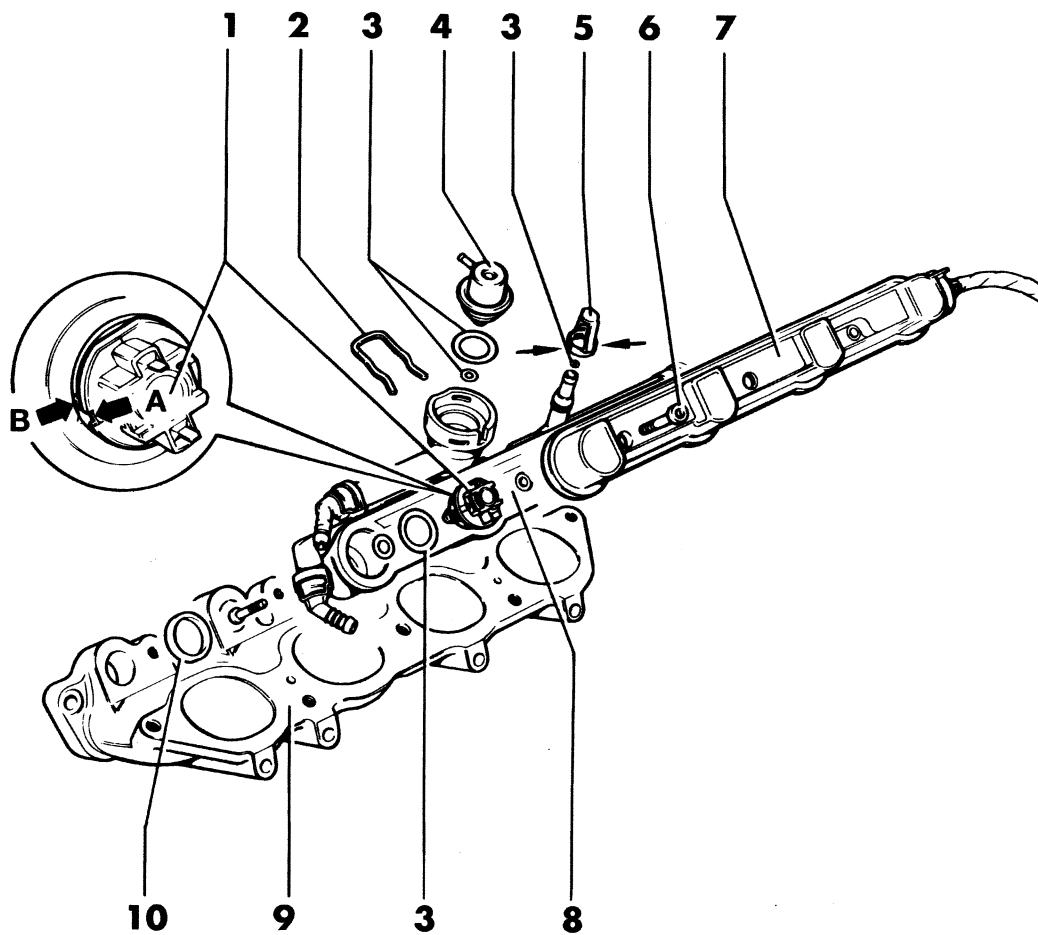
**UPPER PART OF INLET MANIFOLD: EXPLODED VIEW**



24BD23

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1. Bolt. 10 Nm.</li> <li>2. Throttle valve tubing.</li> <li>3. Bolt. 3 Nm.</li> <li>4. Idle speed switch.</li> <li>5. Gasket.<br/>Replace.</li> <li>6. Accelerator control cable bracket.</li> <li>7. Manifold intake, top.</li> <li>8. Rubber bushing.</li> </ul> | <ul style="list-style-type: none"> <li>9. Support ring.</li> <li>10. Stabilizer valve bracket.</li> <li>11. Idle speed stabilization valve.</li> <li>12. Flexible connecting tube.</li> <li>13. Suction take-off connection.<br/>● For regulating fuel pressure.</li> <li>14. Throttle valve potentiometer.</li> <li>15. O-ring.<br/>● Replace if damaged.</li> </ul> |
|---|---|

### FUEL DISTRIBUTOR: EXPLODED VIEW



24BD24

**1. Injector.**

- Resistance:  $15 \pm 20 \Omega$ .
- Mounting position: the injector's notch (arrow A) must align with the fuel distributor pivot (arrow B).

**2. Staple to hold fuel pressure regulator.**

**3. O-ring.**

- Replace if damaged.

**4. Fuel pressure regulator.**

**5. Plug.**

- Fuel pressure measurement connection.
- Squeeze sideways to remove (arrows).

**6. Distributor fixing bolt. 10 Nm.**

**7. Top of fuel distributor.**

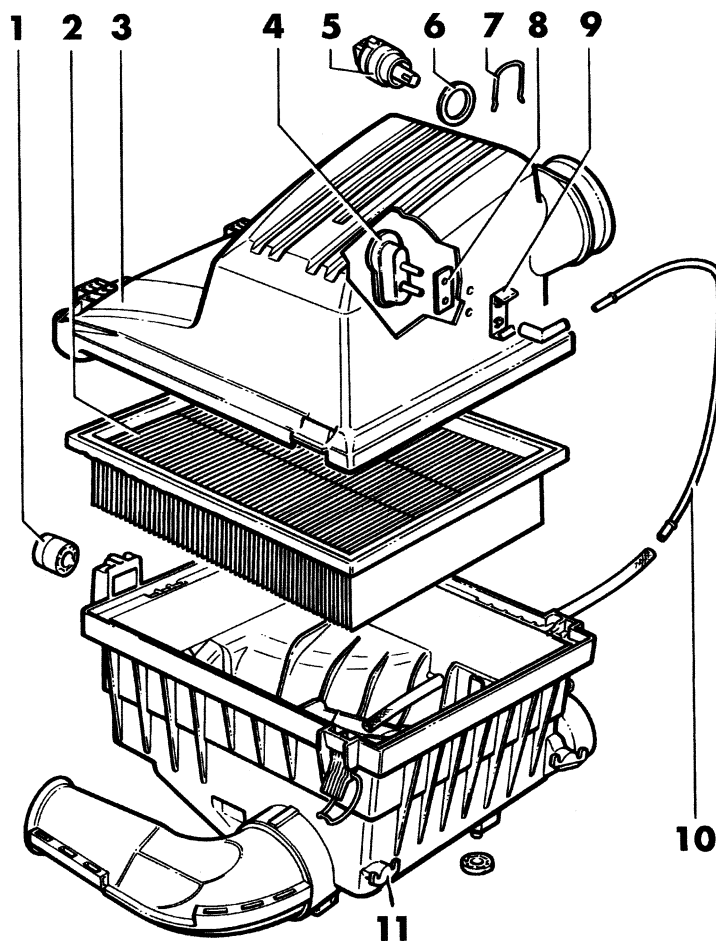
**8. Lower part of fuel distributor.**

**9. Manifold intake, bottom.**

**10. O-ring.**

- Replace if damaged.

**AIR FILTER AND CASE: EXPLODED VIEW**



24BD25

- |   |   |
|---|---|
| <p>1. Rubber hose.</p> <p>2. Filter cartridge.</p> <p>3. Upper part of air filter.</p> <p>4. Temperature controller.</p> <ul style="list-style-type: none"><li>● For pre-heating inlet air.</li><li>● Connecting tube of metal or grooved to the regulating flap.</li></ul> <p>5. Intake air temperature transmitter.</p> <ul style="list-style-type: none"><li>● Press-fitted into the inlet manifold.</li></ul> | <p>6. Gasket.</p> <ul style="list-style-type: none"><li>● Replace if damaged.</li></ul> <p>7. Fixing plate.</p> <p>8. Gasket.</p> <p>9. Fixing plate.</p> <p>10. Suction tube.</p> <p>11. Lower part of air filter.</p> |
|---|---|

### SAFETY PRECAUTIONS TO BE TAKEN INTO ACCOUNT WHEN HANDLING THE INJECTION AND IGNITION SYSTEMS

To prevent personal injuries and damages to the injection and ignition system, take the following into account:

- Connect and disconnect the injection and ignition system cables with the ignition turned off only (including the measuring device cables).
- If the starter motor is to be operated without starting up the engine, unplug the Hall generator connector from the ignition distributor.
- The starting help with a quick battery charger is only allowable during 1 minute and at 16.5 V maximum.
- Washing of the engine must be carried out with the ignition disconnected only.
- When performing electric welding or spot welding, fully disconnect both battery terminal leads.
- When the vehicle is subject to temperatures in excess of 80 °C (i.e. paint cabins), the vehicle must be let to cool down before starting up the engine.

### CLEANING REGULATIONS

When working on the fuel feed and injection systems, the following cleanliness rules must be strictly observed:

- Clean thoroughly the clamps before loosening them.
  - Place the removed parts on a clean base and cover them with plastic or paper sheets. Never use clothes which may release fibers.
  - Carefully cover all exposed parts when the repair is not to be carried out immediately.
  - Fit clean parts only.
  - Remove the spare parts from the packing just before fitting them.
- (Do not use parts which have been stored unpacked.)
- When the system is opened:
    - Avoid working with compressed air.
    - Do not move the vehicle

### IMPORTANT CONSIDERATIONS REGARDING INJECTION

- The injection and ignition control unit is equipped with a faults memory. Before carrying our repairs and for fault-finding, the suction connections must be checked.
- Always replace the friction clamps with screw clamps.
- A minimum voltage of 11.5 V is required for the correct operation of the electrical components.
- Do not use silicone-based sealants. Silicone particles ingested by the engine do not burn inside the cylinders and prevent the correct functioning of the lambda probe.
- Whenever the control unit remains disconnected for more than one hour, carry out a "Basic Adjustment" as described in this repair group.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

### CARRY OUT BASIC ADJUSTMENT

#### Checking conditions

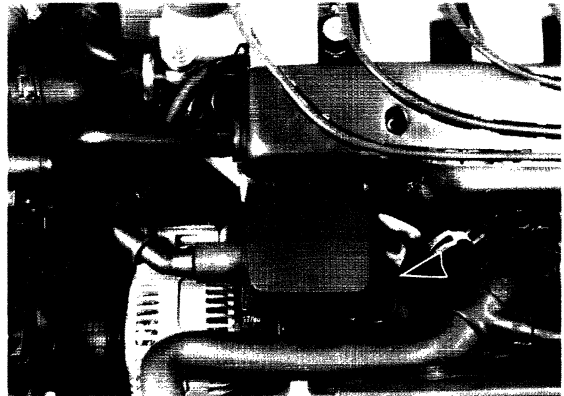
- Engine oil temperature 80 °C minimum.
- Electrical devices disconnected (the radiator fan must not operate during the test).
- Air conditioner disconnected.
- Air tight exhaust system.
- Idling switch closed.
- Accelerator control cable correctly adjusted.
- Correct ignition timing.
- **VAG 1551** fault-finder connected (no fault memorized).

#### Checking



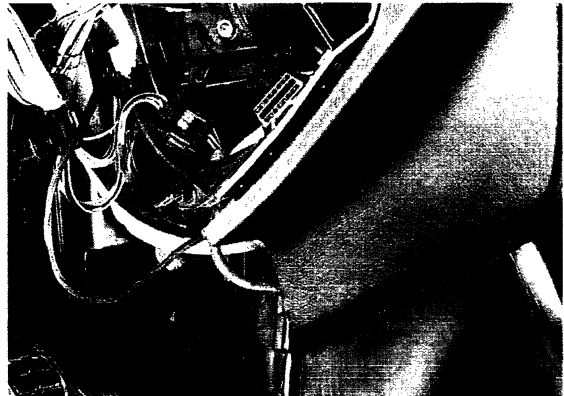
24A128

- Connect the ignition timing and engine speed checking equipment **VAG 1367** using the pick up clamp **1367/8** or connect directly the equipment **VAG 1767**.



24A143

- Remove the sump gases breather tube from the pressure regulation valve and hang it so that it breathes only fresh air.



24B004

- Connect the fault detector equipment **VAG 1551** to the 16 pin connector located at the right of the steering column on the dashboard lower part, using the cable **VAG 1551/3**.
- Read and erase the fault memory as indicated in this Group.
- Start up the engine and let it run at the idle speed.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

Use the fault detector equipment **VAG 1551** in the following way:

- Press the key **1** to enter the operating mode "Quick data transmission".
- Press the keys **0** and **1** for the address code "Engine electronics" and confirm by pressing the key **Q**.
- Press the key **→**.
- Press the keys **0** and **4** to enter the function "Begin basic adjustment" and confirm by pressing the key **Q**.
- Enter **01** for the "Group indication number" and confirm the selection by pressing the key **Q**.

The display will show:

<b>System in basic adjustment</b>				<b>1</b>	→
<b>1</b>	<b>2</b>	<b>3</b>	<b>00000000</b>		

Continue with the check only when the 8 digits of indication field 4 are 0.

**Note**

If a 1 appears in one or several positions of indication field 4 it means that the checking conditions are not met.

Meaning of the digits in display field 4:

	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
	<b>Faults stored in memory</b>	<b>Automatic gearbox</b>	<b>Air conditioning compressor</b>	<b>Idle speed switch</b>	<b>Lambda adjustment</b>	<b>Throttle valve position</b>	<b>Engine speed</b>	<b>Engine temperature</b>
<b>0</b>	No faults	Lever in "P" or "N" position	Disconnected	Closed	Correct	Closed	> 2500 rpm	> 80 °C
<b>1</b>	Faults memorized	A gear is engaged	Connected	Open	Not correct	Open	> 2500 rpm	< 80 °C

- Check the ignition timing:  
 Test value: approx. 6°, oscillating before TDC.  
 Adjustment value: No adjustment is necessary in this engine since the distributor has a fixed position and the ignition timing is varied according to calculations made by the control unit.  
 When the ignition timing is correct, check that:

- Idle speed ..... **770 ÷ 870 rpm**
- Allow the engine to idle for at least one minute.
- Read the lambda probe signal in display field 3. The value should oscillate by more than 0.3 V.
- After the checking procedure is over, proceed as follows with the fault detector equipment **VAG 1551**:
  - Press the key **→**.
  - Press the keys **0** and **6** to enter the function "End data transfer" and confirm by pressing the key **Q**.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

**IMPORTANT NOTE:** Never disconnect the **VAG 1551** fault-finder from the power connector after terminating a function without first pressing the 06 keys for "End of transmission". This could block the control unit, preventing the engine from starting. If this problem occurs, disconnect the battery for at least 30 seconds, then re-connect it. Then connect the **VAG 1551** fault-finder and consult the faultsmemory.

