V.A.G Service.

V·A·G

Workshop Manual Audi 100, Audi 200.

2.2 litre fuel injection engine (K-Jetronic/turbocharger)

May 1980 edition.

THE AUDI 100 / AUDI 200 WORKSHOP MANUAL CONSISTS OF THE FOLLOWING BOOKLETS:

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Workshop Manual Audi 100, Audi 200.

2.2 litre fuel injection engine (K-Jetronic/turbocharger)

May 1980 edition

Supersedes the 2.2 litre engine booklet, March 1978 edition

The Workshop Manual is divided into separate booklets, which can also be ordered individually, so they can be used in every work-bay as and when required.

This booklet is valid for the new Audi 100 and for the Audi 200 as from the start of production (August 1976/ January 1980). It describes all principal repair operations which require special instructions to ensure satisfactory work.

Arrangement of booklets

There is an alphabetical index and another index according to repair operations in every booklet to facilitate finding the information required. Where special tools and workshop equipment are required, these are listed with the repair operations in the table of contents.

This list also shows where the alternative Audi special tools can be used instead of the VW tools, and vice versa.

Technical data are listed before the repair instructions. Where necessary, the repair instructions start with an exploded drawing which shows the most important repair notes. There are also photographs, referred to in the exploded drawings, to show the position of parts in the vehicle or illustrate the use of special tools as required. When a particular sequence has to be followed for dismantling and assembling, the major steps in the operation are described after the exploded drawing. Similarly, adjustment procedures are described as a complete operation.

Workshop Bulletins

Workshop Bulletins will be allocated to the individual booklets and should be filed at the back of the booklet concerned. To remind you that bulletins have been published, please mark the bulletin number by hand on the page of the manual given in the bulletin.

Fault finding

General fault finding instructions are incorporated in the Workshop Manual. The following additional fault finding guides have also been published:

K-Jetronic
Brakes
Automatic Gearbox.

Further instructions on tracing and repairing likely faults are given in the "Fault Finding Handbook."

Technical information should always be made available to all foremen and mechanics because compliance with the instructions given is essential to ensure vehicle roadworthiness and safety. In addition, the normal safety precautions to be observed when working on motor vehicles are also applicable.

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LIST OF ENGINES AND INFORMATION SOURCES

The following table contains engine code letters and general information on all engines which have been installed in Audi 100/Audi 200 vehicles to date; it also lists the publications which cover these engines.

Code letters		CN	WA	WB	WC	WD	
Engine data							
Manufactured	from	8.78	8.76	3.78	5.77	5.77	5.77
	to		7.78			7.79	
Capacity	litres	2.0	2.0	2.2	2.2	2.2	2.2
Output	kW at rpm	51/4800	85/5500	85/5500	100/5700	79/5300	79/5300
Torque	Nm at rpm	123/3000	168/3500	166/4000	185/4200	155/4000	155/4000
Bore	mm	76.5	86.5	79.5	79.5	79.5	79.5
Stroke	mm	86.4	84.4	86.4	86.4	86.4	86.4
Compression ratio		23.0	9.3	8.3	9.3	8.0	8.0
Valve timing at 1 mm valve lift and zero clearance							
inlet opens before TDC		5° after	6°	6°	0°	6°	6°
inlet closes after BDC		21°	42°	44°	51°	44°	44°
exhaust opens before BDC		27°	46°	40°	40°	40°	40°
exhaust closes after TDC		5° before	2°	10°	10°	10°	10°
RON	min.	45 CZ	98	91	98	91	91
Carburetor/Fuel injection		Diesel	2B3	2B2/2B5 *	K-Jetronic	K-Jetronic	K-Jetronic
Distributor		–	046905205 C	035905205 A** 035905205 D***	035905205	035905205 B	035905205 B
Exhaust gas recirculation		–	–	–	–	X	X
Catalyst		–	–	–	–	–	–
Lambda closed loop		–	–	–	–	–	–
Turbocharger		–	–	–	–	–	–
Engine is specially tuned for:						USA	Canada
Information	Order No.[1]						
Workshop Manual							
1.6 l engine	0.97.537.111 . .	–	–	–	–	–	–
2.0 l engine	0.97.537.121 . .	–	X	–	–	–	–
2,2 l carburetor engine	0.97.537.132 . .	–	–	X	–	–	–
2.2 l fuel injection engine	0.97.537.271 . .	–	–	–	X	–	–
5-cyl. Diesel engine	0.97.537.241 . .	X	–	–	–	–	–
Maintenance	0.97.537.102 . .	X	X	X	X	–	–
US tourist vehicles	000 533 852 . .	–	–	–	–	X	X
Fault finding guide:							
K-Jetronic	000 530 423 . .	–	–	–	X	X	X
Current defects:							
Service Handbook [2]		X	X	X	X	–	–
Fault Finding Handbook [3]	000 530 451 . .	X	X	X	X	–	–

* From 1980 models onwards
** For automatic gearbox only
*** For manual gearbox only

1) See service publications list for language index
2) Distributed in W. Germany only
3) Distributed in export countries only

LIST OF ENGINES AND INFORMATION SOURCES

The following table contains engine code letters and general information on all engines which have been installed in Audi 100/Audi 200 vehicles to date; it also lists the publications which cover these engines.

WE			WF	WG	WJ	WK	YV
5.77 7.78	3.77	8.78	8.76	8.77	1.80	1.80	8.76
2.2	2.2	2.2	2.0	2.2	2.2	2.2	1.6
79/5300	85/5300	79/5300	77/5500	100/5700	125/5300	100/5400	63/5600
163/4000	168/4000	163/4000	155/3500	185/4200	265/3300	202/3000	124/3200
79.5	79.5	79.5	86.5	79.5	79.5	79.5	79.5
86.4	86.4	86.4	84.4	86.4	86.4	86.4	80.0
8.0	8.0	8.0	7.0	9.3	7.0	7.0	8.2
6°	6°	6°	6°	0°	3°	3°	4°
44°	44°	44°	42°	51°	47°	47°	46°
40°	40°	40°	46°	40°	43°	43°	44°
10°	10°	10°	2°	10°	7°	7°	6°
91	91	91	83	98	98	91	91
K-Jetronic	K-Jetronic	K-Jetronic	2B3	K-Jetronic	K-Jetronic	K-Jetronic	2B2/2B5 *
035905205 B	035905205 B	035905205 B	046905205 C	035905205 C	035905205 F	035905205 H	049905206 D
X	X	–	–	X	–	–	–
X	–	X	–	–	–	X	–
–	–	X	–	–	–	X	–
–	–	–	–	–	X	X	–
California Japan	Sweden	California Japan	Countries with low octane fuel (M 240)	Sweden		USA (incl. California and Japan)	
–	–	–	–	–	–	–	X
–	–	–	X	–	–	–	–
–	–	–	–	–	–	–	–
–	X	–	–	X**	X	–	–
–	–	–	–	–	–	–	–
–	–	–	X	X	X	–	X
X	–	X	–	–	–	X	–
X	X	X	–	X	X	X	–
–	–	–	X	–	X	–	X
X	X	X	–	X	–	X	–

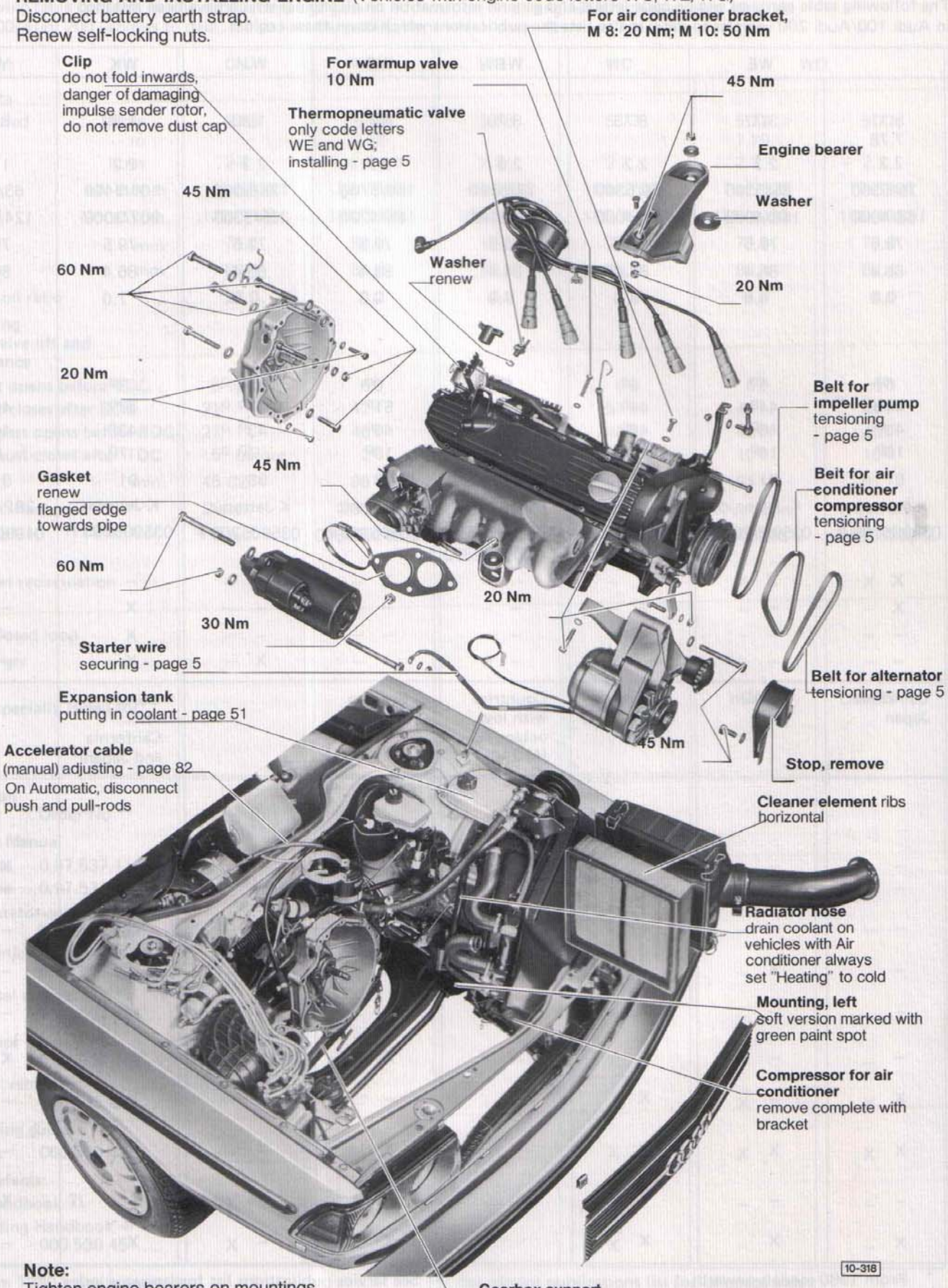
* From 1980 models onwards
** For automatic gearbox only
*** For manual gearbox only

1) See service publications list for language index
2) Distributed in W.Germany only
3) Distributed in export countries only

10 Removing and installing engine

REMOVING AND INSTALLING ENGINE (Vehicles with engine code letters WC, WE, WG)

Disconect battery earth strap.
Renew self-locking nuts.



Note:
Tighten engine bearers on mountings with engine idling.

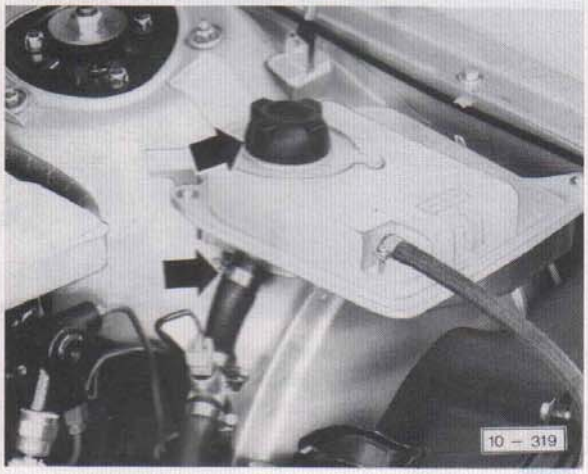
REMOVING AND INSTALLING ENGINE

(Vehicles with engine code letters WC, WE, WG)

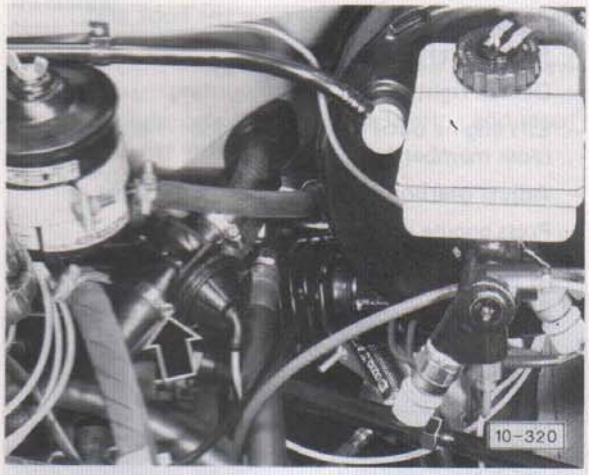
The engine is lifted out without the gearbox

Removing

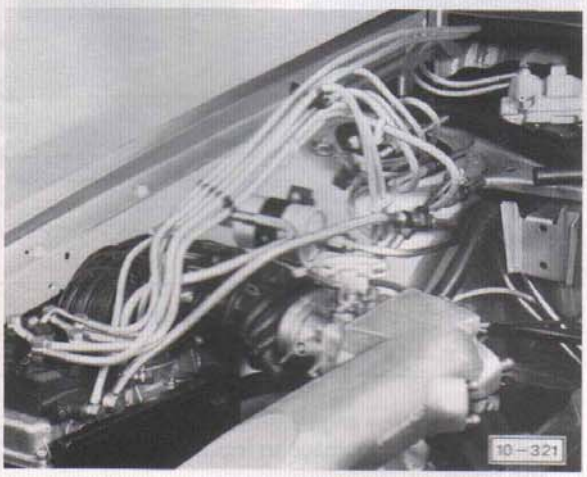
– Detach battery earth strap.



– Take cap off expansion tank.
– Detach coolant hose from expansion tank.
– Drain coolant; catch coolant for later use.



– Detach coolant hose at connector, drain coolant.



– Remove warm-up valve, cold start valve and injectors.

Note:
All fuel lines should remain connected.

– Detach air duct and vacuum hoses from intake manifold and throttle assembly.
– Remove air cleaner cover and filter element.

– Disconnect lock cable by pulling guide sleeve in direction of arrow.

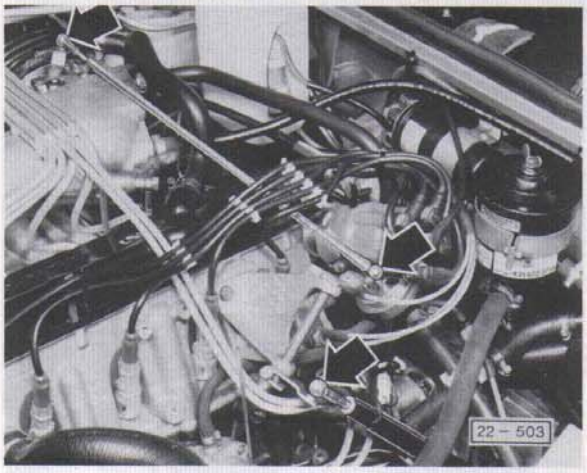
If air conditioner is fitted:
Remove radiator grille, detach condenser and tilt it outwards.

Vehicles with power assisted steering
– Remove impeller pump but leave pipes connected.

Vehicles with engine code letters WE and WG
Remove vacuum amplifier and thermopneumatic valve on cylinder head.

– Detach ignition coil from bulkhead.
– Detach windshield washer container.
– Detach PAS reservoir from bracket.
– Remove distributor cap with ignition leads and rotor arm.

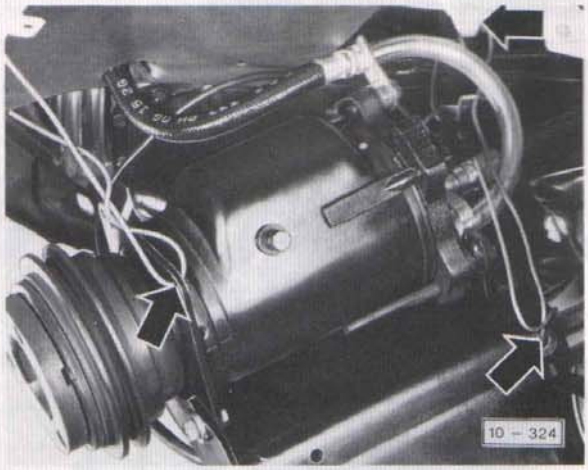
Vehicles with manual gearbox:
Disengage throttle cable from throttle assembly and pull through support bracket on cylinder head cover.



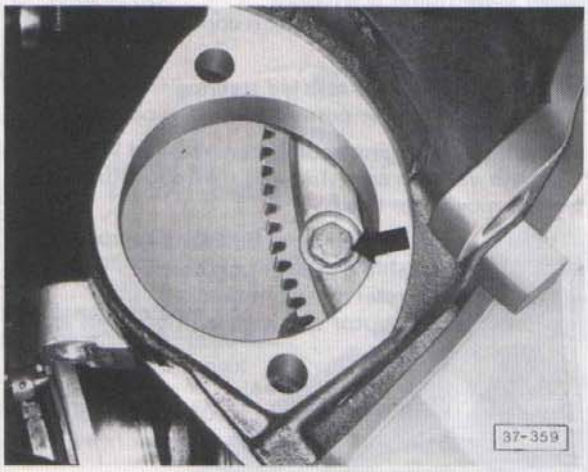
Vehicles with automatic gearbox:
Disengage push rod and pull rod.

10 Removing and installing engine

If air conditioner is fitted:
Detach compressor complete with bracket, leaving pipes connected.

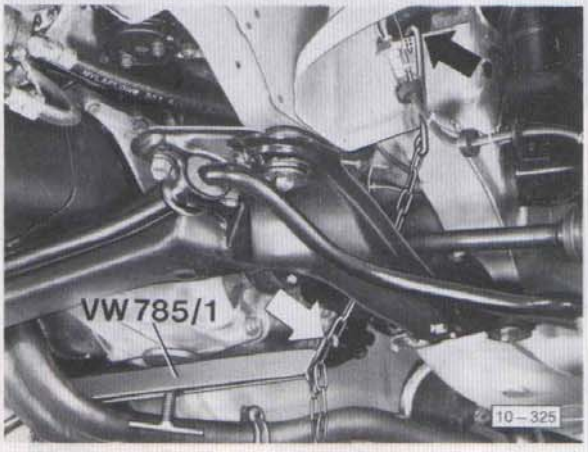


– Secure air conditioner compressor.
– Detach exhaust pipe from manifold and gearbox bracket.
– Remove front stop from cross member.
– Remove generator and bracket.
– Remove starter.

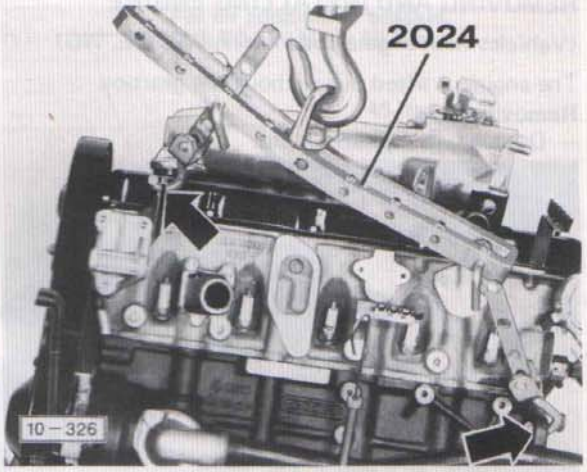


Vehicles with automatic gearbox
Detach converter.

– Remove all lower engine-gearbox bolts.



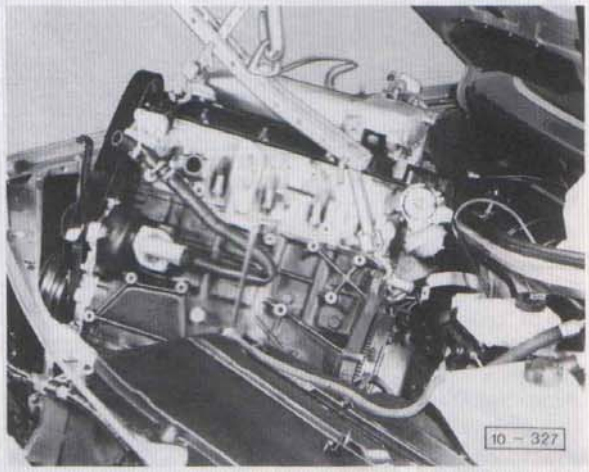
– Install gearbox support.
– Remove upper engine-gearbox bolts.



– Attach lifting bar:
Position 3 – hole 2
Position 8 – hole 4

Note:
To ensure that the engine lifts properly the hooks must be attached in the right hole and the right position. The positions marked 1 - 4 on the cross bar must be towards the pulley end. The holes in the hook bars are counted from the hook end.

– Remove left engine bearer.
– Detach right bearer from mounting.
– Lift engine until vibration damper is just above cross member I.
– Adjust gearbox support to take up weight.
– Press engine off gearbox.



– Lift engine futher while turning it to the right.
– Turn engine to transverse position and lift it right out.

Caution
While lifting, the engine must be guided carefully to prevent damage to input shaft, clutch and body.

Vehicles with automatic gearbox:
Secure converter to prevent it from falling off.

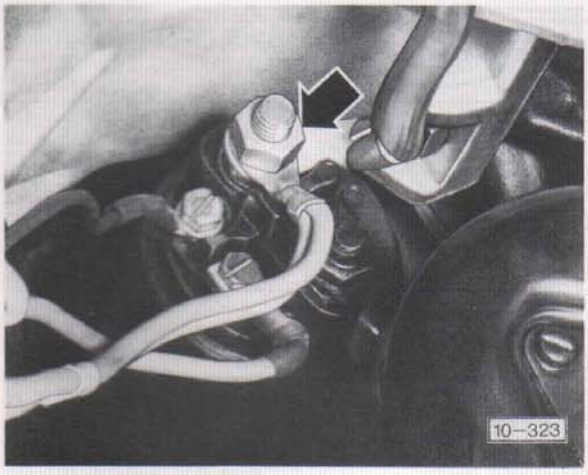
Mounting engine on repair stand

– To facilitate work on the engine, mount it on a repair stand with bracket VW 540.

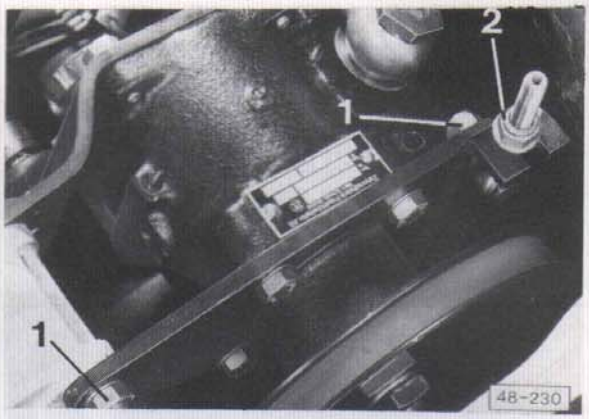
> **Important**
> Do not measure the cylinder bores (see repair group 13) with the engine mounted on the repair stand because this may cause a certain amount of distortion.

Installing:
Note the following points when installing the engine.

– Check clutch release bearing for wear, and renew if necessary.
– Lightly lubricate clutch release bearing and input shaft splines with MoS_2 grease.
– Always renew self-locking nuts.

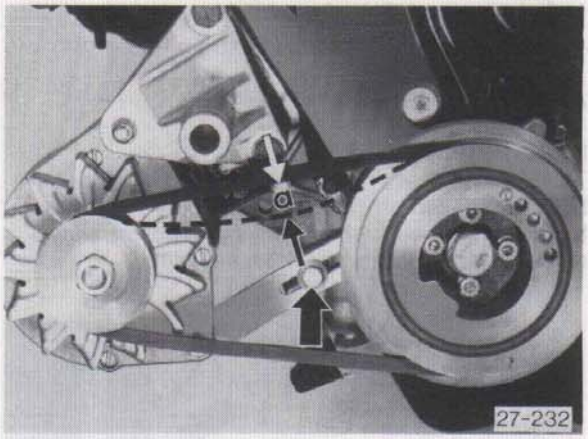


– Securing starter wire.



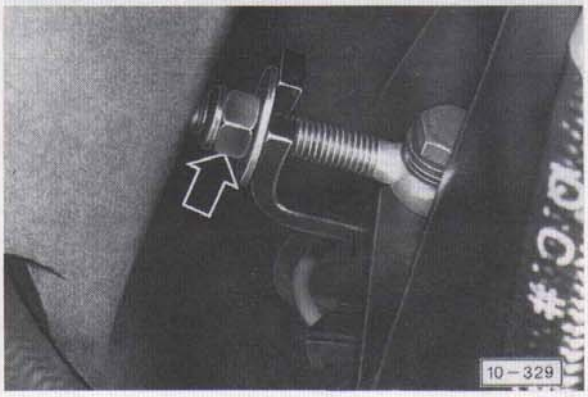
– Tensioning impeller pump belt:
Loosen nuts – 1 –
Turn adjusting nut – 2 – as required
Tighten nuts – 1 –.

Note:
Belt tension is correct if the belt yields about 10 mm when pressed with the thumb halfway between the two pulleys.



– Tension alternator belt: a = 10-15 mm. Loosen bolt (arrow), swing alternator outwards and then tighten bolt again.

If air conditioner is fitted:

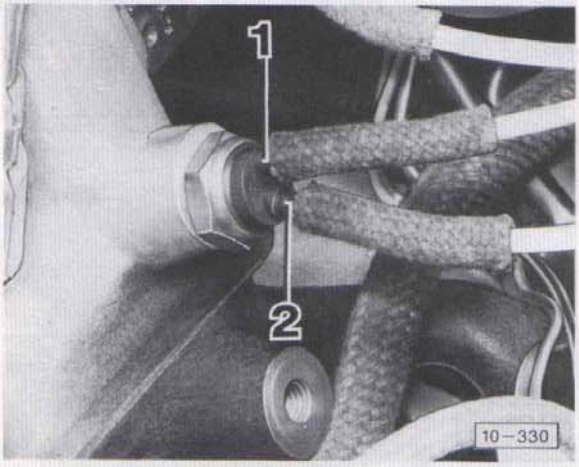


– Tension compressor belt by turning nut on tensioner as required after loosening 4 mountings on alternator bracket.

Note:
Belt tension is correct if the belt yields about 10 mm when pressed with the thumb halfway between the pulleys.

10 Removing and installing engine

Vehicles with engine code letters WE and WG

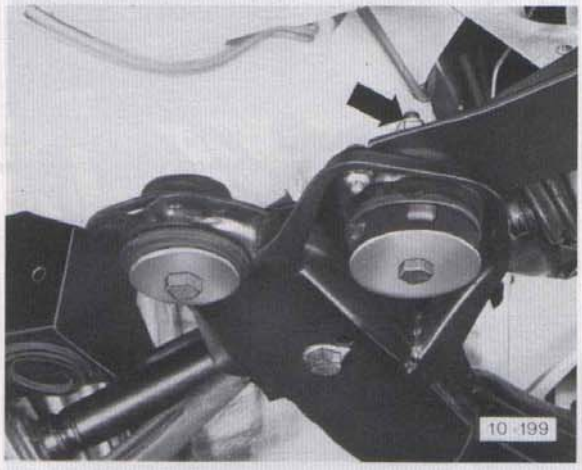


Install thermopneumatic valve.
Straight connection – 1 – goes to EGR valve and angled connection – 2 – to vacuum booster.

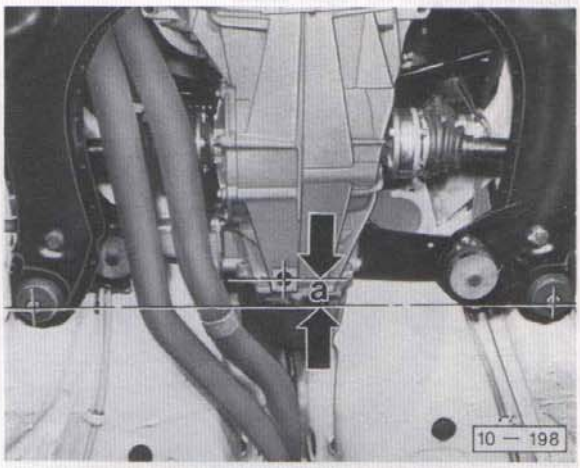
- Adjust accelerator cable – page 82
- Fill cooling system – page 51
- Align exhaust system free of strain – page 84

ALIGNING ENGINE AND GEARBOX

Note:
This is only necessary if the engine and gearbox have **both** been taken off the mounts. If **only** the engine has been removed, tighten the engine bearer/engine mount attachments with the engine idling.



- Loosen both nuts securing gearbox carriers to mountings.
- Loosen both nuts on engine bearers, left and right.

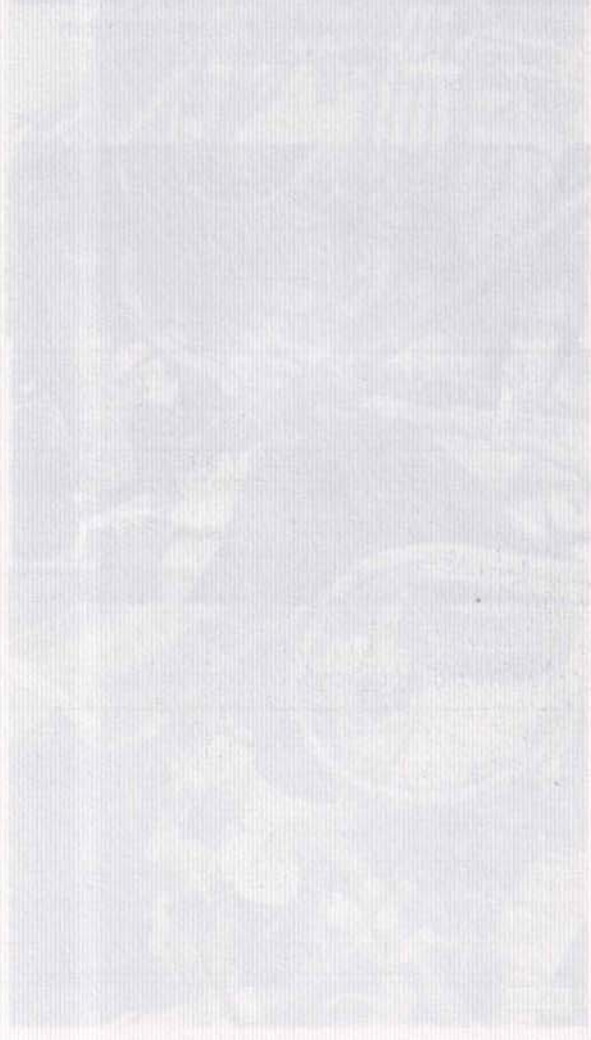


Manual gearbox:
Distance a = 29.4 ± 1.5 mm

Automatic gearbox:
Distance a = 127.4 ± 1.5 mm

- Move gearbox and engine in longitudinal direction by shaking them on the mountings.

Note:
Engine and gearbox connot be adjusted laterally or vertically.



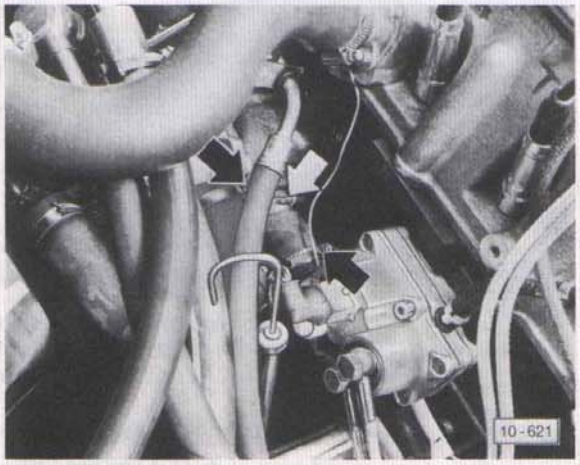
REMOVING AND INSTALLING ENGINE

Vehicles with engine code letters WJ

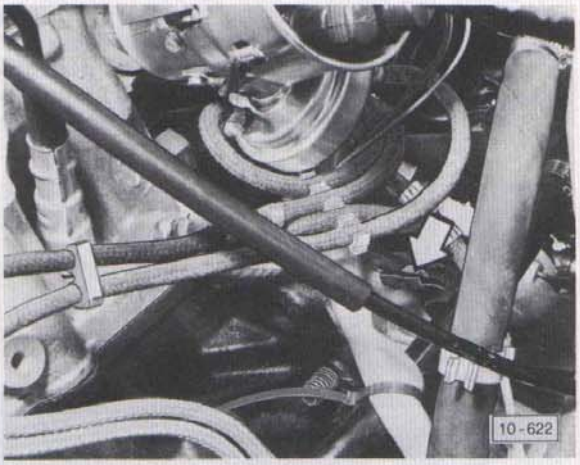
The engine is lifted out without the gearbox.

Removing:

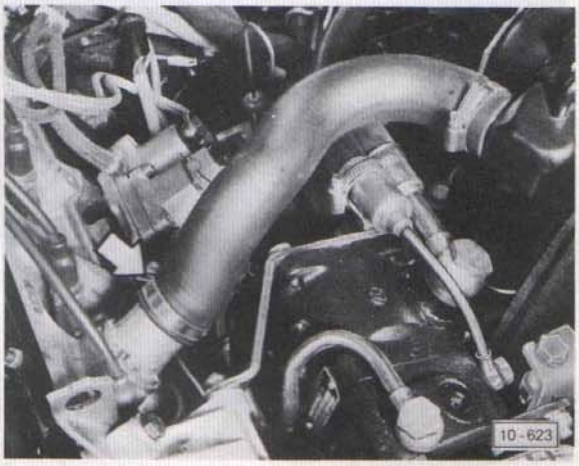
– Detach battery earth strap.
– Take cap off expansion tank.



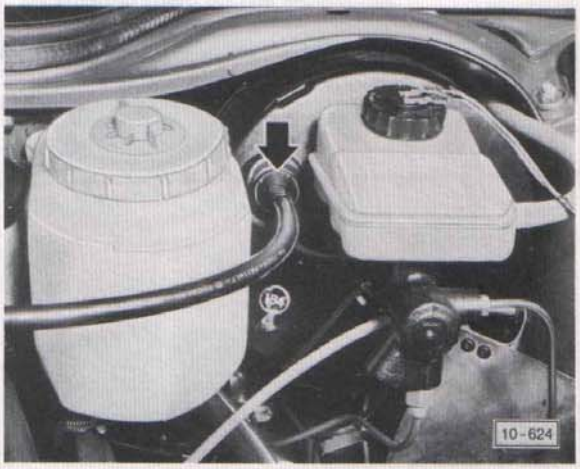
– Drain coolant by detaching coolant hose from thermostat housing and coolant pipe. Catch coolant for later use.



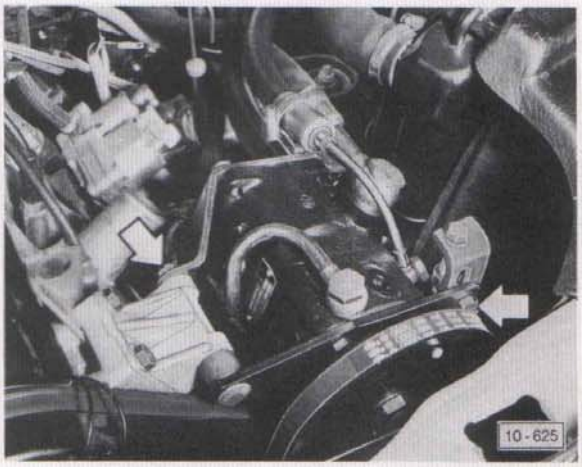
– Remove mounting screw from coolant pipe.



– Detach top hose from engine.
– Disconnect plug from thermoswitch.
– Detach heater hose from engine block.



– Disconnect vacuum hose from brake servo.



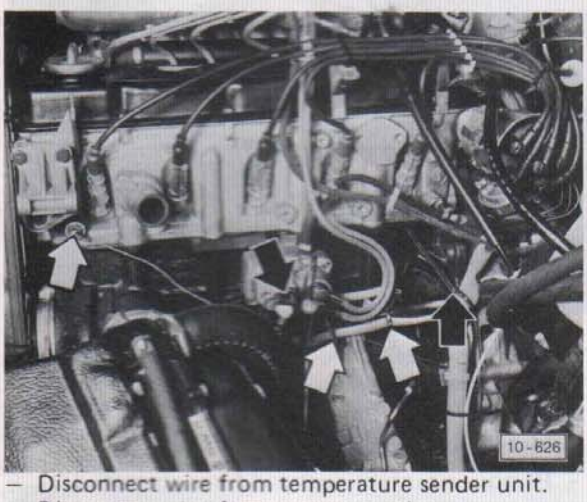
Vehicles with power assisted steering

– Remove impeller pump for PAS.

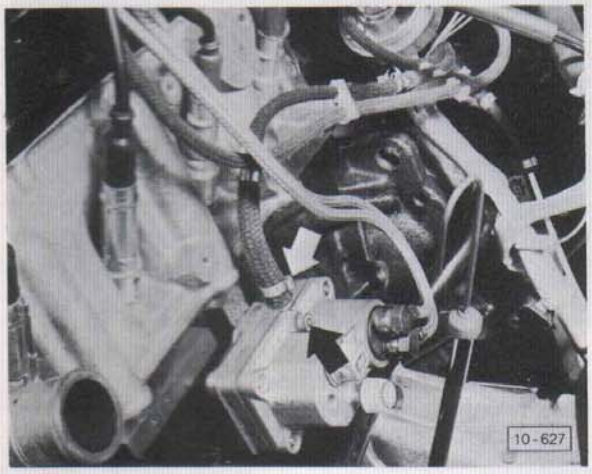
Note:

Leave hoses connected.