If a fault has been memorized, consult the table in this repair group.

If this problem occurs, disconnect the battery for at least 30 seconds, then re-connect it. Then connect the **VAG 1551** fault-finder and consult the faultsmemory.

If a fault has been memorized, consult the table in this repair group.

If the theoretical values are not obtained:

- Check the sealing of the inlet system (unwanted air).
- Check for leaks in the exhaust system between the cylinder head and the catalytic converter.
- Check the lambda regulation and probe.
- Carry out a test cycle, re-check the faults memory and repeat the idling verification.

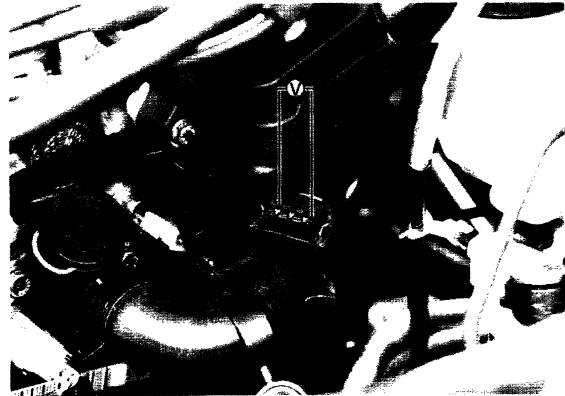
### CHECKING THE NO. 1 CYLINDER IDENTIFICATION TRANSMITTER/HALL TRANSMITTER

Check values:

- Transmitter fault recognized by self diagnosis.

Checking process:

- Remove the Hall transmitter connector (ignition distributor).



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- Connect the **VAG 1526** digital multi-meter to the outer contacts of the connector using the **VAG 1594** auxiliary cables.

- Turn on ignition.

Theoretical value: at least 10 V.

- Turn the ignition off.

- Connect the **VAG 1598/18** tester to the control unit cable harness.

- Check the continuity of the cables between the tester and the Hall transmitter triple connector.

Hall transmitter connector	VAG 1598/18 terminal
1	33
2	44
3	45

- Also check the cables for a short circuit between them.

Theoretical value:  $\infty \Omega$ .

If no fault is found in the cables and there is voltage between contacts 1 and 3:

- Replace the transmitter.
- If no fault is found in the cables and there is no voltage between contacts 1 and 3:
- Replace the Digifant control unit.

### CHECKING THE LAMBDA PROBE AND REGULATION

Conditions for checking:

- Idling speed adjustment correct.
- No leaks in exhaust system between catalytic converter and cylinder head.

Checking process:

- Connect the fault detector **VAG 1551**.
- Start the engine and leave it idling.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **01** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 1				→
1	2	3	XXXXXXXX	

- Continue with the check when the display in field 2 is over 80 °C.

- Allow the engine to idle for 2 minutes.

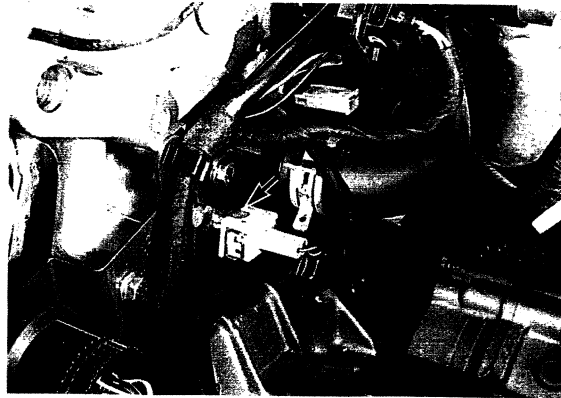
- Connect the **VAG 1363A** CO tester to the end of the exhaust pipe.

- Check the CO contents:

Theoretical value: < 0.5 % in volume.

- Watch the lambda probe voltage in display field 3; it should oscillate at least 30 times a minute in the range: 0 ÷ 1.0 V.

If the oscillation is slower, the cause of the fault must be investigated.



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- Remove the connector from the coolant temperature transmitter. The probe's voltage must increase and then decrease within the range of the previous adjustment.

- Insert the connector. The probe's voltage must decrease and then increase to the previous regulation margin.

### Note

During the test, the engine speed must not exceed 1500 rpm, otherwise the control unit will interpret the detached connector as a fault.

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.

If the probe has not regulated:

- Check the lambda probe with the **VAG 1598/18** tester, following the table given in this group.

If no fault is found:

- Replace the lambda probe.

Possible causes of a probe regulation frequency that is too low:

- The slots or holes in the probe's head are blocked.
- The probe's ventilation hole (near the connecting cable) is blocked.
- Probe has been subjected to thermal overload (vit-rified).
- Probe damaged by fuel containing lead.

### CHECKING THE LAMBDA PROBE HEATING

- See the table for checking the injection system with the **VAG 1598/18**, at the end of this group.

### IDLING SPEED STABILIZATION CHECKING

Conditions for checking:

- Idling speed adjustment correct.
- Coolant temperature 85 °C minimum.

Check the operation

- Check operation using the actuator diagnosis.

Check the adjustment

- Connect the fault detector **VAG 1551**.
- Start the engine and leave it idling.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **03** for the "Display group number" and confirm with **Q**.

The display shows:

Read measuring values block 3				→
1	2	3	4	

Allow the engine to run for at least 1 minute.

- Remember the value shown in field 4.

Theoretical value:  $7 \div 25$  %.

(Idling speed 770 ÷ 870 rpm)

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

If the theoretical value is reached:

- Check the sealing of the inlet system (unwanted air).
- Replace the idling stabilizer valve.
- Replace the Digifant control unit.

# Engine 24

## Fuel preparation: 2.0 l 16 V engine

### TESTING THE ENGINE LOAD STATES

#### Note

Checks whether the Digifant control unit recognizes the engine load states (idling, partial load, full load, deceleration).

Conditions for checking

- Coolant temperature 80 °C minimum.
- Connect the fault detector **VAG 1551**.
- Start the engine and leave it idling.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **04** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 4				→
1	2	3	XXXXXXX	

- Display field 4: note the 8-digit numeric block (the four to the right have no meaning).

Display when:

#### ● Idling:

The second digit on the left should be a 1.

Display: 01000000

#### ● Partial load:

- Accelerate evenly.

The third digit on the left should be a 1.

Display: 00100000

#### ● Full load:

- Accelerate fully (suddenly).

The fourth digit from the left must be 1 briefly.

Display: 00010000

#### ● Deceleration:

- Increase the engine speed to over 3000 rpm.
- Close the throttle valve suddenly.

While the speed is over 1500 rpm, the first digit on the left must be 1.

Display: 1000000 (briefly).

#### Note

Below 1500 rpm, idling is recognized.

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

If the theoretical values are not obtained:

- Consult the faults memory, eliminate the faults and erase the memory.
- Check the throttle valve potentiometer.
- Check the idling switch.

### CHECKING THE THROTTLE VALVE POTENTIOMETER

- Connect the fault detector **VAG 1551**.
- Turn on ignition.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **03** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 3					→
1	2	3	4		

- Read the idling speed in display field 3.

Theoretical value: **0** °:

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

- Slowly open the throttle valve to its maximum, checking the angle shown in field 3. The number value should increase evenly in the whole margin.

### Note

The value shown depends on the throttle valve potentiometer's tolerances and does not match the actual opening angle. The maximum allowable displayed angle is 86 °.

If the value does not increase uniformly:

- Replace the throttle valve potentiometer.
- If the display remains constantly at 0 ° or approx. 90 °:

Indication	Cause	Continue the check
0 °	Break or short circuit to earth	Check with the <b>VAG 1598/18</b>
Approx. 90 °	Short circuit to positive	Check with the <b>VAG 1598/18</b>

### Continuation with the check if 0 ° is displayed:

- Unplug the throttle valve potentiometer three-pin connector.



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- Jumper contacts 1 and 2 of the connector using the **VAG 1594** auxiliary cables and watch the display.

### Display 90 °:

- Replace the throttle valve potentiometer.

### Display 0 °:

Measure voltage between contacts 1 and 3 of plug. Theoretical value: approximately 5 V.

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Connect the **VAG 1598/18** tester to the control unit cabling harness.

If there is a voltage of approx. 5 V.

- Check for breaks in the cable between terminal 40 of the tester and contact 2 of the throttle valve potentiometer connector, using the electrical schematics.

Cable resistance: 1.5 Ω max.

- Also check the cable for a short circuit to earth.

Theoretical value: ∞ Ω.

If there is no voltage:

- Check for breaks in the cable between terminal 41 of the tester and the triple connector and between terminal 33 and contact 3, using the electrical schematics.

Cable resistance: 1.5 Ω max.

### Continuation of the test if approx. 90 ° is displayed:

- Unplug the throttle valve potentiometer three-pin connector.

### Display 0 °:

- Replace the throttle valve potentiometer.

### Display 90 ° 0:

- Measure and note down the voltage between contacts 1 and 2 in the connector.
- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Unplug the Digifant control unit connector.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

If there is a voltage of approx. 5 V:

- Check the cable in the triple connector, contact 2, for a short circuit, using the electrical schematics.

If the voltage is approx. battery voltage:

- Check the cable in the triple connector, contact 2, for a short circuit to battery positive, using the electrical schematics.

If no fault is detected in the wires:

- Replace the Digifant control unit.

### CHECKING THE COOLANT TEMPERATURE TRANSMITTER

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **01** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 1 →			
1	2	3	XXXXXXXX

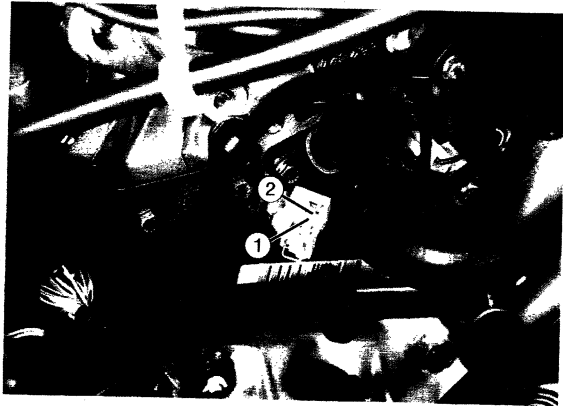
- Check the value of the coolant temperature in display field 2.

Indication	Cause	Continue the check?
-40 °C	Interruption or short circuit to positive	Check as described in this repair group
120 °C	Short circuit to ground	Check as described in this repair group
Approx. coolant temperature <sup>1)</sup>	—	Check as described in this repair group

- 1) If the temperature shown differs greatly from the transmitter's ambient temperature, check the transmitter's cables for resistance.
- 2) The check is only possible with the engine cold.

### Continuation of the check if -40 °C is shown

- Unplug the cooling liquid temperature transmitter connector.



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- Jumper the contacts using the **VAG 1594** auxiliary cables and watch the display.

### 120 °C displayed:

- Replace the coolant temperature transmitter (2).

### -40 °C displayed:

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Connect the **VAG 1598/18** tester to the control unit cabling harness.

- Check the cable between tester terminal 14 and contact 1 of the double connector for breaks, using the electrical schematic.
  - Cable resistance: 1.5  $\Omega$  max.
  - Also check the cable for a short circuit to battery positive.  
Theoretical value:  $\infty \Omega$ .
- If no wire fault is detected:
- Replace the Digifant control unit.

### Continuation of the test if 120 °C is displayed:

- Unplug the cooling liquid temperature transmitter connector.
- Jumper the contacts using the **VAG 1594** auxiliary cables and watch the display.

### -40 °C displayed:

- Replace the coolant temperature transmitter.

### -120 °C displayed:

- Press the  $\rightarrow$  key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Connect the **VAG 1598/18** tester to the control unit cabling harness.
- Check the cable between the control unit connector and the double connector for a short circuit with the ignition cable and engine earth, using the electrical schematics  
Theoretical value:  $\infty \Omega$ .

If no wire fault is detected:

- Replace the Digifant control unit.

### Continuation of the test if the coolant temperature is displayed:

Functional test of transmitter.

- Watch the value of the coolant temperature (Display group 01, display field 2).

The value should increase evenly without interruption.

### Notes

- If the value displayed in the fault finder increases by steps of 2 to 5 °C, this is due to the control unit and not to a faulty transmitter.
  - If within certain temperature ranges the engine fails and the temperature does not increase steadily, that means that the temperature signal is subject to temporary interruptions and the transmitter must be replaced.
- Press the  $\rightarrow$  key.
  - Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

### CHECKING THE INLET AIR TEMPERATURE TRANSMITTER

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **02** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 2				$\rightarrow$
1	2	3	4	

- Check the cable between tester terminal 14 and contact 1 of the double connector for breaks, using the electrical schematic.
  - Cable resistance: 1.5  $\Omega$  max.
  - Also check the cable for a short circuit to battery positive.  
Theoretical value:  $\infty \Omega$ .
- If no wire fault is detected:
- Replace the Digifant control unit.

### Continuation of the test if 120 °C is displayed:

- Unplug the cooling liquid temperature transmitter connector.
- Jumper the contacts using the **VAG 1594** auxiliary cables and watch the display.

### -40 °C displayed:

- Replace the coolant temperature transmitter.

### -120 °C displayed:

- Press the  $\rightarrow$  key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Connect the **VAG 1598/18** tester to the control unit cabling harness.
- Check the cable between the control unit connector and the double connector for a short circuit with the ignition cable and engine earth, using the electrical schematics  
Theoretical value:  $\infty \Omega$ .

If no wire fault is detected:

- Replace the Digifant control unit.

### Continuation of the test if the coolant temperature is displayed:

Functional test of transmitter.

- Watch the value of the coolant temperature (Display group 01, display field 2).

The value should increase evenly without interruption.

### Notes

- If the value displayed in the fault finder increases by steps of 2 to 5 °C, this is due to the control unit and not to a faulty transmitter.
- If within certain temperature ranges the engine fails and the temperature does not increase steadily, that means that the temperature signal is subject to temporary interruptions and the transmitter must be replaced.
  - Press the  $\rightarrow$  key.
  - Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

### CHECKING THE INLET AIR TEMPERATURE TRANSMITTER

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **02** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 2				$\rightarrow$
1	2	3	4	

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

Continuation of test if ambient temperature is identified:

- Remove the inlet air temperature transmitter without removing the connector.
- Remember the inlet air temperature value shown in field 4.
- Apply cooling spray to the transmitter, watching the temperature value, which should decrease.
- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

### CHECKING THE ENGINE SPEED TRANSMITTER

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **02** for the "Display group number" and confirm with **Q**.

The display shows:

Read the measurement value block 2				→
1	2	3	4	

- Remember the injection time shown in display field 2.
- Operate the starter motor. The injection time display should change.
- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

If the time displayed does not change:

- Remove the three-way connector to the transmitter.
- Measure the voltage between contacts 1 and 3 of the connector.

Theoretical value: 9 V.

- Turn the ignition off.
- Connect the **VAG 1598/18** tester to the control unit cabling harness.

- Check for breaks in the cable between the tester and the three-way connector, using the electrical schematics.

Contact 1 and terminal 68

Contact 2 and terminal 67

Contact 1 and terminal 33

Cable resistance: 1.5 Ω max.

- Also check the cables for short circuits between them:

Theoretical value: ∞ Ω.

If no fault is found in the cables and there is voltage between contacts 1 and 3:

- Replace the engine speed transmitter.

If no fault is found in the cables and there is voltage between contacts 1 and 3:

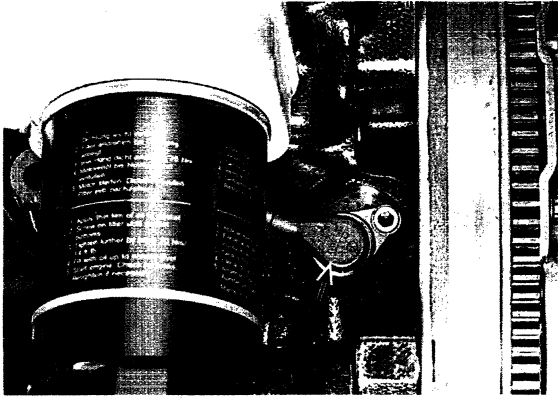
- Replace the Digifant control unit.

### REPLACE THE ENGINE REVOLUTIONS TRANSMITTER

#### Note

The failure of this sensor causes the engine to stop immediately and it cannot be re-started, even sporadically. The faults memory in the control unit will detect and store the fault.

- Disconnect the battery negative lead.
- Remove the bolt or nut fixing the front engine support to the rubber/metal bush.
- Fit the **U-30025** cross-member with the **U-30017** adaptor, to prevent pressure of the engine on the support.
- Remove the bolts holding the starter motor bracket.



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- Remove the engine position sensor.
- To re-fit it, proceed in the reverse order to the above. Oil the O-ring and take care to position the sensor correctly to avoid oil leaks.

### CHECKING THE INLET MANIFOLD PRESSURE TRANSMITTER

- Switch on the **VAG 1551** fault-finder in function **08** "Read measurement block values" and values group **02**.
    - Engine idling.
    - Engine temperature above 80 °C.
- The display will show:

Read measuring values block 2 →			
1	2	3	4

- Watch measurement field 4, which should show between 10 ... 60 %.
- If a constant value of approximately 80 % is shown (this value of 80 % will appear on the **VAG 1551** screen for a few seconds and then value will not remain constant):
- Check that there is no oil in the suction tube leading to the control unit and that its length is 1 metre.
  - Press the → key.
  - Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.

### CHECKING THE IDLING SWITCH

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission" and **01** to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **01** for the "Display group number" and confirm with **Q**.

Read the measurement value block 1 →			
1	2	3	XXXXXXXX

Watch the fourth digit from the left in display field 4, a block of 8 digits.

Theoretical value: 00000000

Slightly open the throttle valve; the fourth digit should change to 1.

Indication: 00010100

If the theoretical values are not obtained:

Indication	Cause	Continue the check
Always 0	Short circuit to ground	As follows
Always 1	Interruption or short circuit to positive	As follows

#### Continuation of the test if the display is always 0:

- Remove the two-way connector from the idling switch.

#### Display 1:

- Changing the idling switch.

#### Display 0:

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Unplug the Digifant control unit connector.

- Check the cables to the control unit in the two-way connector 1 for a short circuit to cable 2 and to vehicle earth.

If no wire fault is detected:

- Replace the Digifant control unit.

### Continuation of test if the display is always 1:

- Remove the two-way connector from the idling switch.
- Jumper the connector contacts with the **VAG 1594** auxiliary cables and watch the display.

### Display 0:

- Changing the idling switch.

### Display 1:

- Press the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.
- Connect the **VAG 1598/18** tester to the control unit cabling harness.
- Check for breaks in the cables between the tester and the two-way connector, using the electrical schematics.

Contact 1 and terminal 2.

Contact 2 and terminal 23.

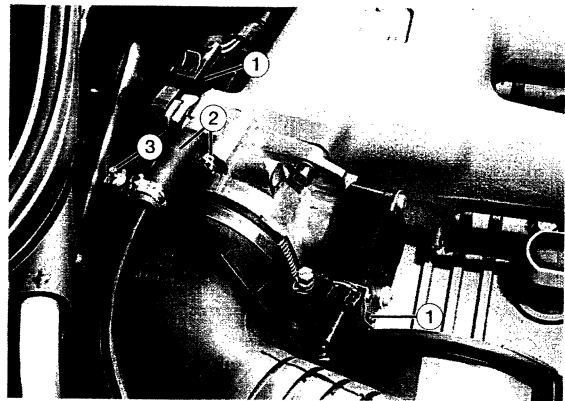
Cable resistance: 1.5 Ω max.

If no fault is detected in the wires:

- Replace the Digifant control unit.

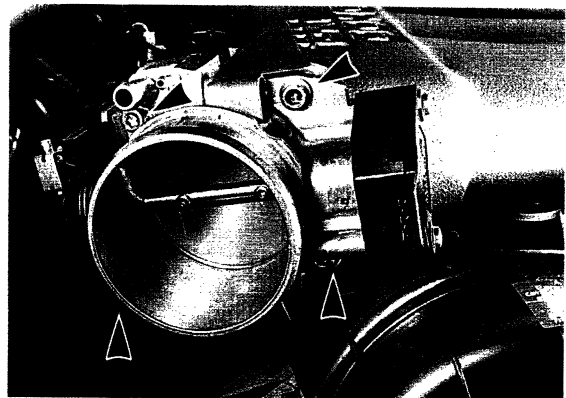
### Changing the idling switch

- Remove the inlet tube from the throttle valve manifold.



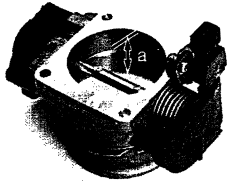
24B072

- Remove the electrical connections to the throttle valve potentiometer and switch (1). Remove the suction tubes from the throttle valve manifold (2) and remove the accelerator cable (3).



24B073

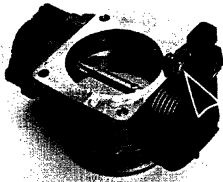
- Remove the throttle valve manifold.



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- Measure the distance between the throttle valve and the sealing surface -a- and note it down.
- Adjust the throttle valve by moving the idling switch until the distance -a- is obtained again.

### Adjust the idling switch



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- Release the idling switch.
- Slowly close the throttle valve (the stop on the cam disc must not make contact with the switch).

- Measure the distance between the throttle valve and the sealing surface -a- and note it down.
- Adjust the throttle valve by move the throttle valve switch. Adjustment distance a = the noted value + 0.5 mm.

### Note

The throttle valve must be adjusted with special care and the adjustment distance -a- must never be exceeded.

### CHECKING THE INJECTION CONTROL UNIT POWER SUPPLY

#### Conditions for checking

- Battery voltage over 11 V.
- Alternator, OK.

#### Checking process

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission" and 01 to select "Engine electronics".
- Press the **08** keys to select the function "Read measurement value block" and confirm the selection by pressing the **Q** key.
- Enter **02** for the "Display group number" and confirm with **Q**.

The display will show:

Read the measurement value block				2	→
1	2	3	4		

- Read the idling speed in display field 3.  
Theoretical value: approx. battery voltage.
  - Press the → key.
  - Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- If the value indicated oscillates or does not reach battery voltage:
- Turn the ignition off.
  - Connect the **VAG 1598/18** tester to the control unit cabling harness.

- Turn on ignition.
- Use the **VAG 1526** digital multimeter and the **VAG 1594** auxiliary cables to measure the power supply voltage between terminals 1 and 23 of the tester:  
Theoretical value: 11 V min.
- Also measure the voltage between terminals 1 and 9 of the tester:  
Theoretical value: 9 V min.

If the theoretical values are not obtained:

- Replace the power supply relay.

Check the power supply voltage on terminal 15.

- Use the **VAG 1526** digital multimeter and the **VAG 1594** auxiliary cables to measure the power supply voltage between terminals 1 and 23 of the tester.

Theoretical value: 11 V min.

If the minimum rated value is not reached:

- Check the connectors using the electrical schematics.

#### **CHECK THE SIGNAL OF THE STARTER ENGINE**

##### **Checking process**

- Connect the **VAG 1598/18** checking unit to the installation connector.
- Connect the **VAG 1526** digital multimeter in voltage measuring to terminals 1 and 7 of the checking unit.
- Operate the starter.

The digital multimeter should read 8 V min.

If the minimum rated value is not reached:

- Check the wiring to the starter motor terminal 50, following the wiring diagram.

#### **ADAPTATION OF THE IMMOBILIZER SYSTEM TO THE ENGINE CONTROL UNIT**

##### **Condition**

- The vehicle's key must be available and this must have been memorized as "authorized" by the immobilizer control unit.

Process:

- Connect the fault detector **VAG 1551**.
- Enter **1** for "Rapid data transmission and 25 to select "Immobilizer", and confirm with the **Q** key.
- After the control unit has replied to the immobilizer control unit, press the → key.

The display shows:

<b>Read the measurement value block</b>	<b>HELP</b>
<b>Key in value group number XX</b>	

- Enter **10** for the "Adaptation" function and confirm with **Q**.

The display shows:

<b>Adaptation</b>
<b>Key in channel number XX</b>

- Enter **00** for channel **0** and confirm with **Q**.

The display shows:

<b>Adaptation</b>	<b>Q</b>
<b>Erase adaptive values?</b>	

- Confirm the selection by pressing the **Q** key.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

The display shows:

**Adaptation** →  
**The adaptive values are erased**

- Complete adaptation with the → key.
- Enter **06** for "End of data transmission" and confirm by pressing the **Q** key.
- Turn the ignition off.

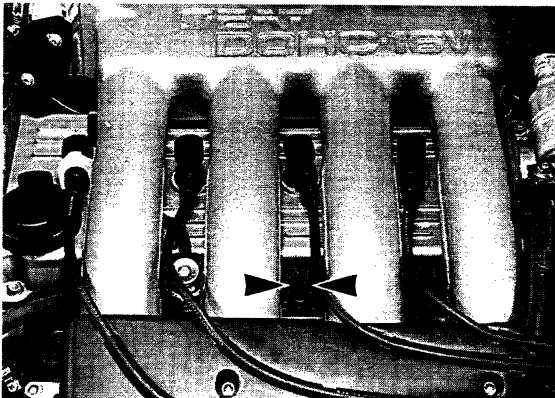
**Warning!**  
Before turning the ignition back on, wait at least **30 seconds** in order for the control unit relay to disconnect from the power supply.

### Note

When the ignition is switched on again, the identification of the control unit of the engine will be introduced into the immobiliser control unit.

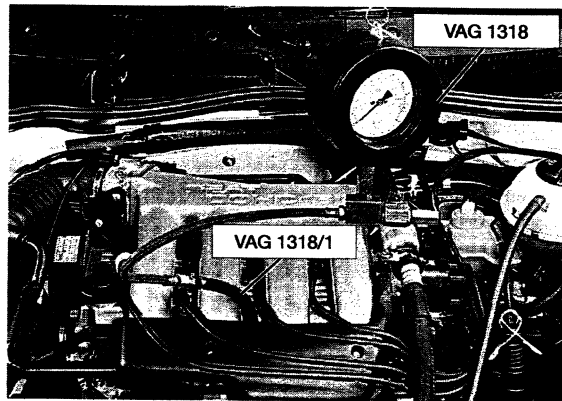
### CHECK THE FUEL PRESSURE REGULATOR AND THE RETENTION PRESSURE

- Fuel pump flow correct.



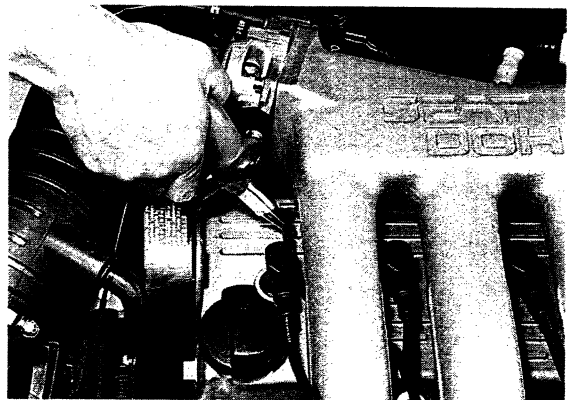
24B076

- Remove the measurement connection cover by pressing its sides to free it.



24B077

- Connect the **VAG 1318** measuring device, with the key closed (lying across the fuel flow), using the **VAG 1318/1** adaptor, to the fuel distributor pressure take-off.
- Start the engine and leave it idling.
- Measure fuel pressure.  
Theoretical value: approximately **2.5 bar**.



24B078

- Squeeze the pressure regulator's flexible tube. The pressure should drop by about **3 bar**.
- Turn the ignition off.
- Check the air-tightness of the system and the retention pressure, monitoring the drop shown on the pressure gauge. After 10 minutes it should be approx. **2 bar**.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

If the pressure drops below **2 bar**:

- Start the engine and leave it idling.
- Wait until the pressure rises again, switch off the ignition and, at the same time, squeeze the flexible return tube on the fuel distributor.

If the pressure does not drop:

- Change the fuel regulator.