– Take off impeller pump belt.
– Place impeller pump in plenum chamber.

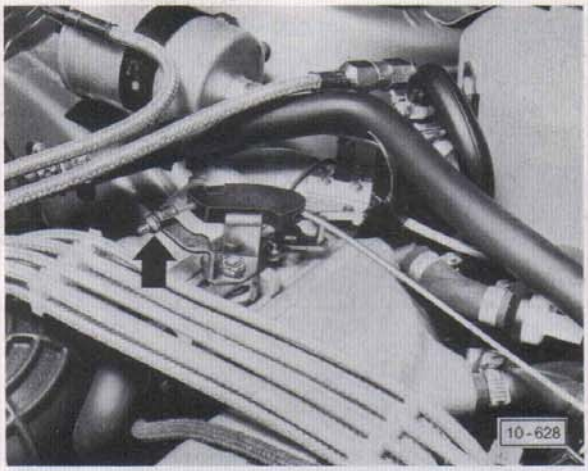


– Disconnect wire from temperature sender unit.
– Disconnect plug from warm-up valve.
– Move harness clear.
– Disconnect plug from oil pressure switch.

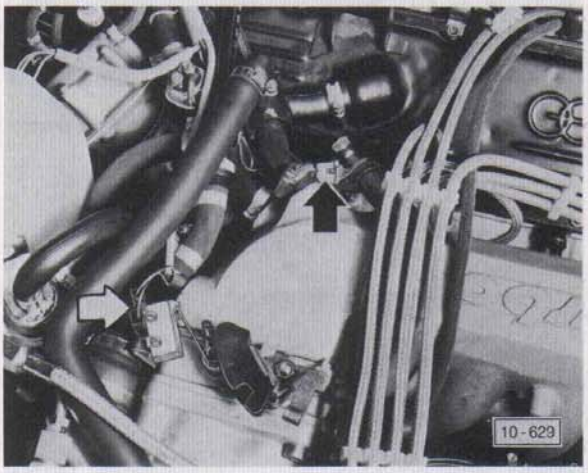


– Remove warm-up valve.

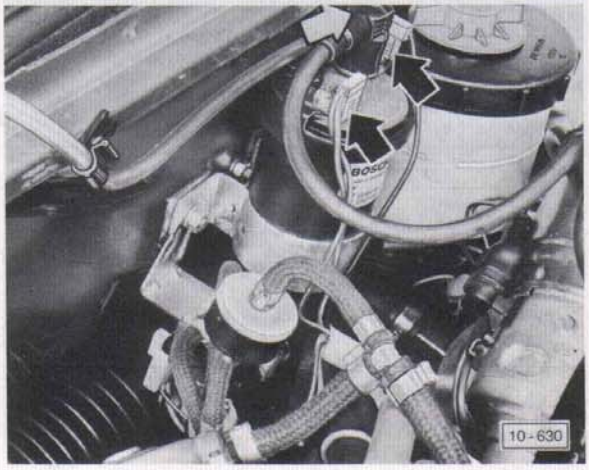
Note:
Leave fuel lines connected.
– Detach vacuum hose.



– Disengage accelerator cable and pull through support bracket.



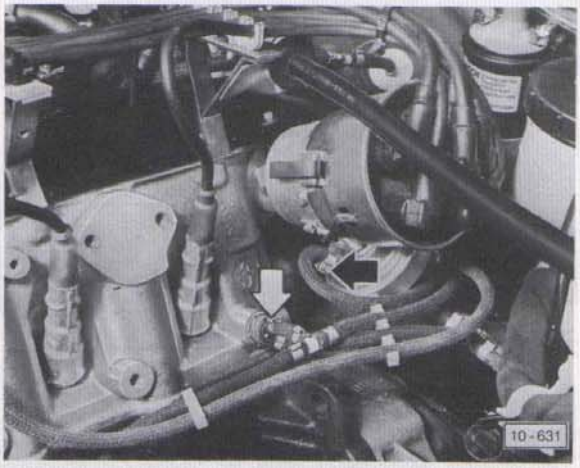
– Detach windshield washer container and disconnect wire.
– Disconnect wiring from throttle switch, cold start valve and auxiliary air valve.
– Unscrew wire from thermoswitch for regulator valve.



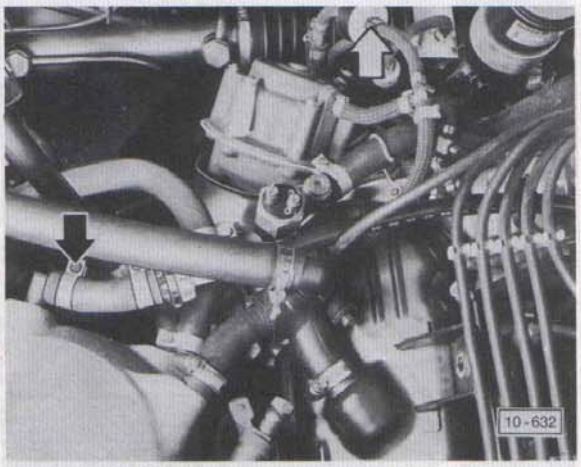
– Disconnect wiring from ignition coil, terminals 1, 4 and 15.

10 Removing and installing engine

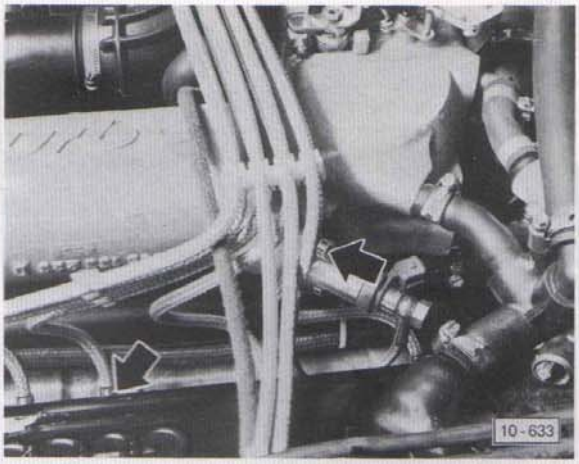
– Disconnect plug from two-way valve (straight connection).
– Disconnect plugs from thermo time switch, temperature sender unit and Hall generator on distributor; move wiring harness clear.



– Disconnect vacuum hoses from thermopneumatic valve and vacuum retard unit on distributor.
– Unscrew thermopneumatic valve from cylinder head.
– Take off distributor cap.



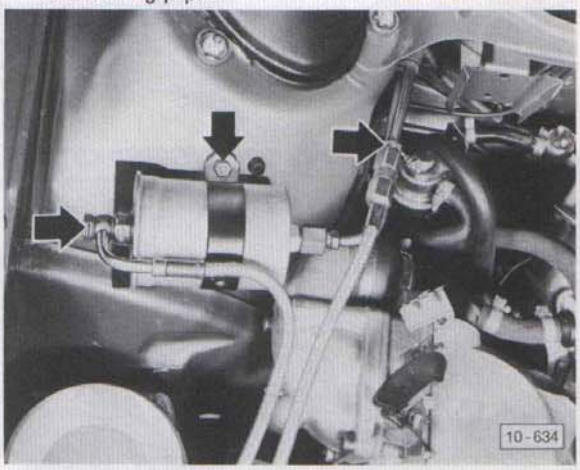
– Disconnect vacuum hose from intake manifold and delay valve.



– Pull injectors out of their seats and remove cold start valve.

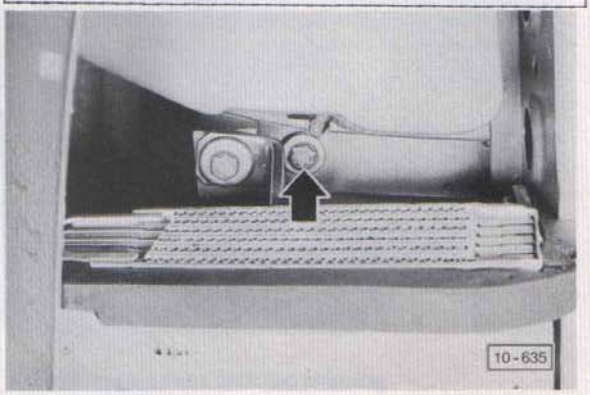
Note:
Leave fuel lines connected.

– Remove air intake duct and turbocharger connecting pipe.

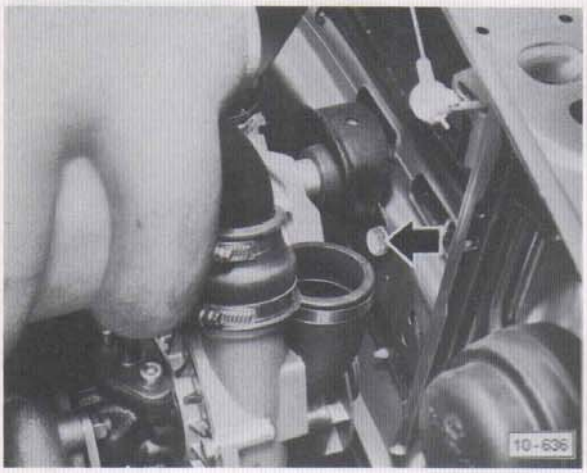


– Disconnect fuel return line.
– Detach fuel line at fuel filter (supply line).
– Detach fuel filter from wheelhousing.

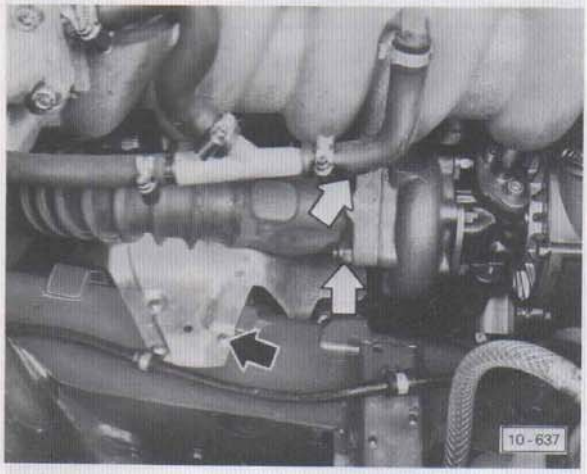
Important
Plug fuel connections to protect them from dirt.



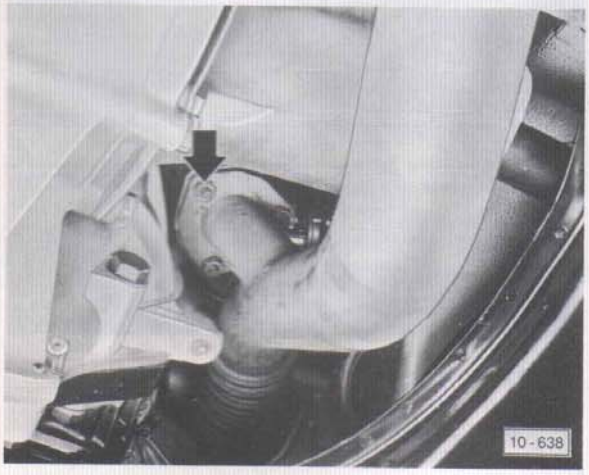
– Remove mixture control unit and air cleaner housing complete and lay aside. First detach lower mounting.



– Detach front stop from cross member I.
– Unscrew top engine/gearbox mounting bolts, leaving one easily accessible bolt in place.

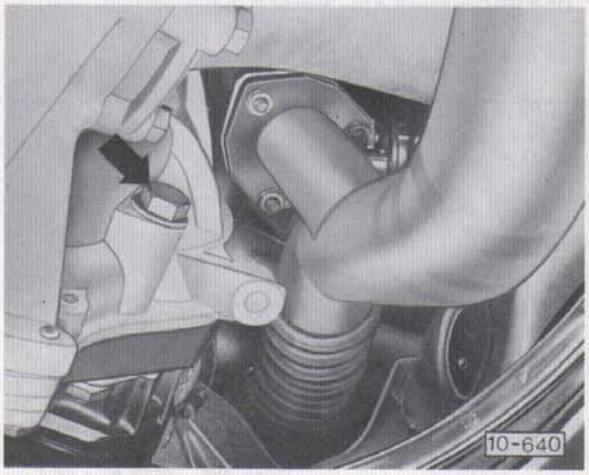


– Detach front exhaust pipe at turbocharger.
– Detach cover plate.

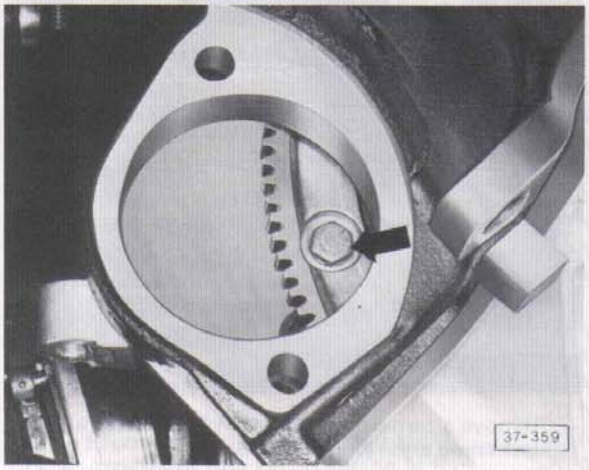


– Detach exhaust pipe from waste gate.

– Detach exhaust pipe at gearbox bracket and front silencer.

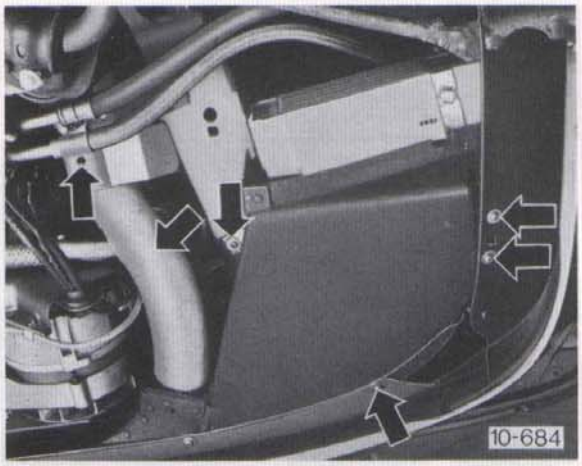


– Remove starter and secure clear to one side, leaving wiring connected.
– Unscrew wire from oil temperature sender unit.

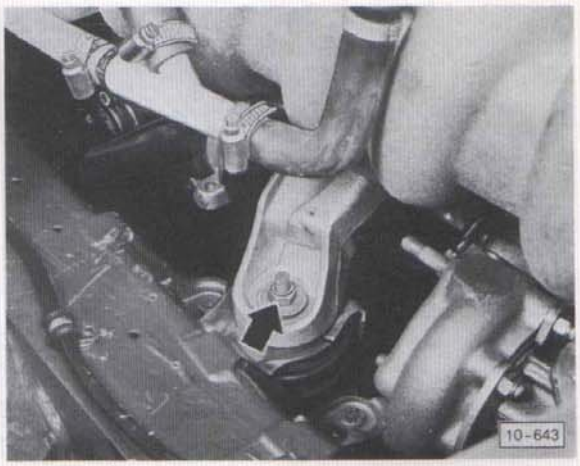


Vehicles with automatic gearbox:
Detach torque converter

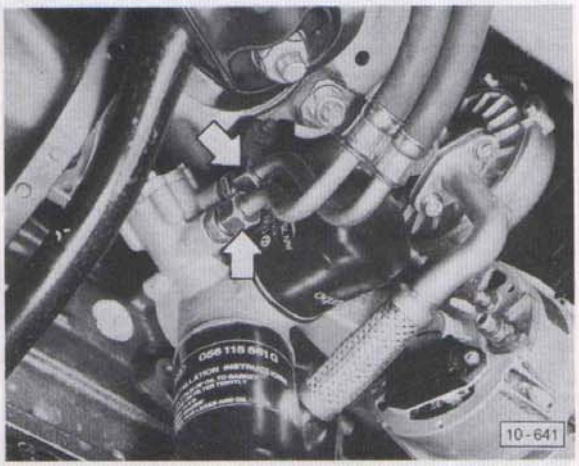
10 Removing and installing engine



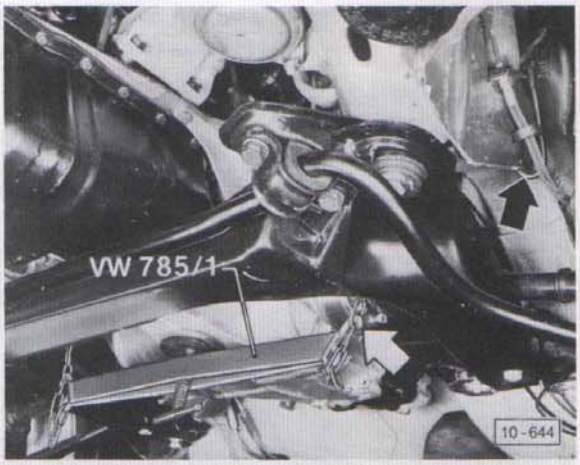
– Remove cover for oil cooler and cooling hose for engine mount.



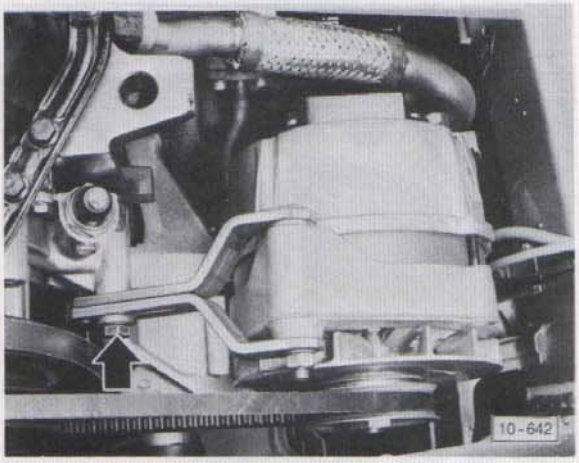
– Detach left and right engine bearer/engine mount attachments.



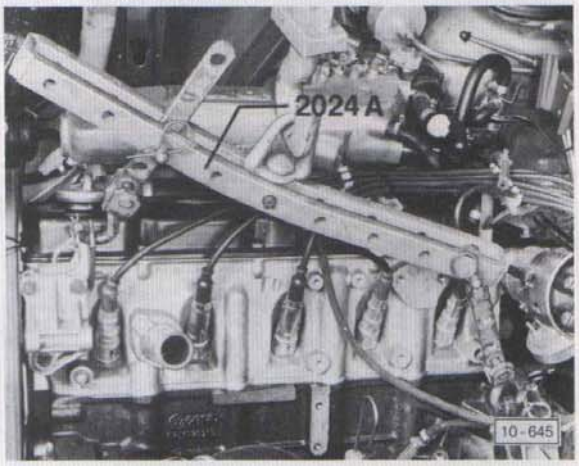
– Detach oil lines going to oil cooler.
– Remove bottom engine/gearbox mounting bolts.



– Attach gearbox support.

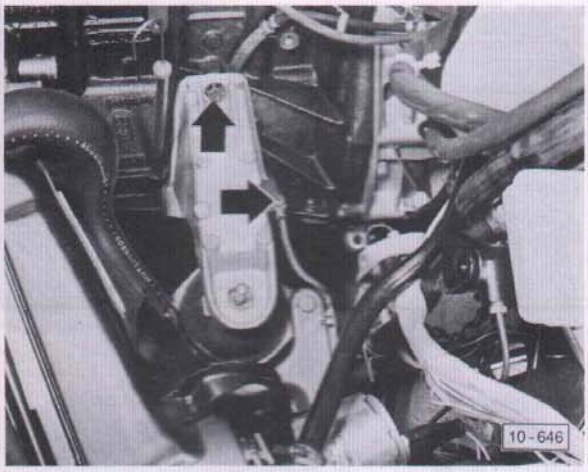


– Remove alternator complete with bracket after slackening and removing V-belt.
– Secure alternator clear to one side, leave wiring connected.

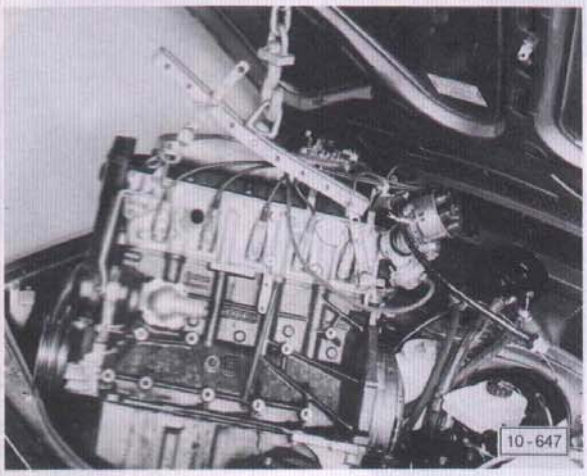


– Attach lifting bar:
position 3 – hole 2
position 8 – hole 4

Note:
To ensure that the engine lifts properly the hooks must be attached in the right hole and the right position. The positions marked 1 – 4 on the cross bar must be towards the pulley end. The holes in the hook bars are counted from the hook end.



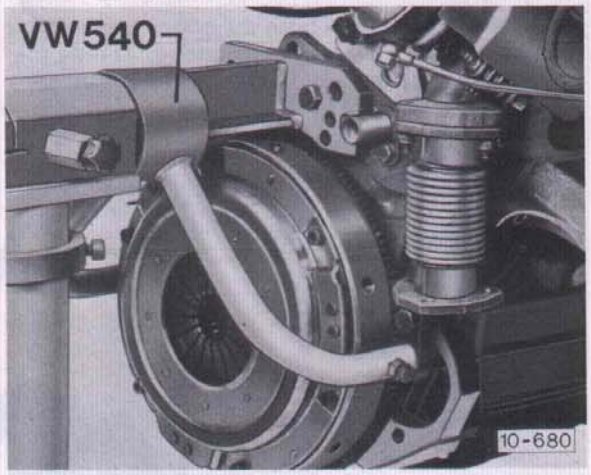
– Remove left engine bearer.
– Detach earth cable.
– Lift engine.
– Adjust gearbox support to take up weight.
– Remove upper engine/gearbox mounting bolt.
– Separate engine from gearbox.
– Lift engine until waste gate is above top of bulkhead.



– Lift engine further, at the same time turning it to the right, and then lift right out.

Caution
When the engine is lifted out it must be guided carefully to prevent damage to the input shaft, clutch and body.
The clutch pedal must not be depressed when the engine is out, otherwise the slave cylinder can be pressed past its end position.

Mounting engine on repair stand



– To facilitate work on the engine it should be mounted on a repair stand with bracket VW 540.

Important
Do not measure the cylinder bores (see repair group 13) with the engine mounted on the repair stand because this causes a certain amount of distortion.

Installing:
Install the engine in reverse sequence.
Tighten the engine/engine mount and engine mount/subframe attachments with the engine idling.

Note the following points when installing the engine:

– Check clutch release bearing for wear, renew if necessary.
– Lightly lubricate clutch release bearing and input shaft splines with MoS_2 grease.
– Always renew self-locking nuts.
– Adjusting accelerator cable – page 82
– Filling cooling system – page 51
– Aligning exhaust system free of strain – page 85

Tightening torques:

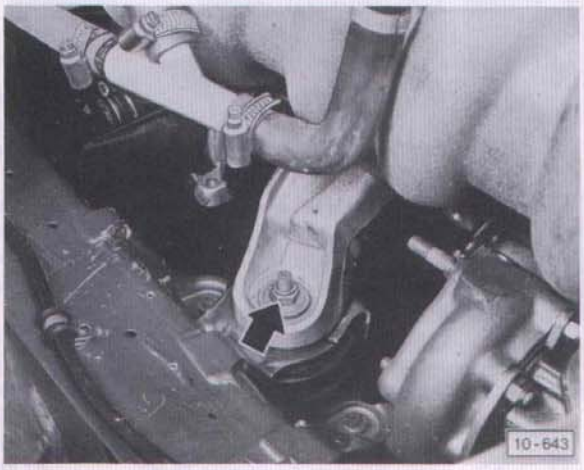
1 –	Engine to gearbox	
	M 8:	30 Nm
	M 10:	45 Nm
	M 12:	60 Nm
2 –	Torque converter to drive plate	30 Nm
3 –	Exhaust pipe to gearbox bracket	30 Nm
4 –	Exhaust pipe to manifold	30 Nm
5 –	Subframe to body	110 Nm
6 –	Air conditioner compressor bracket to engine	40 Nm
7 –	Torque support to engine	45 Nm
8 –	Engine support to engine mount	45 Nm
9 –	Pipe connection to engine	20 Nm
10 –	Front stop to cross member I	45 Nm
11 –	Alternator bracket to engine M 8	20 Nm
12 –	Alternator to bracket M 8	20 Nm
13 –	Warm-up valve to engine	20 Nm
14 –	PAS impeller pump	20 Nm

10 Removing and installing engine

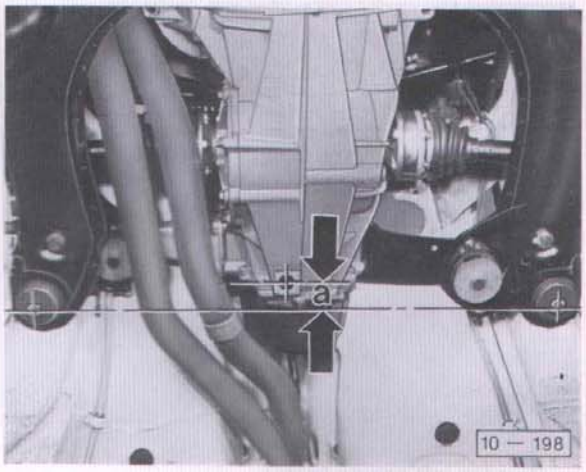
ALIGNING ENGINE AND GEARBOX

This is only necessary if **both** the engine and gearbox have been detached from the mountings. If **only** the engine has been removed, tighten the engine bearer/ engine mount and engine mount/subframe attachments with the engine idling.

– Loosen both nuts securing gearbox carriers to mountings.



– Loosen left and right engine bearer/engine mount attachments.



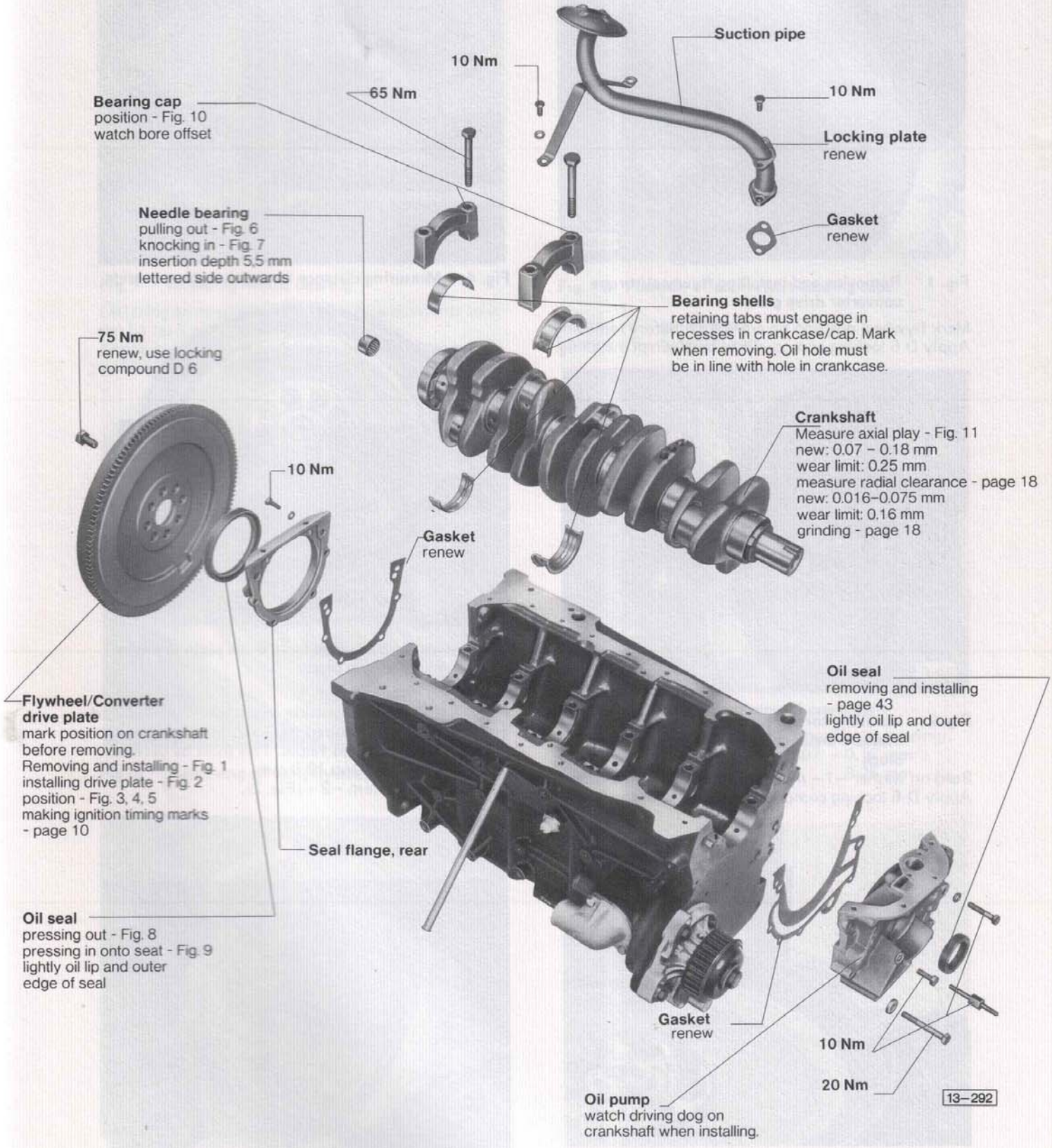
Manual gearbox:
Distance a = 29.4 ± 1.5 mm

Automatic gearbox:
Distance a = 127.4 ± 1.5 mm

– Move the engine and gearbox in longitudinal direction by shaking them on the mountings.

Note:
The engine and gearbox cannot be adjusted laterally or vertically.

REMOVING AND INSTALLING CRANKSHAFT AND FLYWHEEL



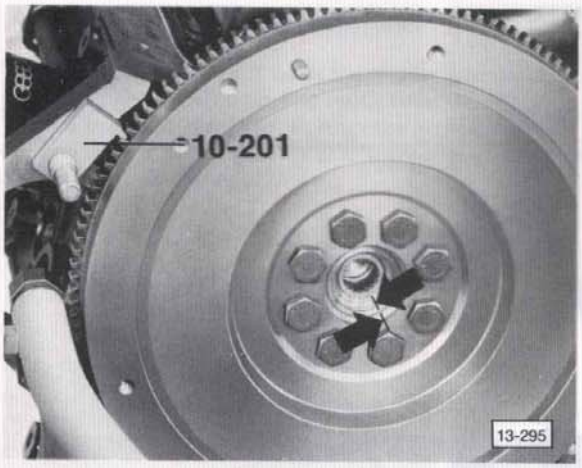


Fig. 1 Removing and installing flywheel/torque converter drive plate

Mark flywheel position on crankshaft before removing.
Apply D 6 locking compound to bolts when installing.

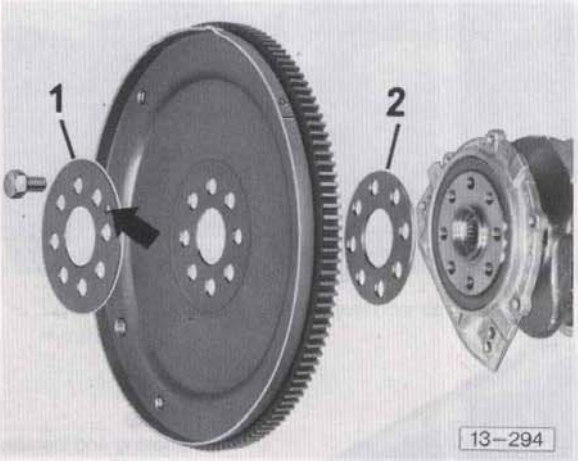


Fig. 2 Installing torque converter drive plate: first measure distance from drive plate to engine block

Bead on washer –1– must face towards torque converter.
Apply D 6 locking compound to bolts when installing.

Fig. 3 Measuring distance from drive plate, inside

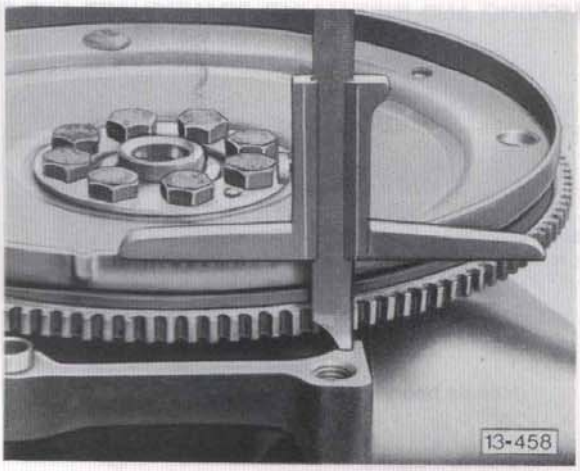


Fig. 4 Measuring distance from drive plate, outside

Fig. 5 Measure distance from drive plate to engine block in two places

Calculating distance:
Distance measured outside minus distance measured inside gives the required distance. Take the average of the two measured values. This must be between 17.2 and 18.8 mm.
Otherwise fit shim –2– (Fig. 2).

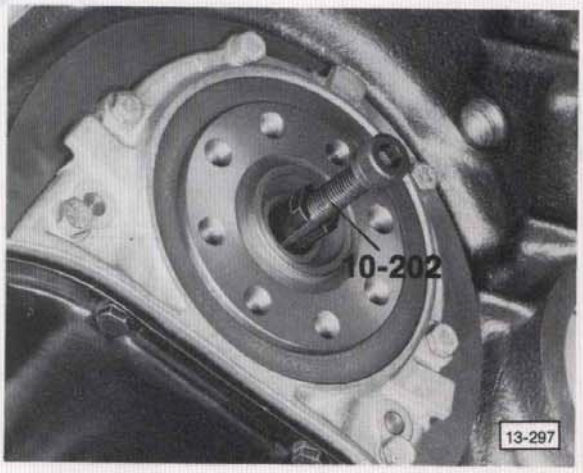


Fig. 6 Removing needle bearing

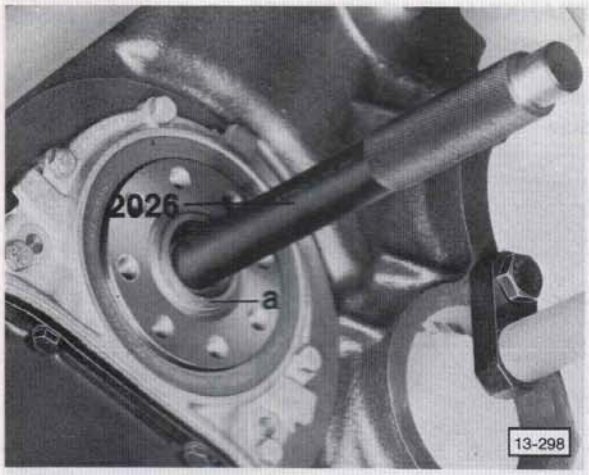


Fig. 7 Installing needle bearing

Lettering on needle bearing must face outwards so it can be read when bearing is installed.
Knock in to a depth of 5.5 mm (measured from surface –a– to needle bearing).

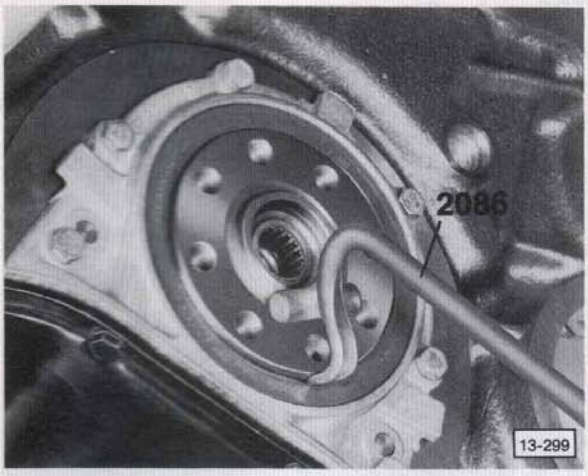


Fig. 8 Removing oil seal, flywheel end

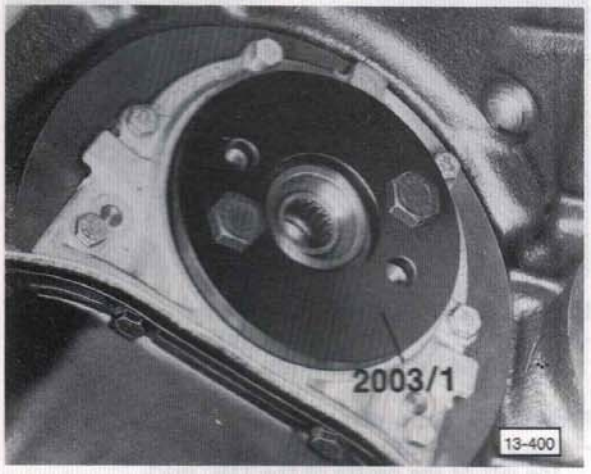


Fig. 9 Installing oil seal, flywheel end

Lightly oil sealing lip and outer rim of oil seal before installing.