If the pressure drops again:

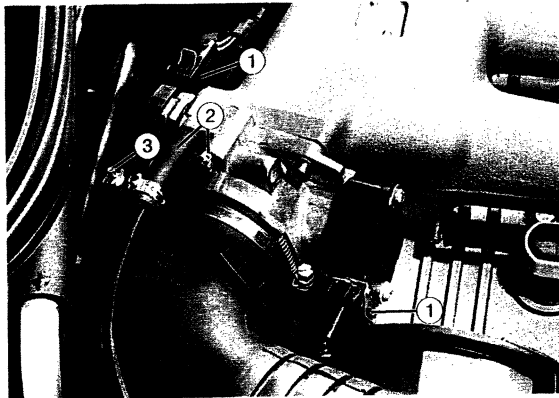
- Check the retention valve on the fuel and injectors pump.
- Check the air-tightness of the joins in the tubes, O-rings on the fuel distributor and injectors.

### Note

Before removing the pressure measuring device, release the fuel pressure by opening the stop-cock and placing a vessel under the outlet.

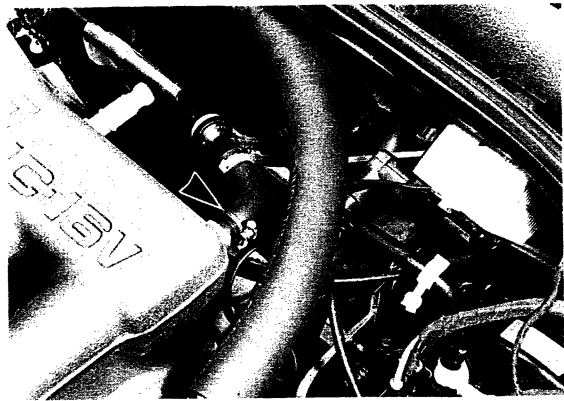
### FUEL DISTRIBUTOR WITH INJECTORS Removal, replacement and checking

- Disconnect the battery's positive terminal.
- Remove the inlet air temperature transmitter.
- Remove the inlet nozzle.



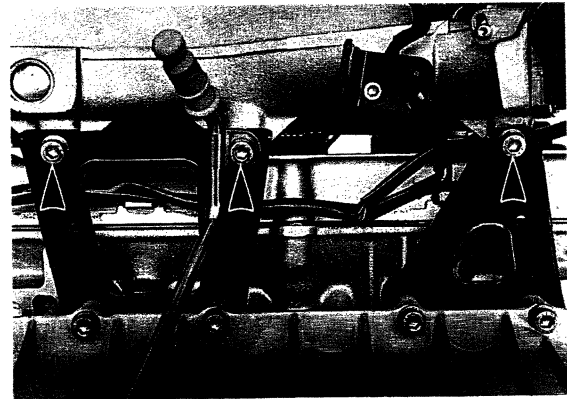
24B072

- Remove the electrical connections to the throttle valve potentiometer and switch (1). Remove the suction tubes from the throttle valve manifold (2) and remove the accelerator cable (3).



24B079

- Remove the brake servo suction tube.

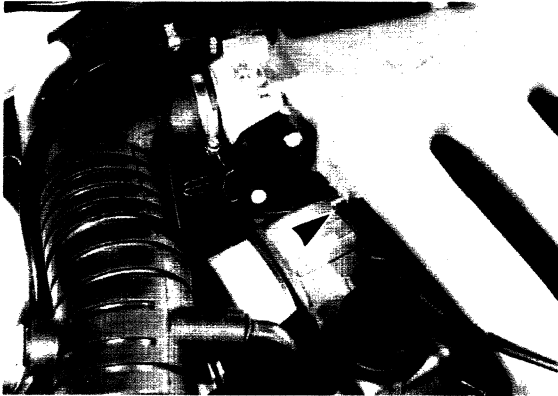


15B062

- Remove the bolts from the rear of the inlet manifold brackets.

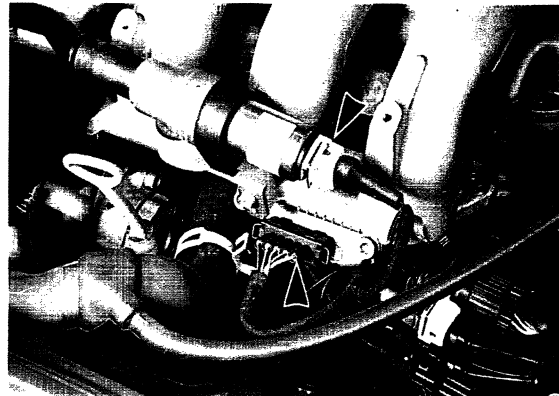
# Engine 24

Fuel preparation: 2.0 I 16 V engine



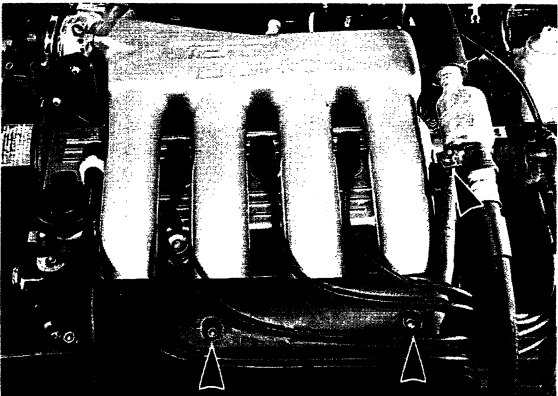
24B068

- Remove the suction tube from the pressure regulator.
- Remove the spark plug cables.



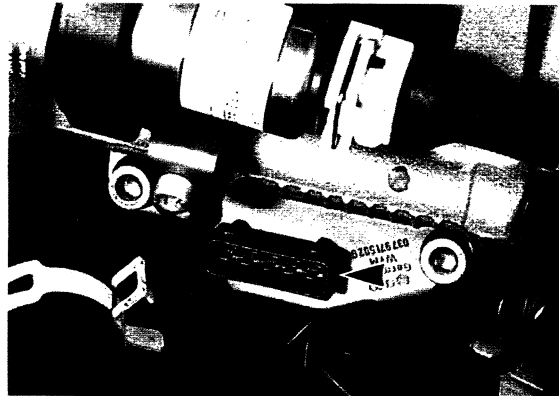
24A131

- Remove the electrical connections from the idling stabilizer and the fuel distributor.



24B080

- Remove the channelling supporting the spark plug cables.

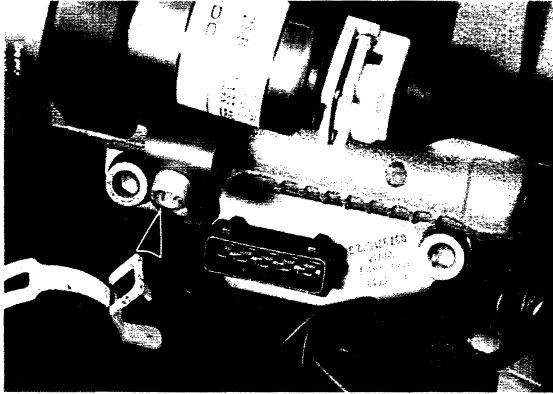


24A132

- Remove the fuel distributor's male connector from its bracket.

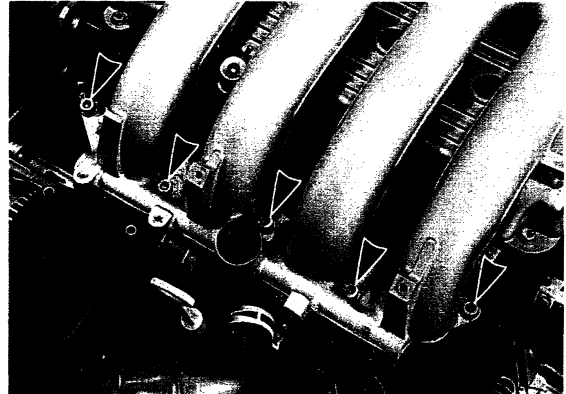
# Engine 24

Fuel preparation: 2.0 l 16 V engine



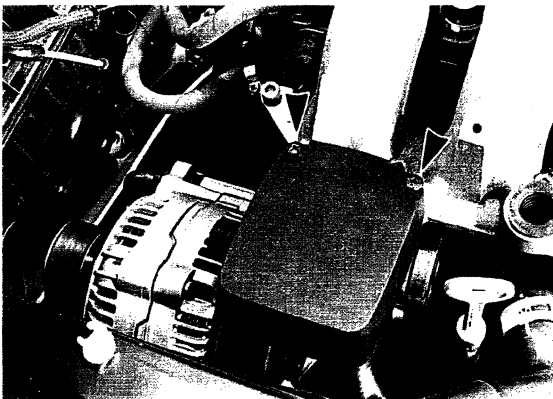
24A133

— Remove the stabilizer together with its bracket.



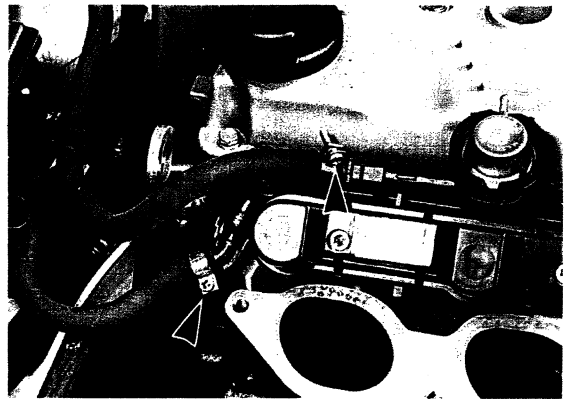
24B085

— Remove the bolts from the front upper part of the inlet manifold and remove it.



24B084

— Remove the sump gasses regulating valve.

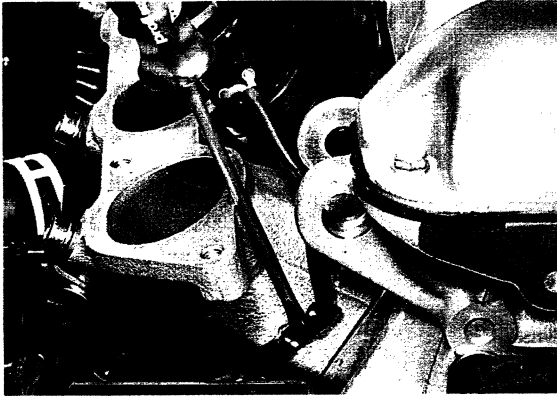


24B086

— Disconnect the fuel entry and return tubes from the distributor.

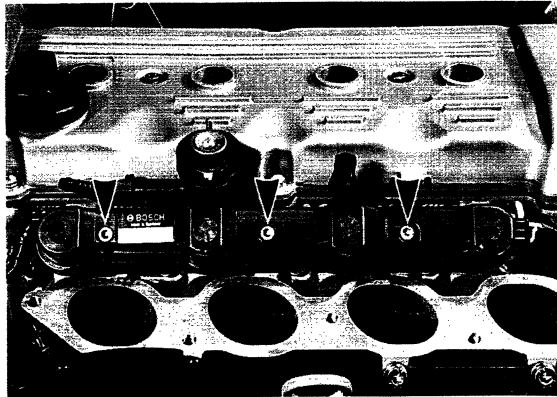
# Engine 24

## Fuel preparation: 2.0 I 16 V engine



24B087

- Remove the fuel distributor installation fixing from its housing on the lower part of the inlet manifold.

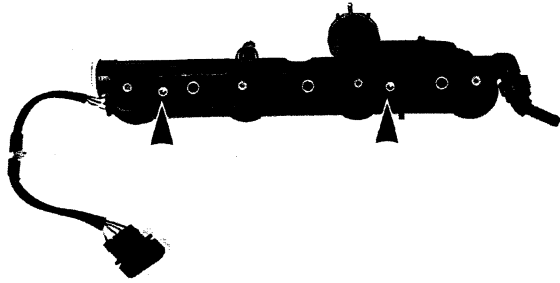


24B088

- Unscrew the bolts which hold the fuel distributor to the lower part of the manifold and remove it.

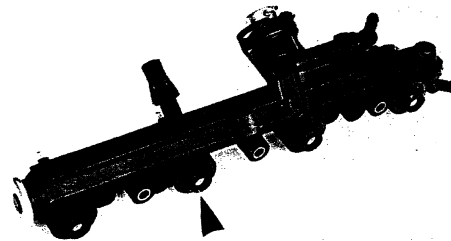
### Removal and replacement of injectors.

- Fuel distributor tube removed.



24A134

- Remove the fixing bolts from the two distributor halves.



24B090

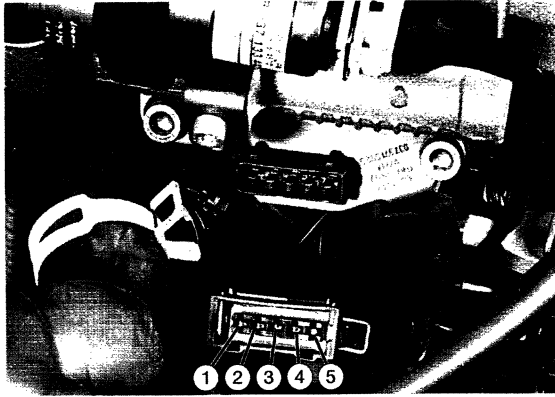
- Remove the injectors from their housing, by its interior, pushing smoothly and taking care not to damage the O-rings.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

### Injector power supply voltage

- Remove the power supply connector from the fuel distribution tube.



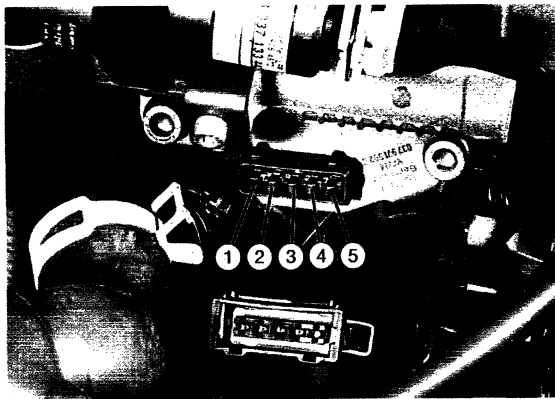
24A135

- Connect the **VAG 1527** test lamp to the connector's terminals, using the **VAG 1594 A** cables and adapters.
- Operate the starter. The LED should flash.
- Repeat the test with contacts 2 and 5, 3 and 5 and 4 and 5.

The LED should not flash:

- Carry out an electrical check using the **VAG 1598/18**.
- If necessary, replace the Digifant control unit.