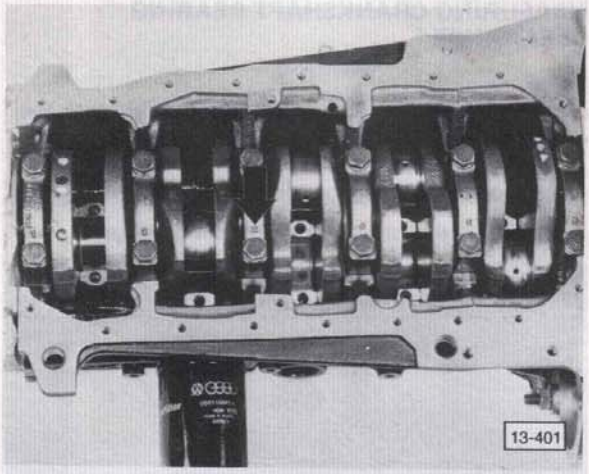


Fig. 10 Position of crankshaft bearing caps

Bearing –1– pulley end
Bearing –6– flywheel end

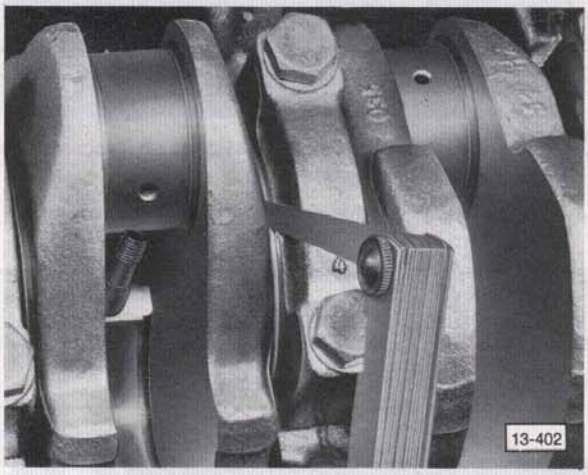


Fig. 11 Measuring axial play of crankshaft

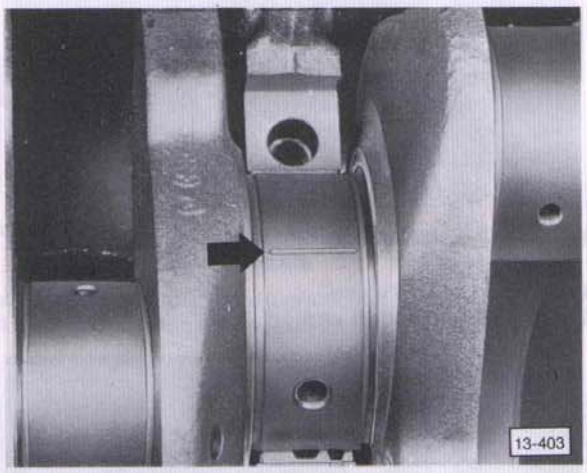
Measure axial play at no. 4 bearing (thrust bearing).

Clearance when new	0.07 – 0.18 mm
Wear limit	0.25 mm

MEASURING CRANKSHAFT BEARING CLEARANCE

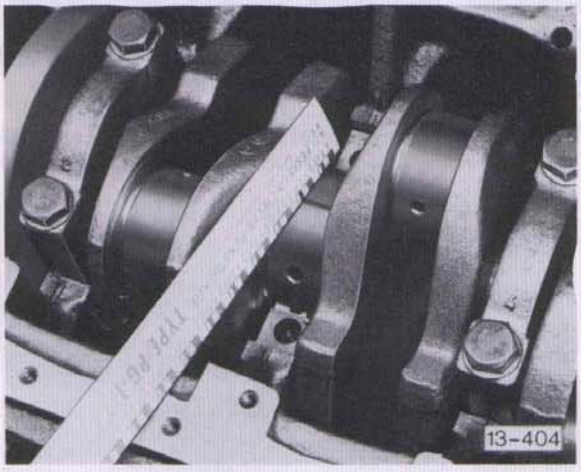
Note:
The bearing clearance can also be measured with the engine installed, using Plastigage.

- Remove crankshaft bearing cap.
- Clean bearing shell and crankshaft journal.



- Place a suitable length of Plastigage strip across the journal or in the bearing cap.
- Fit crankshaft bearing cap with shell and torque to 65 Nm.

Caution
Do not turn crankshaft.



- Compare width of Plastigage strip with measuring scale.

New:	0.016 – 0.075 mm
Wear limit:	0.16 mm

CRANKSHAFT UNDERSIZES

(Dimensions in mm)

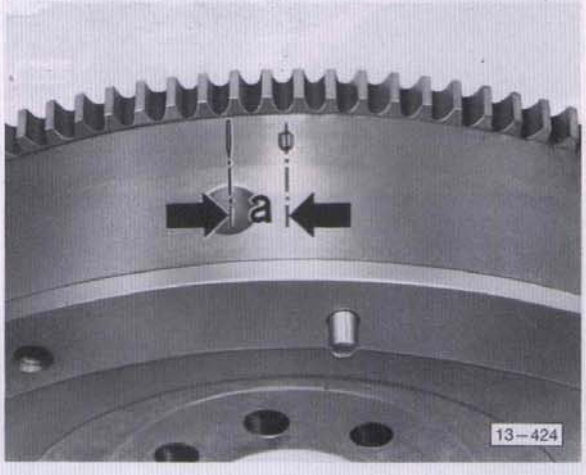
Size	Main journal dia.		Crankpin dia.	
Standard	58.00	–0.022 –0.042	46.00	–0.022 –0.042
1st undersize	57.75	–0.022 –0.042	45.75	–0.022 –0.042
2nd undersize	57.50	–0.022 –0.042	45.50	–0.022 –0.042
3rd undersize	57.25	–0.022 –0.042	45.25	–0.022 –0.042

MAKING IGNITION TIMING MARK ON FLYWHEEL

Replacement flywheels and drive plates have only a TDC mark – 0 –.

When a new flywheel or drive plate is fitted the appropriate ignition timing mark (notch) must be made on the replacement part. This involves measuring the length of the arc.

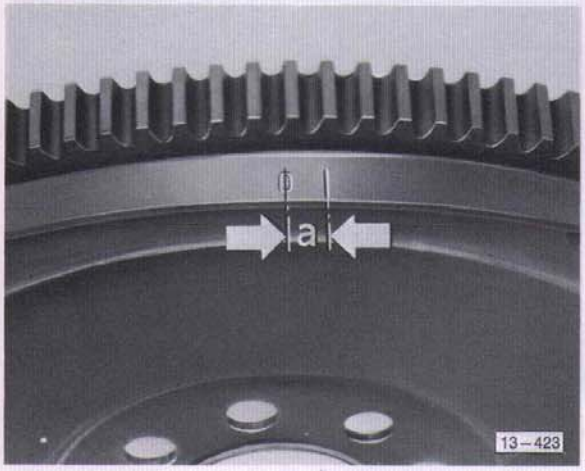
Engines with code letters WC, WG only



Up to and including 1979 model year
- Mark off notch for ignition timing 12.1 mm (a) to the left of the centre of the TDC mark.

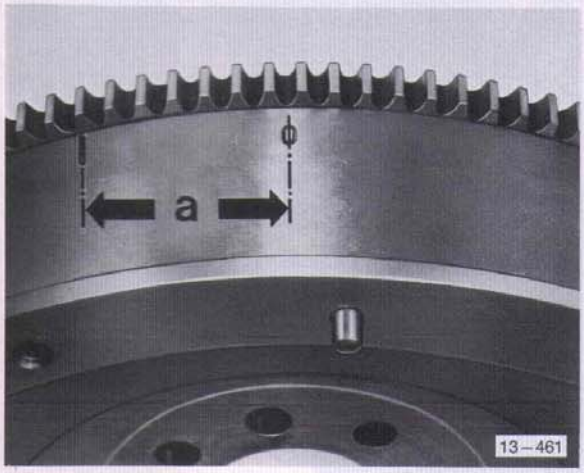
From 1980 model year onwards
- Mark off notch for ignition timing 14.5 mm (a) to the left of the centre of the TDC mark.

Engines with code letters WE only



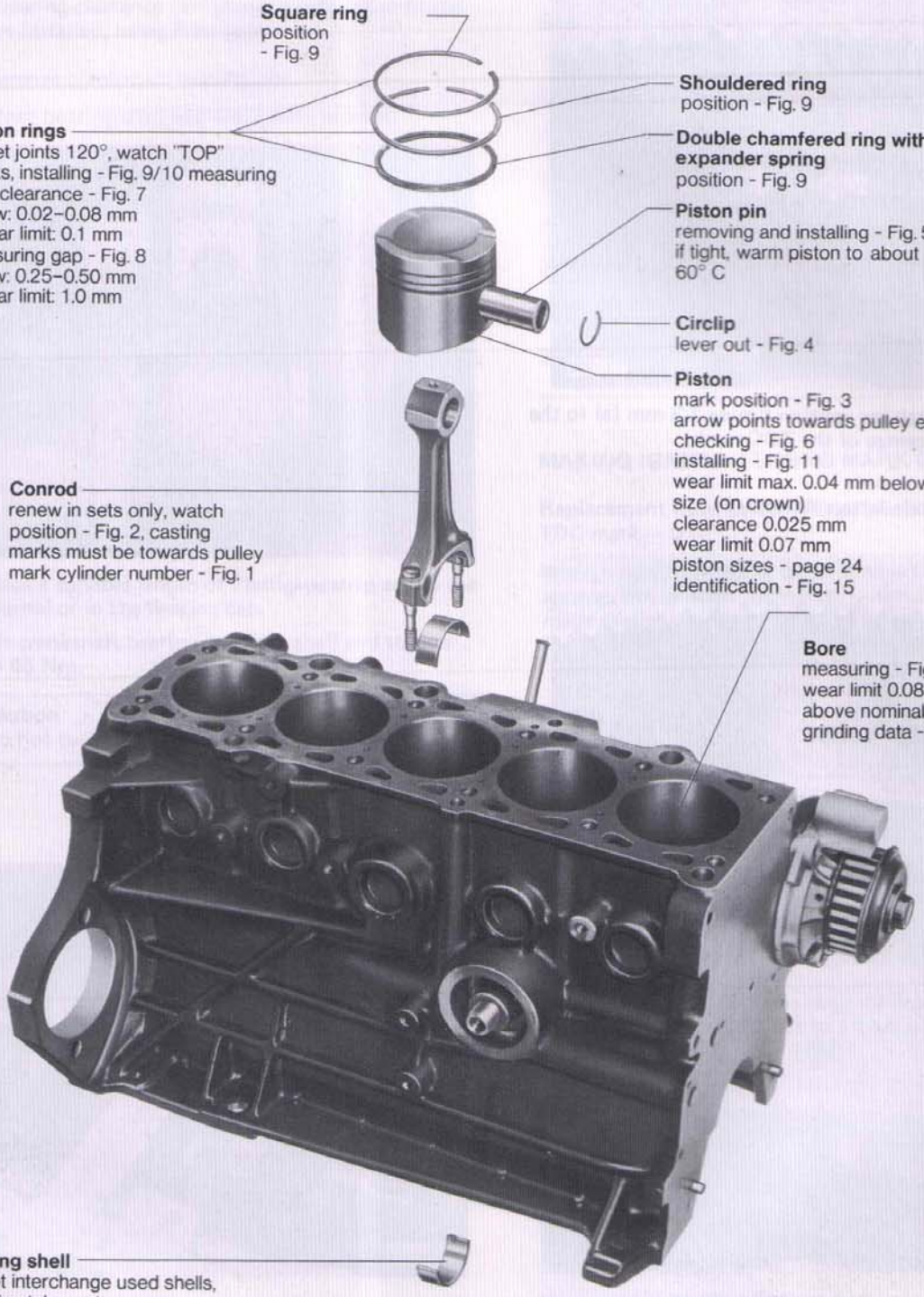
– Mark off notch for ignition timing 7.3 mm (a) to the right of the centre of the TDC mark.

Engines with code letters WJ only



– Mark off notch for ignition timing 51.6 mm (a) to the left of the centre of the TDC mark.

REMOVING AND INSTALLING PISTONS AND CONRODS



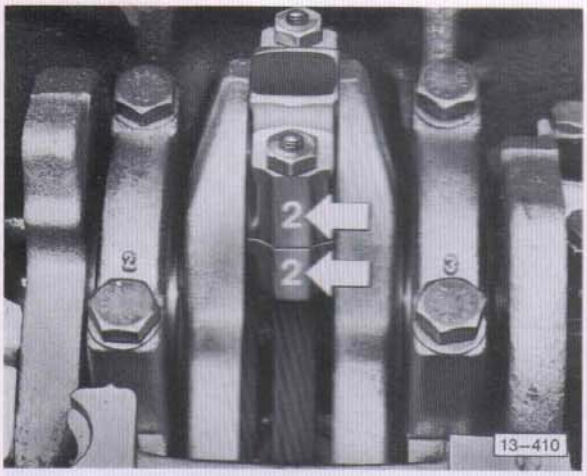


Fig. 1 Mark which cylinders the conrods belong to

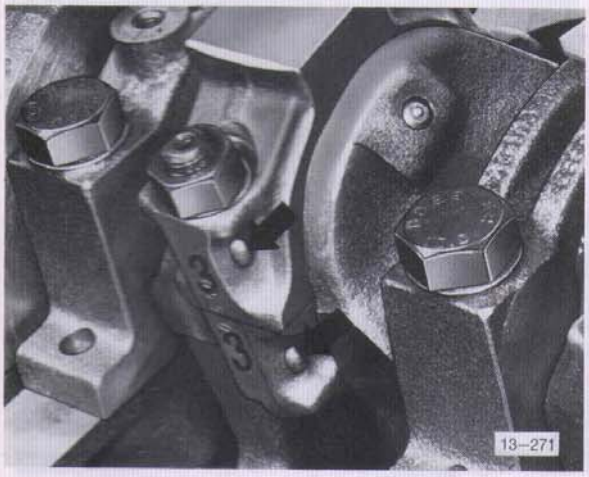


Fig. 2 Conrod fitting position

Casting marks towards pulley.

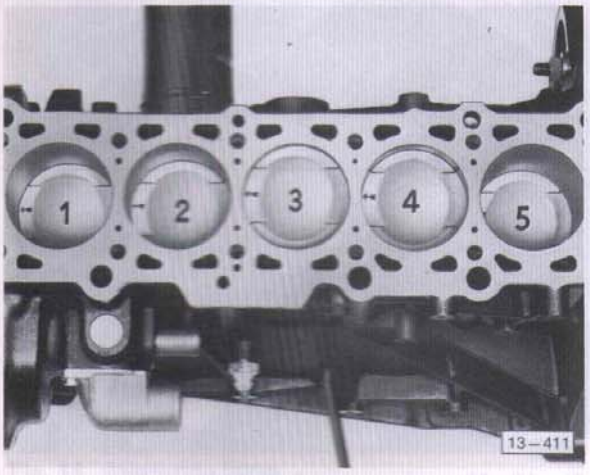


Fig. 3 Mark pistons

Arrow points towards pulley.
Mark which cylinders the pistons belong to.

Fig. 4 Levering circlip out

Fig. 5 Removing and installing piston pin

Note:
If tight, heat piston to about 60° C.

Fig. 6 Measuring piston

Measure 10 mm from lower edge and at 90° to pin axis.
Wear limit: 0.04 mm below nominal dimension (on crown) Fitting clearance 0.025 mm, wear limit 0.07 mm

Fig. 7 Measuring ring clearance
New 0.02 – 0.08 mm, wear limit 0.1 mm

Fig. 10 Removing and installing rings

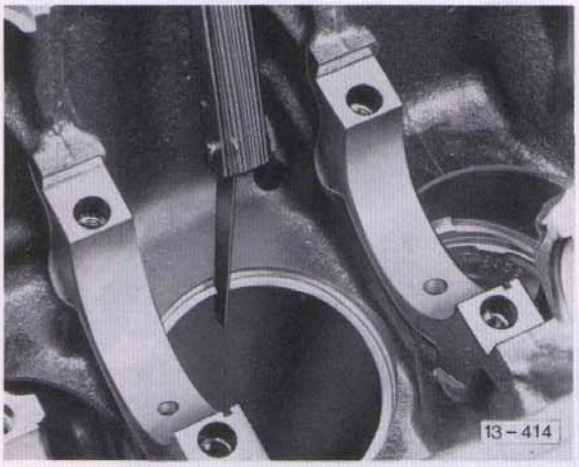


Fig. 8 Measuring ring gap
Push ring squarely into cylinder about 15 mm from lower edge.

New	0.25 – 0.5 mm
Wear limit	1.0 mm

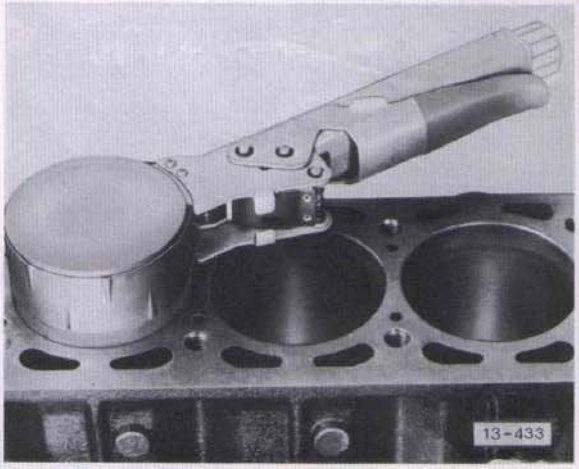


Fig. 11 Installing pistons

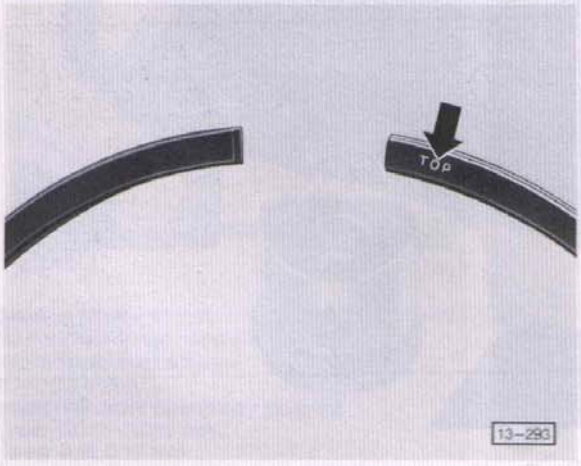


Fig. 9 Ring fitting positions
TOP must be upwards.
Chamfer on square ring (inside) must be upwards.
Shoulder on shouldered ring (outside) must be towards piston pin.

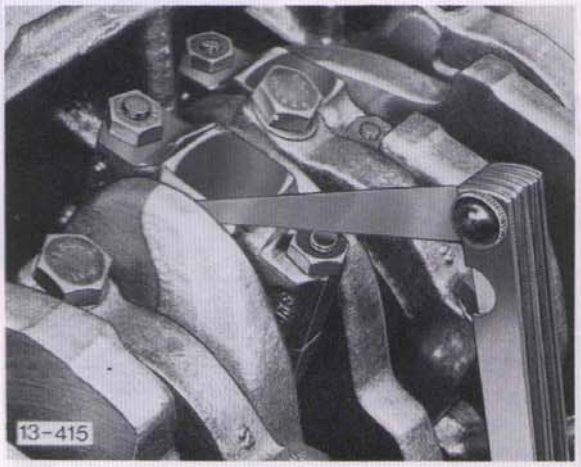


Fig. 12 Measuring conrod axial play
wear limit 0.4 mm

Fig. 13 Measuring bores
– Measure with internal dial gauge

Caution
Do not measure cylinder bores with engine mounted on repair stand as this causes a certain amount of distortion.

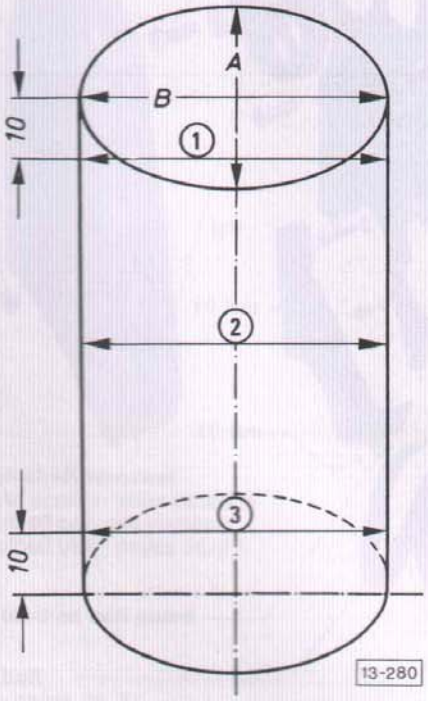


Fig. 14 Measuring bores
Measure at three points in both directions – A – and – B –.
Wear limit max. 0.08 mm above nominal dimension as given under bore grinding data – page 24.

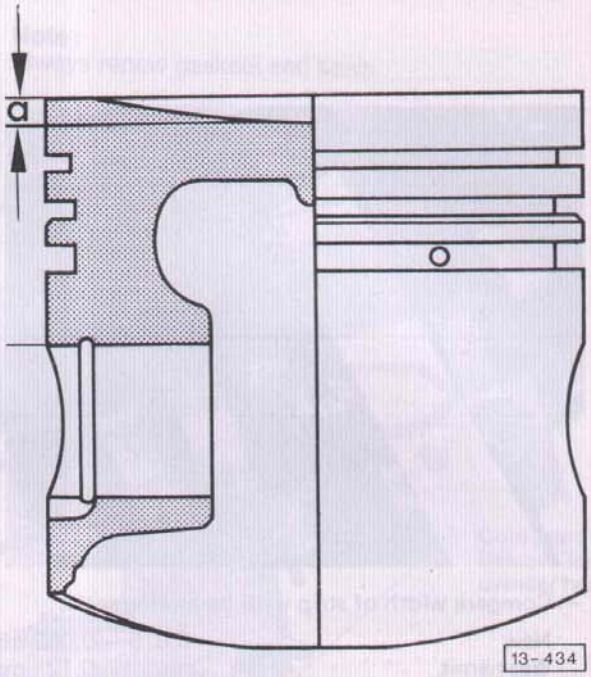


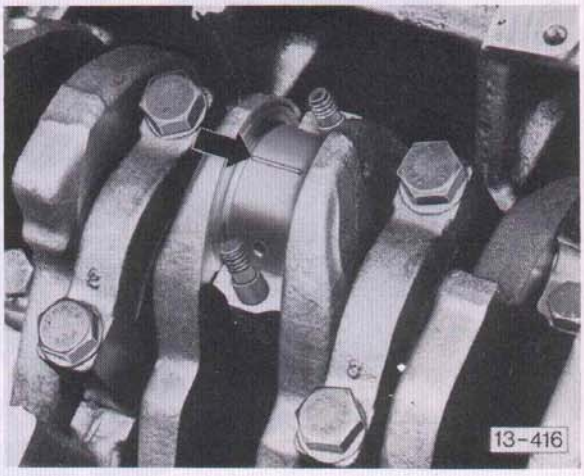
Fig. 15 Piston identification

Engine code	Dimension –a–
WC	5.9 mm
WE	6.5 mm
WG	5.9 mm
WJ	12.5 mm

MEASURING CONROD RADIAL CLEARANCE

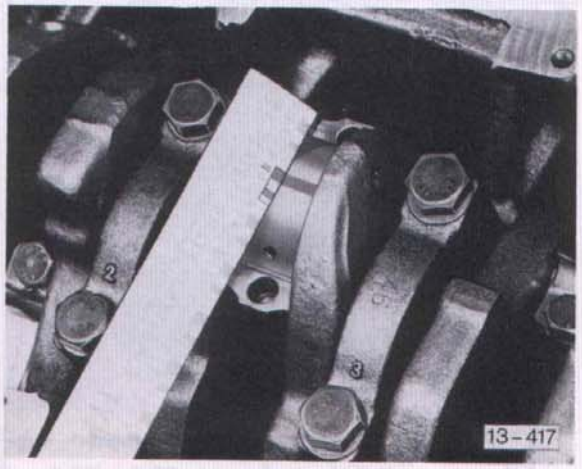
Note:
Can be measured – even with engine in – using Plastigage.

– Take conrod cap off.
– Clean bearing shell and crank pin.



– Lay strip of Plastigage on journal or cap as shown.
– Install cap and tighten nuts to 50 Nm.

Caution
Do not turn crankshaft.



– Compare width of strip with measuring scale.

New	0.015 – 0.062 mm
Wear limit	0.12 mm

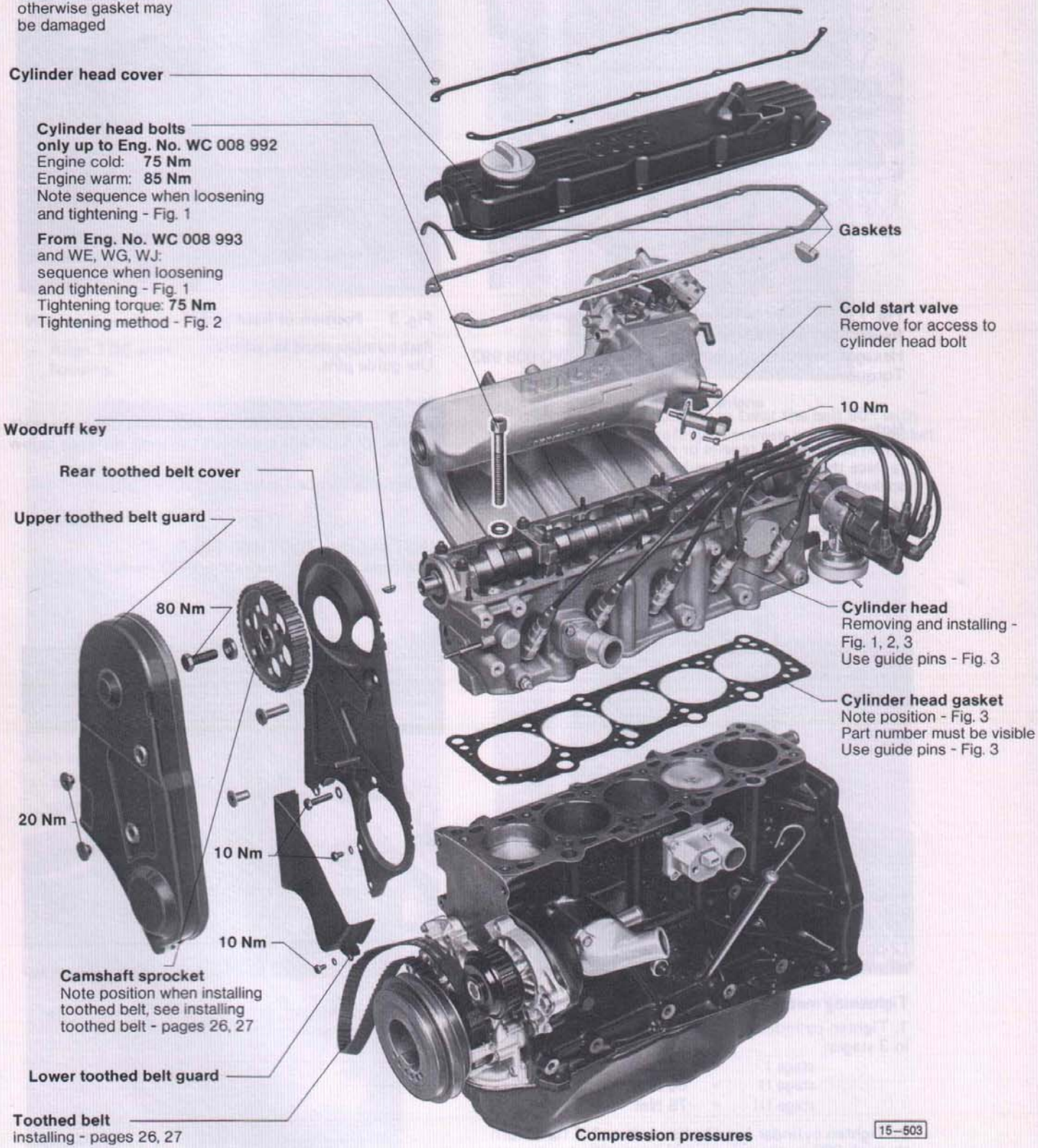
PISTON SIZES (mm)

	Piston size	Bore grinding size
Standard	79.48	79.51
1st oversize	79.73	79.76
2nd oversize	79.98	80.01
3rd oversize	80.48	80.51

15 Cylinder head, valve gear

REMOVING AND INSTALLING CYLINDER HEAD

Note:
Always renew gaskets and seals



Measuring compression
Pull high tension cable out of distributor terminal 4 and earth it with an extension lead
Measure at starter speed, throttle wide open, engine oil temperature at least 30° C.

Compression pressures 15–503

Engine code letters	WC, WG	WE	WJ
Specified pressure:	9–13	8.5–12	7–9
Wear limit:	7.5	7.0	5.0
Max. difference between cylinders	3.0	3.0	2.0

Pressures given in bar

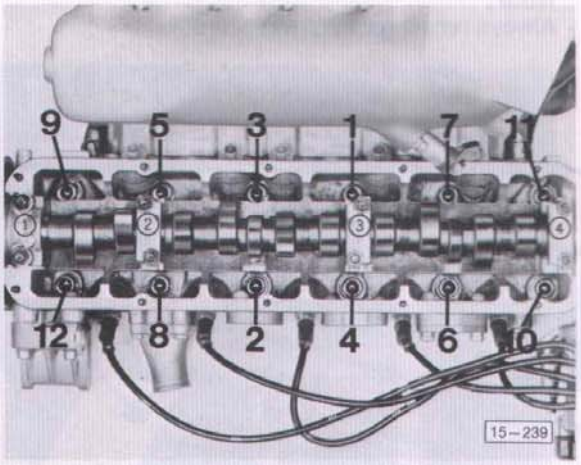


Fig. 1 Cylinder head bolt tightening sequence
Reverse sequence when loosening
Hexagon socket head bolts up to Eng. No. WC 008 992
Torque:

engine cold 75 Nm

Note:
When carrying out repairs or reinstalling the head, replace the hexagon socket head bolts with 12 point socket head bolts (see Fig. 2).

If this is done, it is not necessary to retighten the cylinder head bolts after 1000 km.

Fig. 2 Cylinder head bolts with 12 point socket head
12 point socket head bolts from Eng. No. WC 008 993, WE, WG, WJ

Tightening method:

1. Tighten cylinder head bolts in specified sequence in 3 stages:

stage I	=	**40 Nm**
stage II	=	**60 Nm**
stage III	=	**75 Nm**

2. Tighten cylinder head bolts another 1/4 turn (turn through 90° in one movement) in specified sequence.

These bolts must not be retightened after **repair work or as part of the Standard Service.**

The bolts need not be renewed when carrying out repairs.

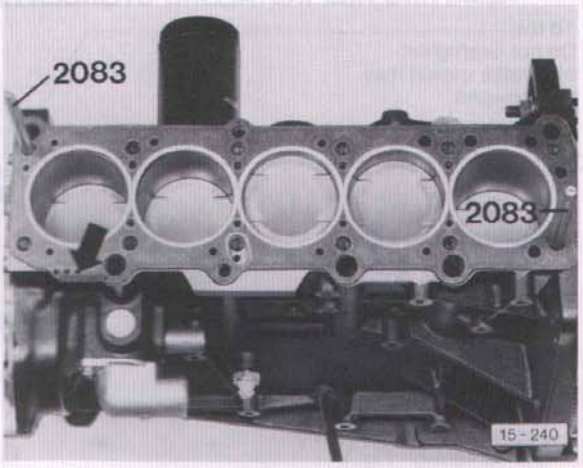


Fig. 3 Position of head gasket
Part number must be visible.
Use guide pins.

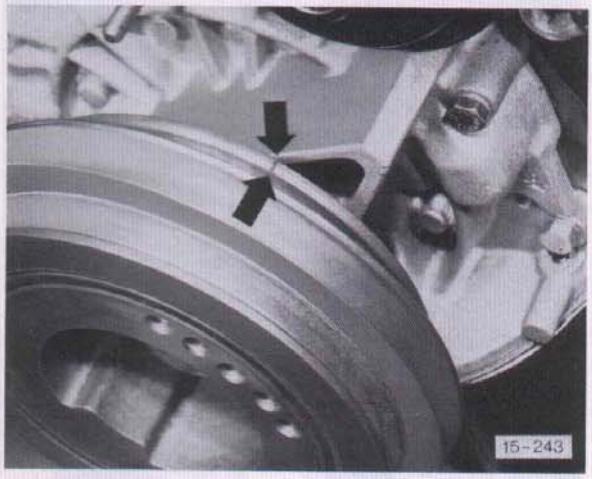
Note:
Before installing the cylinder head turn the crankshaft so that all 5 pistons are about the same distance below TDC.
Otherwise an open valve may strike a piston.

INSTALLING TOOTHED BELT
(Vehicles up to and including 1979 model year)

– Align marking on camshaft sprocket with upper surface of gasket.

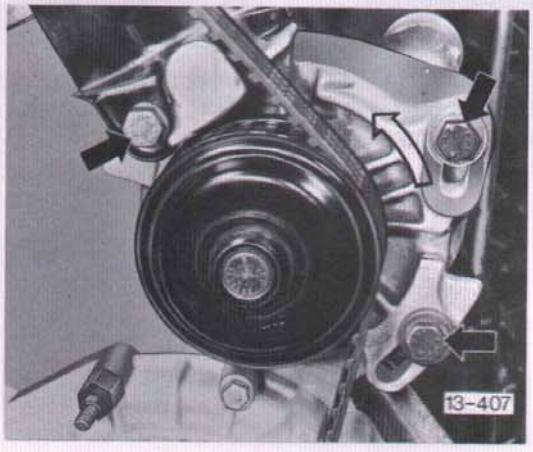
With engine in situ

– Align TDC mark – 0 – with marking cast in bell-housing.

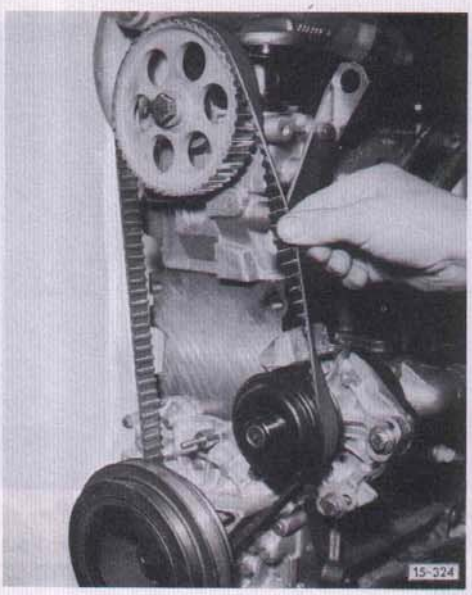


With engine out

– Align notch on pulley with adjusting mark on oil pump housing.



– Fit toothed belt and tension belt by slackening water pump mountings and turning water pump to the left.



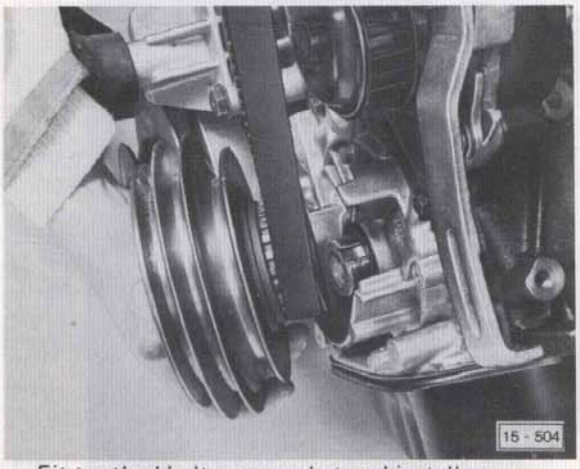
– It should just be possible to twist the belt 90° with the thumb and forefinger between camshaft sprocket and water pump.

– Install toothed belt guard and V-belt.

INSTALLING TOOTHED BELT

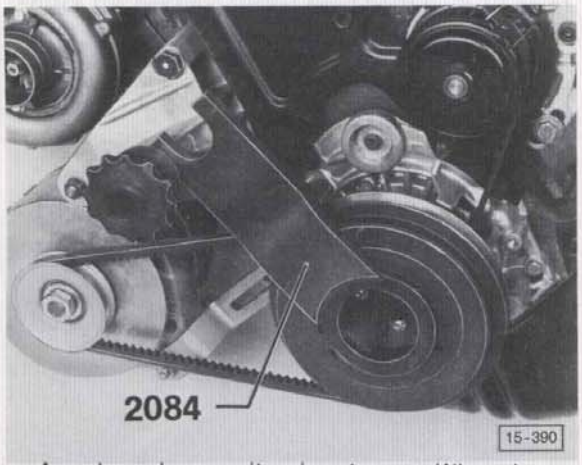
(Vehicles from 1980 model year onwards)

– Align marking on camshaft sprocket with upper surface of gasket.

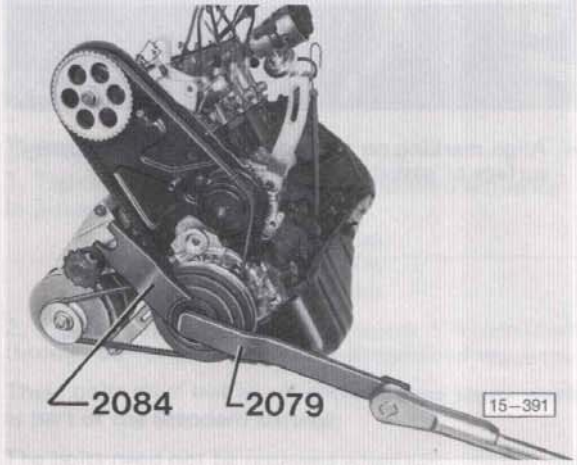


– Fit toothed belt on sprocket and install on crankshaft with vibration damper.

Caution
Ensure that toothed belt is not jammed between oil pump and sprocket when fitting vibration damper.

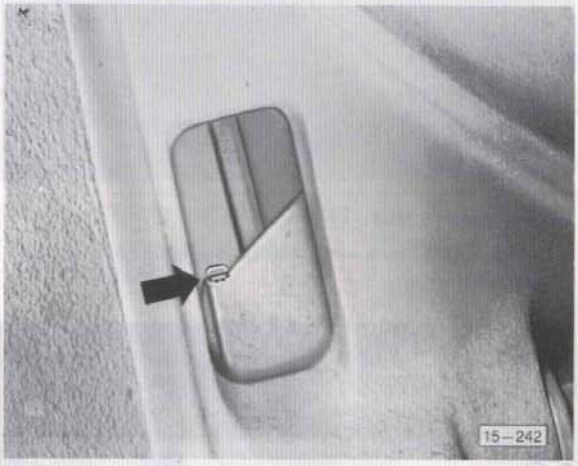


– Attach retainer to vibration damper. When the engine is installed the retainer is braced against the front engine mounting stop on cross member I.



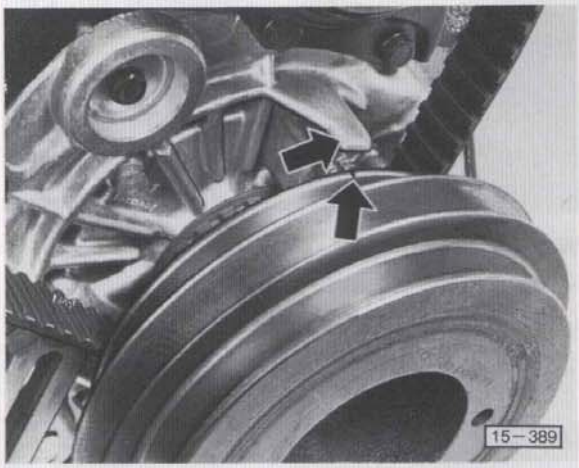
– To secure vibration damper reposition retainer 2084 on engine mount accordingly.
Tightening torque 350 Nm.

Important
This torque only applies when extension 2079 is used:
torque wrench must be in line with extension.



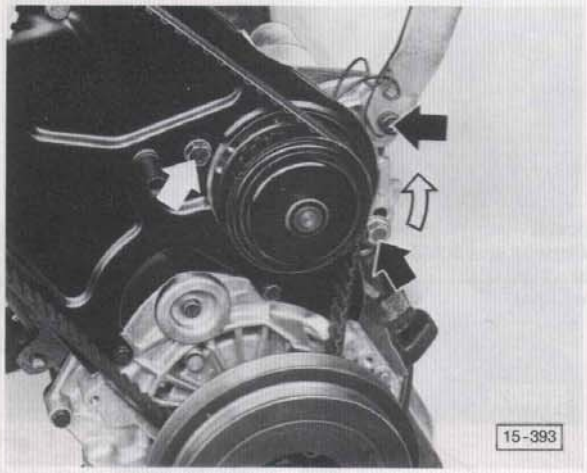
With engine in situ

– Align TDC marking – 0 – with cast marking on bellhousing.

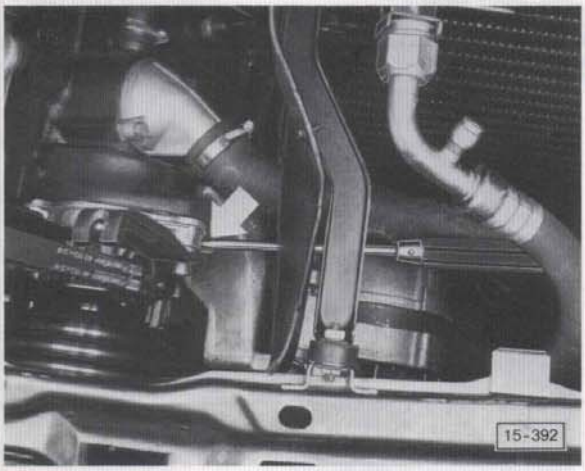


With engine removed

– Align notch on pulley with adjusting mark on oil pump housing.



– Install toothed belt and tension belt by slackening water pump mountings and turning water pump to the left (upwards).



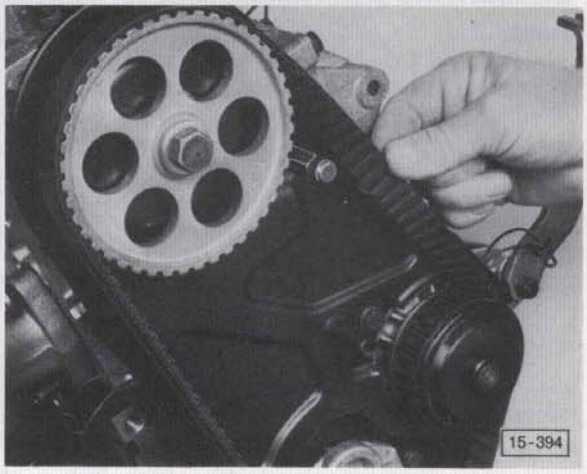
With engine installed:

– Detach top radiator cover.

– Tension toothed belt by slackening water pump mountings and turning water pump to the left (upwards):
insert screwdriver through opening for hose in radiator cowl.

– Install upper radiator cover.

– Install lower toothed belt guard.



– It should just be possible to twist the toothed belt 90° with thumb and forefinger between camshaft sprocket and water pump.

– Install toothed belt guard.

Vehicles with power assisted steering only

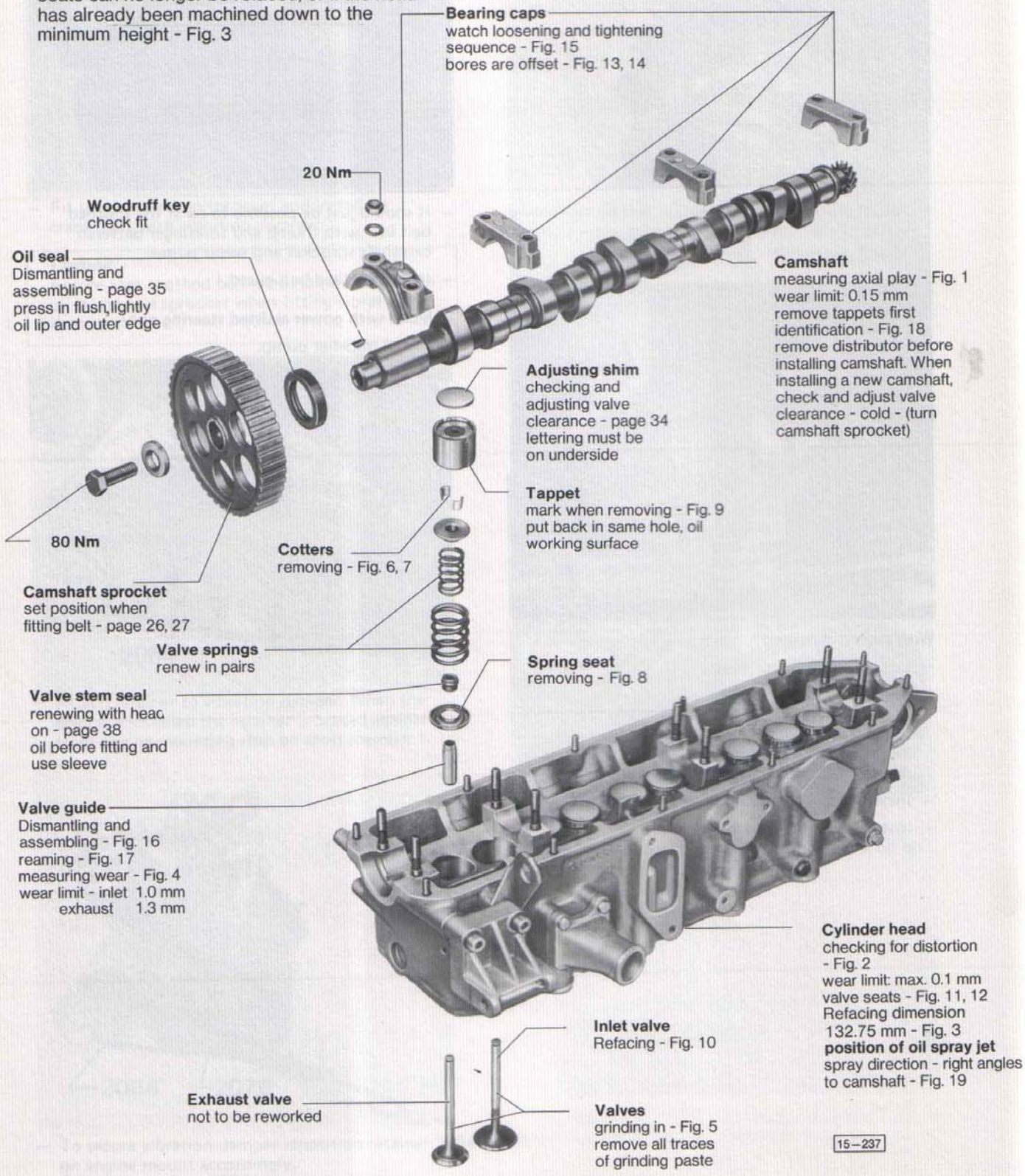
– Install impeller pump.

– Install V-belt and tension belt.

15 Cylinder head, valve gear

DISMANTLING AND ASSEMBLING VALVE GEAR

Note:
When valves have been renewed and ground in or the camshaft renewed, the valve clearance must be checked after about 1000 km with engine warm, and adjusted if necessary. Valve guides should not be renewed if head is cracked or valve seats can no longer be refaced, or if the head has already been machined down to the minimum height - Fig. 3



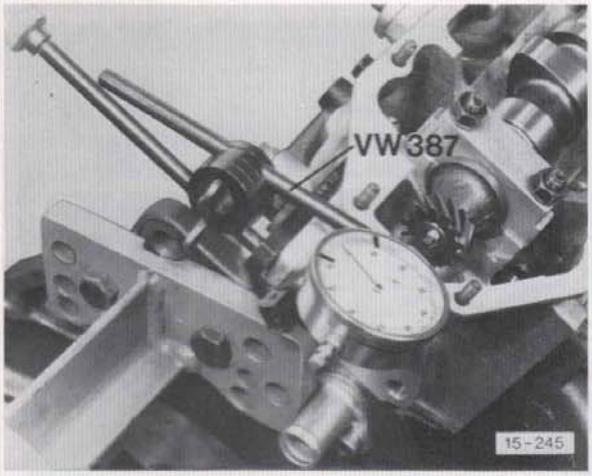


Fig. 1 Measuring camshaft axial play

Wear limit: 0.15 mm

– Remove tappets beforehand, camshaft must be free of strain.

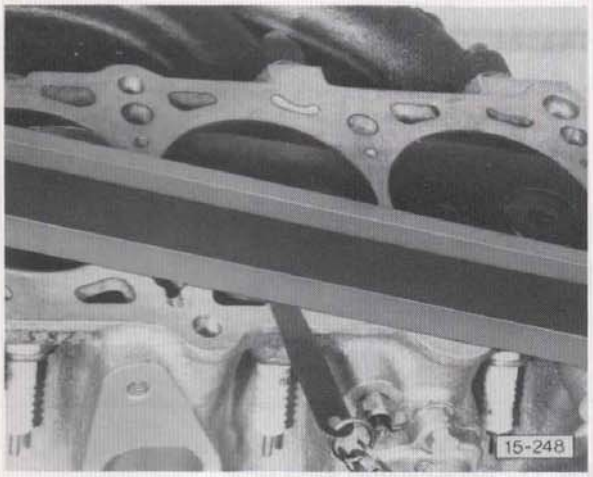


Fig. 2 Checking head for distortion

Wear limit: 0.1 mm

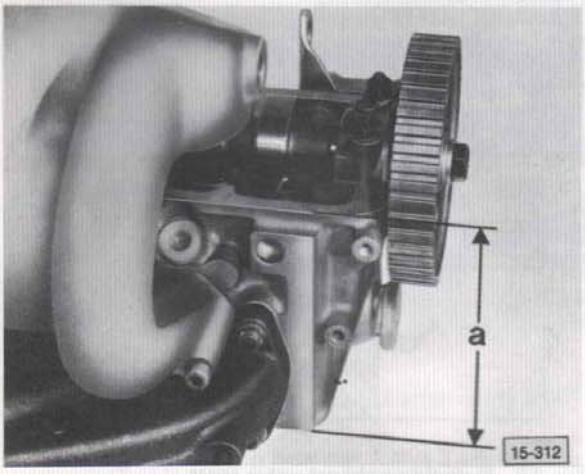


Fig. 3 Head machining dimension

Minimum height = 132.75 mm (a)
Surface finish:
Peak to valley height + waviness = 15 µ

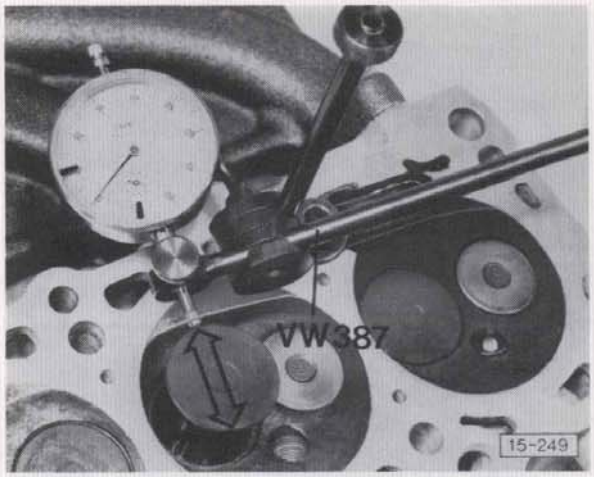


Fig. 4 Measuring valve guide wear

Remove desposits with cleaning reamer.
Place new valve in guide. End of stem must be flush with end of guide.

Ensure that correct valve is used (exhaust and inlet different).

Wear limit:		
	Inlet guide	1.0 mm
	Exhaust guide	1.3 mm

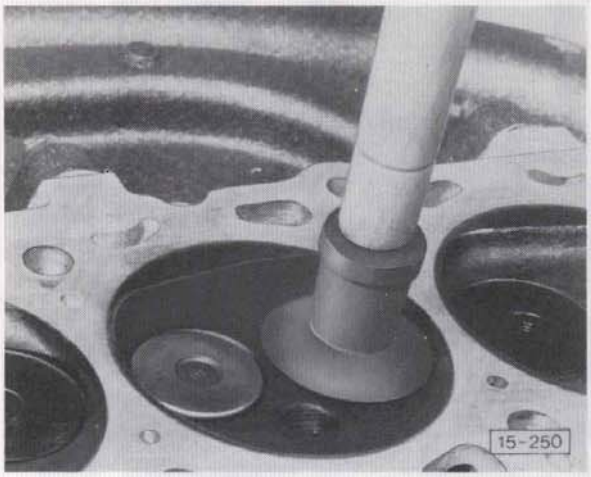


Fig. 5 Grinding valves in

Caution!
Ensure that all traces of grinding paste are removed.

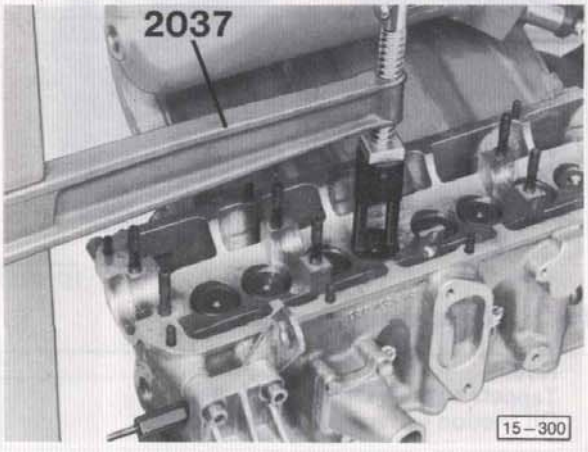


Fig. 6 Removing valve cotters

With head off.

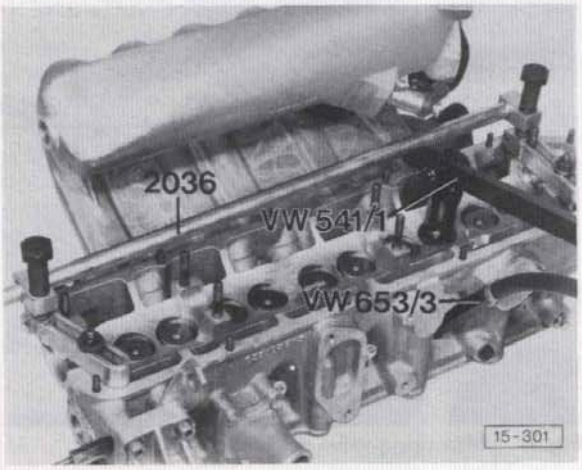


Fig. 7 Removing valve cotters

With head on.
Connect compressed air hose and maintain pressure of a least 6 bar. Use special tool 2036, note attachment to bearings 1 and 4.

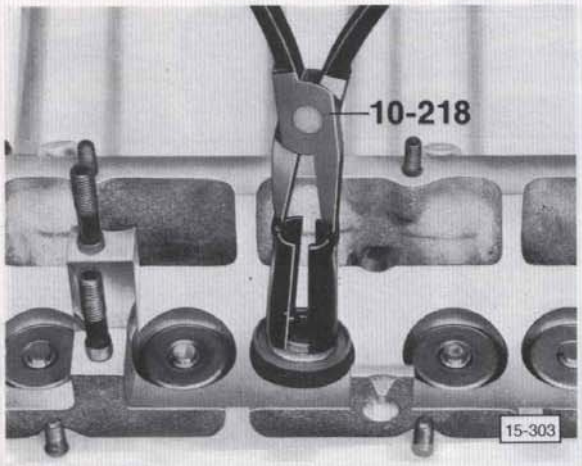


Fig. 8 Removing spring seats

Fig. 9 Mark tappets on removal

Note:
Tappets must not be interchanged.
Oil friction surface before installing.

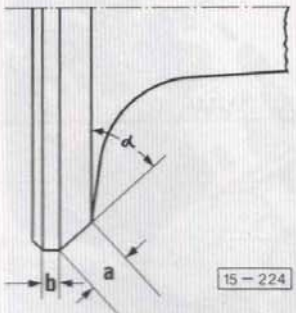


Fig. 10 Refacing inlet valves

α = 45°
a = max. 3.5 mm
b = min. 0.5 mm

Note:
Exhaust valves are not to be machined.
Grind in by hand only.

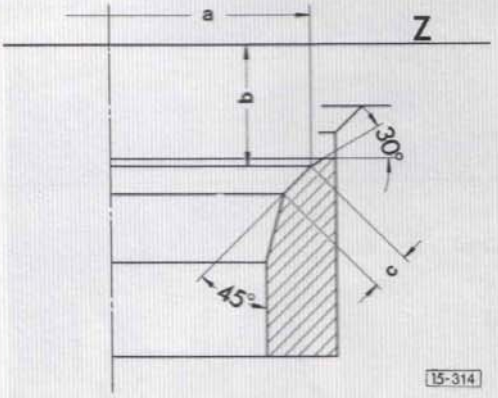


Fig. 11 Refacing inlet valve seats

a = 37.2 mm dia. Z = head lower edge
b = 9.0 mm 30° = Upper correction angle
c = 2.0 mm 45° = Seat angle

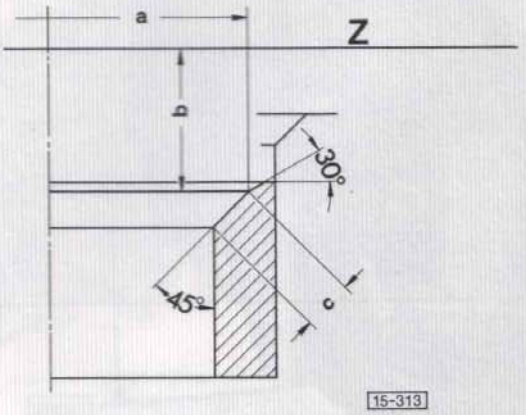


Fig. 12 Refacing exhaust valve seats

*a = 32.8 mm dia. Z = Head lower edge
b = 9.6 mm 30° = Upper correction angle
c = 2.4 mm 45° = Seat angle
*a = 30.8 mm dia. on engines with code letters WE.

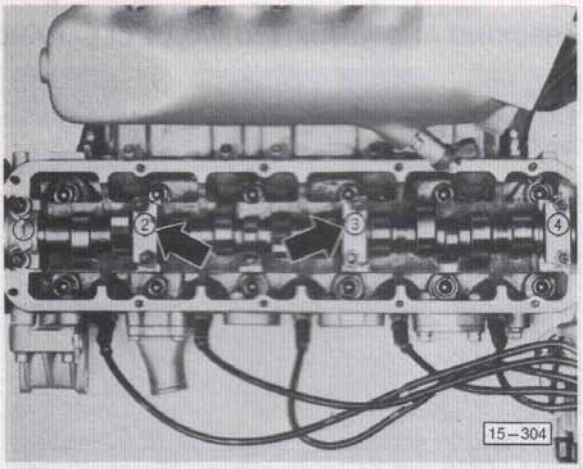


Fig. 13 Position of bearing caps

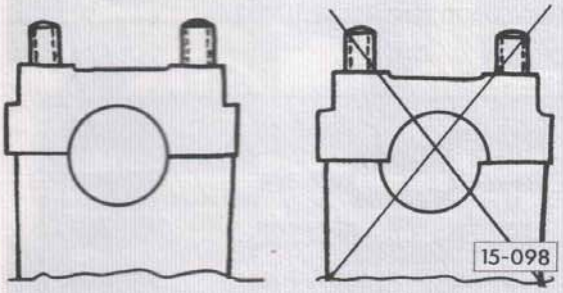


Fig. 14 Position of bearing caps

Watch offset

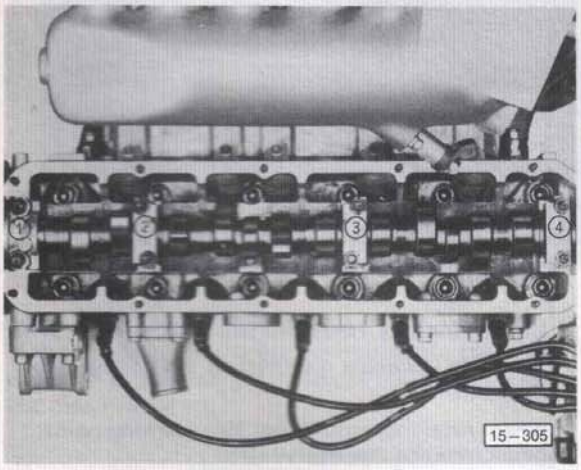


Fig. 15 Installing bearing caps

Tighten nuts on bearings 2 and 4 alternately and diagonally.

Then tighten nuts on bearings 1 and 3 alternately and diagonally.

Note:
When removing, use same sequence as for installing.

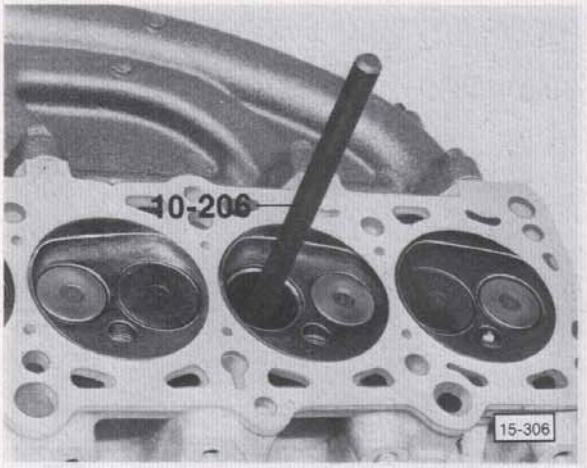


Fig. 16 Removing and installing valve guides

Coat new guides with oil and press them in from the camshaft side with head cold.

Note:
When the shoulder on the guide makes contact the pressure must not exceed 1 tonne as otherwise the shoulder may break off.

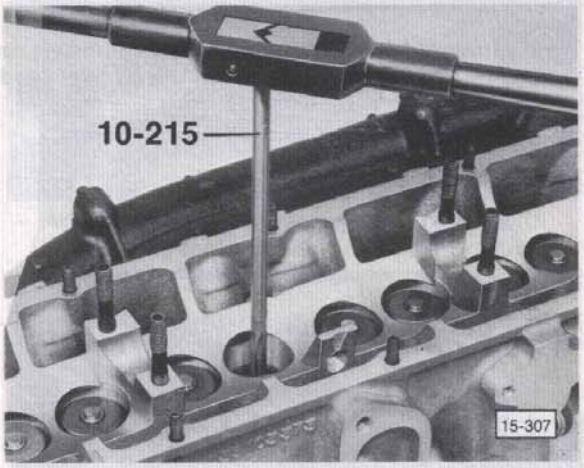


Fig. 17 Reaming valve guides

Ream guide out with hand reamer. Use plenty of cutting oil.

Refacing valve seats – Figs. 11, 12.
Grinding in valves – Fig. 5.

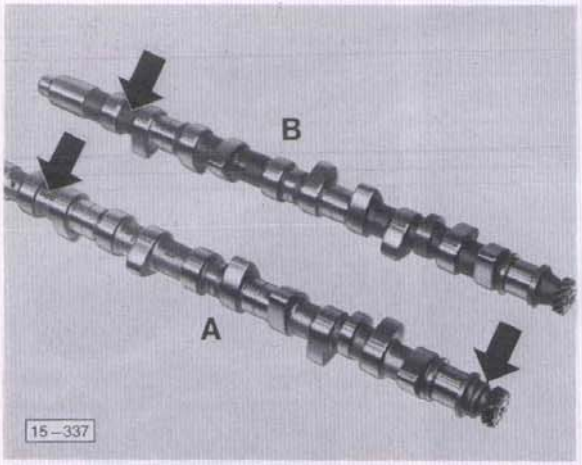


Fig. 18 Camshaft identification

Camshaft – A – in engines with code letters WE
Cast ring near distributor drive gear.
Number 035 C cast in between no. 1 cylinder inlet and exhaust cams.

Camshaft – B – in engines with code letters WC, WG, WJ
Number 035 B cast between no. 1 inlet and exhaust cams.

Note:
When camshaft is in suitable position, the numbers can be seen through the oil filler hole in the cylinder head cover.

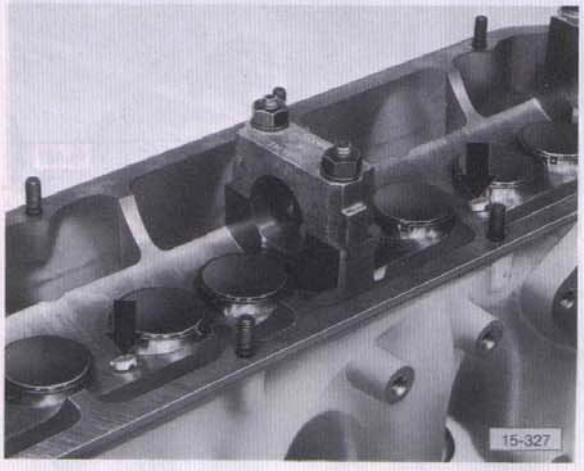


Fig. 19 Position of oil spray jet
Direction of spray is at right angles to camshaft.

CHECKING AND ADJUSTING VALVE CLEARANCE

Note:
The clearance is checked and adjusted with engine warm (coolant temperature above 35° C).

Specified clearance, engine warm:

inlet valves	0.20 – 0.30 mm
exhaust valves	0.40 – 0.50 mm

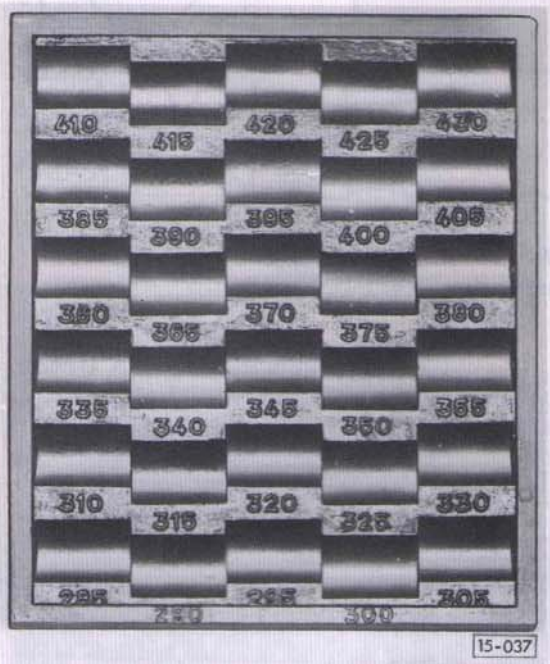
When repairs have been carried out on the head, the valves must be adjusted with the engine cold:

Specified clearance, engine cold:

inlet valves	0.15 – 0.25 mm
exhaust valves	0.35 – 0.45 mm

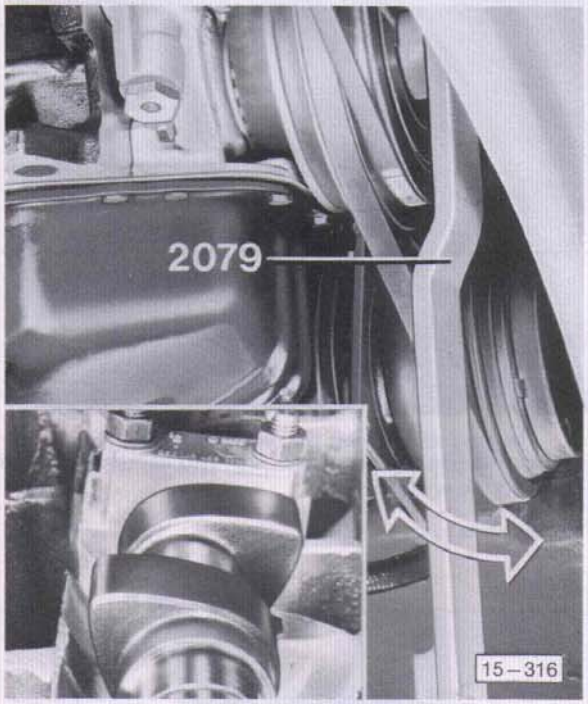
The clearance is set with shims (thicknesses from 3.00 – 4.25 mm).

After repairs to the cylinder head, e.g. renewing and grinding in valves or renewing camshaft, the valve clearance must be checked and adjusted with the engine warm after about 1000 km.

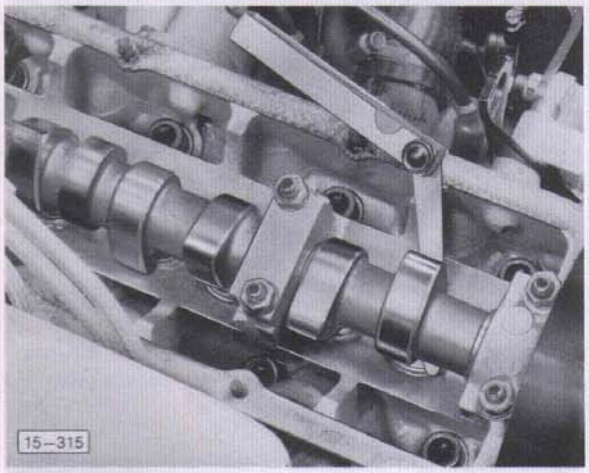


– Use sorting tray 10-212 to store the shims.
The shim thickness is etched on the underside of the shim.
When installing, ensure that this marking points down into the tappet.
Used shims can be installed again provided that they are not damaged.

– Remove air duct and cylinder head cover.



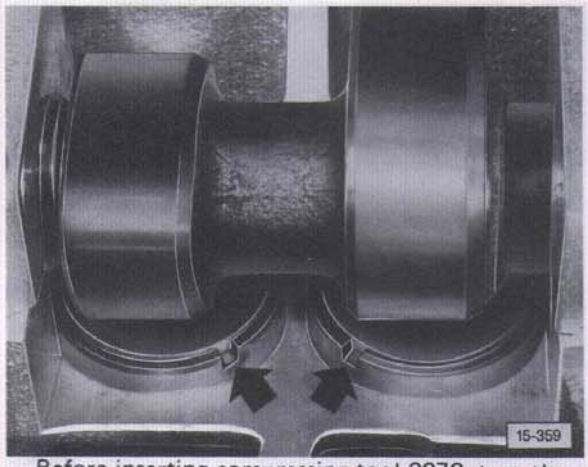
– Turn crankshaft so that cams for the cylinder to be adjusted point upwards at similar angles.



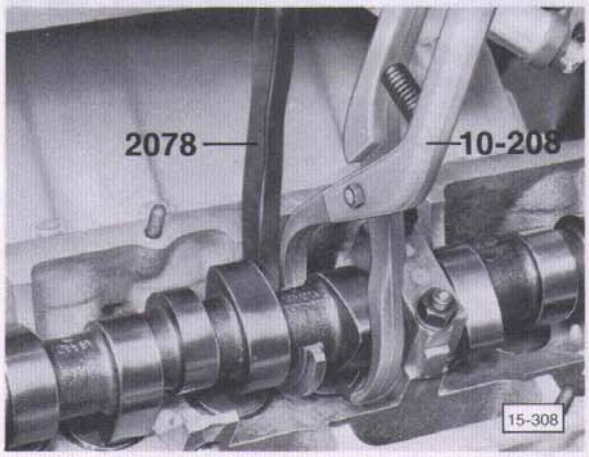
– Measure valve clearance.

Note:
If the measured clearances are not within the specified tolerances, try to adjust the clearance to the mean value, e.g.:

	Inlet valve	Exhaust valve
Specified clearance:	0.20–0.30 mm	0.40–0.50 mm
Measured clearance:	0.35 mm	0.35 mm
Clearance is	0.05 mm too large	0.05 mm too small
Try and adjust clearance to	0.25 mm	0.45 mm



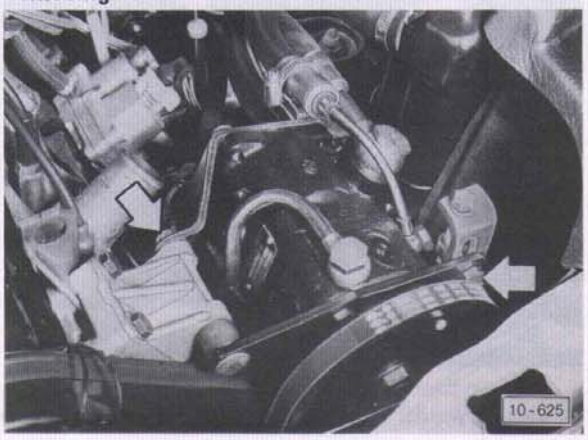
– Before inserting compressing tool 2078, turn the tappets so that the slots on the intake side face inwards.



– Adjust clearance by pressing down tappet with compressing tool and inserting shim of required thickness (lettering faces downwards).

REMOVING AND INSTALLING CAMSHAFT OIL SEAL

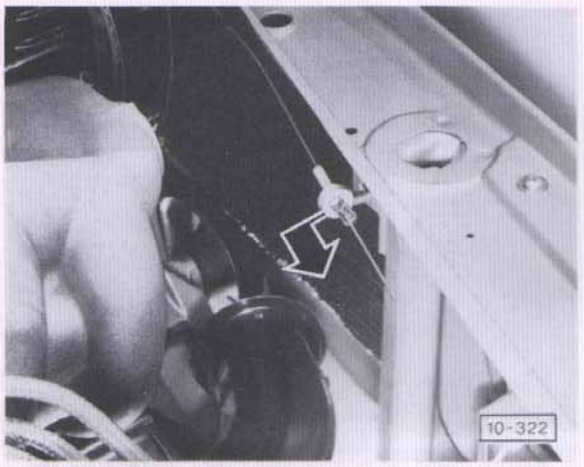
Removing:



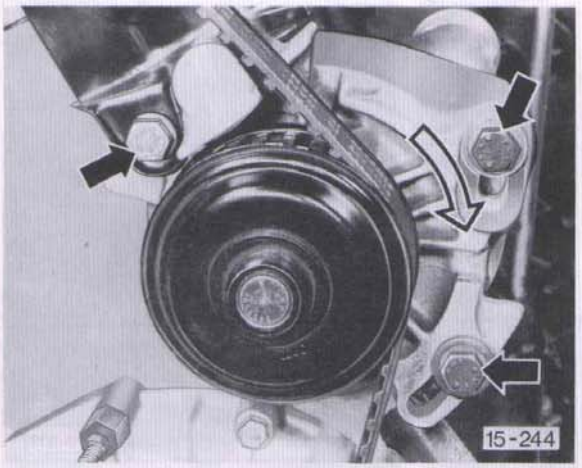
– Remove impeller pump for PAS.
– Detach impeller pump belt.

Note:
Leave hoses connected.

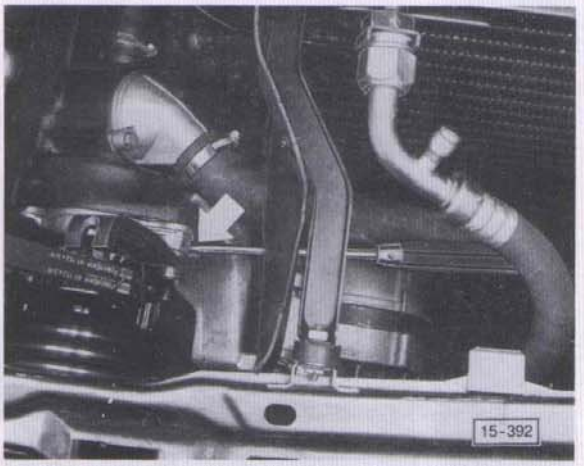
– Place impeller pump to one side.
– Remove upper toothed belt guard.
– Set crankshaft with No. 1 cylinder at TDC.



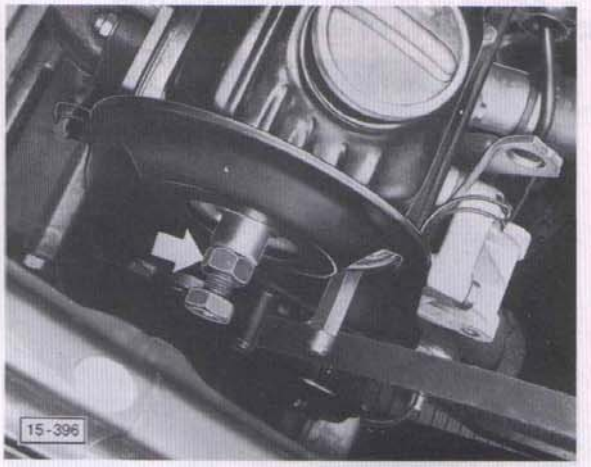
– Disconnect lock cable.
– Loosen camshaft sprocket bolt.