### Check the injector resistance



24A136

- Connect the **VAG 1526** digital multimeter in resistance measurement mode to the terminals of the distributor tube, using the **VAG 1594 A** auxiliary cables.

Injector	1	2	3	4
Contacts	1 and 5	2 and 5	3 and 5	4 and 5

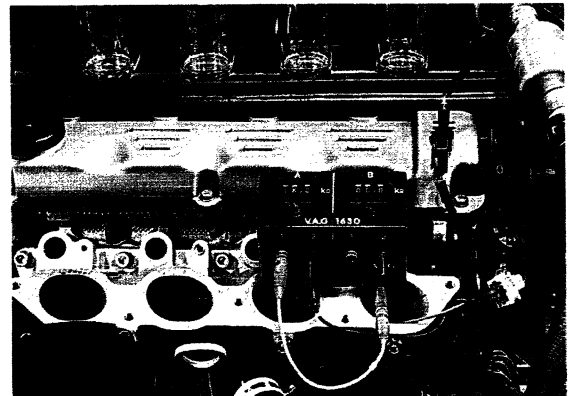
Approximate resistance:  $15 \div 20 \Omega$ .

If the minimum rated value is not reached:

- Remove and disassemble the distributor and repeat the check for each of the injectors. If necessary, replace defective injectors.

### Check the spray shape and sealing of the injectors

- Completely remove the fuel distributor (do not remove the fuel tubes).
- Unplug the connector from the coolant temperature sensor.

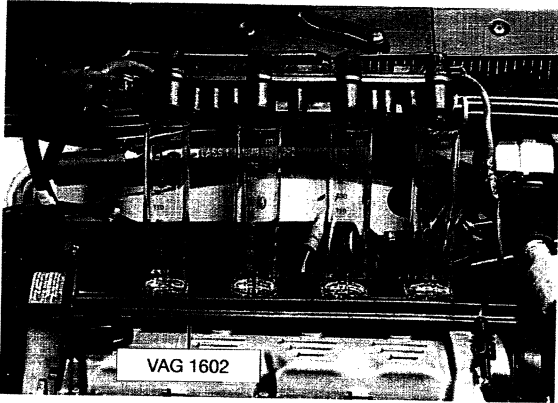


24B093

- Connect the **VAG 1630** digital potentiometer (side A), previously adjusted to  $15 K\Omega$ , using the **VAG 1594 A** auxiliary cables, to the previously removed connector

# Engine 24

## Fuel preparation: 2.0 I 16 V engine



24B094

- Place the fuel distributor with the injectors on the **VAG 1602** measuring device.
- Remove the final stage of the ignition transformer.
- Activate starter motor.

The injectors' sprays should be uniform and pulsing.

- Switch off the ignition and check the injectors' fuel tightness. No more than 2 drops/min should leave each injector.

If this standard is not met, change the injector(s) concerned.

### Note

When fitting the injectors, check that the O-rings are not damaged.

### INLET SYSTEM: CHECKING FOR LEAKS

Test to be carried out using the **G 001 800 A1** engine leaks locating spray.

### Notes

- Because of the suction in the inlet system, the unwanted air leaks detection spray is sucked in. This reduces the burning capacity of the mixture, thus reducing the engine idling speed and causing a large rise in the CO content.
- Always follow the safety rules on the packaging.

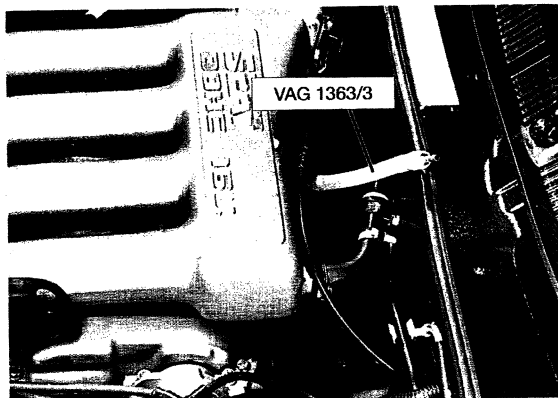


24A128

- Connect the ignition timing and engine speed checking equipment **VAG 1367** using the pick up clamp **VAG 1367/8** or connect directly the equipment **VAG 1767**.

## Engine 24

### Fuel preparation: 2.0 I 16 V engine



24A129

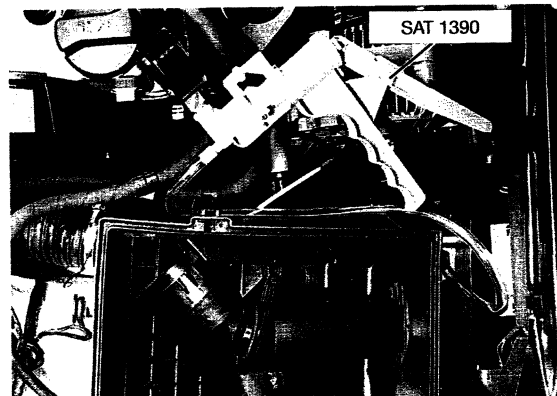
- Connect the CO content checking equipment **VAG 1363A**; connect also the adaptor **VAG 1363/3** to the CO measuring pipe.
- Start the engine and allow it to idle until it reaches running temperature.
- Systematically apply the spray to the inlet system's components.

If the engine idling speed drops and the CO content change:

- Check the sprayed area of the inlet system and eliminate the leaks.

#### CHECKING THE INLET AIR PRE-HEATING SYSTEM

- Engine cold (inlet air temperature below 20 °C).
- Regulator valve suction capsule tight.
- Remove the temperature regulator flexible tube coming from the suction capsule.
- Remove the upper part of the filter casing and remove the filter cartridge.



24B096

- Connect the tube to the **SAT 1390** manual vacuum pump.
- Operate the pump and check the smooth operation of the regulator valve and the operation of the suction capsule.

The regulator valve must close the cold air inlet.

Check the temperature regulator.

- Connect the suction tube to the temperature regulator.
  - Start the engine and leave it idling.
- Check the position of the regulator valve after at least 20 seconds.

Temperature of the temperature regulator	Position of the regulator valve
Less than 20 °C	Cold air inlet closed
Over 30 °C	Hot air inlet closed
Between 20 and 30 °C	Between cold and hot air inlets

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

### SUMMARY TABLE FOR DISPLAY GROUPS IN FUNCTION 08 "READ MEASUREMENT VALUES BLOCK"

Display group number	Display in the corresponding field
00	The meaning of this group is defined in the following table
01	1 = engine speed 2 = coolant temperature 3 = lambda probe voltage 4 = adjustment conditions
02	1 = engine speed 2 = Injection time 3 = battery voltage 4 = inlet air temperature
03	1 = engine speed 2 = engine load signal 3 = throttle valve angle 4 = opening of stabilizer valve
04	1 = engine speed 2 = engine load signal 3 = no meaning 4 = operating state*

\* Meaning of the operation state digits if they are 1:

1	1	1	1	1	1	1	1
Deceleration	Idling	Partial load	Full load	No meaning	No meaning	No meaning	No meaning

Display group number	Display in the corresponding field
05	1 = engine speed 2 = AKF valve signal 3 = fuel consumption signal 4 = no meaning
06	1 = lambda integrator value* 2 = lambda integrator value* 3 = self-adapted value for idling stabilization 4 = memorized value for throttle valve potentiometer in "Basic adjustment", throttle valve closed
07	Only used for factory tests

\* The values in display fields 1 and 2 must always be observed together:

- If display field 1 contains a 0, field 2 must show a value between 0 and 70.
- If display field 1 contains 255, display field 2 must indicate a value between 144 and 255.

# Engine 24

Fuel preparation: 2.0 l 16 V engine

Table for values for group 00 in function 08 "Read measurement values block"

Display field	Meaning	Theoretical value	Real value
1	Inlet air temperature	24 ÷ 73	15 ÷ 50 °C
2	Battery voltage	128 ÷ 150	12,0 ÷ 14,2 V
3	Coolant liquid temperature	4 ÷ 10	85 ÷ 105 °C
4	Engine load	60 ÷ 90	23 ÷ 36 %
5	Lambda probe signal	100 ÷ 240	0 ÷ 1,0 V
6	Lambda regulation timing	0	—
7	Lambda probe status counter	0 ÷ 20	—
8	Throttle valve potentiometer voltage	12 ÷ 49	0,25 ÷ 0,95 V
9	Injection time	5 ÷ 8	2,5 ÷ 4,0 ms
10	Engine speed	212 ÷ 202	770 ÷ 870/min

**AUTODIAGNOSIS WITH THE FAULT DETECTOR  
EQUIPMENT VAG 1551  
READ THE FAULT MEMORY**

- Connect the **VAG 1551** fault finder to the diagnosis connectors located in the switch hole on the left of the steering column.
- Start the engine.

If the engine does not start:

- Operate the starter for 6 seconds. Do not switch off the ignition afterward.
- Activate the printer by pressing the PRINT key (the key's pilot light comes on).
- Press the **1** key to select the function "Quick data transmission".
- Press the **0** and **1** keys to select the function "Engine electronics". Confirm the selection by pressing the **Q** key.
- Press the → key.

The display will show:

<b>Rapid data transmission</b> <b>Select function XX</b>	<b>HELP</b>
---	-------------

- Press the **02** keys to enter the "Consult faults memory" function and confirm by pressing the **Q** key.

The display will show:

<b>X faults detected</b>
--------------------------

The display shows the number of faults detected or "No fault detected".

If one or more faults are memorized, they are displayed on the screen and printed one by one.

The display then show:

<b>Rapid data transmission</b> <b>Select function XX</b>	<b>HELP</b>
---	-------------

If no fault has been memorized:

Press the → key.

- Press the **06** keys to enter the "End transmission" function and confirm it by pressing the **Q** key.

To find and eliminate the faults printed out, see the table with the **VAG 1551** fault-finder described in this repair group.

- Erase the faults memory as described below.

**ERASE FAULT MEMORY**

- Fault eliminated.
- Carry out a test run of at least 10 minutes' duration.

During the run:

- The coolant temperature must reach at least 80 °C.
- The rpm must reach at least 3000 rpm.
- The accelerator pedal must be pressed down fully for a brief period.
- Press the **1** key to select the function "Quick data transmission".
- Press the **0** and **1** keys to select the function "Engine electronics". Confirm the selection by pressing the **Q** key.
- Press the key →.

The display will show:

<b>Rapid data transmission</b> <b>Select function XX</b>	<b>HELP</b>
---	-------------

- Press the **02** keys to enter the "Consult faults memory" function and confirm by pressing the **Q** key.
- Press the → key until all the memorised faults have been displayed and the following appears on screen:

<b>Rapid data transmission</b> <b>Select function XX</b>	<b>HELP</b>
---	-------------

- Press the **05** keys to enter the "Erase faults memory" function and confirm by pressing the **Q** key.
- The display will show:

<b>Rapid data transmission</b> <b>The faults memory is erased</b>	→
--	---

- Press the → key.
- The display will show:

<b>Rapid data transmission</b> <b>Select function XX</b>	<b>HELP</b>
---	-------------

- Press the **06** keys to enter the "End transmission" function and confirm it by pressing the **Q** key.
  - Carry out a new test run and check the faults memory again.
- It should not show any fault.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

### SELECTABLE FUNCTIONS WITH THE FAULT DETECTOR VAG 1551

Selectable functions	Ignition on	Engine idling
02 Fault memory query	X	X
03 Diagnosis of controls	X	—
04 Start basic adjustment	X	X
05 Erase fault memory	X	X
06 End transmission	X	X
08 Read measurement value block	X	X
00 Fault memory direct query for all vehicle control units	X	X

### DRIVER DIAGNOSIS WITH THE FAULT DETECTOR VAG 1551

When making the driver diagnosis, the following components are operated in the same order they are shown:

1. Fuel pump relay.
  2. Idle speed stabilization valve.
  3. Activated carbon tank solenoid valve.
- Connect the fault detector **VAG 1551** using the cable **VAG 1551/1**.
  - Turn on ignition.
  - Press the **1** key to select the function "Quick data transmission".
  - Press the **01** keys to select the function "Engine electronics" and confirm the selection by pressing the **Q** key.

- Press the → key.
  - Press the **03** keys to select the function "Controller diagnostic".
- The display will show:

<b>Quick data transmission</b> <b>03 - Actuators diagnosis</b>	<b>Q</b>
---	----------

- Activate the fuel pump relay.
- Confirm the selection by pressing the **Q** key.
- The display will show:

<b>Actuators diagnosis</b> <b>Fuel pump relay</b>	→
--	---

The fuel pump relay must activate (make a "click") until the → key is pressed to move to the next actuator.

#### Note

When the fuel pump relay is activated, the pump also functions audibly.

If the relay does not work:

- Check the pump relay using the electrical schematics.

Activate the idling stabilizer valve:

- Press the → key.

The display will show:

<b>Actuators diagnosis</b> <b>Idle speed stabilization valve</b>	→
---	---

The idling stabilizer valve must actuate (the sound it makes when connecting and disconnecting is audible) until the → key is pressed to pass to the next actuator.

**SELECTABLE FUNCTIONS WITH THE FAULT DETECTOR VAG 1551**

Selectable functions	Ignition on	Engine idling
02 Fault memory query	X	X
03 Diagnosis of controls	X	—
04 Start basic adjustment	X	X
05 Erase fault memory	X	X
06 End transmission	X	X
08 Read measurement value block	X	X
00 Fault memory direct query for all vehicle control units	X	X

**DRIVER DIAGNOSIS WITH THE FAULT DETECTOR VAG 1551**

When making the driver diagnosis, the following components are operated in the same order they are shown:

1. Fuel pump relay.
  2. Idle speed stabilization valve.
  3. Activated carbon tank solenoid valve.
- Connect the fault detector **VAG 1551** using the cable **VAG 1551/1**.
  - Turn on ignition.
  - Press the **1** key to select the function "Quick data transmission".
  - Press the **01** keys to select the function "Engine electronics" and confirm the selection by pressing the **Q** key.

- Press the **→** key.
- Press the **03** keys to select the function "Controller diagnostic".

The display will show:

<b>Quick data transmission</b> <b>03 - Actuators diagnosis</b>	<b>Q</b>
---	----------

Activate the fuel pump relay.

- Confirm the selection by pressing the **Q** key.

The display will show:

<b>Actuators diagnosis</b> <b>Fuel pump relay</b>	<b>→</b>
--	----------

The fuel pump relay must activate (make a "click") until the **→** key is pressed to move to the next actuator.