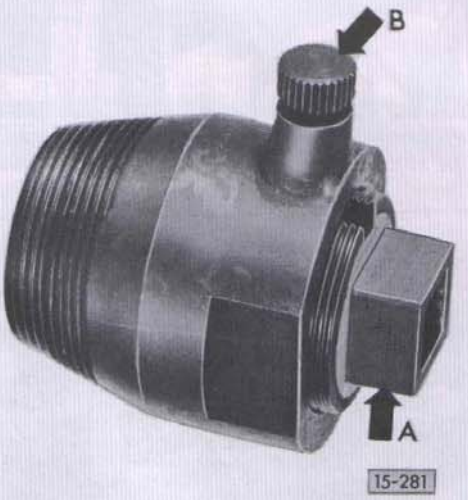
– Slacken toothed belt (vehicles up to and including 1979 model year) by loosening water pump mountings and turning water pump in direction of arrow.



– Slacken toothed belt (vehicles from 1980 model year onwards) after detaching upper radiator cover.
– Slacken water pump mountings and turn water pump to the right (downwards) by inserting screwdriver through opening for hose in radiator cowl.
– Detach toothed belt.
– Remove camshaft sprocket and Woodruff key from camshaft.



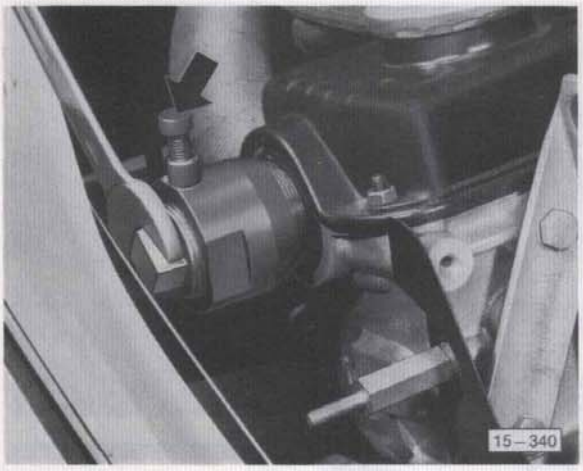
– Screw camshaft sprocket bolt into camshaft 3 turns and lock with lock nut.



– When using the oil seal extractor, note the following points:

unscrew the inner part – arrow A – 3 to 4 turns out of the outer threaded part and secure with knurled screw – arrow B –.

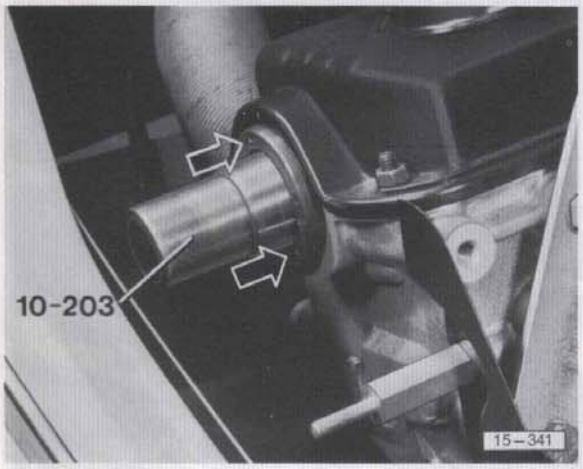
– Oil outer threads of extractor, place in position on seal and screw as far as possible into seal, pressing firmly in direction of arrow.



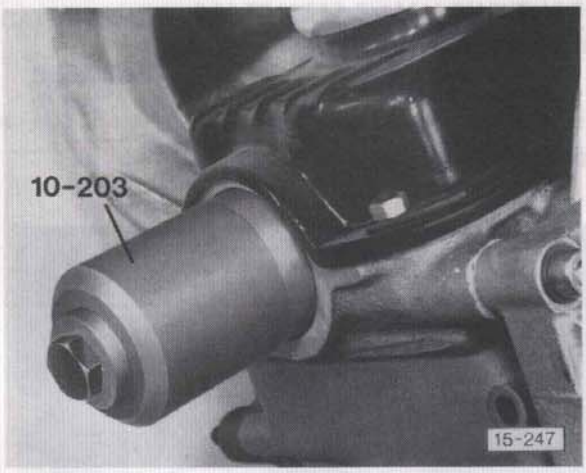
– Loosen knurled screw and turn inside part of extractor against camshaft until oil seal is pulled out.
– Clamp extractor in vice using the flats and pull off oil seal with pliers.

Installing:

Note:
Lightly oil sealing lip and outer rim of seal.



– Place oil seal in position with fitting sleeve.



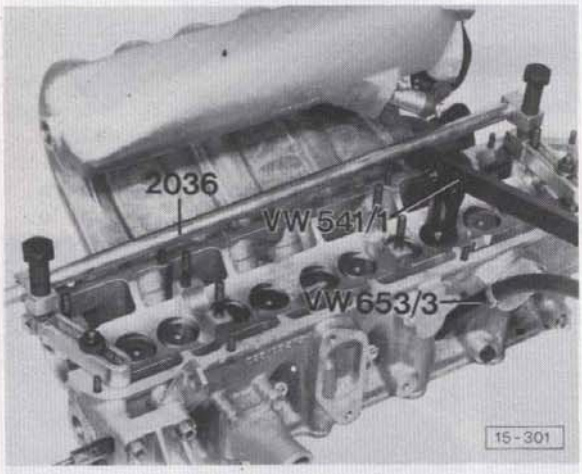
– Press in oil seal until it is behind the chamfer in the cylinder head. Use the washer from the camshaft sprocket mounting bolt.

Important
Do **not** press seal in fully home because it would then cover the oil return drilling.

RENEWING VALVE STEM SEALS
(Cylinder head in situ)

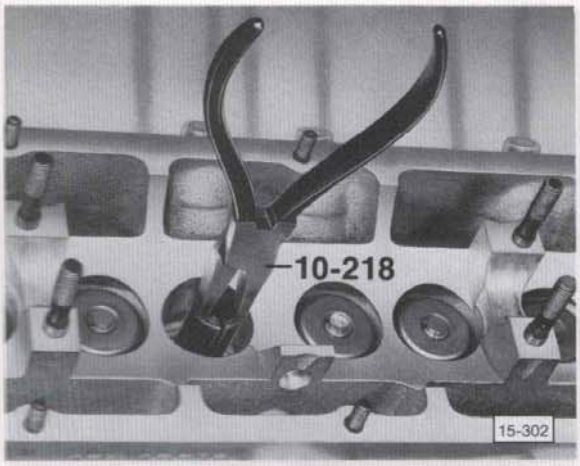
- Remove camshaft and tappets.
- Remove spark plugs.
- Engage 4th gear and apply handbrake.

- Connect compressed air hose to plug hole and maintain a pressure of at least 6 bar.

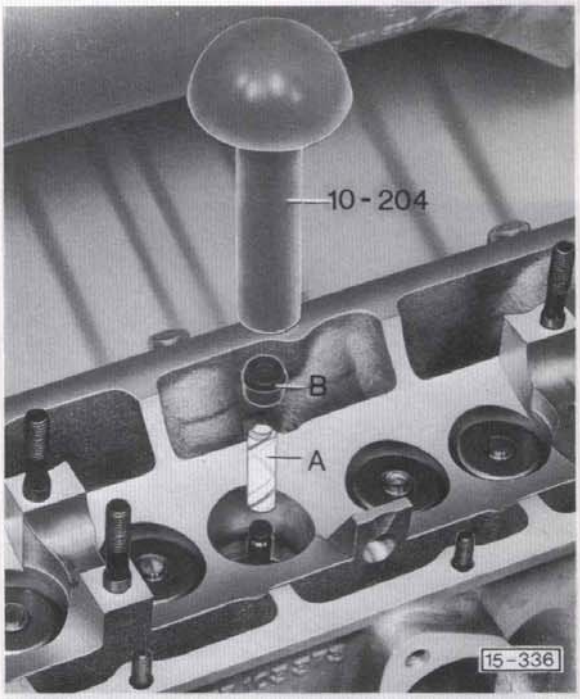


- Remove valve springs, place special tool over one stud at bearing 1 and two studs at bearing 2.

Note:
Tight valve cotters can be loosened by tapping lightly on the lever of the tool.



- Pull off valve stem seal.



- Install plastic sleeve – A – on valve stem. Oil seal – B – and carefully push it on to valve stem with special tool.

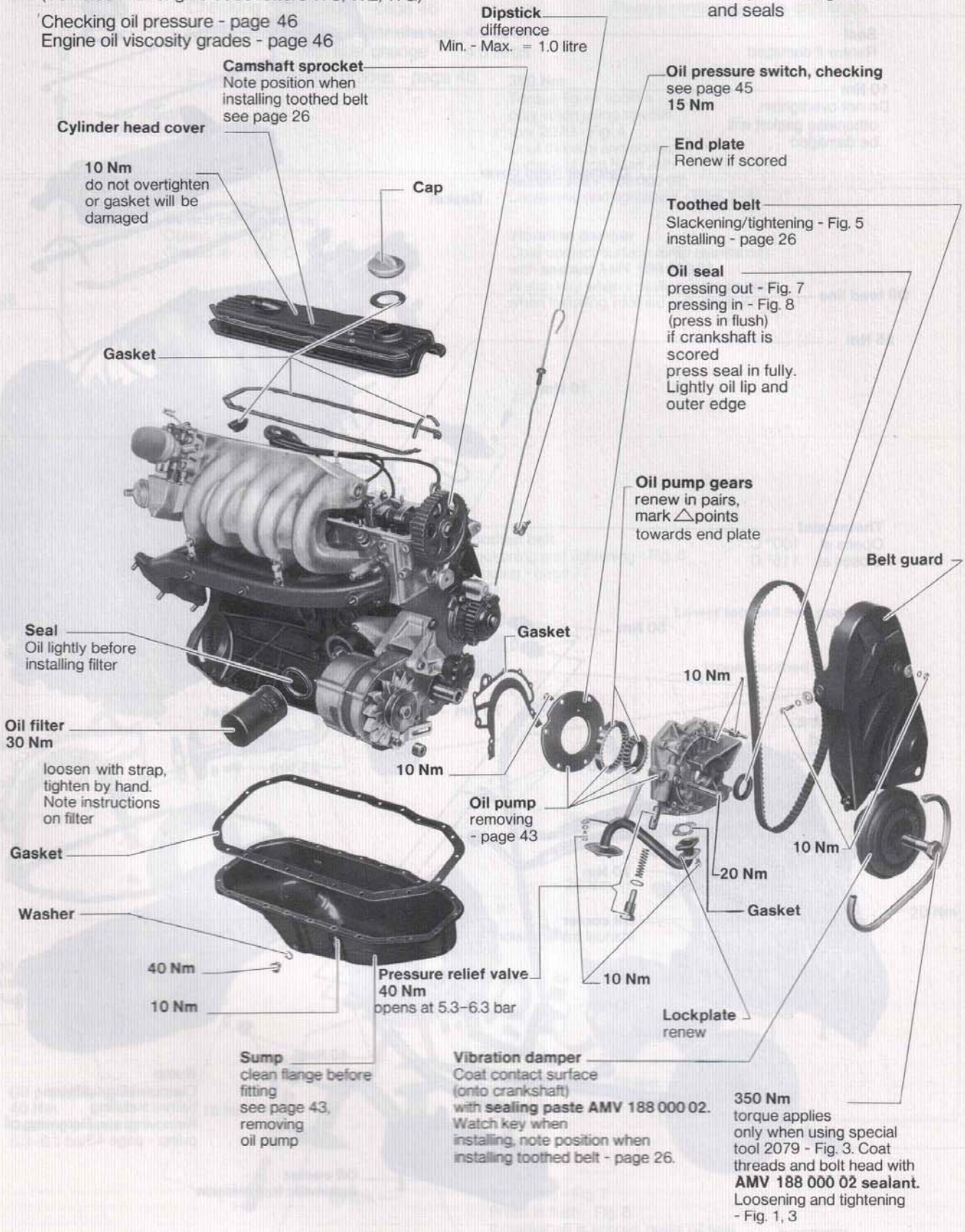
Note:
The seals will be damaged if they are fitted without using the plastic sleeve – A –.

REMOVING AND INSTALLING PARTS OF LUBRICATION SYSTEM

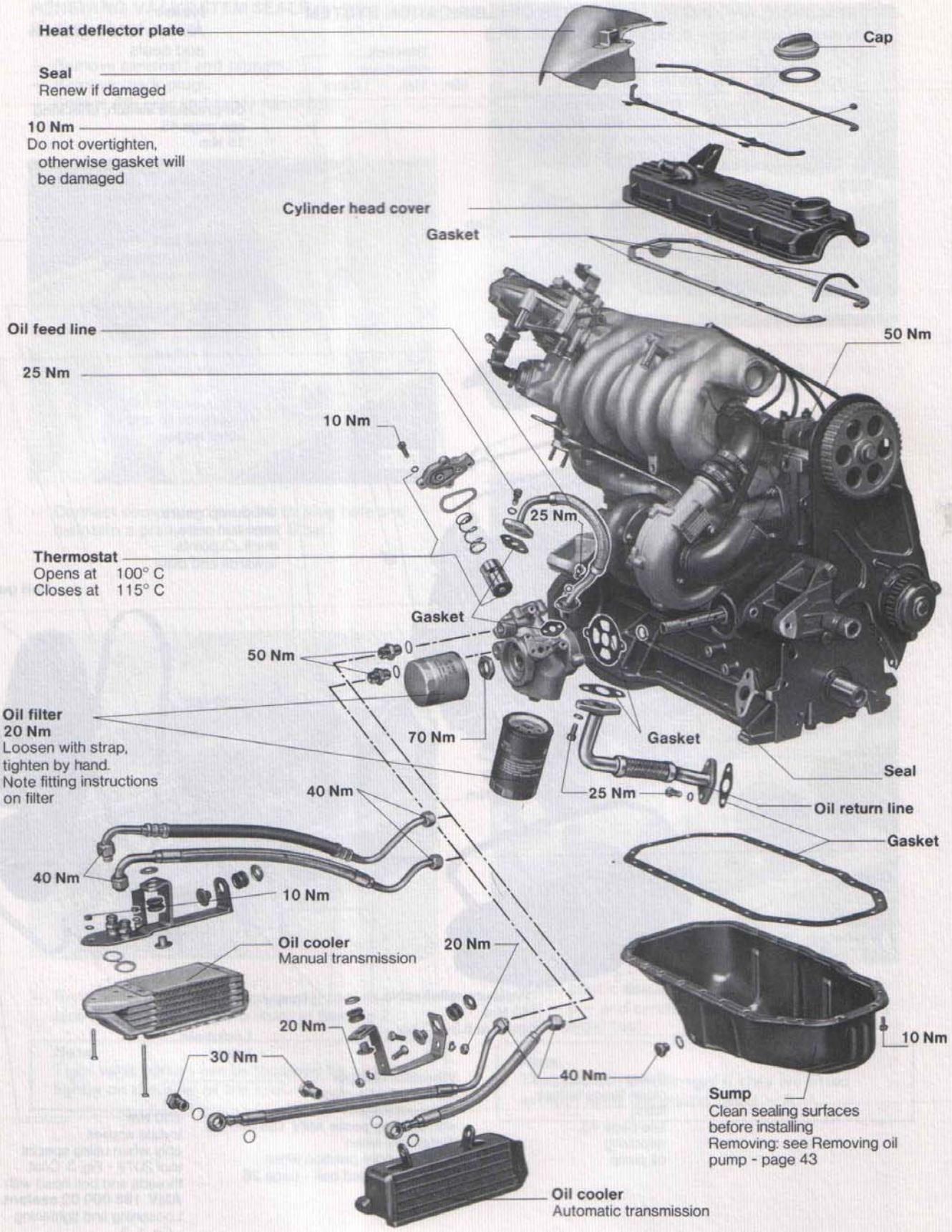
(Vehicles with engine code letters WC, WE, WG)

Checking oil pressure - page 46
Engine oil viscosity grades - page 46

Note:
Always renew gaskets and seals



17–216


Heat deflector plate
Cap
Seal
Renew if damaged
10 Nm
Do not overtighten, otherwise gasket will be damaged
Cylinder head cover
Gasket
Oil feed line
50 Nm
25 Nm
10 Nm
25 Nm
Thermostat
Opens at 100° C
Closes at 115° C
Gasket
50 Nm
Oil filter
20 Nm
Loosen with strap, tighten by hand.
Note fitting instructions on filter
70 Nm
Gasket
Seal
40 Nm
25 Nm
Oil return line
Gasket
40 Nm
10 Nm
Oil cooler
Manual transmission
20 Nm
20 Nm
30 Nm
40 Nm
10 Nm
Sump
Clean sealing surfaces before installing
Removing: see Removing oil pump - page 43
Oil cooler
Automatic transmission

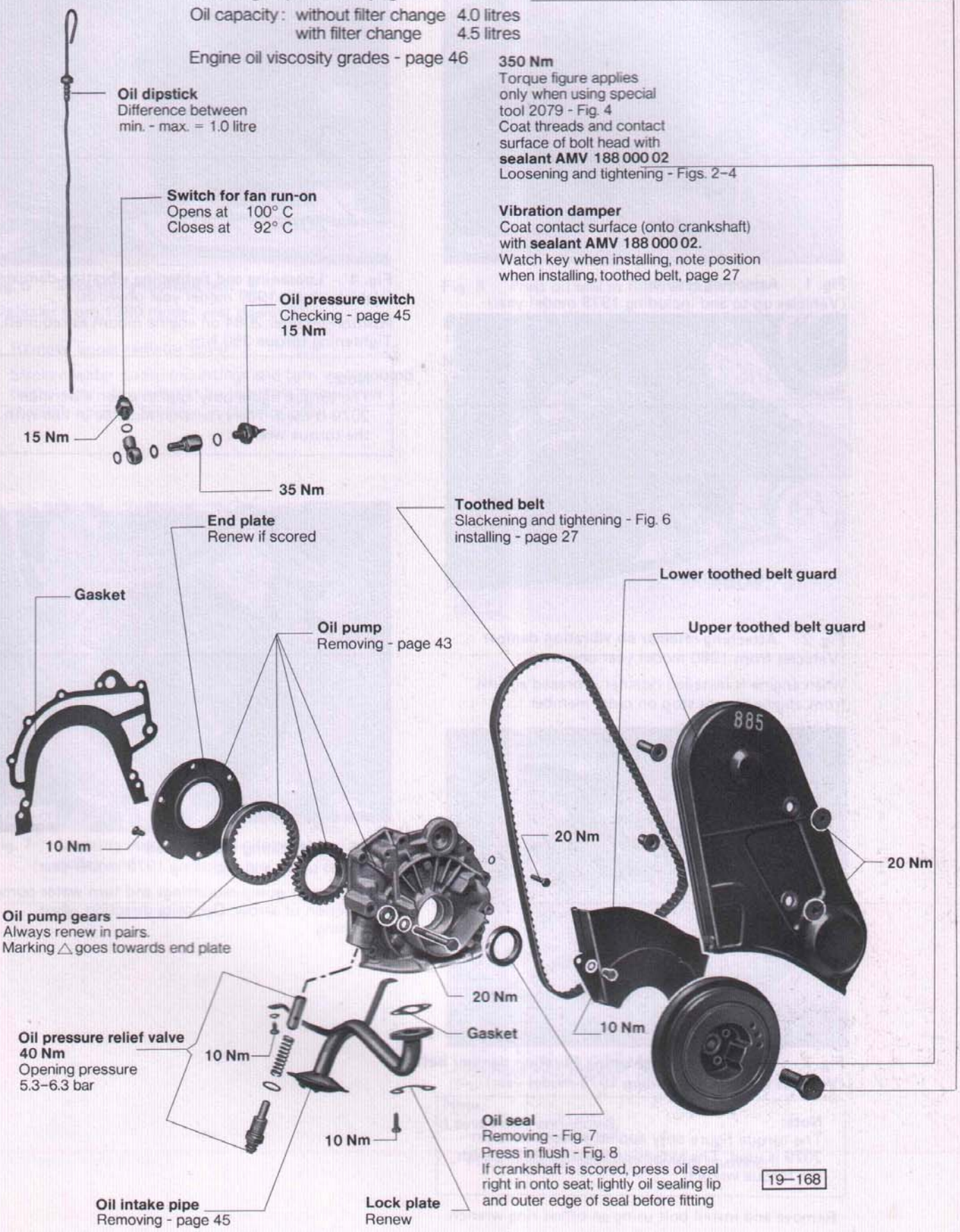
REMOVING AND INSTALLING PARTS OF LUBRIKATING SYSTEM

(Vehicles with engine code letters WJ)
Checking oil pressure - page 46

Oil capacity: without filter change 4.0 litres
with filter change 4.5 litres

Engine oil viscosity grades - page 46

Note:
Always renew gaskets and seals.



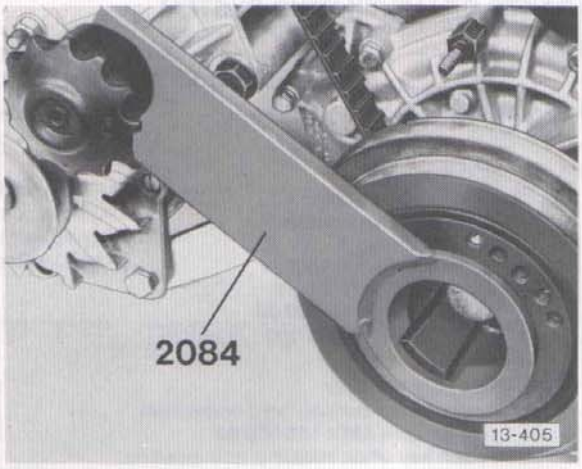


Fig. 1 Attaching retainer
(Vehicles up to and including 1979 model year)

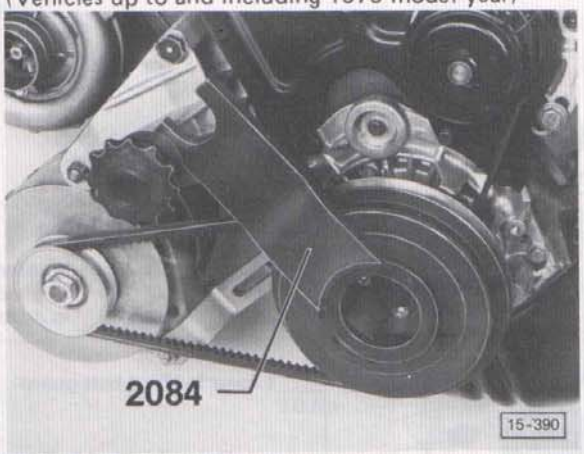


Fig. 2 Attaching retainer on vibration damper
(Vehicles from 1980 model year onwards)

When engine is installed retainer is braced against front engine mount stop on cross member I.

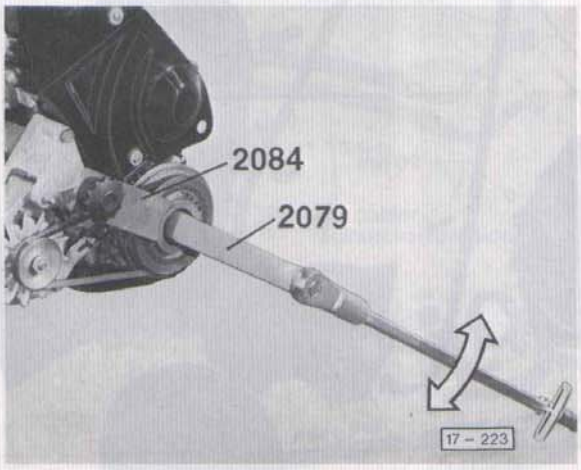


Fig. 3 Loosening and tightening vibration damper bolt
(Vehicles up to and including 1979 model year)

Note:
The torque figure only applies when extension 2079 is used. The extension must be in line with the torque wrench.

Remove and install bolt using an offset ring wrench.

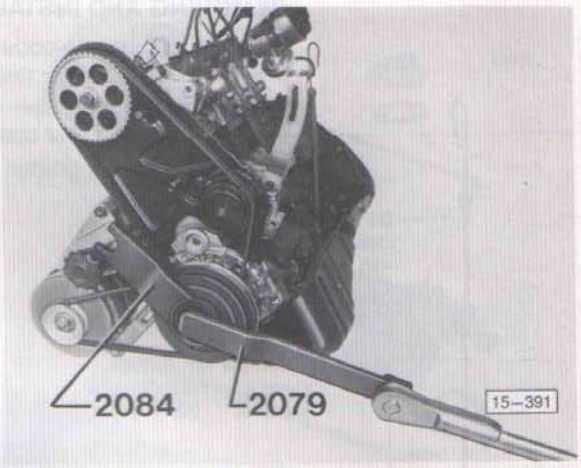


Fig. 4 Loosening and tightening vibration damper bolt
(Vehicles from 1980 model year onwards)

Position retainer 2084 on engine mount as required. Tightening torque 350 Nm.

Note:
The torque figure only applies when extension 2079 is used. The extension must be in line with the torque wrench.

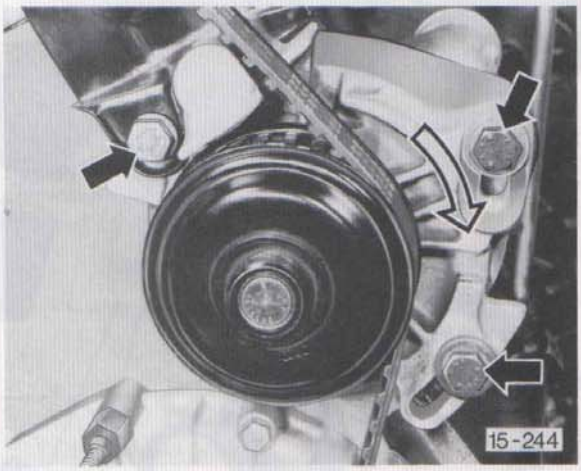


Fig. 5 Slackening toothed belt
(Vehicles up to and including 1979 model year)

Loosen water pump mountings and turn water pump in direction of arrow. Opposite direction when tightening.

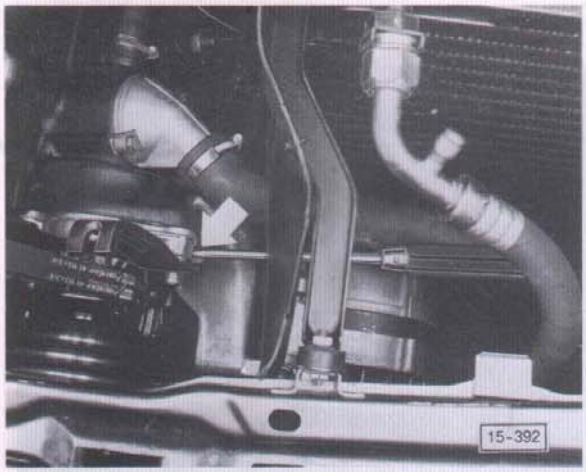


Fig. 6 Slackening toothed belt

(Vehicles from 1980 model year onwards)

– Remove upper radiator cover.

– Slacken water pump mountings and turn water pump to the right (downwards) by inserting screwdriver through opening for hose in radiator cowl.

Fig. 7 Levering out crankshaft oil seal at pulley end

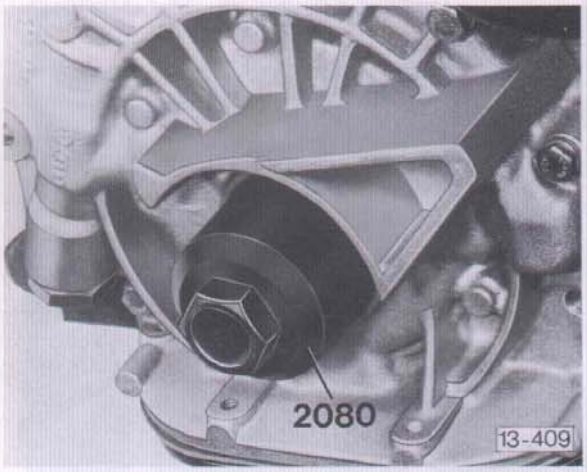


Fig. 8 Press oil seal in flush at pulley end

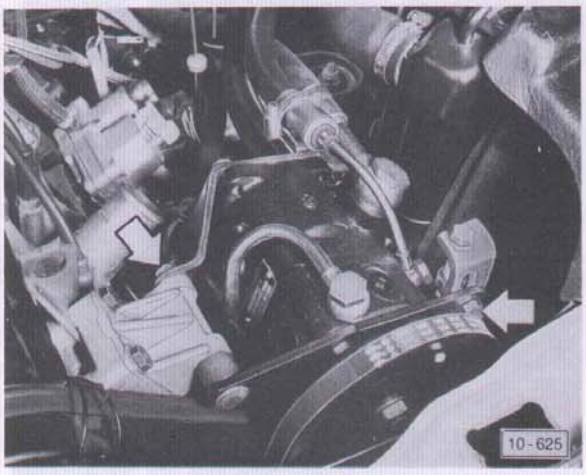
Use vibration damper mounting bolt.

Note:
Lightly oil sealing lip and outer rim of oil seal

> **Important**
> If crankshaft is scored, oil seal should be pressed right in onto seat.

REMOVING OIL PUMP

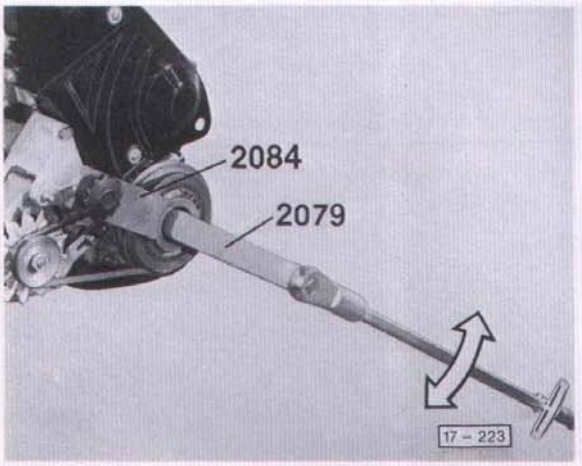
– Slacken and remove V-belts for alternator, air conditioner compressor and PAS impeller pump.



– Remove PAS impeller pump.

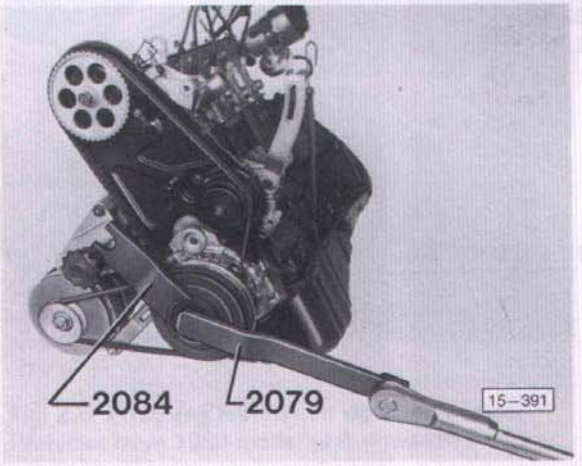
Note:
Leave hoses connected.

– Place impeller pump in plenum chamber.



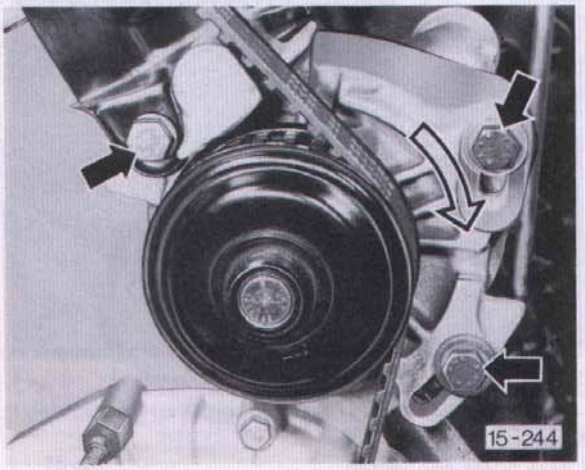
(Vehicles up to and including 1979 model year)

– Loosen vibration damper mounting bolt.
– Remove toothed belt guard.



(Vehicles from 1980 model year onwards)

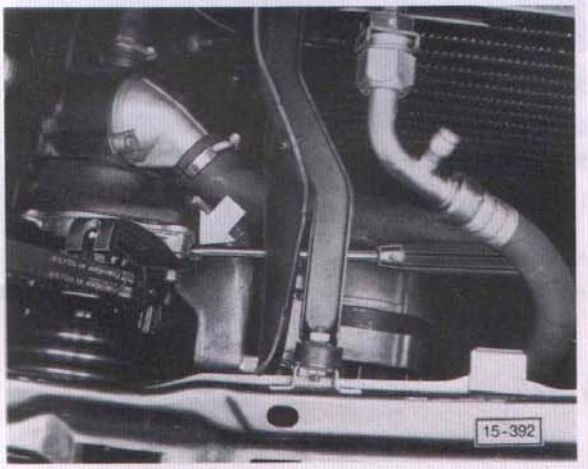
– Loosen vibration damper mounting bolt.
– Remove upper toothed belt guard.



– Slacken and remove toothed belt (vehicles up to and including 1979 model year) by slackening water pump mountings and turning pump in direction of arrow.

Important
Do not turn crankshaft at this stage.

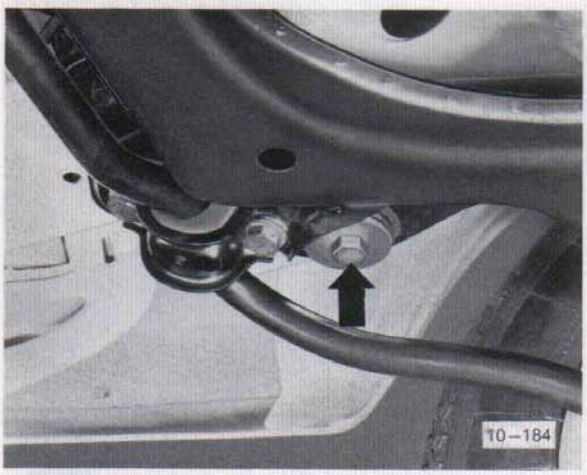
– Remove vibration damper with toothed belt sprocket.
– Take out dipstick.
– Drain engine oil.



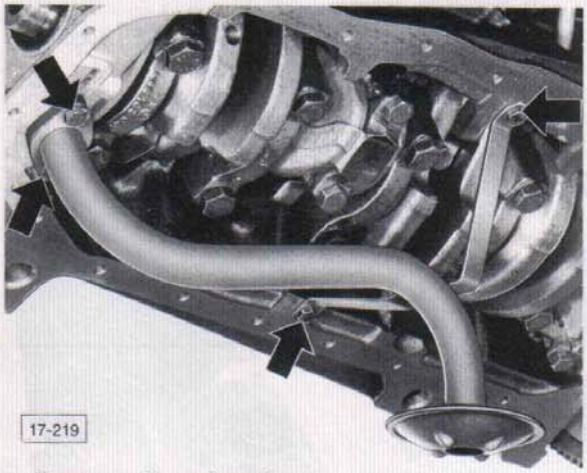
– Slacken toothed belt (vehicles from 1980 model year onwards): remove upper radiator cover, slacken water pump mountings and turn water pump to the right (downwards) by inserting screwdriver through opening for hose in radiator cowl.
– Remove lower toothed belt guard.

Important
Do not turn crankshaft at this stage.

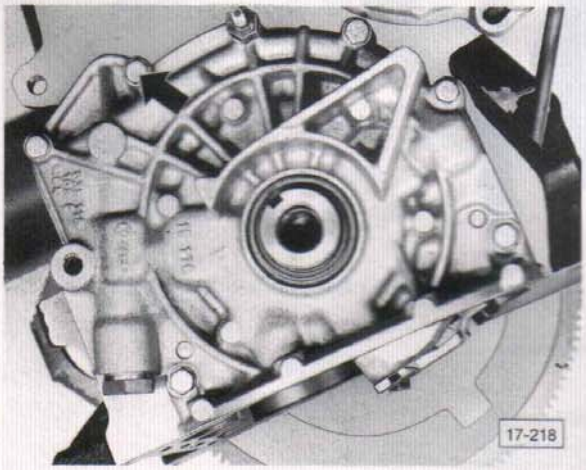
– Remove vibration damper with toothed belt sprocket.
– Take out dipstick.
– Drain engine oil.



– Remove both front subframe mounting bolts.
– Remove sump.

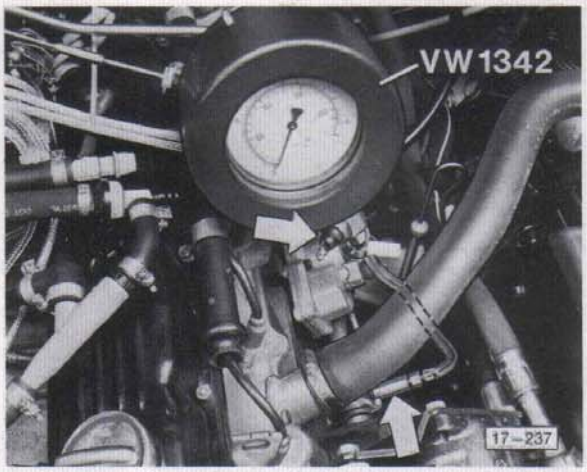


– Remove oil suction pipe.



– Remove oil pump.

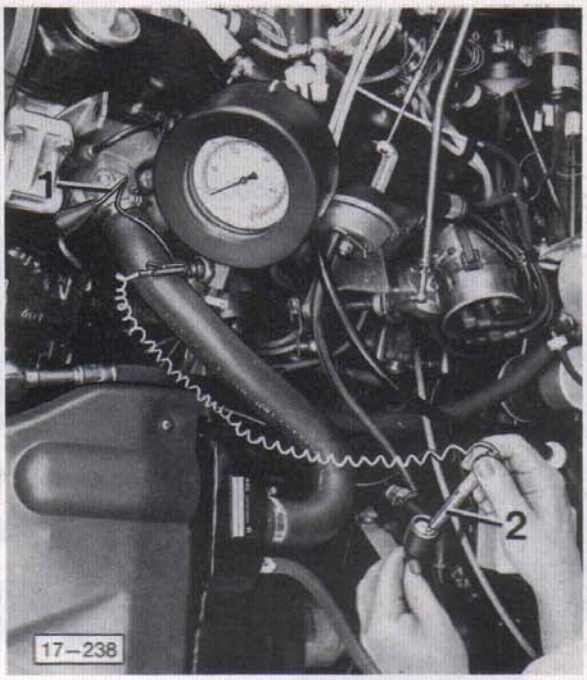
CHECKING OIL PRESSURE SWITCH



– Remove oil pressure switch and screw switch into test appliance.