**Note**

When the fuel pump relay is activated, the pump also functions audibly.

If the relay does not work:

- Check the pump relay using the electrical schematics.

Activate the idling stabilizer valve:

- Press the **→** key.

The display will show:

<b>Actuators diagnosis</b> <b>Idle speed stabilization valve</b>	<b>→</b>
---	----------

The idling stabilizer valve must actuate (the sound it makes when connecting and disconnecting is audible) until the **→** key is pressed to pass to the next actuator.

## Engine 24

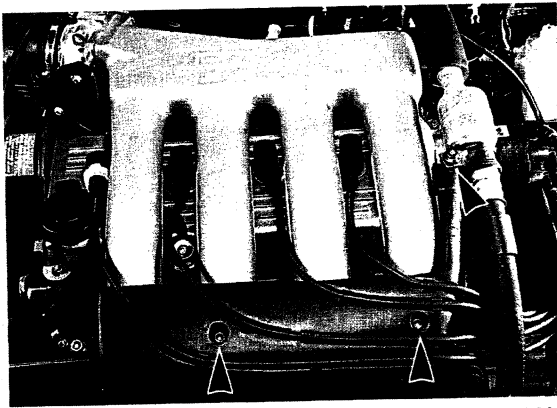
### Fuel preparation: 2.0 I 16 V engine

#### Warning

When the checking of the actuator elements has been completed, you must exit the **VAG 1551**, using function **06** "End data transmission" and then switch off the ignition. Otherwise, if you try to start up immediately, the fuel pump will remain in constant operation even although the motor stops.  
If this occurs, disconnect the positive terminal of the battery for more than 30 seconds.

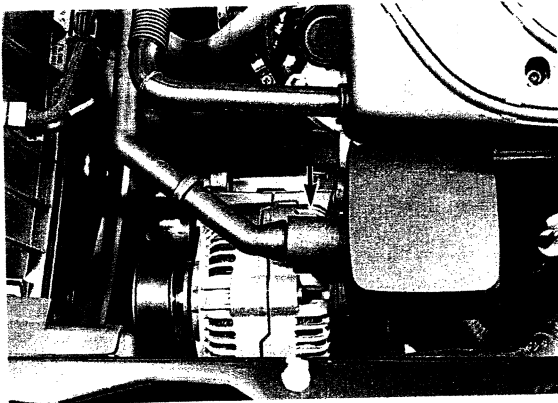
#### PINKING SENSORS

- Right sensor tightening torque:



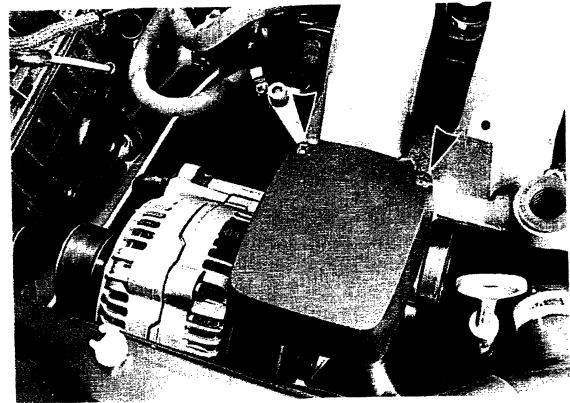
24B080

- Remove the bolts from the spark plug cable guide.



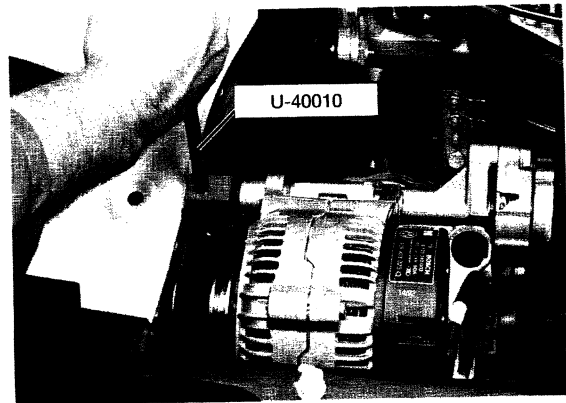
24B066

- Remove the tube from the sump gases breather valve to the inlet manifold.



24B084

- Remove the sump gases breather valve bracket.



24A142

- Remove the alternator belt using the **U-40010** tool.

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

- Remove the alternator belt tensioner.
- Apply the **U-40083** tool and tighten to **20 Nm**.
- Left sensor tightening torque:
- Apply the **U-40083** tool and tighten to **20 Nm**.
- To replace (both):
- Remove the bolt fixing the pinking sensor.
- Remove the sensor's electrical connector from its bracket.

### FAULT TABLE FOR FAULT DETECTOR VAG 1551

- Before replacing any component diagnosed as faulty, all connector pin contacts, cables and ground connections must be thoroughly checked, specially if the fault is diagnosed as sporadic (S/P).
- The diagnostic is carried out in the "Quick data transmission" mode.
- The fault code and the intermittent ones are not displayed on the **VAG 1551** display; they are only shown in the paper from the printer if it is active.

MESSAGE DISPLAYED	FAULT POSSIBLE REASONS	FAULT ELIMINATION
00515 <span style="float: right;"><b>2113</b></span> Hall pulse generator No signal	Faulty Hall generator System discontinuity	— Check Hall generator — Check cables
00518 <span style="float: right;"><b>2212</b></span> Throttle valve potentiometer Short circuit to ground Break/short circuit to the positive terminal No fault detected/sporadic fault	Cables shortcircuited to ground Cable discontinuity Faulty potentiometer Briefly: cable break, short circuit or interruption in the potentiometer	— Check the electrical system and the potentiometer — Check the electrical system and the potentiometer — Check cables and connectors for loose contacts in accordance with the electrical schematics
00519 <span style="float: right;"><b>2222</b></span> Inlet manifold pressure transmitter No signal	Digifant control unit, defective Defective suction tube to the Digifant control unit, or tube not connected	— Check the pressure transmitter with the VAG 1551 — Check tube electrical schematics

MESSAGE DISPLAYED	FAULT POSSIBLE REASONS	FAULT ELIMINATION
<b>00522</b> <b>2312</b> Cooling liquid temperature transmitter Shortcircuit to the positive terminal/cable discontinuity No fault detected/sporadic fault	Faulty transmitter Faulty transmitter	— Check the complete system with transmitter — Check installation and transmitter — Check cables and connectors for loose contacts in accordance with the electrical schematics
<b>00523</b> <b>2322</b> Intake air temperature transmitter Short circuit to ground Cable discontinuity/shortcircuit to the positive terminal No fault detected/sporadic fault	Faulty transmitter Cables short-circuited to ground Faulty transmitter Cable discontinuity Briefly: installation break, short circuit or transmitter interruption	— Check the complete system with transmitter — Check the complete system with transmitter — Check installation and transmitter — Check cables and connectors for loose contacts in accordance with the electrical schematics
<b>00525</b> <b>2342</b> Lambda probe No signal Short circuit to ground or to the positive terminal	Faulty probe System discontinuity The installation has a short circuit to positive	— Replace probe — Check the installation, the lambda probe and adjustment
<b>00532</b> <b>2234</b> Power supply Signal too low Signal too large	Battery voltage over 15.5 V Battery voltage below 6.1 V	— Check the alternator — Check the battery

# Engine 24

## Fuel preparation: 2.0 l 16 V engine

MESSAGE DISPLAYED	FAULT POSSIBLE REASONS	FAULT ELIMINATION
005224 Pinking sensor 1 No signal	<b>2142</b> Cable break or short circuit in the sensor's cable Defective sensor Pinking not detected by the control unit	— Defective sensor — Change the sensor — Change the control unit
00540 Pinking sensor 2 No signal	Cable break or short circuit in the sensor's cable Defective sensor (left pinking sensor in direction of travel) Pinking not detected by the control unit	— Check the installation toward the sensor — Change the sensor — Change the control unit
00513 Engine speed transmitter No signal	Faulty transmitter Cable discontinuity	— Replace transmitter — Check system using the electrical schematics

# Engine 24

## Fuel preparation: 2.0 l 16 V engine

MESSAGE DISPLAYED	FAULT POSSIBLE REASONS	FAULT ELIMINATION
65535 Faulty control unit	1111 Digifant control unit components	— Replace (see Repair Group 24)
01087 Basic adjustment not carried out	The engine control unit is not matched to the engine	— Carry out basic adjustment
00740 Transmitter for identifying cylinder 1	Faulty transmitter Or break in cable	Check G 145
01249 Injector of cylinder 1-N30*	Break or short circuit in the cables to the injectors of cylinders 1, 2, 3 or 4  Injector of cylinder 1, 2, 3 or 4 (N30 ... N33) faulty	Check N30 ... N33
17978 Engine control unit blocked	Communications failure with transponderr	Check transponder (Repair Group 96)

\* The self diagnosis detects the failure of an injector, but not which one, even though the display shows number 1. If this fault is found in the memory, check them all.

If when checking the cables any faulty connection between cable and terminal is found and the terminal must be replaced, use tool **U-40901** to remove the terminal.

# Engine 24

## Fuel preparation: 2.0 l 16 V engine

**VAG 1598/18 TEST TABLE**

Adjust the V measurement margin (voltage)				
Step	VAG 1598/18 terminal	Checking	Conditions for the checking	Nominal values
1	1 and 23 1 and 9	Digifant control unit power supply	Turn on ignition	About battery voltage
2	1 and 38	Power supply terminal 15 for Digifant control unit	Turn on ignition	
3	1 and 7	Starter motor cable terminal 50	Remove the Hall transmitter connector	8 V min.
4	Jump 1 and 6	Cable to fuel pump relay	Ignition on	Working of fuel pump should be clearly audible
5	Jump 1 and 28	Cable to lambda probe heating relay	Ignition on Jumper terminals 1 and 6 of the <b>VAG 1598/18</b> tester Remove the lambda probe connector and connect the <b>VAG 1526</b> digital multimeter to contacts 1 and 2 of the connector	About battery voltage
6	1 and 31	Active carbon tank electromagnetic valve	Ignition on	About battery voltage
7	1 and 39	Cable to air conditioning	Ignition on Switch on the ventilation fan Set the air conditioning to full power	Battery voltage

# Engine 24

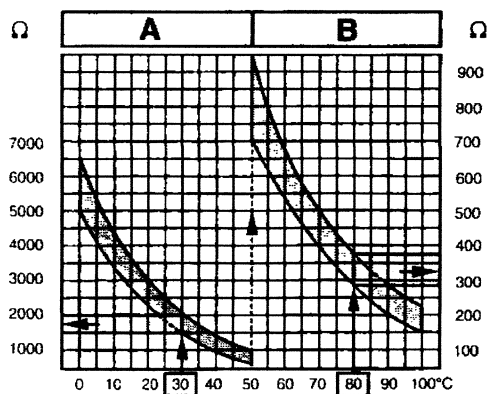
## Fuel preparation: 2.0 l 16 V engine

Ignition turned off Adjust the measurement margin $\Omega$ (resistance)				
Step	VAG 1598/18 terminal	Checking	Conditions for the checking	Nominal values
8	33 and 45	Cables to the Hall transmitter	Remove the transmitter connector Jump contacts 1 and 3 on the connector	1.5 $\Omega$ max.
	33 and 44		Jumper contacts 1 and 2 in the connector	
9	67 and 68	Cables to the engine speed transmitter	Remove the transmitter connector Jumper contacts 1 and 2 in the connector	1.5 $\Omega$ max.
	33 and 68		Jump contacts 1 and 3 on the connector	
10	14 and 33	Cooling liquid temperature transmitter	—	See drawing 24AD13
11	33 and 36	Intake air temperature transmitter	—	See drawing 24AD13
12	20 and 42 20 and 65 42 and 65	Cables to the lambda probe	—	∞ $\Omega$
	20 and 42		Remove the probe connector Jumper contacts 3 and 4	
13	10 and 32 10 and 34 32 and 34	Cables to pinking sensor 1	—	∞ $\Omega$
	32 and 34		Remove the sensor's connector (brown on cylinder head bracket, left side) Jumper contacts 1 and 2 in the connector	
	10 and 34		Jump contacts 1 and 3 on the connector	

# Engine 24

## Fuel preparation: 2.0 I 16 V engine

- Graph of cooling liquid liquid temperature transmitter resistance and intake air values.



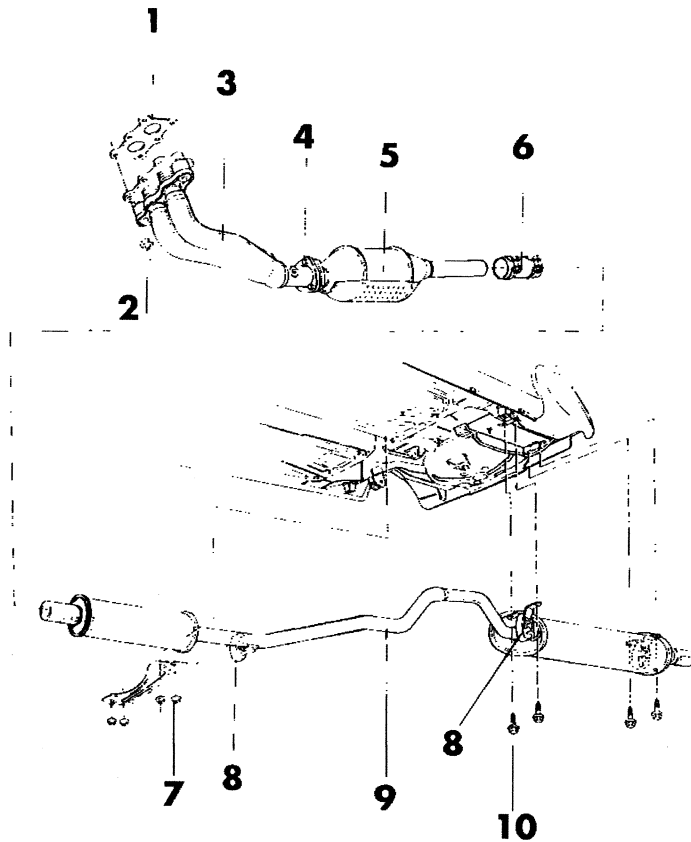
24DD05

Step	VAG 1598/18 terminal	Checking	Conditions for the checking	Nominal values
14	55 and 56 55 and 57 56 and 57	Cables to the pinking sensor 2	—	$\infty \Omega$
	56 and 57		Remove the connector to the pinking sensor (black, on the cylinder head bracket, left side) Jump contacts 1 and 3 on the connector	1.5 $\Omega$
	55 and 57		Jumper contacts 1 and 3 of the sensor's connector	
15	21 and 23	Idle speed switch	Throttle valve closed	1.5 $\Omega$
			Open the throttle valve	$\infty \Omega$
16	27 and 38	Idle speed stabilization valve	—	3.5 ÷ 6.0 $\Omega$
17	8 and 1	Cables to the final stage of the ignition transformer	Remove the connector Jumper contacts 1 and 2 in the connector	1.5 $\Omega$

Adjust the V measurement margin (voltage)				
18	1 and 19	Air conditioner start-up signal cables	Turn on ignition Switch on the heater fan Switch on the air conditioner to its maximum cooling power	About battery voltage

**EXHAUST SYSTEM: 2.0 I 16 V DIGIFANT ENGINE. EXPLODED VIEW**

After performing assembly work on the exhaust system, special attention must be paid to avoid any tension and to prevent any part coming too close to the bodywork. If necessary, loosen the clamps and align the exhaust, so that there is sufficient clearance along its entire length.  
Replace self-locking nuts.



26BD07

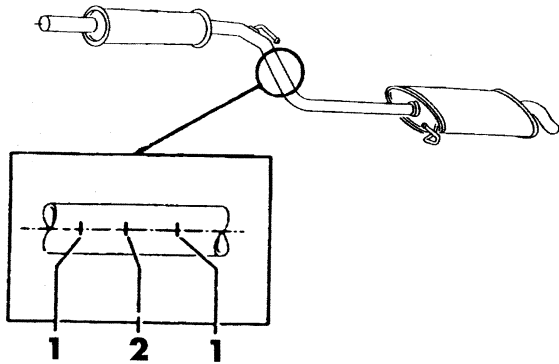
- |  |  |
|--|--|
| <p><b>1. Gasket.</b><br/>Replace.</p> <p><b>2. Nut fixing exhaust pipe to manifold. 40 Nm.</b><br/>Take into account the tightening instructions.</p> <p><b>3. Front exhaust pipe.</b></p> <p><b>4. Bolt fixing exhaust pipe to front muffler. 20 Nm.</b><br/>Replace the middle ring if defective or no seal.</p> | <p><b>5. Catalyst.</b></p> <p><b>6. Double clamp.</b></p> <p><b>7. Fixing nut.</b></p> <p><b>8. Rubber support.</b></p> <p><b>9. Final exhaust stage.</b><br/>Take into account the replacement instructions.</p> <p><b>10. Bolt fixing rubber mounting insulators to the bodywork. 25 Nm.</b></p> |
|--|--|

# Engine 26

## Exhaust installation: 2.0 I 16 V engine

### FINAL EXHAUST STAGE: Replacement

The final stretch of the exhaust consists of a single part. However, in the event of repair, both the central and final mufflers can be replaced individually; in order to carry out this operation, follow the instructions given below.



26BD08

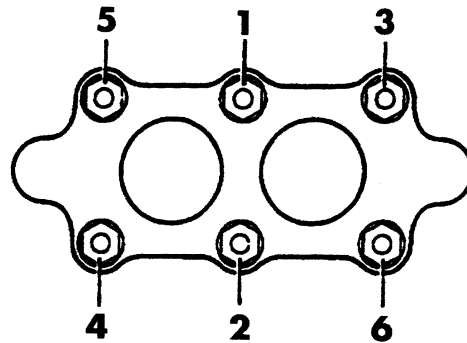
Raise the vehicle and locate the marks on the exhaust pipe between the central and final silencers (see drawing).

Then cut the tube across at the central mark (2) and remove the faulty section.

When cutting the exhaust pipe, it is necessary to use the tool **U-40075**.

Insert and join the new sections, using the double repair clamp supplied as a spare part; this clamp must be aligned with the marks (1) on the ends of the tubes.

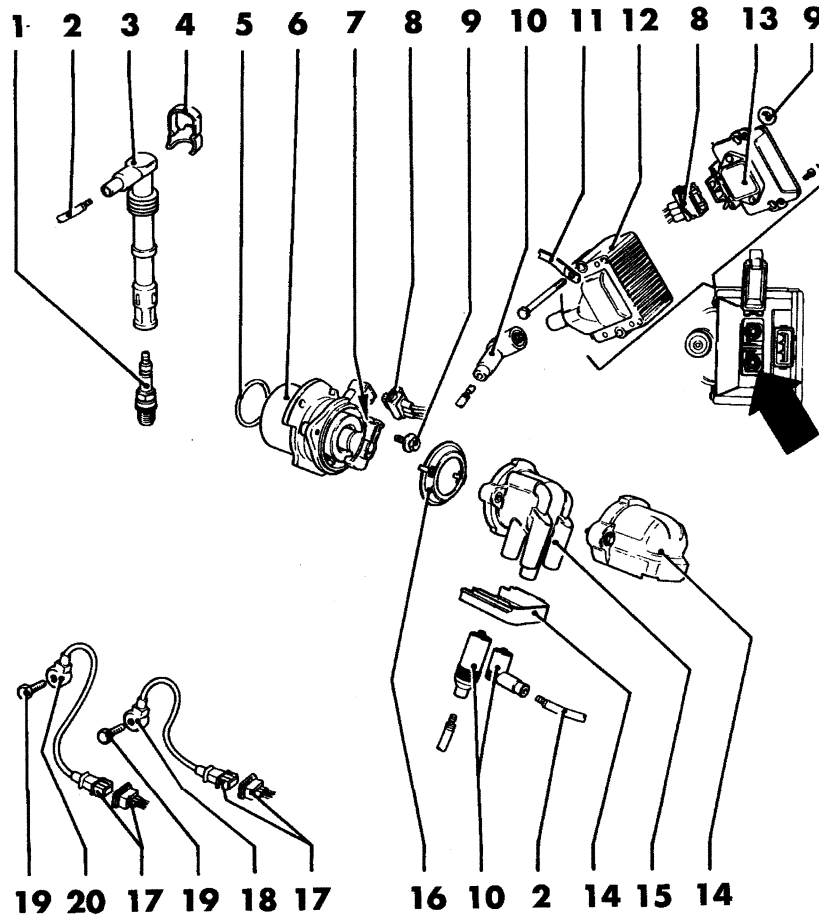
### INSTRUCTIONS FOR TIGHTENING THE EXHAUST PIPE TO THE MANIFOLD



26BD10

Tighten the fixing nuts following the order indicated in the drawing.

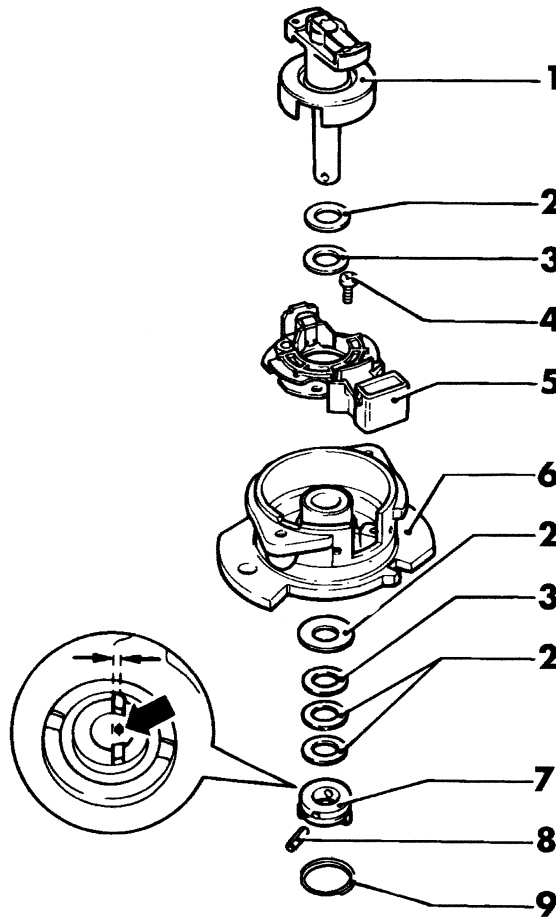
**DIGIFANT 2.0 I 16 V IGNITION SYSTEM: EXPLODED VIEW**



28AD23

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li><b>1. Spark plugs. 30 Nm.</b><br/>Remove and install with the U-30037 tool.</li> <li><b>2. Ignition cables.</b><br/>Check the resistance.</li> <li><b>3. Spark plug connectors.</b><br/>Resistance between 4 and 6 K<math>\Omega</math>. Remove only with extractor ring.</li> <li><b>4. Extractor ring.</b></li> <li><b>5. O-ring.</b><br/>Replace if damaged.</li> <li><b>6. Ignition distributor with Hall generator.</b><br/>Resistance between 0.6 and 1.4 K<math>\Omega</math>.</li> <li><b>7. No. 1 cylinder mark.</b></li> <li><b>8. Connector.</b></li> <li><b>9. 10 Nm.</b></li> <li><b>10. Interference suppression connector.</b><br/>Resistance between 0.6 and 1.4 K<math>\Omega</math>.</li> <li><b>11. Ground stip.</b></li> <li><b>12. Ignition transformer.</b></li> <li><b>13. Ignition transformer final stage.</b></li> </ul> | <ul style="list-style-type: none"> <li><b>14. Cap.</b></li> <li><b>15. Distributor cover.</b><br/>Must not be cracked nor show current leak marks, nor contact wear.<br/>Check the wear and that the brush is free to operate.</li> <li><b>16. Dust boot.</b></li> <li><b>17. Triple connector for pinking sensor.</b><br/>For pinking sensor 1: brown<br/>For pinking sensor 2: black.</li> <li><b>18. Pinking sensor 1.</b><br/>Seen on the right in the direction of travel.</li> <li><b>19. Pinking sensor fixing bolt. 20 Nm.</b><br/>The tightening torque affects the operation of the pinking sensor.</li> <li><b>20. Pinking sensor 2.</b><br/>Seen on the left in the direction of travel.</li> </ul> |
|---|---|

### IGNITION DISTRIBUTOR: EXPLODED VIEW



28BD09

**1. Ignition distributor shaft.**

With diaphragm of ignition distributor rotor  
Disassemble the pin (7) and remove it.

**2. Washer(s).**

**3. Plastic washer.**

**4. Bolt. 3 Nm.**

**5. Hall transmitter.**

**6. Ignition distributor casing.**

**7. Coupling.**

Mark the position of the driven pivot with respect to  
the shaft (1) before removing.

**8. Cotter pin.**

**9. Safety spring.**

**Note**

When assembling, check that the coupling (7) slides smoothly on the pin (8) and that the clearance between the ignition distributor shaft (1) is not reduced.

## SAFETY MEASURES REGARDING THE DIGIFANT INJECTION AND IGNITION SYSTEM

To prevent personal injuries and damages to the injection and ignition system, take into account the following rules:

- The injection and ignition system cables, including the high voltage cables, can only be plugged and unplugged with the ignition turned off.
- If the engine must rotate without starting up, unplug the Hall generator connector (ignition distributor).
- The starting help with a quick charger is only allowed for 1 minute as a maximum and without exceeding 16.5 V.
- Washing of the engine must be carried out with the ignition disconnected only.
- When performing electric welding or spot welding, fully disconnect both battery terminal leads.
- Do not connect any capacitor to terminal 1 (-).
- Do not replace the 1 K $\Omega$  ignition distributor rotor (code R1) for other, not even to protect the radio from statics.
- To protect the radio from statics, use only 1 K $\Omega$  resistances for the high voltage cables and 5 K $\Omega$  spark plug connectors.

## ADJUSTMENT DATA AND SPARK PLUGS

ENGINE	ABF
Ignition timing	6 $\pm$ 3°
Speed RPM	770 $\div$ 870
Ignition order	1-3-4-2
Spark plugs (manufacturer's designation)	C6 VPYC
Electrode gap in mm	0.6
Tightening torque	30 Nm

## IGNITION DISTRIBUTOR ROTOR: REPLACEMENT

The rotor of the ignition distributor is fixed to the shaft. If it is to be replaced, it must be destroyed, by crushing it with pliers, for example. Do not break it with a hammer as this could destroy the distributor shaft or the bearing.

Remove any traces which may remain on the shaft and stick the new rotor in place with AMV 185 101 A1.

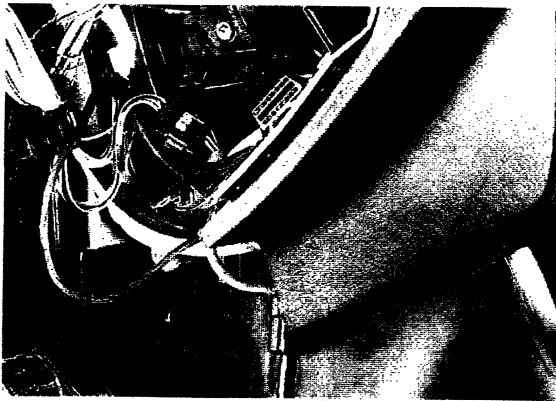
## IGNITION TIMING

### Checking

- All equipment must be connected with the ignition switched off.
- Engine oil minimum temperature 80 °C.
- All electrical loads disconnected.

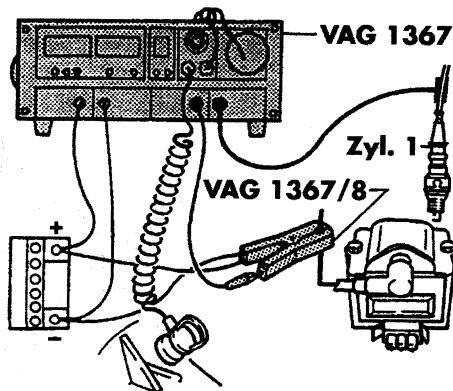
# Engine 28

## Ignition system: 2.0 I 16 V engine



24B004

- Correct functioning of the lambda probe.
- Connect the fault detector equipment **VAG 1551** to the 16 pin connector located at the right of the steering column on the dashboard lower part, using the cable **VAG 1551/3**.
- Consult and erase the faults memory, as described in this group, but do not end transmission with the 0 and 6 keys.