Caution
A small amount of oil will escape.

– Screw test appliance into cylinder block in place of oil pressure switch.

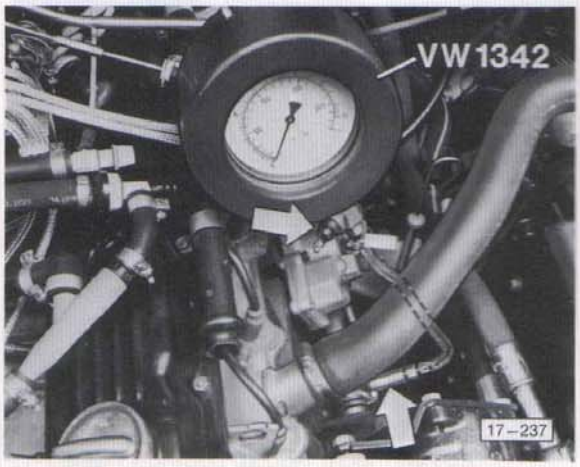


– Connect wire – 1 – (tester earth) to earth.
– Disconnect plug from brake light switch on brake master cylinder.
– Connect test lamp – 2 – to oil pressure switch and contact for red wire on disconnected plug.
– Test lamp must come on, otherwise renew oil pressure switch.
– Start engine and increase engine speed.
The lamp must go out at a pressure of

0.3 – 0.6 bar

otherwise renew oil pressure switch.

CHECKING OIL PRESSURE



– Remove oil pressure switch and screw switch into test appliance (normal commercial type).

Caution
A small amount of oil will escape.

– Screw test appliance into cylinder block in place of oil pressure switch.

– Start engine and run at idle.

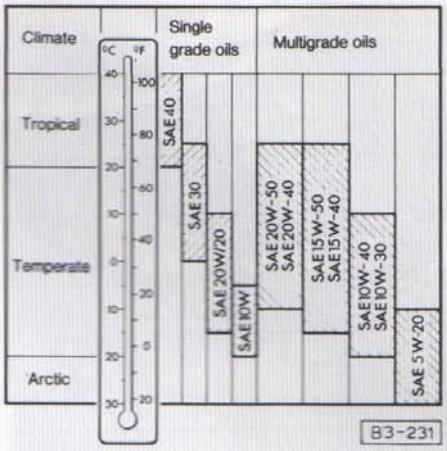
– With SAE W 20 engine oil at an oil temperature of 80° C the oil pressure should be at least

1.0 bar.

– Increase engine speed to 5500 rpm; oil pressure should then be at least

5.3 bar.

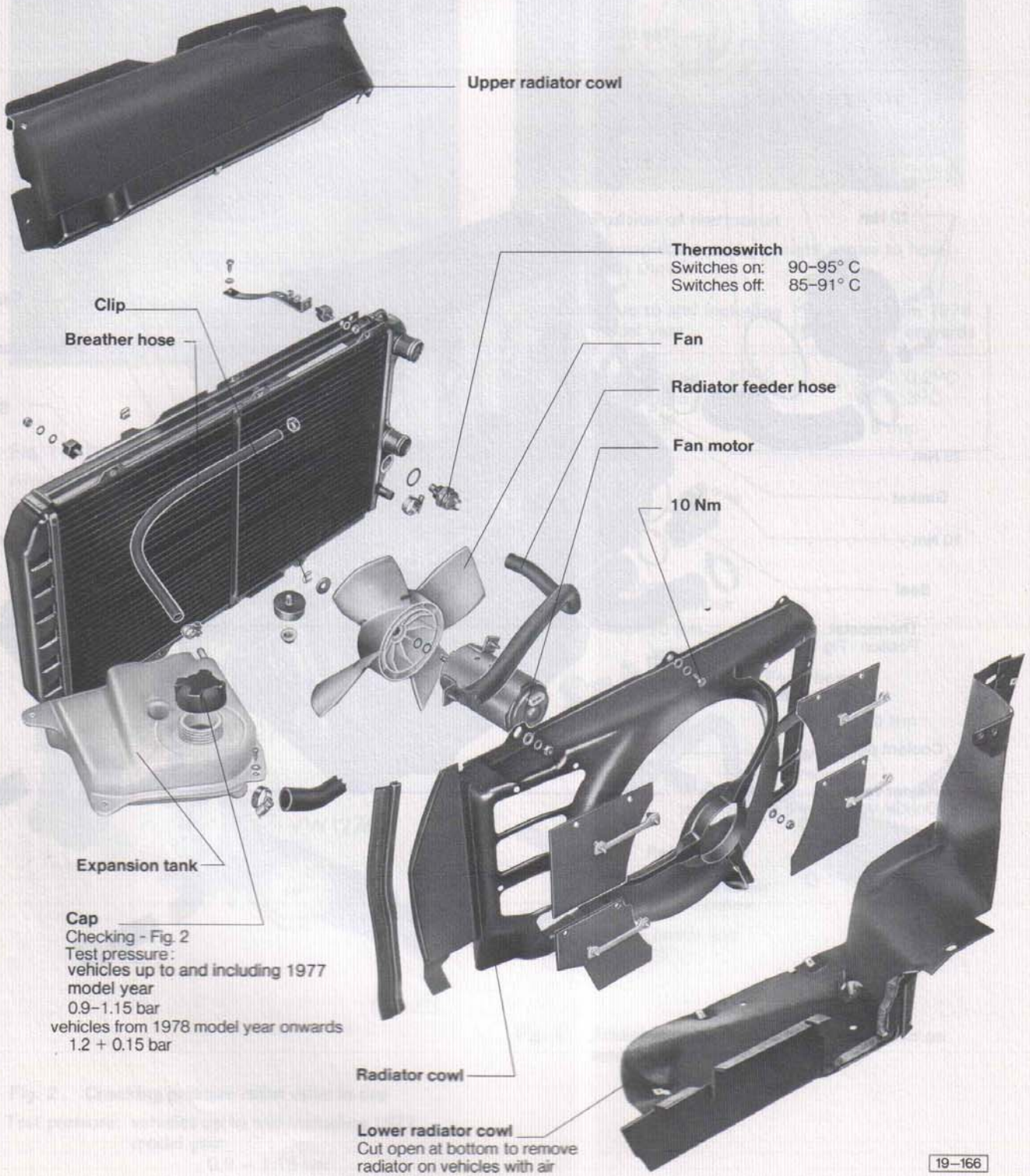
Engine oil viscosity grades



Only use branded HD oils designated "SE" according to the API system.

REMOVING AND INSTALLING COOLING SYSTEM COMPONENTS

Checking cooling system for leaks - Fig. 1
Antifreeze concentration - page 51
Draining and filling cooling system - page 50
Additional components of cooling system for automatic gearbox - Fig. 4
Position of thermostat - Fig. 3



REMOVING AND INSTALLING COOLING SYSTEM COMPONENTS

Checking cooling system for leaks - Fig. 1
Antifreeze concentration - page 51
Draining and filling cooling system - page 50
Additional components of cooling system for automatic gearbox - Fig. 4

Note:
Always renew gaskets and seals

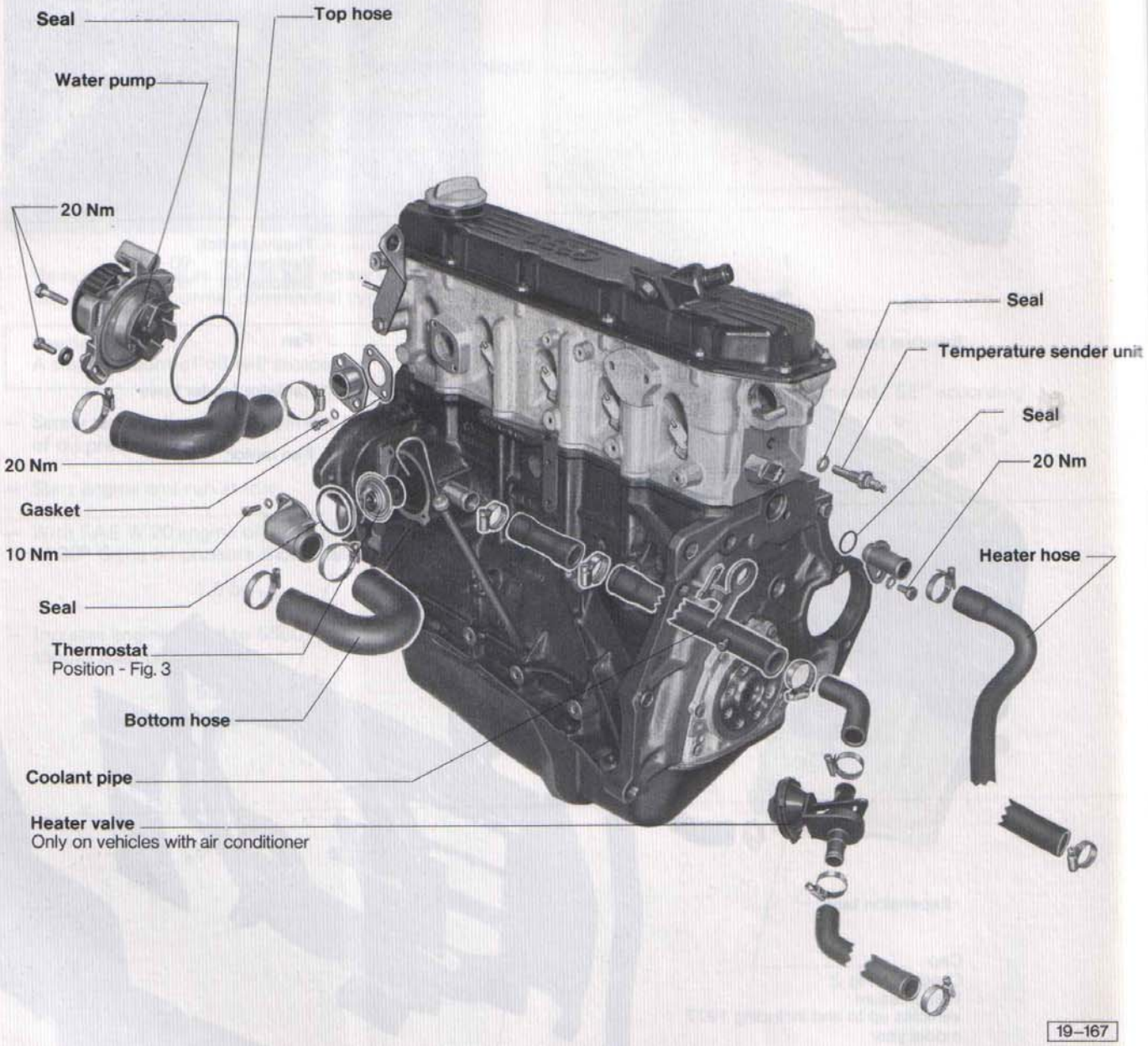


Fig. 1 Checking cooling system for leaks

Always test with engine warm.

Test pressure: vehicles up to and including 1977 model year
0.8 – 1.0 bar
vehicles from 1978 model year onwards
1.2 + 0.15 bar

Fig. 2 Checking pressure relief valve in cap

Test pressure: vehicles up to and including 1977 model year
0.9 – 1.15 bar
vehicles from 1978 model year onwards
1.2 + 0.15 bar

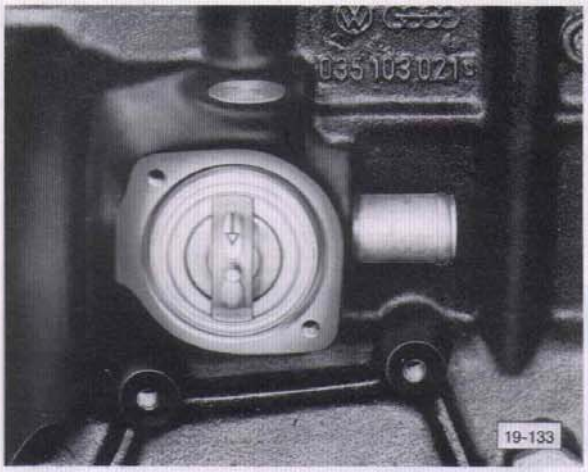


Fig. 3 Position of thermostat

Arrow or crosspiece must be at right angles to hose connection as shown.

	Vehicles up to and including 1977 model year	Vehicles from 1978 model year onwards
Starts to open approx.	80°C	87 ± 0.2°C
fully open approx.	94°C	102 ± 3°C
Minimum valve lift	7 mm	8 mm

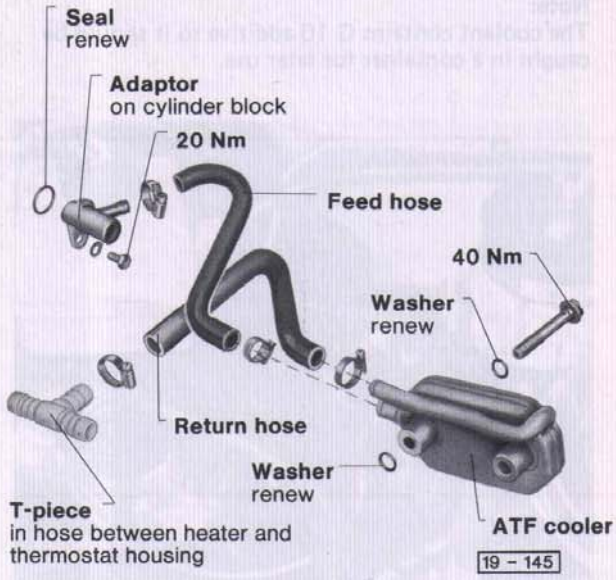
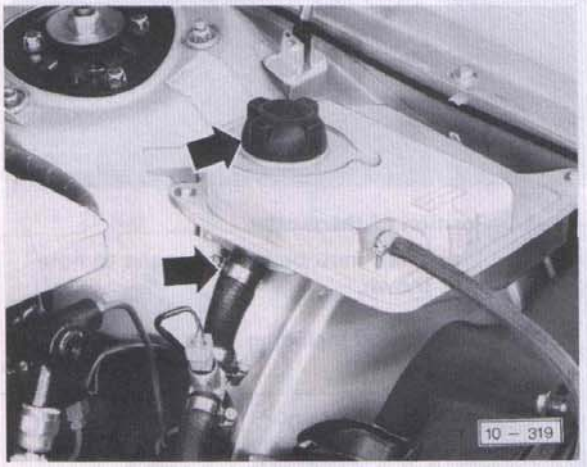


Fig. 4 Additional cooling system components on vehicles with automatic gearbox

DRAINING AND FILLING COOLING SYSTEM

Draining:
(Vehicles up to and including 1979 model year)

– Set heater control to warm (only on vehicles with air conditioner).



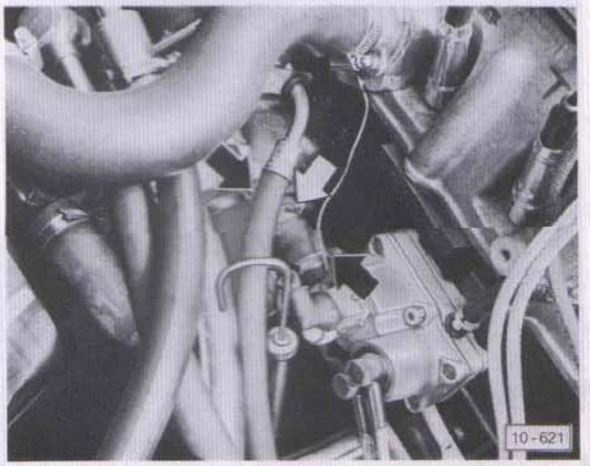
– Take cap off expansion tank (to relieve pressure).
– Drain coolant by detaching feeder hose from expansion tank.

Note:
The coolant contains G 10 additive so it should be caught in a container for later use.

– Detach heater hose at connection.

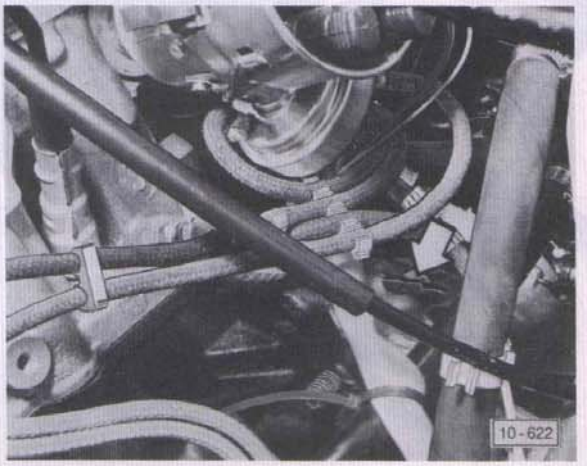
Draining:
(Vehicles from 1980 model year onwards)

– Set heater control to warm (only on vehicles with air conditioner).
– Take cap off expansion tank (to relieve pressure).



– Drain coolant by detaching coolant hose from thermostat housing and coolant pipe.

Note:
The coolant contains G 10 additive so it should be caught in a container for later use.



– Unscrew coolant pipe mounting bolt.
– Detach coolant hose from coolant pipe.

Filling cooling system

The cooling system is filled at the factory with a mixture of water and G 10 antifreeze/corrosion inhibiter.

G 10 protects the system from frost and corrosion and prevents scaling. The additive also raises the boiling point of the water.

In countries with a tropical climate the higher boiling point of the coolant mixture is an aid to reliability in service.

For these reasons the cooling system must always be kept filled throughout the year with a mixture of G 10 and water.

- Set heater control to warm (vehicles with air conditioner only).
- Pour coolant into expansion tank until the level is about 2 cm above the minimum mark on the expansion tank.
- Screw cap onto expansion tank.
- Run engine until electric radiator fan cuts in.

- Check coolant level in expansion tank and top up as required.

With the engine warm the level must be slightly above the minimum mark, with the engine cold it should be at least up to the tip of the arrow.

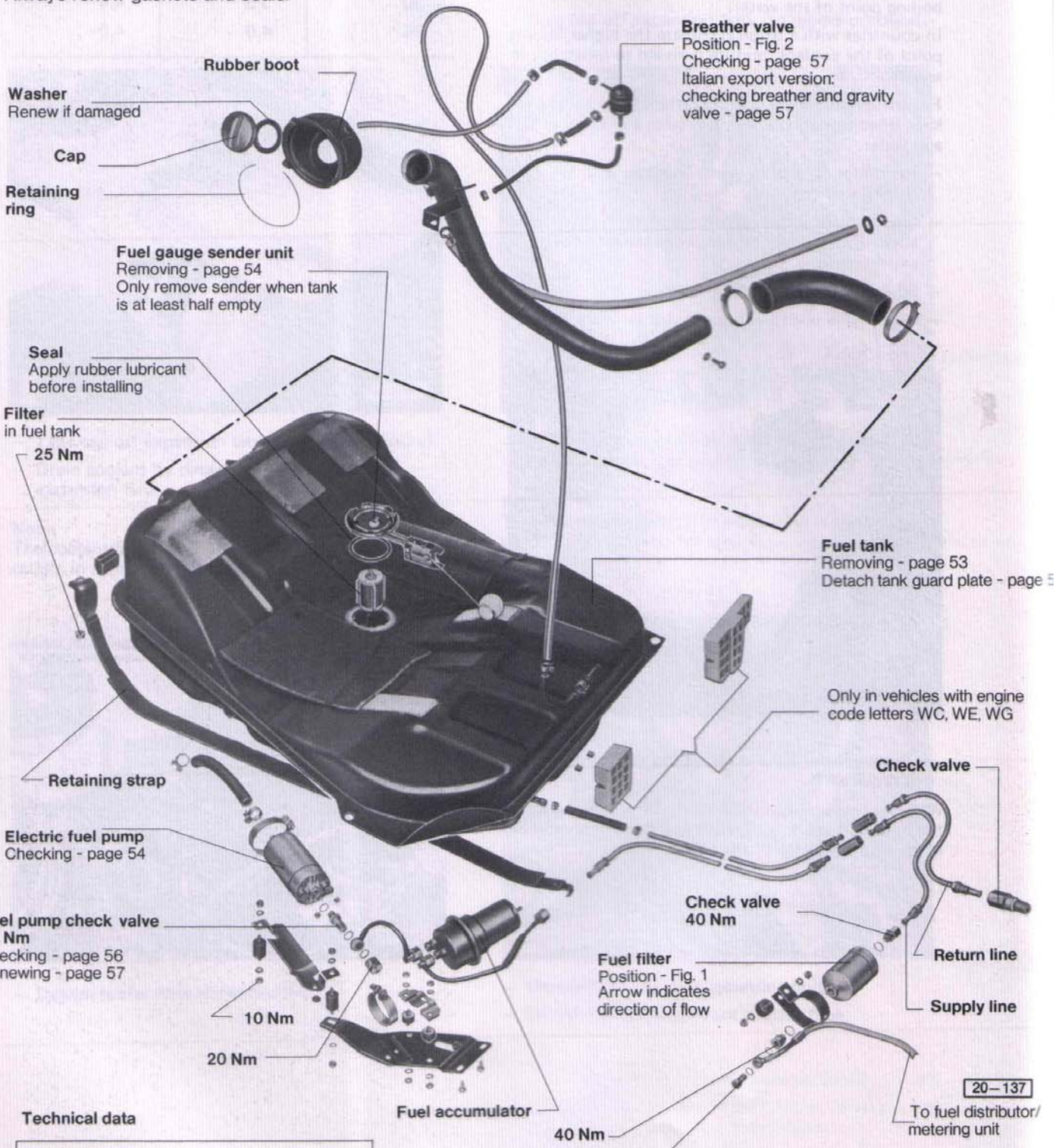
Antifreeze concentration (litres):

Frost protection down to °C	G 10	Water
– 25	3.2	4.8
– 30	3.6	4.4
– 35	4.0	4.0

REMOVING AND INSTALLING FUEL SYSTEM COMPONENTS

Checking fuel pump relay - page 58. Relay must be inserted in socket J when installing. Renewing O-rings on pressure regulator/ relief valve - see Checking fuel pump check valve, page 56

Note :
Always renew gaskets and seals.



Technical data

Electric fuel pump:		
Delivery rate (minimum),	cc/sec.	900/30
Current draw,	amps	8.5

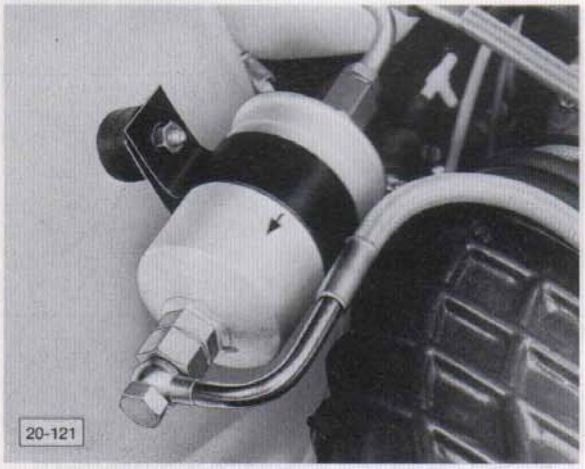


Fig. 1 Position of fuel filter
Arrow indicates direction of flow to fuel distributor

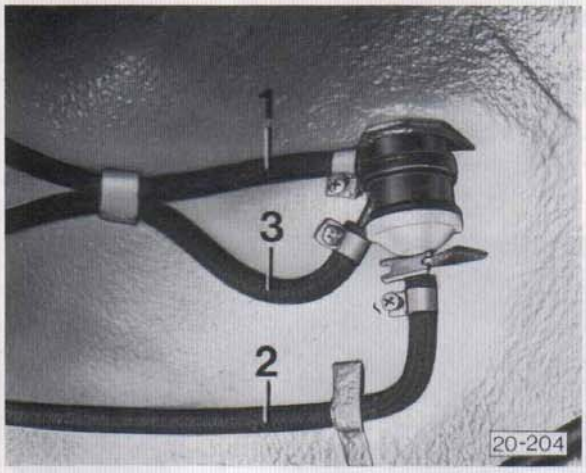
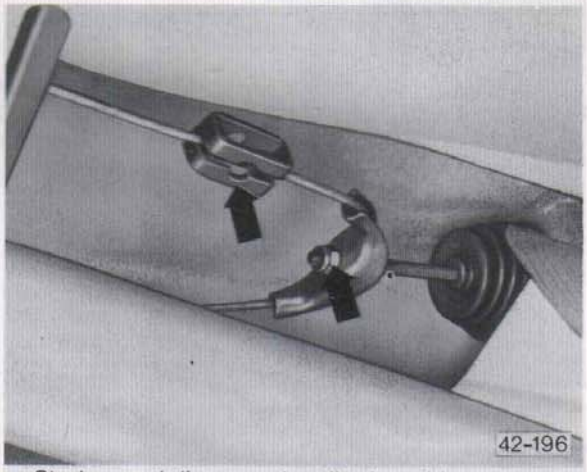
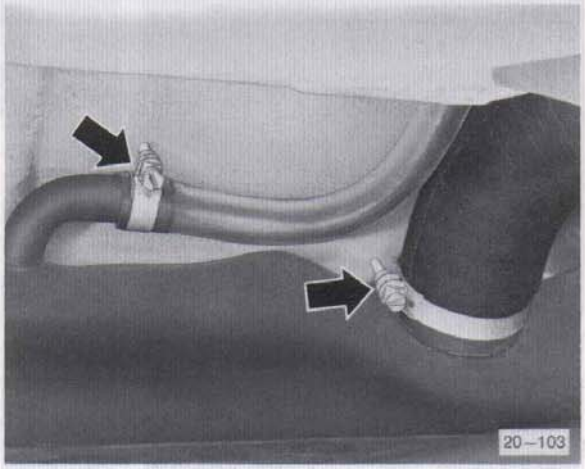


Fig. 2 Fuel tank breather valve – position
Hose –1– goes to rubber boot on fuel filler neck.
Hose –2– goes to fuel filler neck.
Hose –3– goes to fuel tank.

REMOVING FUEL TANK

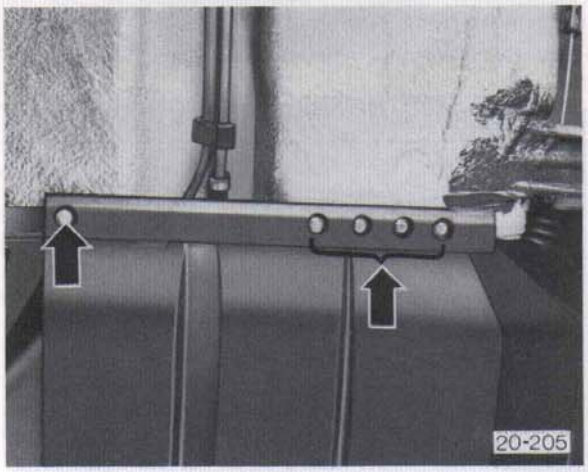


– Slacken and disengage handbrake cable.
Vehicles with engine code letters WJ:
– Pull handbrake cable through at fuel tank.

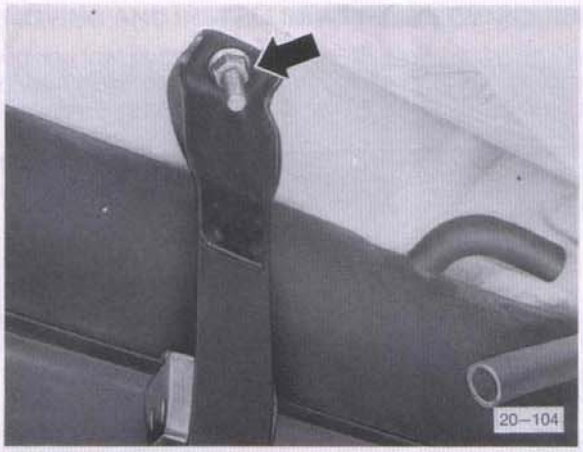


– Detach breather hose and filler pipe connection.

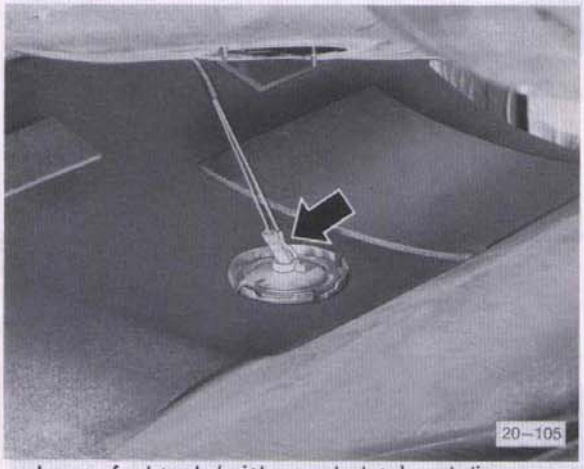
Vehicles with engine code letters WJ only



– Detach fuel tank guard plate.
– Disconnect fuel line and plug connection.



– Detach both retaining straps.



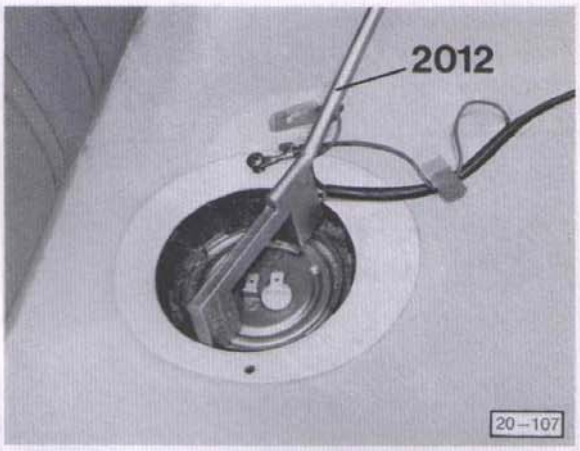
– Lower fuel tank (with guard plate) and disconnect wiring from fuel gauge sender unit.
– Take out tank.

REMOVING FUEL GAUGE SENDER UNIT

Caution
Only remove sender unit when tank is at least half empty.

– Remove rear seat cushion.

– Remove access plate.



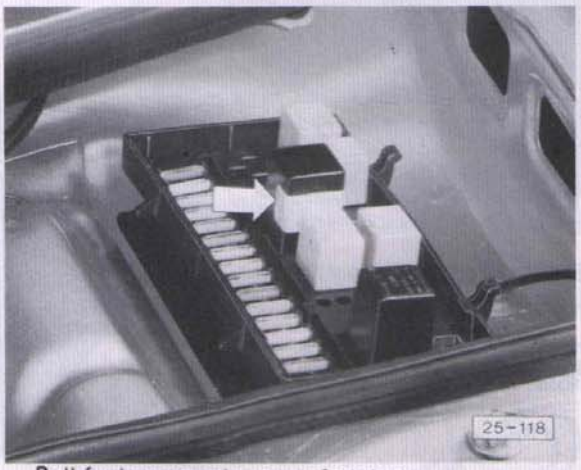
– Remove sender unit (bayonet fitting).

Note:
Note position when installing.

CHECKING ELECTRIC FUEL PUMP

Note:
For this test the fuse for the fuel pump relay (fuse no. 5 in fusebox) must be intact, and the fuel filter must be okay.

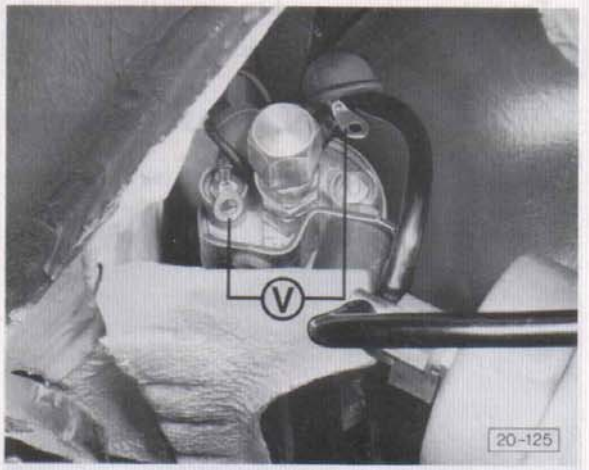
– Battery fully charged, at least 12 V.
– Disconnect plugs from warm-up valve and auxiliary air valve.



– Pull fuel pump relay out of socket.

– Connect plug for remote control switch – – VW 1348/3 – in contacts J 39 and J 40 on relay plate.

– Disconnect fuel pump wire, first detach fuel accumulator with bracket (leave fuel lines connected).

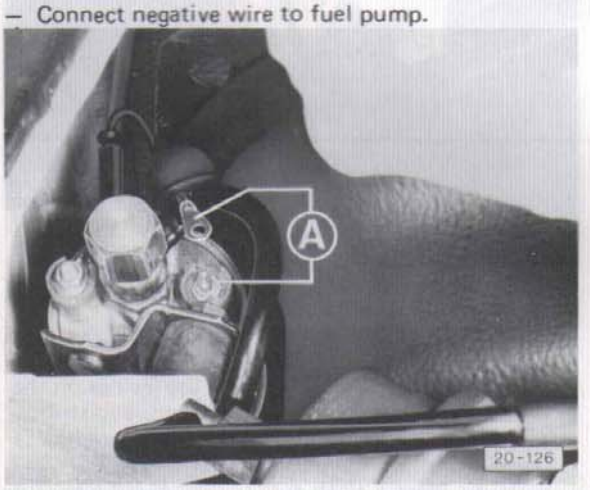


– Measure voltage with voltmeter: keep remote control switch pressed down.

Specified voltage: at least 11.5 V

Caution
Risk of short circuit – do not allow positive wire to touch earth.

– Connect negative wire to fuel pump.



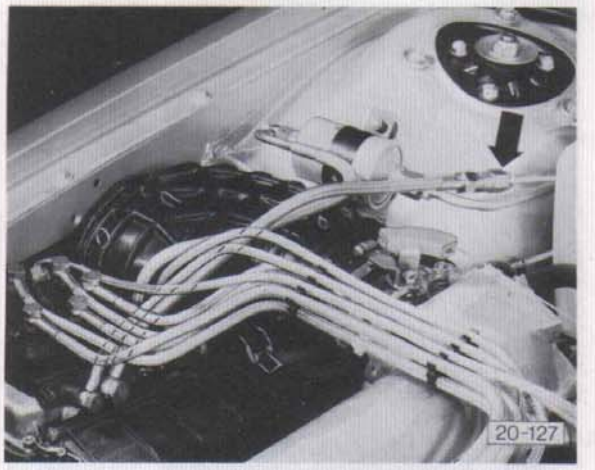
– Measure current draw with ammeter: keep remote control switch pressed down.

Specified current draw: not more than 8.5 amps.

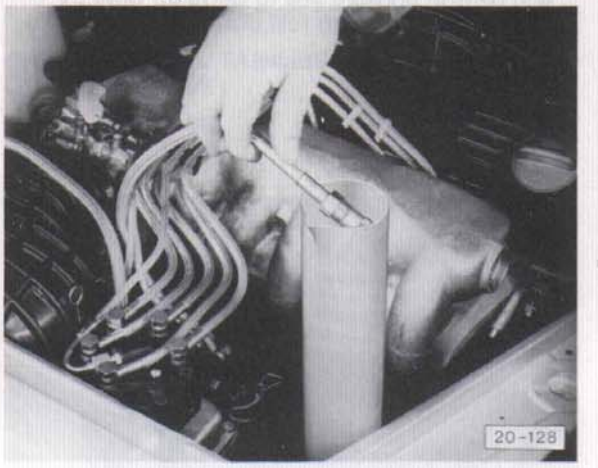
Caution
Risk of short circuit. Do not allow positive wire to touch earth.

Note:
Renew the fuel pump if the current draw is higher than the specified figure.

– Connect wire back on electric fuel pump.



– Disconnect fuel return line and place end of line in measuring glass.



– Check delivery rate by operating remote control switch (keep knob pressed down) for 30 seconds.

In this time the fuel pump must deliver at least 900 cc.

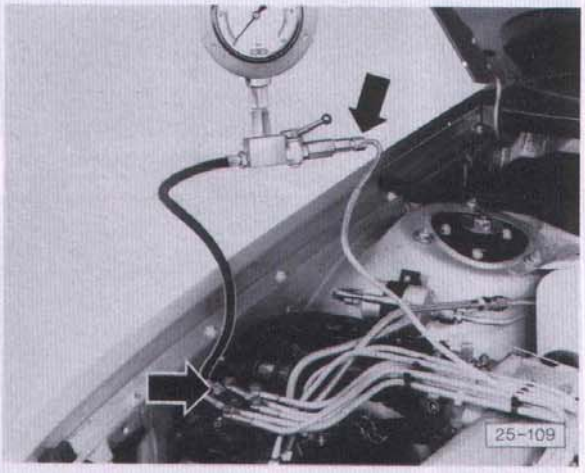
Note:
Renew the fuel pump if the power supply is okay but the delivery rate insufficient.

CHECKING FUEL PUMP CHECK VALVE

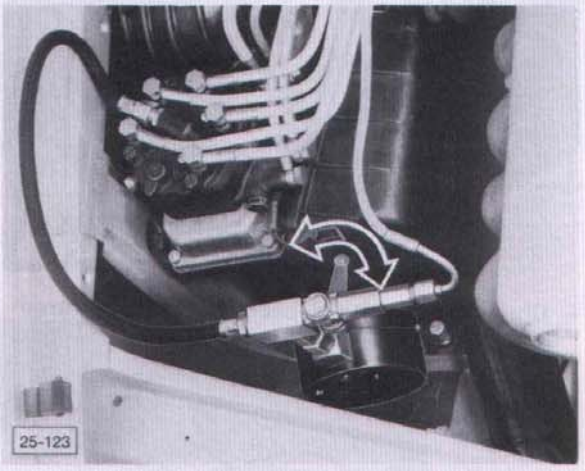
Note:

For this test it is essential that the fuel distributor (metering unit), the cold start valve, fuel accumulator, fuel pump and injectors are working properly and that there are no leaks.