28BD10

- Connect the equipment **VAG 1367** using the pick up clamp **VAG 1367/8**, or connect directly the equipment **VAG 1767**, to check the ignition timing and the engine speed.
- Start up the engine and let it run at the idle speed.

Use the fault detector equipment **VAG 1551** in the following way:

- Press the key 1 to enter the mode "Quick data transmission".

- Press the keys 01 to select the "Engine electronics" function and confirm by pressing the Q key.
  - Press the key →.
  - Press the 04 keys to enter the function "Start basic adjustment" and confirm by pressing Q.
- The display will show:

System in basic adjustment	HELP
Input the value group number XX	

- Press the keys 00 to enter the measurement values group number. Confirm the selection by pressing the Q key.
- The display will show:

System in basic adjustment	HELP
1 2 3 4 5 6 7 8 9 10	

(The numbers which appear on the display do not have any meaning for this test.)

- With TDC transmitter.  
The ignition timing is indicated directly.  
Test value:  $6 \pm 3^\circ$  before TDC.
- At the fault detector equipment **VAG 1551**: press the key →.
- Type 06 to select the function "End data transmission" and confirm the selection by pressing the key Q.

### IGNITION TIMING ADJUSTMENT CHECKING

- Engine oil minimum temperature: 80 °C.
- Connect the equipment **VAG 1367** using the pick up clamp **VAG 1367/8** or directly connect the equipment **VAG 1767**.
- Start up the engine and let it run at the idle speed.
- Adjust the ignition checking equipment for 3500 rpm.
- Increase the engine speed slowly to over 3500 rpm, until the ignition timing value is shown.  
Theoretical value:  $32 \div 36^\circ$  before TDC.

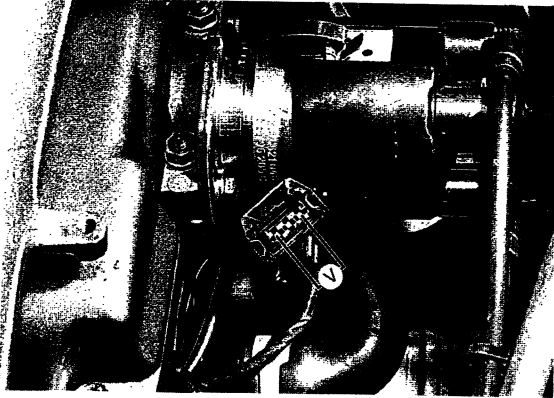
### CHECKING THE HALL PULSE GENERATOR

The electrical checking of the functioning and cabling of the Hall pulse generator is given in the self-diagnosis tables for the **VAG 1551** fault-finder and the **VAG 1598/18** tester, described in Group 24.

As well as testing with this equipment the following is carried out.

**Checking the power supply**

- Unplug the Hall pulse generator connector.



28B025

- Connect the digital tester **VAG 1526**, set for measuring DC voltage, to the connector outer pins using the auxiliary cables **VAG 1594 A**.

- Turn on ignition.

Rated value: 10 volts minimum.

If there is voltage:

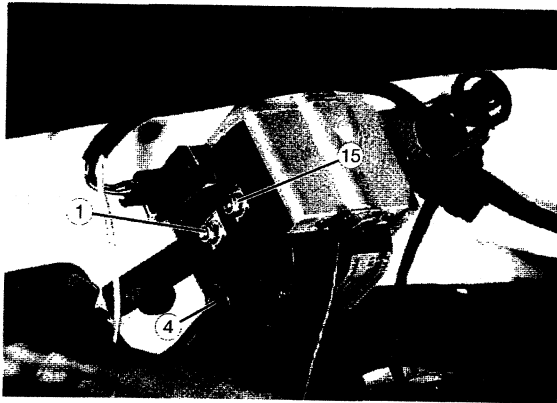
- Change the Hall transmitter.

If there is no voltage:

- Change the Digifant control unit.

**CHECKING THE IGNITION TRANSFORMER**

- Remove the triple connector and the high tension cable from the ignition transformer.



28B005

- Check the primary winding resistance using the digital tester **VAG 1526**, between the pins 1 and 15.

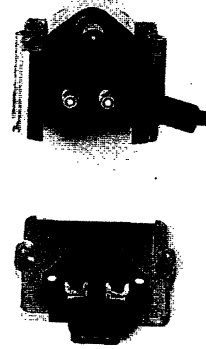
Rated value:  $0.5 \div 0.7 \Omega$ .

- Check the secondary winding resistance between the pins 4 and 15.

Rated value:  $3 \div 4 K\Omega$ .

If the above rated values are not met:

- Remove the ignition transformer.



28B006

- Remove the bolts fixing the power stage to the ignition transformer housing and loosen the nuts of the terminals 1 and 15.

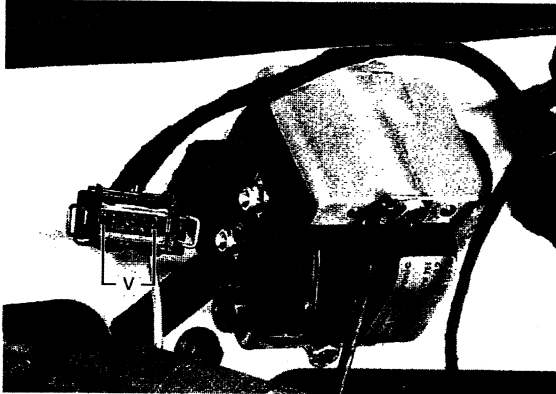
- Remove the power stage.

- Repeat the checking.

**CHECKING THE IGNITION TRANSFORMER FINAL STAGE**

- Ignition transformer OK.
- Hall generator, correct.
- Engine speed transmitter correct.

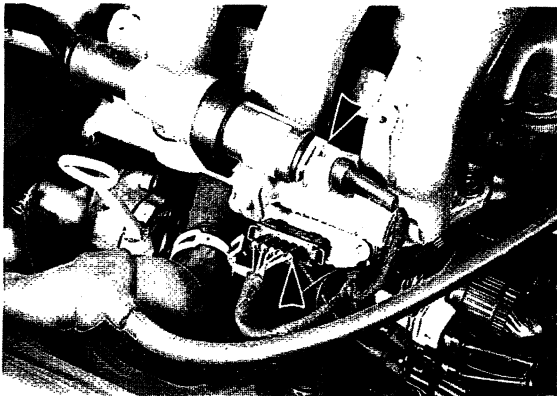
**Checking the power supply**



28B007

- Unplug the final power stage connector from the ignition transformer.
- Connect the digital tester **VAG 1526**, using the auxiliary cables **VAG 1594 A**, to the connector pins 1 and 3.
- Turn on ignition.  
Nominal value: approximately battery voltage.
- Turn the ignition off.

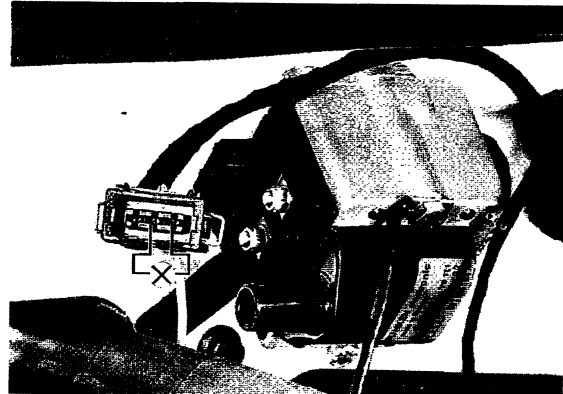
**Operation checking**



24A131

- Remove the 5-pin connector from the common injectors connection.

(No fuel must enter the cylinders as the catalyst could be damaged.)

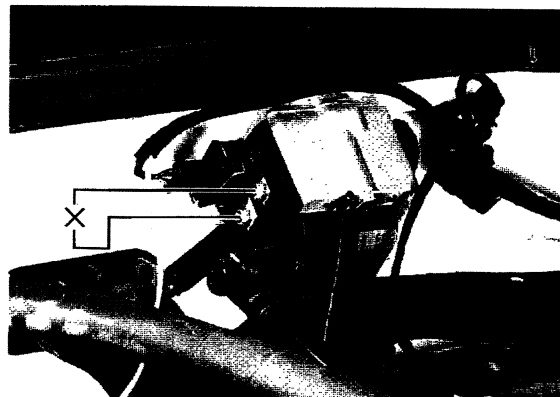


28B008

- Connect the voltage checking lamp **VAG 1527** using the auxiliary cables **VAG 1594 A** and the intermediate connectors **VAG 1594/15**, to the ignition transformer final stage connector pins 2 and 3.
- Operate the starter motor and check that the LEDs flash.

If the LED does not flash:

- Change the Digifant control unit.
- Connect the triple connector and the ignition cable to the transformer.



28B009

- Connect the **VAG 1527** voltage test lamp using the clips from the **VAG 1594 A** between contacts 1 and 15 of the ignition transformer.

# Engine 28

## Ignition system: 2.0 l 16 V engine

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- Turn the ignition on:  
The LED should light up for between 1 and 2 seconds.
- Activate starter motor:  
The LEDs should flash; if necessary, replace the final stage.

### CAUTION

During the above test, do not touch the terminals of the ignition transformer not the test equipment cables.

# Engine

## List of tools: 2.0 l 16 V engine

### LIST OF REQUIRED TOOLS

Tool No.	Designation and use	Group/Page
Ar-2204 A	Rotary trestle .....	10/8
U-10014	Pliers to remove hydraulic tappets .....	15/17
U-10050	Tool for centring the clutch disc .....	13/13
U-10050/F	Adaptor for U-10050 .....	13/13
U-10070	Valve guide oil seal puller .....	15/21
U-10073/1	Cylinder head fixing base .....	15/18
U-10080	Percussion tool for removing oil seals .....	13/12
U-10083	Base for sorting the pushers and valves .....	15/17
U-10095	Pliers to remove and fit hose clamps .....	19/4
U-20000	Flange for fixing the engine to the trestle .....	10/8
U-20002/1	Wrench for holding distribution gears .....	13/6
U-20004	Centering legs extractor .....	15/6
U-20008	Tool for removing/refitting the piston pins .....	13/21
U-30002	Tool for fitting the intermediate shaft oil seal .....	13/16
U-30006	Tool for removing/refitting the valve guides .....	15/22
U-30006/A	Base for removing/refitting valve guides .....	15/22
U-30006/B	Base for removing/refitting valve guides .....	15/22
U-30007	Tool for fitting the valve guide oil seal .....	15/21
U-30009	Tool for tightening the timing belt .....	13/6
U-30011	Drive head for removing/refitting the oil pump drive shaft bushings .....	17/6
U-30015	Tool for holding the clutch cable .....	10/4
U-30017	Adaptor fixing engine unit .....	10/6
U-30022	Tool for removing/refitting the cylinder head bolts .....	15/5
U-30025	Engine unit holding crossmember .....	10/6
U-30027	Tool for holding the engine flywheel (with the engine fitted to the vehicle) .....	13/7
U-30033	Base plate for tool U-10073/1 .....	15/18
U-30034	Lifting hook for the engine unit .....	10/8
U-30035	Tool for holding the engine flywheel (with the engine on the work bench) .....	13/7
U-30037	Glow plug spanner .....	28/1
U-30042	Tweezers for flexible pipes .....	17/6
U-40010	Tool for removing/refitting the Poly-V belt .....	13/10
U-40011	Wrench for removing/refitting the cooling liquid pump pulley .....	19/7
U-40020	Multiple tothing wrench set .....	15/5
U-40023	Centering legs for installing the cylinder head .....	15/6
U-40050	Tool for removing/refitting the Poly-V belt .....	13/10
U-40051	Wrench for removing/refitting the oil sump allen head bolts	17/4
U-40051/1	Wrench for removing/refitting the oil sump torx head bolts	17/4
U-40051/2	Wrench for removing/refitting the oil sump hex head bolts.	17/4

# Engine

## List of tools: 2.0 l 16 V engine

### LIST OF REQUIRED TOOLS

Tool No.	Designation and use	Group/Page
U-40052	Tool for fitting the crankshaft oil seal, flywheel side .....	13/13
U-40055	Tool for removing the fuel level sender unit-fuel pump assembly fixing nut .....	20/5
U-40057	Flange for fixing the engine to the trestle .....	10/8
U-40062	Tool for fitting the crankshaft oil seal, distribution side .....	13/15
U-40073	Tool for removing/installing the fuel pump assembly .....	20/5
U-40075	Tool for cutting exhaust pipe .....	26/2
U-40078	Oil filter removal tool .....	17/7
U-40083	Pinking sensor spanner .....	24/36

**LIST OF REQUIRED EQUIPMENTS**

No. of equipment	Designation and use	Group/Page
SAT 1390	Vacuum gun .....	24/29
VAG 1274	Cooling system checking equipment .....	19/8
VAG 1274/3	Adaptor for VAG 1274 .....	19/8
VAG 1274/4	Adaptor for VAG 1274 .....	19/9
VAG 1318	Pressure gauge for checking fuel pressure .....	20/9
VAG 1318/1	Adaptor for VAG 1318 .....	20/9
VAG 1318/10	Adaptor for VAG 1318 .....	20/9
VAG 1318/11	Adaptor for VAG 1318 .....	20/9
VAG 1342	Pressure gauge for checking oil pressure .....	17/7
VAG 1348/3A	Remote control .....	20/8
VAG 1348/3-2	Adaptor cables .....	20/8
VAG 1363/A	CO analyzer .....	24/10
VAG 1363/3	Adaptor for VAG 1363/A .....	24/29
VAG 1367	Equipment for checking rpm and ignition timing .....	24/28
VAG 1367/8	Pick up clamp .....	24/28
VAG 1368	Pressure fall testing equipment .....	20/14
VAG 1381	Pressure gauge for checking the compression ratio .....	13/25
VAG 1501	Adaptor cable .....	24/34
VAG 1526	Digital tester .....	24/9
VAG 1527	Test LED .....	28/6
VAG 1551	Fault detector .....	24/7
VAG 1551/3	VAG 1551 adapter cable .....	24/7
VAG 1594/A	Auxiliary measuring cable set .....	24/9
VAG 1598/18	Verification box .....	24/40
VAG 1602	Measuring device .....	24/28
VAG 1630	Variable potentiometer .....	24/27
VAG 1715	Test equipment .....	20/10
VAG 1763	Pressure gauge for checking the compression ratio .....	13/25
VAG 1767	Equipment for checking rpm and ignition timing .....	24/28