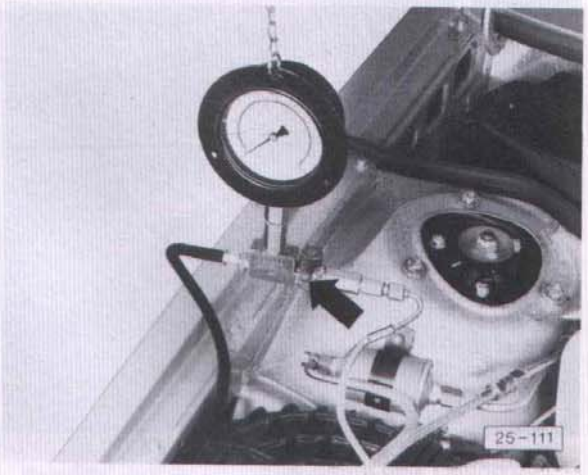
Engine oil temperature at least 50°C.



- Connect pressure gauge between fuel distributor and control pressure line to warm-up valve by screwing adaptor into fuel distributor.
- Start engine and run at idle.



- Bleed pressure gauge by hanging it down.
- Move gauge lever from open to closed position several times in about 20 seconds.



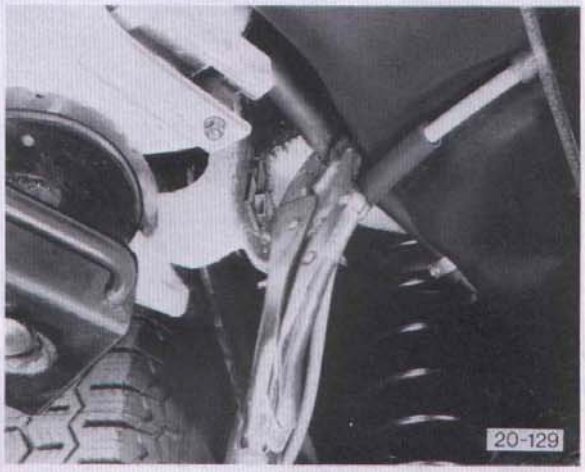
- Move lever to closed position with engine still idling. The system pressure must be within the specified range, see page 66.
- Switch off ignition.
- Watch pressure drop on gauge.

Note:
If pressure drops below

1.8 bar

after 10 minutes, continue test as follows:

- Start engine and run at idle.
- System pressure must be within specified range, see page 66.



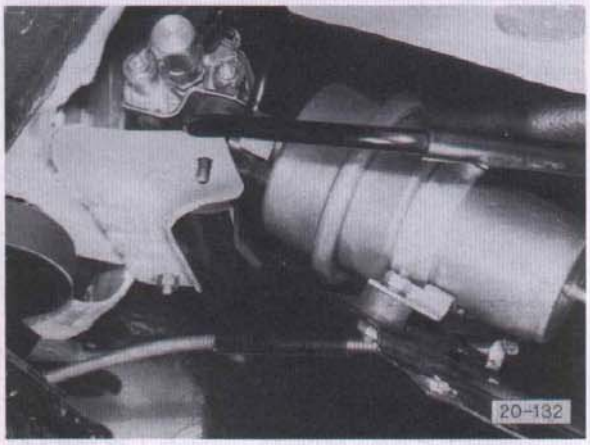
- Pinch suction hose between fuel tank and electric fuel pump and turn off ignition at the same time.
- Watch pressure drop on gauge.
- If pressure does not drop, fit a new check valve.
- If pressure drops further, renew the O-rings on the pressure regulator/relief valve in the fuel distributor. To do this, loosen the control pressure line (large union) on the warm-up to relieve the pressure. Place a cloth over the connection because fuel will spray out.

– Renew O-rings (arrows) on pressure regulator/relief valve

Caution!
Do not alter position of shims –1–

RENEWING FUEL PUMP CHECK VALVE

– Remove fuel tank cap (to release pressure in tank)



– Thoroughly clean pump and pipe near connection
– Disconnect fuel pipe
– Disconnect wiring
– Remove retaining bracket and clamp and take pump off.

– Unscrew check valve and fit new valve and washer
– Tightening torque 20 Nm.

Caution!
Do not clamp fuel pump in vice

CHECKING FUEL TANK BREATHER VALVE

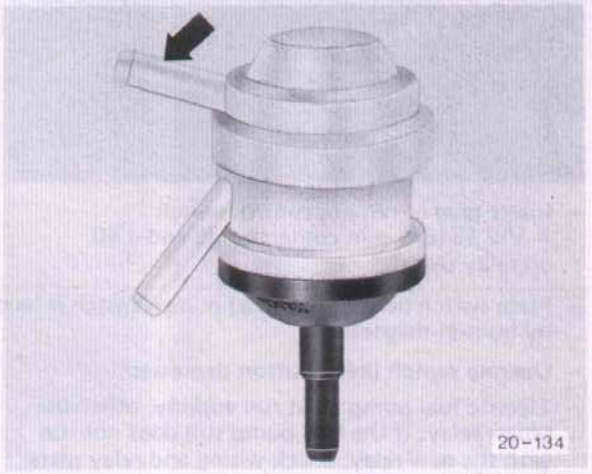
– Remove valve

– Connect a hose to top connection (canister) and put it into a glass of water. Plug centre connection.
– Hold valve vertically as shown and blow through bottom connection with mouth. Resistance must be felt and air bubbles must be visible in the water.

CHECKING FUEL TANK BREATHER AND GRAVITY VALVE

Italian vehicles only

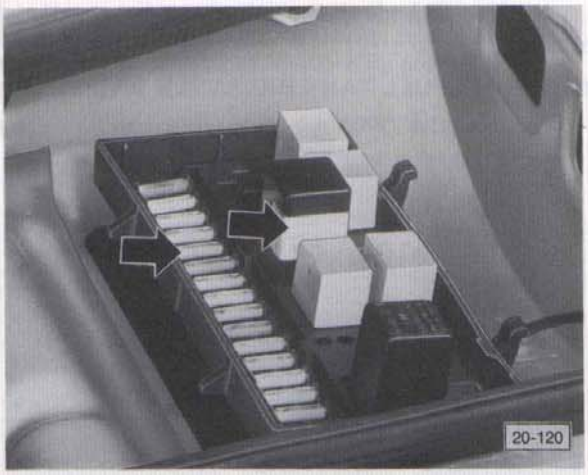
– Remove valve



– Connect a hose to top connection (canister) and put it into a glass of water. Plug centre connection.
– Hold valve vertically as shown and blow through bottom connection with mouth. Then tilt valve to about 45° while blowing. In this position very few bubbles should be seen.

CHECKING FUEL PUMP RELAY

(pump not delivering)



– Check fuse no. 5.

– Pull relay out of socket.

Caution!
When fitting fuel pump relay take care to insert **only in socket J** and not turned 180° in socket C on relay plate.

– Insert plug of remote control switch – VW 1348/3 – in contacts J 39 and J 40 on relay plate.

– Place switch near electric fuel pump (switch is held by built-in magnet).

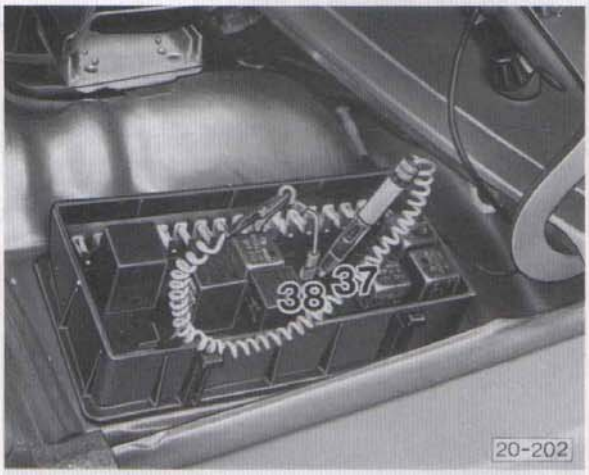
– Operate switch (keep button depressed).

– Electric fuel pump must run audibly, otherwise renew relay. If the fuel pump still does not run with the new relay, check wiring and relay plate for continuity as follows:

– Remove plug of remote control switch – VW 1348/3 – from relay plate.

– Switch on ignition.

– Connect test lamp between contact J 38 and earth. Lamp must come on.

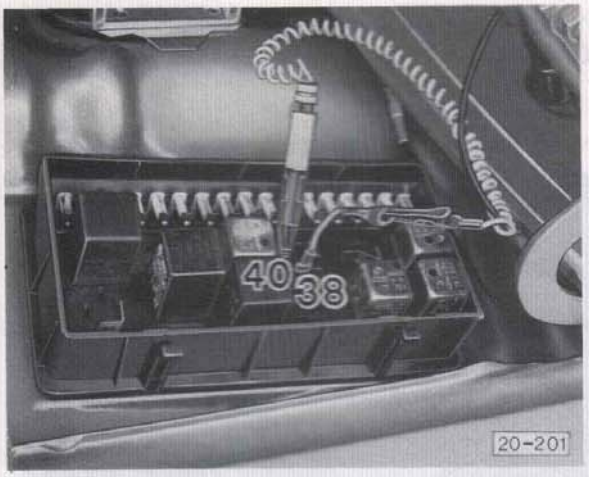


– Connect test lamp between contacts J 38 and J 37. Lamp must come on.

– Switch off ignition.

– Connect test lamp between contacts J 38 and J 41.

– Switch on ignition. Test lamp must come on for about 1–2 seconds.



– Connect test lamp between contacts J 38 and J 40. Lamp must come on.

Note:
If the lamp comes on in all of these tests renew the fuel pump relay.

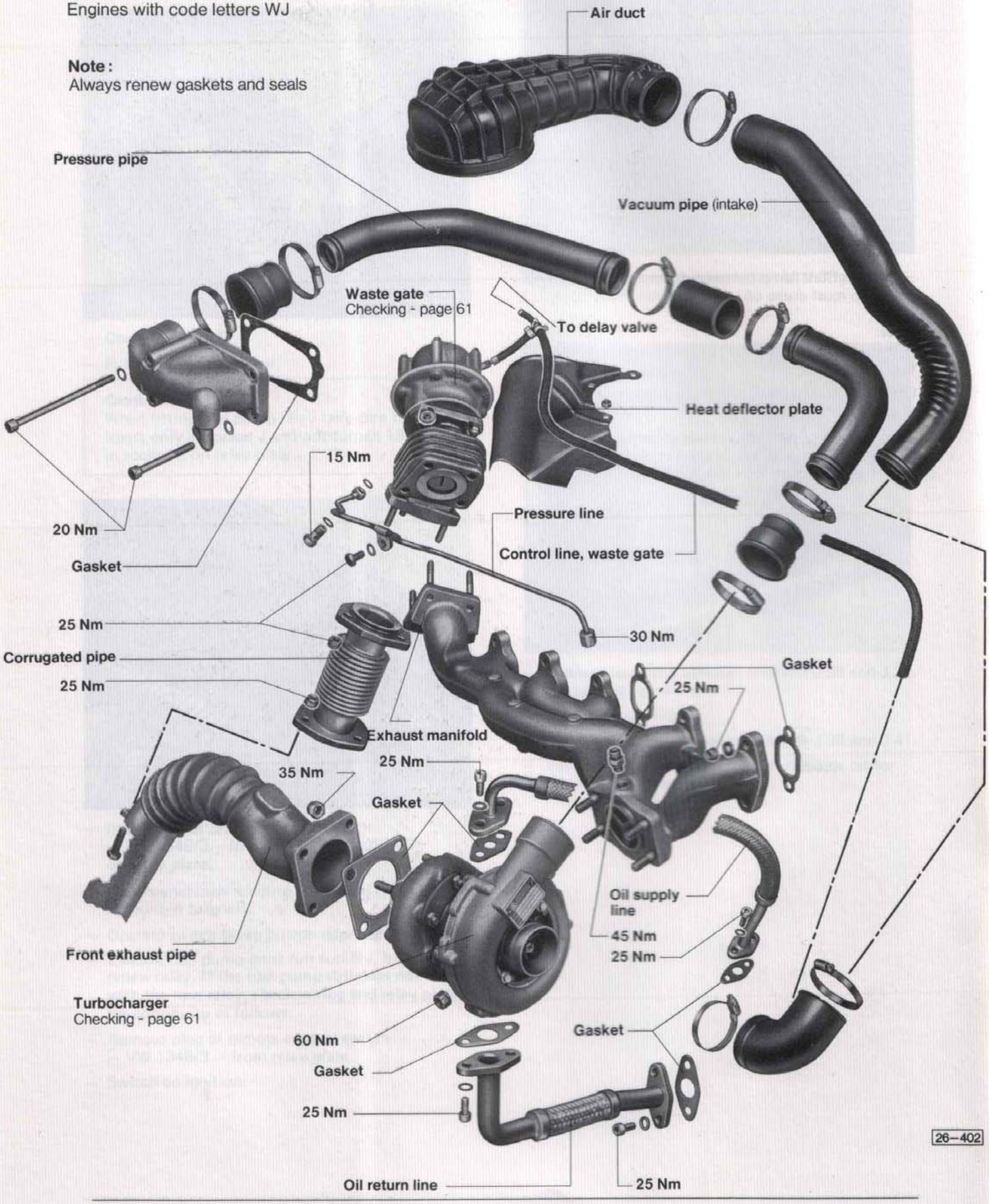
Otherwise trace break in wiring using current flow diagram.

Do not connect test lamp between contacts J 38 and J 41 on vehicles with cruise control. Trace break in circuit using current flow diagram.

REMOVING AND INSTALLING TURBOCHARGER COMPONENTS

Engines with code letters WJ

Note :
Always renew gaskets and seals



CHECKING TURBOCHARGER AND WASTE GATE

Engines with code letters WJ

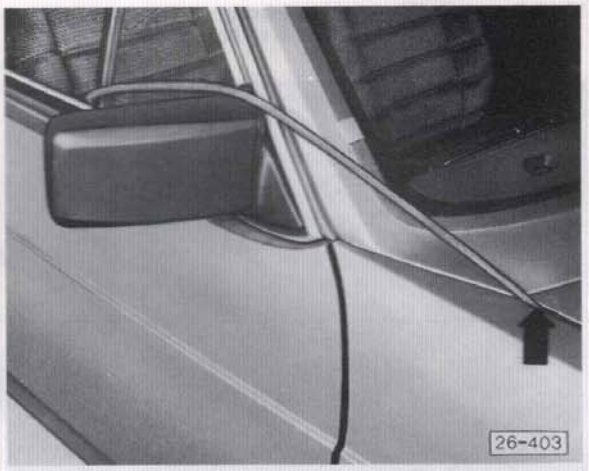
Note:
The boost pressure is measured at full throttle either on the road or on a chassis dynamometer.
Do not take longer than 10 seconds for each measurement.

– Disconnect vacuum line from vacuum advance unit on distributor.

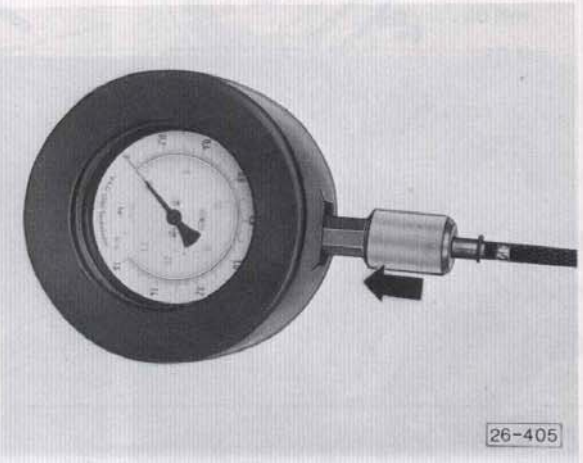
– Connect pressure gauge – V.A.G 1397 – to vacuum advance unit with T-piece.

– Connect disconnected vacuum advance line to T-piece.

Caution
The boost pressure gauge fitted as part of the vehicle's standard instrumentation is not suitable for measuring boost pressure in order to test components. Do not use the boost pressure gauge for this purpose.



– Place pressure gauge – V.A.G 1397 – on front passenger's seat, making sure that the vacuum hose is not pinched where it comes out between engine hood and body.

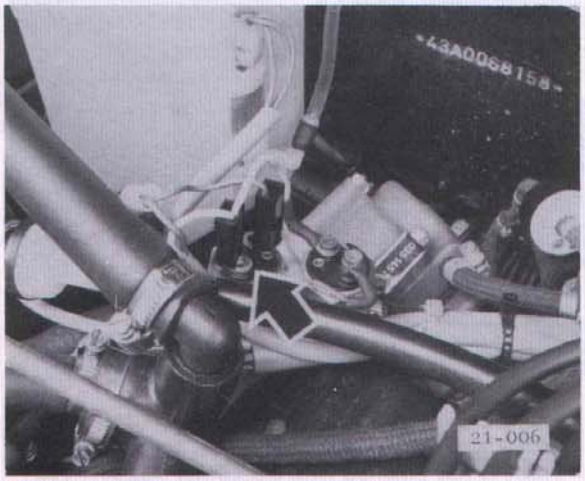


– Open cutoff valve on pressure gauge – V.A.G 1397 – (push valve towards gauge).

Vehicles with manual gearbox:

– With throttle wide open in 2nd gear, apply brakes to keep engine speed down to 5500 rpm.

Vehicles with automatic gearbox:

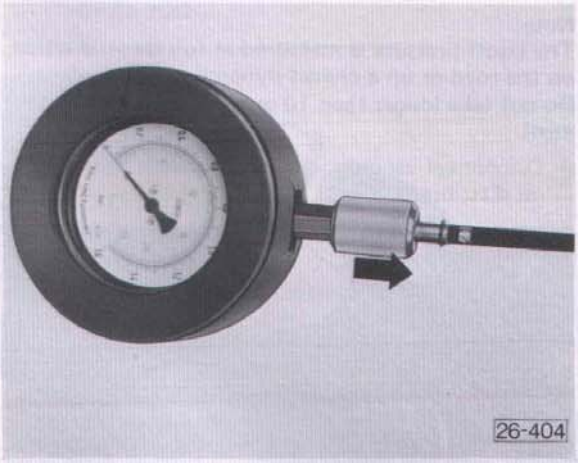


– Disconnect both wires from vacuum switch.

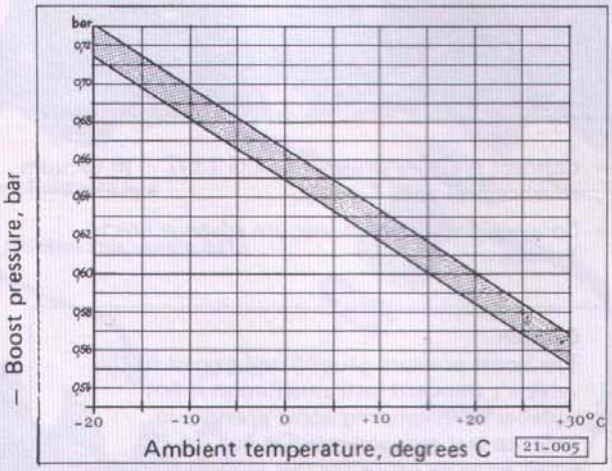
– Connect disconnected wires together with a jumper lead.

– With throttle wide open and selector lever in range II, apply brakes to keep engine speed down to 5500 rpm.

Manual and automatic gearbox:



– Close cutoff valve on pressure gauge – V.A.G 1397 – (pull away from gauge).



– Boost pressure must be in specified range depending on ambient temperature.

If the **gauge readings are as specified,** rectify the fault in the K-Jetronic or ignition system.

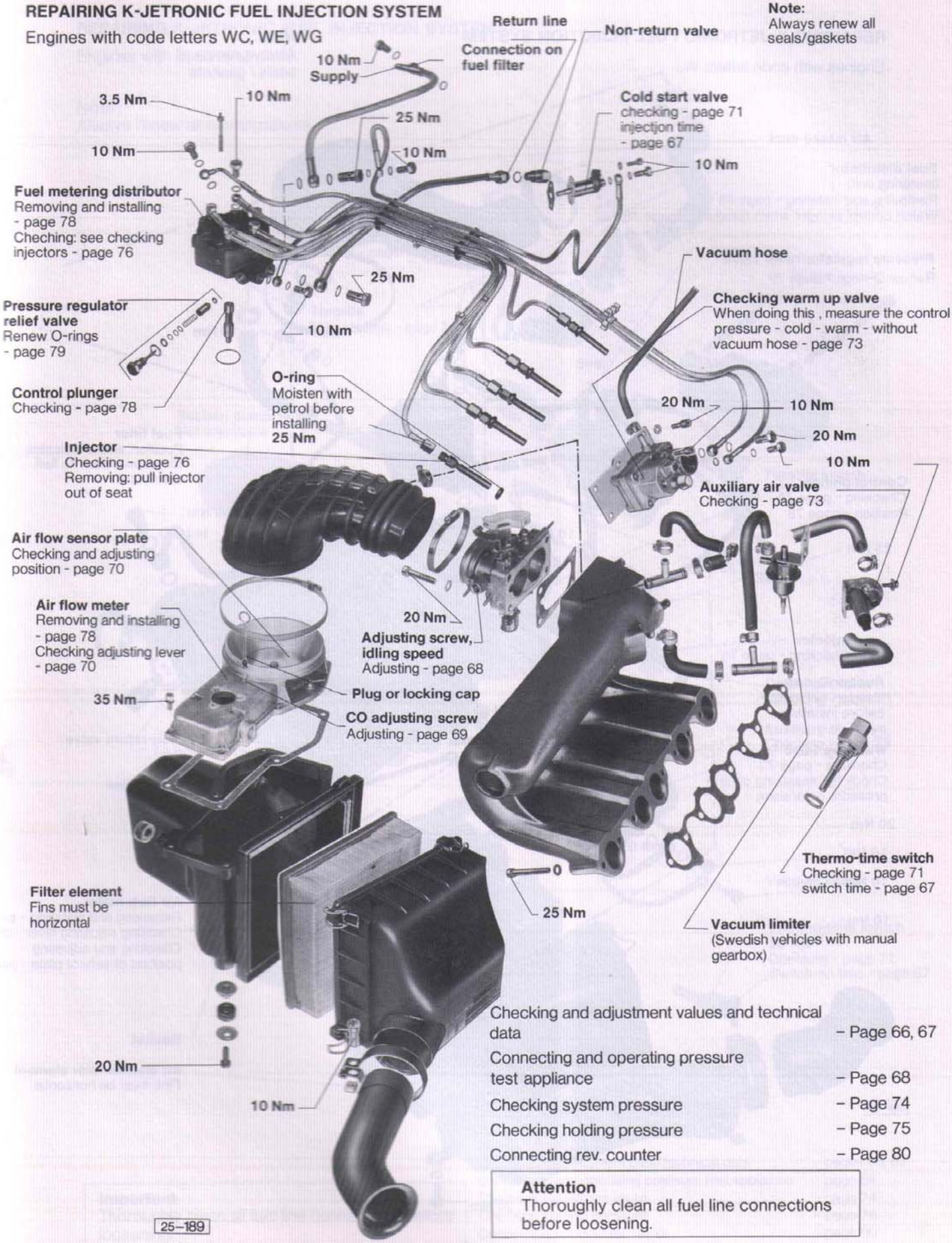
If the **gauge readings are not as specified,** try fitting a new waste gate as a test measure.

If the readings are then still not as specified when the test is repeated, fit a new turbocharger.

REPAIRING K-JETRONIC FUEL INJECTION SYSTEM

Engines with code letters WC, WE, WG

Note:
Always renew all seals/gaskets



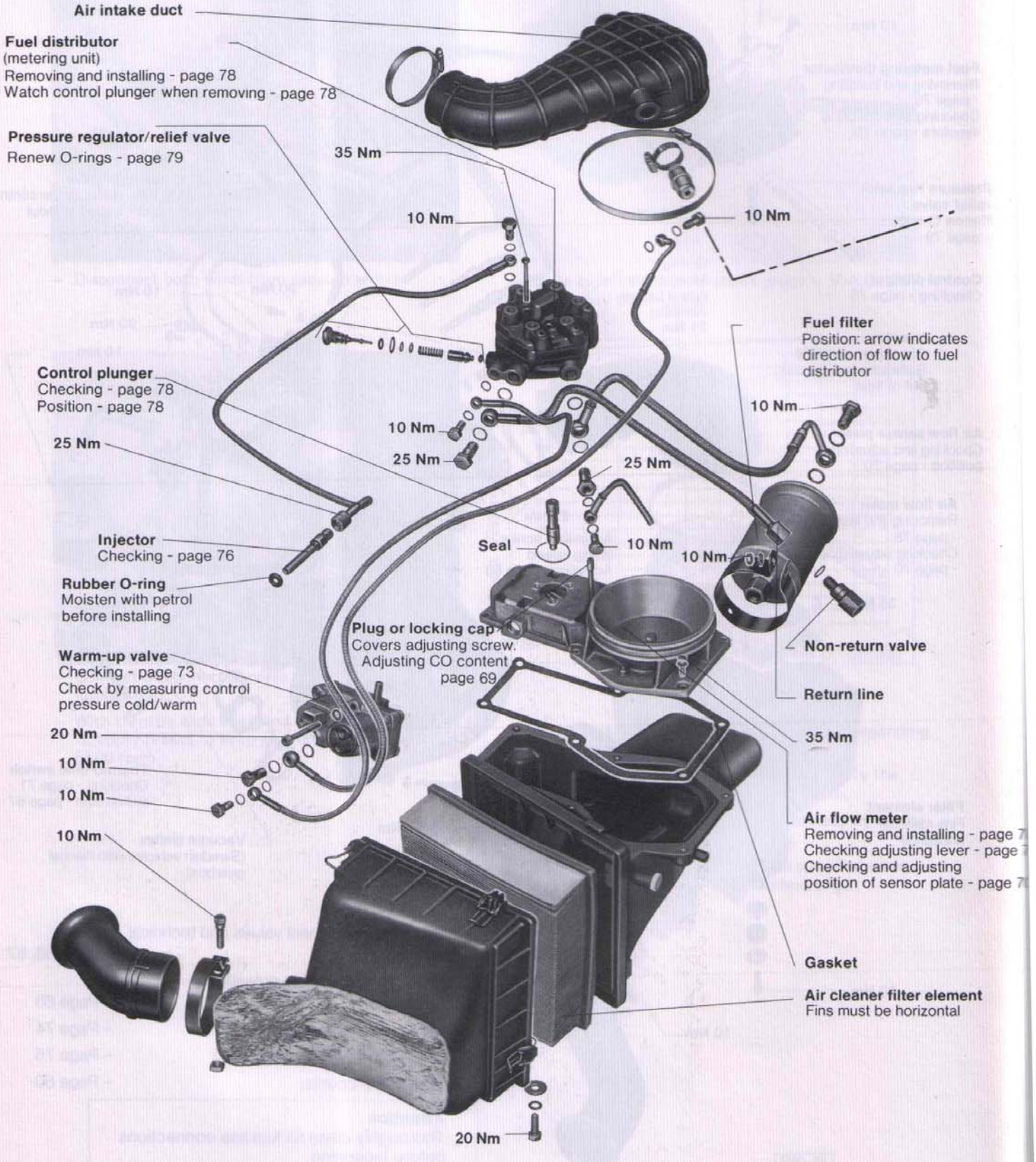
Checking and adjustment values and technical data	– Page 66, 67
Connecting and operating pressure test appliance	– Page 68
Checking system pressure	– Page 74
Checking holding pressure	– Page 75
Connecting rev. counter	– Page 80

Attention
Thoroughly clean all fuel line connections before loosening.

REPAIRING K-JETRONIC FUEL INJECTION SYSTEM

Engines with code letters WJ

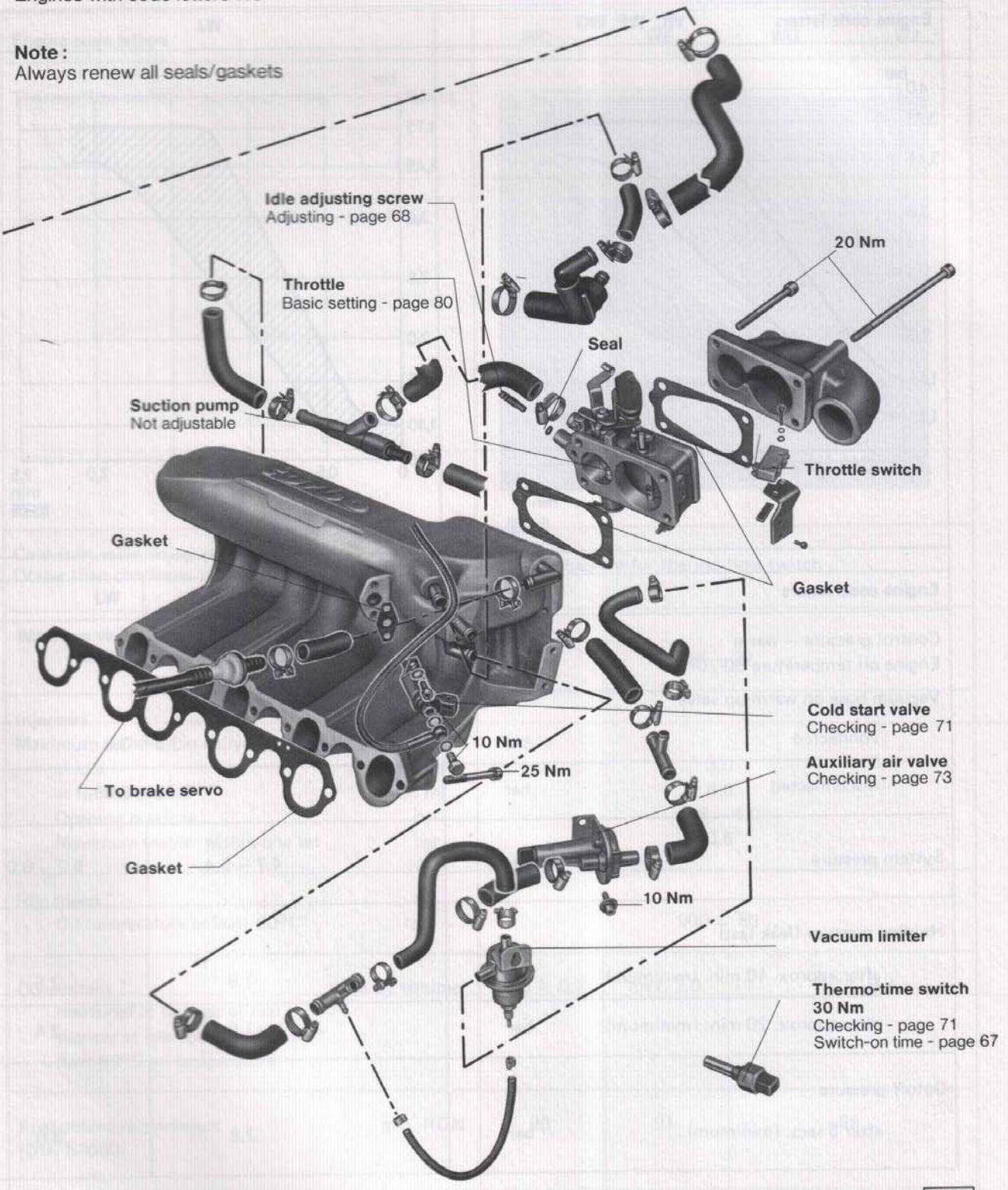
Note:
Always renew all seals / gaskets



REPAIRING K-JETRONIC FUEL INJECTION SYSTEM

Engines with code letters WJ

Note :
Always renew all seals/gaskets



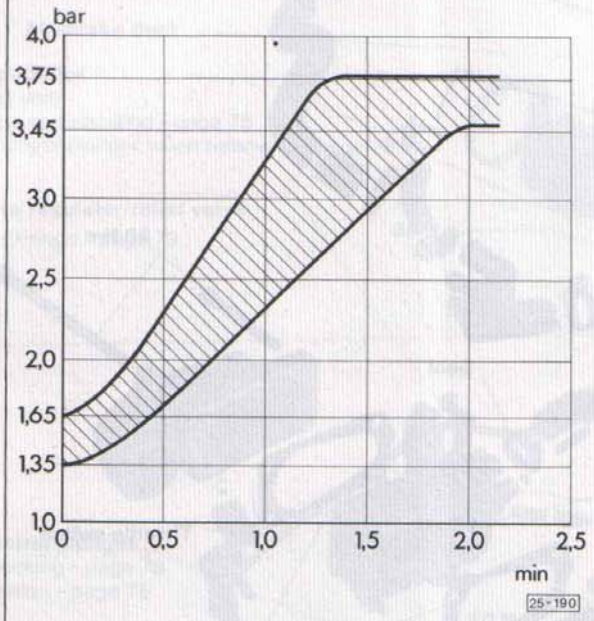
Important
Thoroughly clean all fuel line connections before loosening.

Testing and adjustment data/technical data	- pages 66, 67
Connecting and operating pressure test appliance	- page 68
Checking system pressure	- page 74
Checking holding pressure	- page 75
Connecting rev counter/tester	- page 80

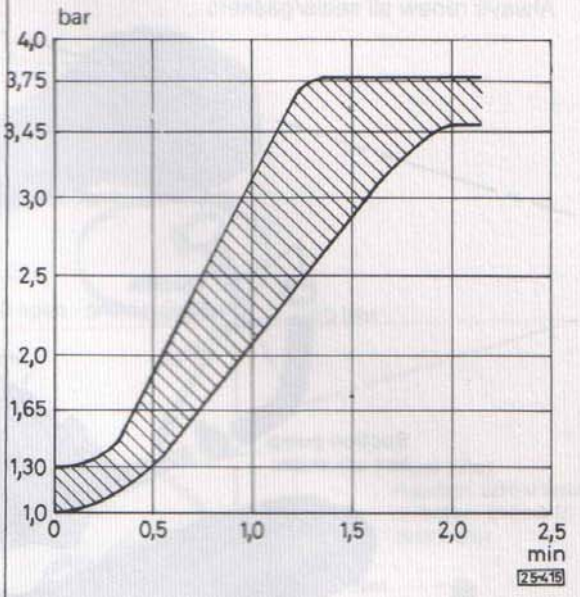
K-JETRONIC SYSTEM – TECHNICAL DATA

Control pressure – cold (vacuum hose on warm-up valve connected): pressure in bar at 20°C ambient temperature

Engine code letters WC, WE, WG

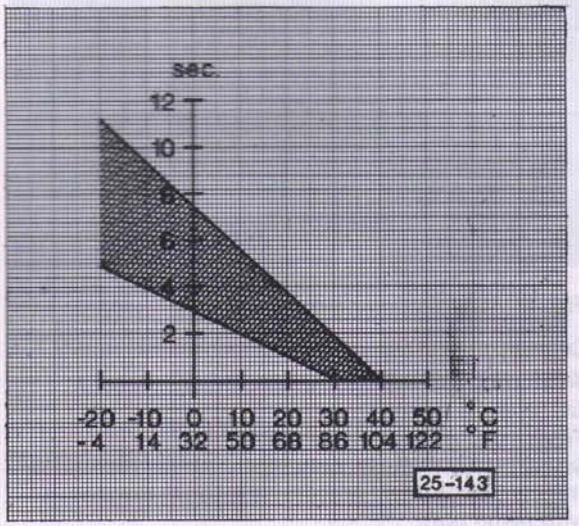


Engine code letters WJ



Engine code letters		WC	WE	WG	WJ
Control pressure – warm Engine oil temperature 50-70°C Vacuum hose on warm-up valve					
connected	bar	3.4 – 3.8			
disconnected	bar	2.75 – 3.05			
System pressure	bar	4.7 – 5.4			5.2 – 6.0
Holding pressure (leak test)					
after approx. 10 min. (minimum)	bar	1.8			2.5
after approx. 20 min. (minimum)	bar	1.6			2.4
Cutoff pressure					
after 5 secs. (minimum)	bar	2.6			3.0

K-JETRONIC SYSTEM – TECHNICAL DATA

Engine code letters		WC	WE	WG	WJ
Thermo-time switch – switch-on time,	secs.				
Cold start valve, injection time, (Valve then continues pulsing only on WJ)	secs.	See diagram for thermo-time switch			
Warm-up valve Heater element resistance	approx. Ω	16 – 22			
Injectors Maximum variation in delivery rate within one set at idle at full throttle Opening pressure Maximum scatter within one set	 max. ml max. ml bar bar	 3.0 8.0 3.6 – 4.0 0.6			
Idle speed * Oil temperature at least 60°C	rpm	900 ± 50			
CO content * measured at tailpipe or rear silencer at idle speed and at least 60°C oil temperature	% by volume	1.0 ± 0.2	max. 2.0	1.0 ± 0.2	
Fuel octane requirement (DIN 51600)	min. RON	98	91	98	

* Note adjustment procedures – pages 68, 69

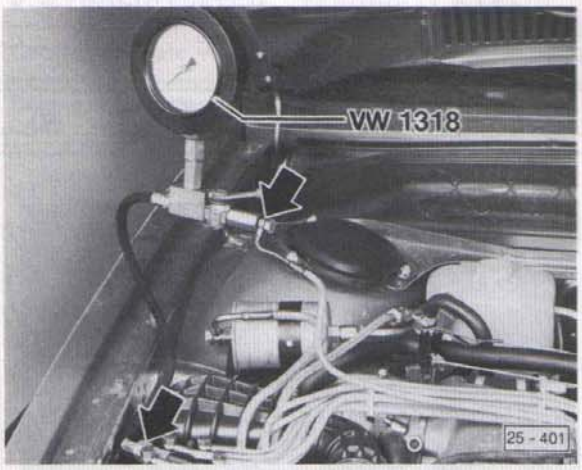


Fig. 1 Connecting pressure gauge

Connect pressure gauge VW 1318 between fuel distributor (metering unit) and control pressure line going to warm-up valve.
From 1979 model year onwards:
Screw pressure gauge connector into fuel distributor and connect control pressure line to pressure gauge with banjo bolt.

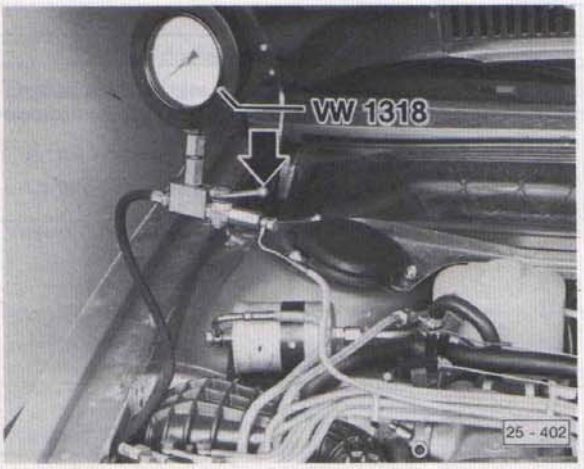


Fig. 2 Pressure gauge valve in open position

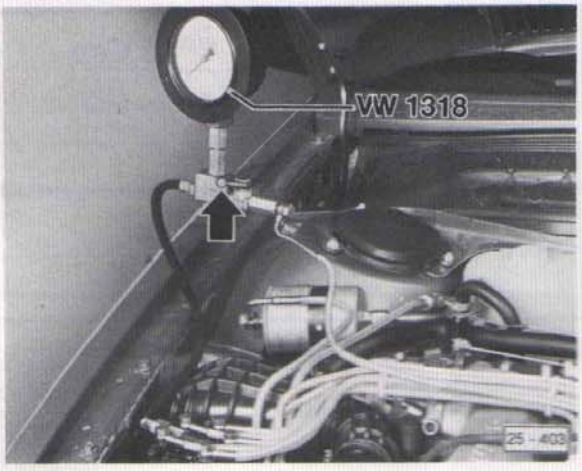
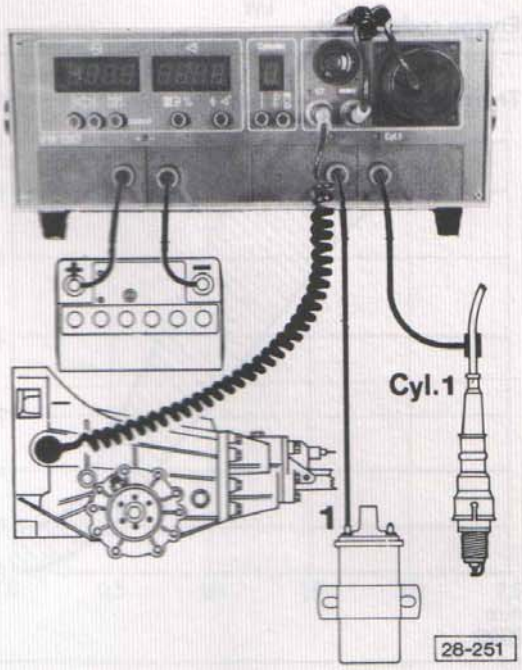


Fig. 3 Pressure gauge valve in closed position

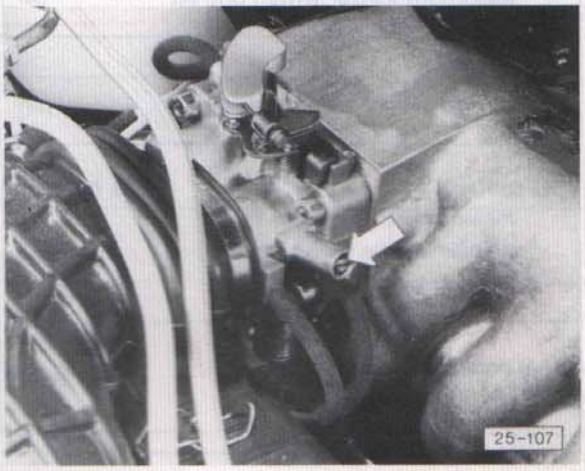
ADJUSTING IDLE SPEED



– Connect tester according to operating instructions.

Note:
Use adaptor for connection to terminal 1 on ignition coil.

– Engine oil temperature at least 60°C.
– High beam headlights switched on.
– Air conditioner switched off.
– Pressure gauge disconnected.
– If injector lines have been detached or renewed the engine must be revved up several times to 3000 rpm and then allowed to idle for at least 2 minutes before carrying out the adjustment.



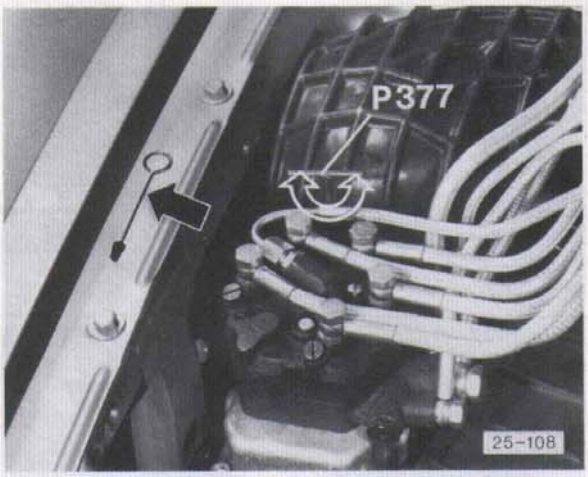
– Adjust idle speed.

Specified idle speed: 900 ± 50 rpm

Note:
Radiator fan must not be running when carrying out adjustment.

ADJUSTING CO CONTENT

- Connect tester according to operating instructions.
- Engine oil temperature at least 60°C.
- Switch on high beam headlights.
- Switch off air conditioner.
- Check idle speed and adjust as required.
- Check ignition timing and adjust as required – page 100.



- Adjust CO content, first remove plug/lock cap.
  Turn to the right to **increase** CO content.
  Turn to the left to **decrease** CO content.

Specified values:

Engine code letters	% by volume
WC	1.0 ± 0.2
WE	max. 2.0
WG	1.0 ± 0.2
WJ	

measured at tailpipe or rear silencer.

Note:

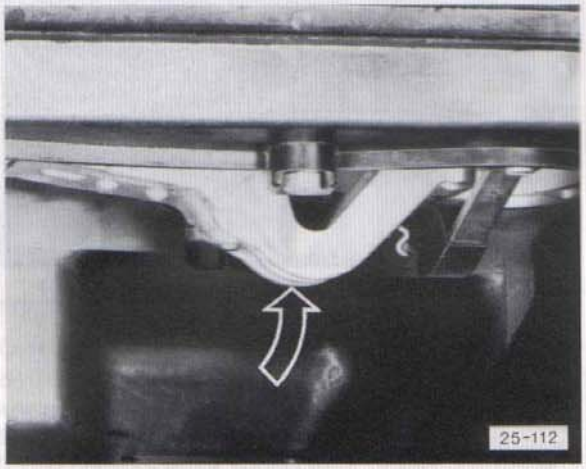
The radiator fan must not be running when carrying out the adjustment.

- If necessary reset idle speed to specified rpm.

Important
When carrying out the CO adjustment do **not** press down or lift up the adjusting screw with the key. Do **not** accelerate the engine when the adjusting key is in position (risk of bending components).
Remove key immediately after each adjustment and accelerate the engine briefly.

CHECKING ADJUSTING LEVER AND CONTROL PLUNGER

– Run engine for about 1 minute.
– Remove air cleaner cover and filter element.



– Move adjusting lever upwards by hand: even resistance must be felt over the whole travel of the lever.
– Move sensor plate down quickly: no resistance must be felt, otherwise renew air flow meter.
– Move sensor plate up and then quickly down again, but stop the sensor plate just before it reaches the rest position. At this point it must be possible to feel the pressure from the control plunger as it comes down, otherwise renew fuel distributor (metering unit).

Note:

If the sensor plate can only be moved upwards with difficulty and/or in jerks, but can be moved easily downwards, this means the control plunger is sticking. Renew the fuel distributor (metering unit).

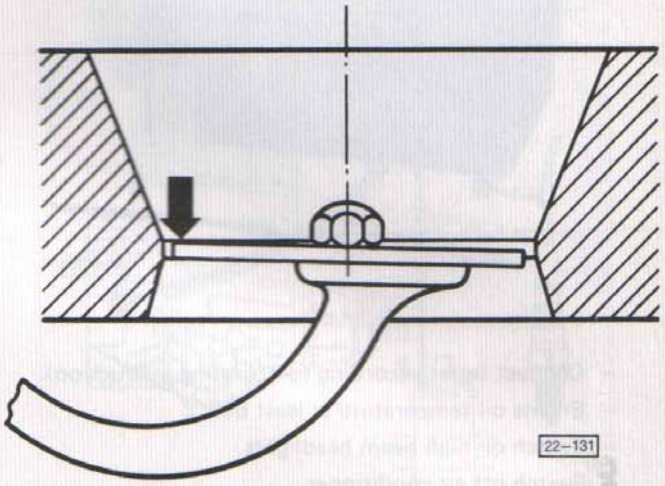
If the sensor plate can only be moved upwards and downwards with difficulty and/or in jerks, this means the adjusting lever is sticking. Renew the air flow meter.

CHECKING AND ADJUSTING POSITION OF AIR FLOW SENSOR PLATE

– Engine oil temperature at least 50°C.

Checking:

– Run engine about 15 seconds.
– Remove air intake duct.



– The upper edge of the sensor plate must align with the point indicated by the arrow or be a maximum of 0.5 mm below the start of the venturi.

Adjusting:

– Lift up sensor plate.

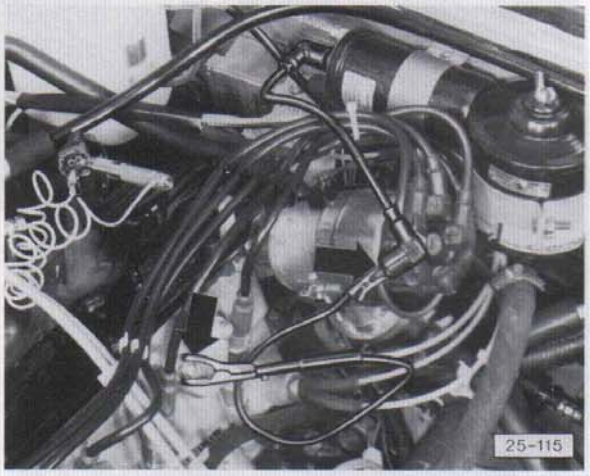
– Adjust position of sensor plate by bending the wire clip.

Caution
Do not damage the air flow meter venturi.
Do not bend the leaf spring.
After adjusting, set idle speed and CO content.

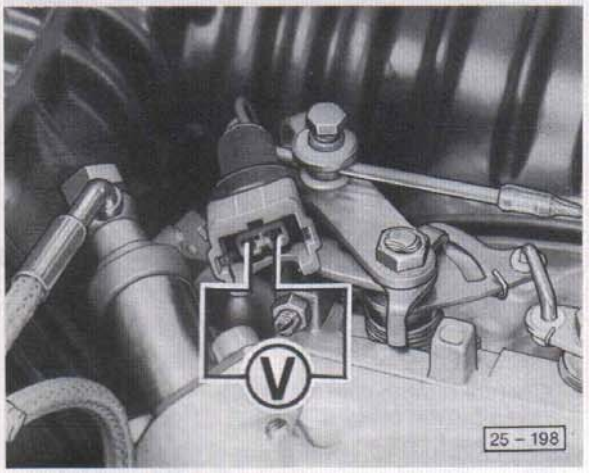
CHECKING THERMO-TIME SWITCH

– Engine cold, coolant temperature below 30°C.

Note:
The thermo-time switch is checked via the electrical connection on the cold start valve.

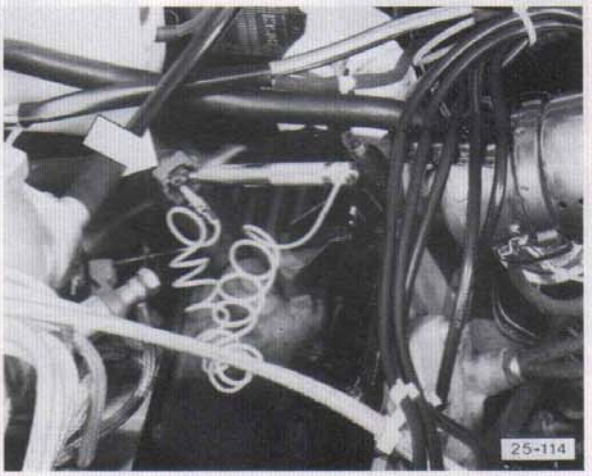


– Pull high tension lead off distributor and connect to earth with extension wire.
– Disconnect plugs from warm-up valve and auxiliary air valve.
– Disconnect plug from cold start valve.
– Check position of plug contacts.



– Check supply voltage by operating starter motor briefly.

Specified voltage: at least 11.5 V.

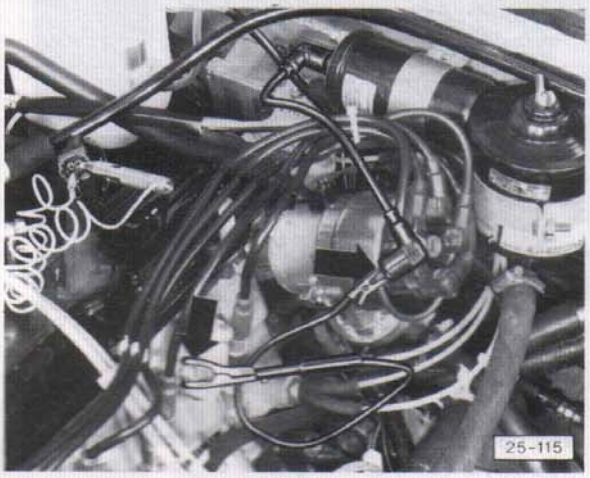


– Connect test lamp to cold start valve plug.
– Operate starter motor approx. 10 secs.; test lamp must come on.
– The first time the lamp comes on it must stay on for a period in the specified time range (diagram on page 67), depending on outside temperature.

Vehicles with engine code letters WJ only
If the starter motor is operated continuously after the period when the lamp first comes on, the lamp will then start flashing continuously. When the engine is warm the lamp only starts flashing after about two seconds. If the lamp **only** flashes at intervals, or if it does **not** flash at all, check the timing relay on the central relay plate or trace the break in the circuit using the current flow diagram.

CHECKING COLD START VALVE

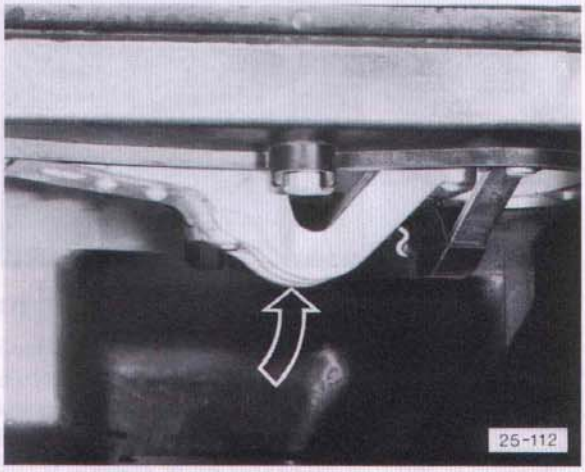
– Engine cold, coolant temperature below 30°C.



– Pull high tension lead off distributor and connect to earth using extension wire.
– Disconnect plugs from warm-up valve and auxiliary air valve.
– Disconnect plug from cold start valve.
– Check position of plug contacts.

CHECKING ADJUSTING LEVER AND CONTROL PLUNGER

– Run engine for about 1 minute.
– Remove air cleaner cover and filter element.



– Move adjusting lever upwards by hand: even resistance must be felt over the whole travel of the lever.
– Move sensor plate down quickly: no resistance must be felt, otherwise renew air flow meter.
– Move sensor plate up and then quickly down again, but stop the sensor plate just before it reaches the rest position. At this point it must be possible to feel the pressure from the control plunger as it comes down, otherwise renew fuel distributor (metering unit).

Note:

If the sensor plate can only be moved upwards with difficulty and/or in jerks, but can be moved easily downwards, this means the control plunger is sticking. Renew the fuel distributor (metering unit).

If the sensor plate can only be moved upwards and downwards with difficulty and/or in jerks, this means the adjusting lever is sticking. Renew the air flow meter.

CHECKING AND ADJUSTING POSITION OF AIR FLOW SENSOR PLATE

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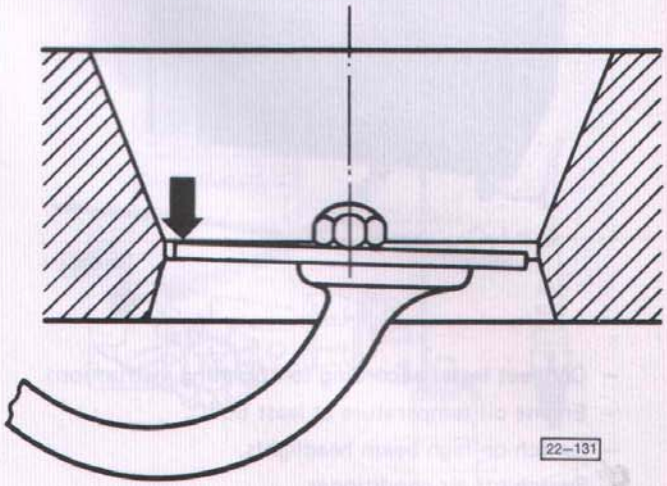
Checking:

– Run engine about 15 seconds.
– Remove air intake duct.



– The upper edge of the sensor plate must align with the point indicated by the arrow or be a maximum of 0.5 mm below the start of the venturi.

Adjusting:

– Lift up sensor plate.

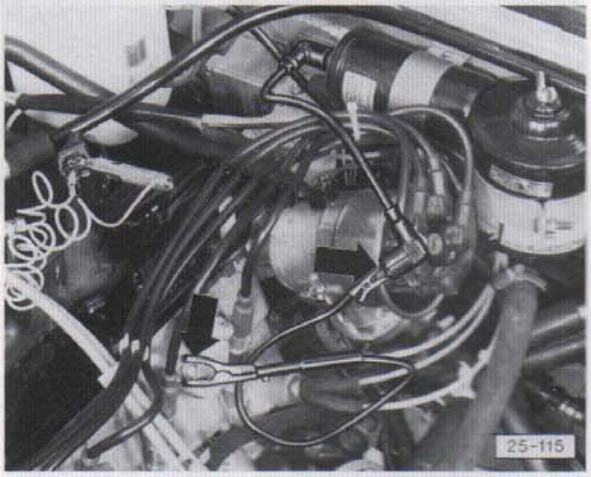
– Adjust position of sensor plate by bending the wire clip.

Caution
Do not damage the air flow meter venturi.
Do not bend the leaf spring.
After adjusting, set idle speed and CO content.

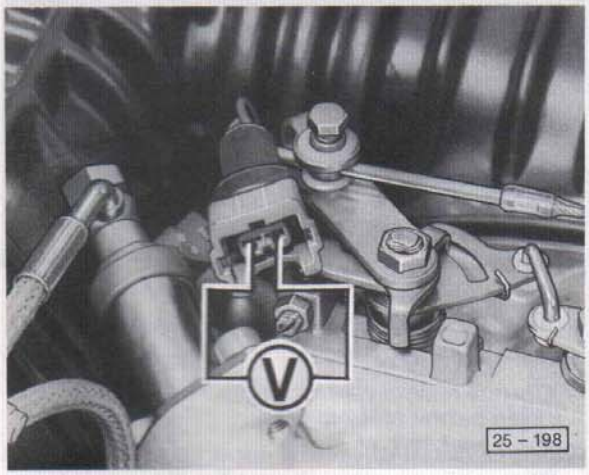
CHECKING THERMO-TIME SWITCH

– Engine cold, coolant temperature below 30°C.

Note:
The thermo-time switch is checked via the electrical connection on the cold start valve.

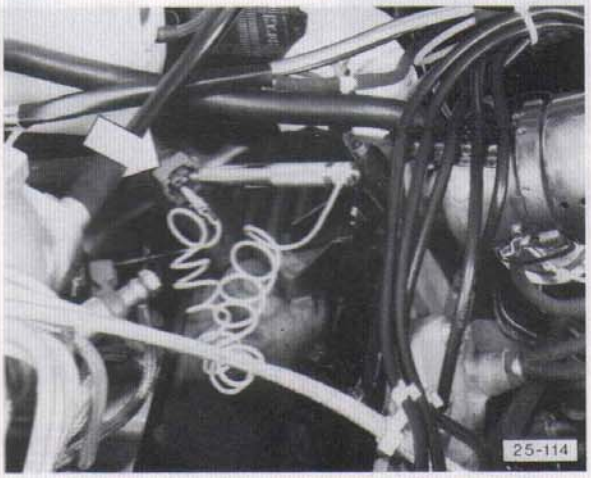


– Pull high tension lead off distributor and connect to earth with extension wire.
– Disconnect plugs from warm-up valve and auxiliary air valve.
– Disconnect plug from cold start valve.
– Check position of plug contacts.



– Check supply voltage by operating starter motor briefly.

Specified voltage: at least 11.5 V.

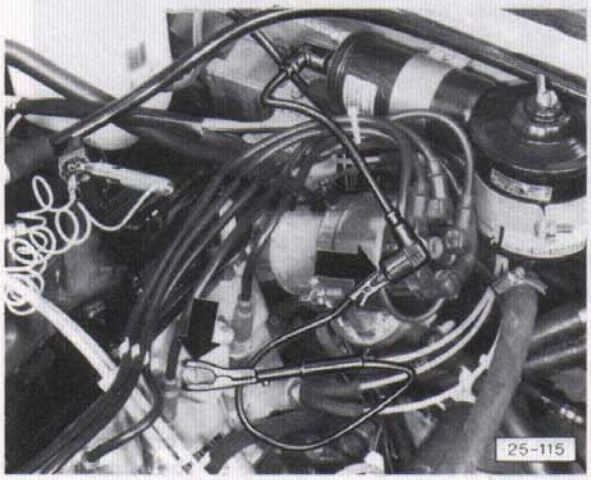


– Connect test lamp to cold start valve plug.
– Operate starter motor approx. 10 secs.; test lamp must come on.
– The first time the lamp comes on it must stay on for a period in the specified time range (diagram on page 67), depending on outside temperature.

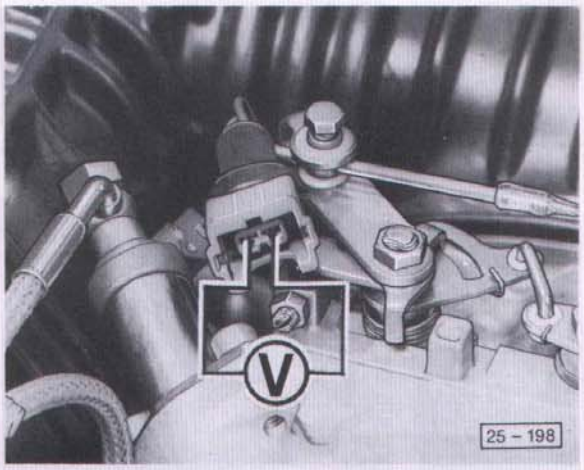
Vehicles with engine code letters WJ only
If the starter motor is operated continuously after the period when the lamp first comes on, the lamp will then start flashing continuously. When the engine is warm the lamp only starts flashing after about two seconds. If the lamp **only** flashes at intervals, or if it does **not** flash at all, check the timing relay on the central relay plate or trace the break in the circuit using the current flow diagram.

CHECKING COLD START VALVE

– Engine cold, coolant temperature below 30°C.

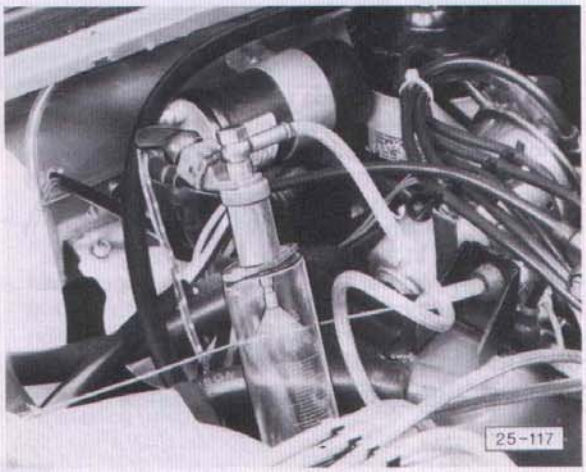


– Pull high tension lead off distributor and connect to earth using extension wire.
– Disconnect plugs from warm-up valve and auxiliary air valve.
– Disconnect plug from cold start valve.
– Check position of plug contacts.



– Check supply voltage by operating starter motor briefly.

Specified voltage: at least 11.5 V.



– Remove cold start valve and hold it over a measuring glass. Leave fuel line connected.
– Reconnect plug to cold start valve.
– Operate starter motor.

The cold start valve must spray in an even cone.

Note:

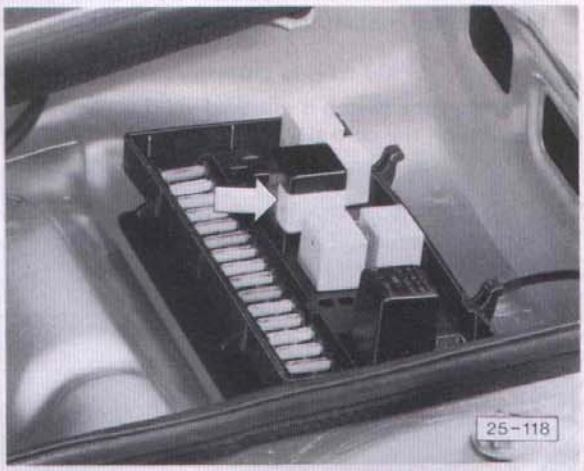
The injection time must be the same as the switch-on time for the thermo-time switch – page 67.

Vehicles from 1980 model year onwards

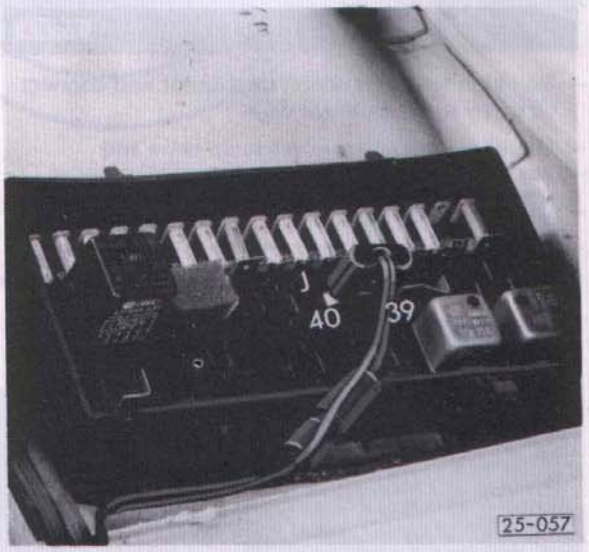
If the starter motor is operated continuously after the period when the valve first opens, the valve will continue spraying in pulses.

When the engine is warm the cold start valve only starts pulsing after about 2 secs. If the cold start valve does **not** spray in pulses, or if it **only** sprays in pulses, check the timing relay on the central relay plate or trace the break in the circuit using the current flow diagram.

– Dry off nozzle of cold start valve.



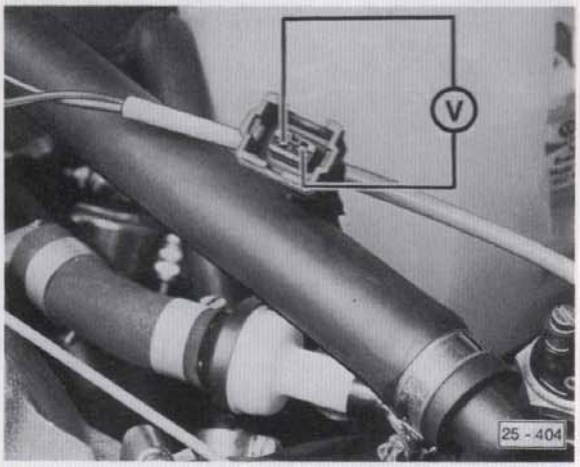
– Pull fuel pump relay out of socket – J –.



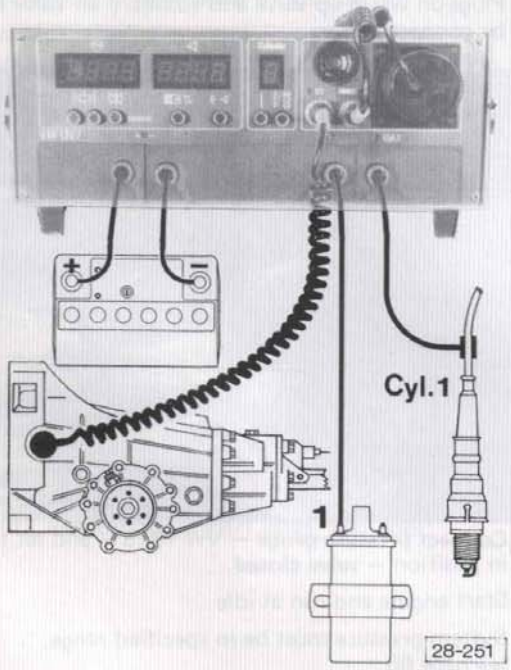
– Insert plug of remote control switch – VW 1348/3 – into contacts J 39 and J 40 on relay plate.
– Place switch near cold start valve (switch is held in place by built-in magnet).
– Operate remote control switch – VW 1348/3 – (keep button pressed down).
– The cold start valve must not drip within a period of one minute, otherwise renew cold start valve.

CHECKING AUXILIARY AIR VALVE

– Engine cold, coolant temperature below 30°C.
– Disconnect plug from auxiliary air valve.
– Check position of plug contacts.



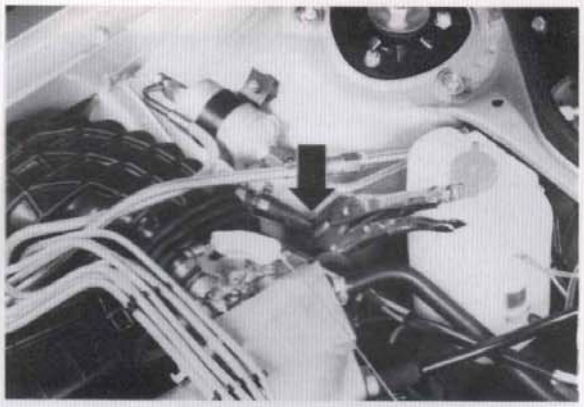
– Check voltage supply: start engine and run at idle
Specified voltage: at least 11.5 V.



– Connect tester according to operating instructions.

Note:
Use adaptor for connection to terminal 1 on ignition coil.

– Plug disconnected from auxiliary air valve.
– Measure engine rpm.
– Leave engine running at idle.



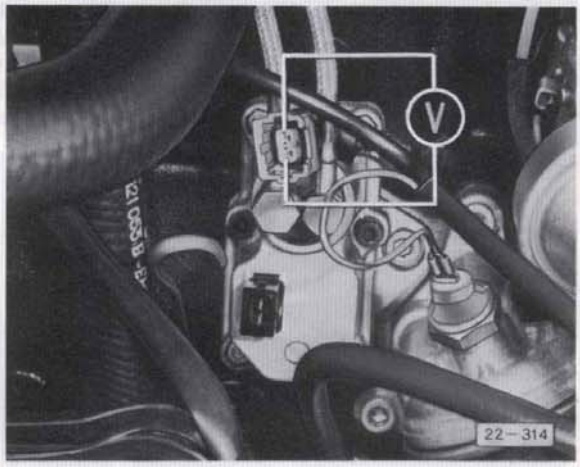
– Pinch together hose between air intake duct and auxiliary air valve.

Note:
The engine speed must drop.

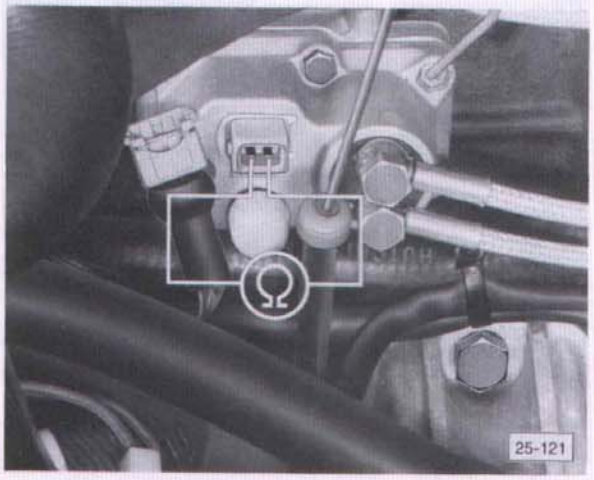
– Repeat test with engine warm and auxiliary air valve plug connected. Engine speed must not change when hose is clamped off.

CHECKING WARM-UP VALVE

– Engine cold.
– Disconnect plugs from warm-up valve and auxiliary air valve.
– Check position of plug contacts.



– Check voltage supply by operating starter motor briefly.
Specified voltage: at least 11.5 V.



– Check heater coil resistance.

Specified resistance: 16–22 Ω

Note:
If there is an open circuit in the heater coil, renew warm-up valve.

– Connect pressure gauge – VW 1318 – and set lever to – **valve open** – position.

– Start engine and run at idle.

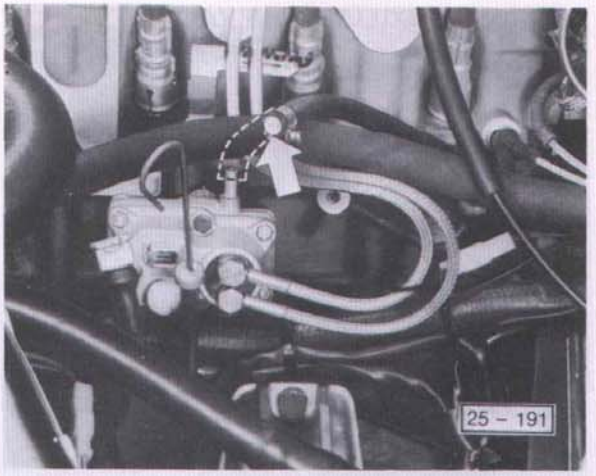
Caution
Do not run engine for more than one minute.

– **Control pressure – cold** – must be within the specified range (see diagram on page 66) corresponding to the elapsed time after the engine is started. Renew warm-up valve if results are not correct.

– Reconnect plugs on warm-up valve and auxiliary air valve.

– Warm up engine to at least 50°C oil temperature and run at idle.

– **Control pressure – warm** – must be within specified range (vacuum hose connected on warm-up valve): 3.4 – 3.8 bar. Renew warm-up valve if pressure is not correct. If the control pressure is higher than specified, then either the warm-up is defective or the fuel filter is blocked or the pressure regulator/ relief valve is defective.



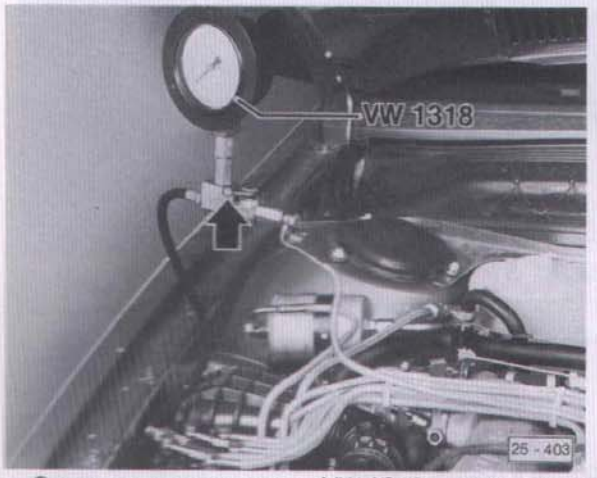
– Pull vacuum hose off warm-up valve and plug hose.

– **Control pressure – warm** – must be within specified range (vacuum hose on warm-up valve disconnected): 2.75 – 3.05 bar, otherwise renew warm-up valve.

CHECKING SYSTEM PRESSURE

Note:
Only check system pressure after checking fuel delivery rate and fuel filter.

– Plugs on warm-up valve and auxiliary air valve must be connected.



– Connect pressure gauge – VW 1318 – and set lever in position – **valve closed.**

– Start engine and run at idle.

– System pressure must be in specified range, see page 66.

Note:
If the system pressure is not as specified, this may be due to the following faults:
fuel line kinked, blocked, leaking; fuel accumulator leaking; fuel filter obstructed; electric fuel pump delivery rate inadequate; pressure regulator/pressure relief valve defective, dirty; fuel distributor (metering unit) defective.
If the specified value is exceeded, this means the return line is obstructed or kinked, or the pressure regulator/ relief valve is defective.

CHECKING HOLDING PRESSURE

- Engine warm, oil temperature at least 50°C.
- Connect pressure gauge – VW 1318.
- Start engine and run at idle.
- Bleed pressure gauge – VW 1318 – by hanging pressure gauge down and moving lever several times within 20 secs. from **valve open** to **valve closed** positions.

- Set lever in – valve open – position.
- **Control pressure – warm** – must be within specified range (vacuum hose on warm-up valve connected): 3.4 – 3.8 bar.
- Switch off ignition.
- Note pressure drop indicated on gauge: after 10 minutes there must be a residual pressure of 1.8 bar.

Note:
If the pressure drops more rapidly, test check valve in electric fuel pump, see page 56.

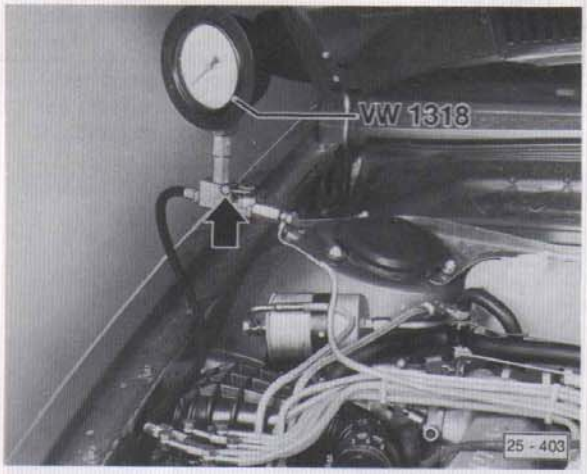
- If the pressure reading is between the figures given on page 66, the test must be extended to 20 minutes. Minimum pressure after 20 minutes; see page 66.

  If the pressure reading is below the specified figure after 20 minutes, this means that the following parts could be leaking: fuel distributor (metering unit), injectors, cold start valve, fuel lines.

CHECKING CUTOFF PRESSURE

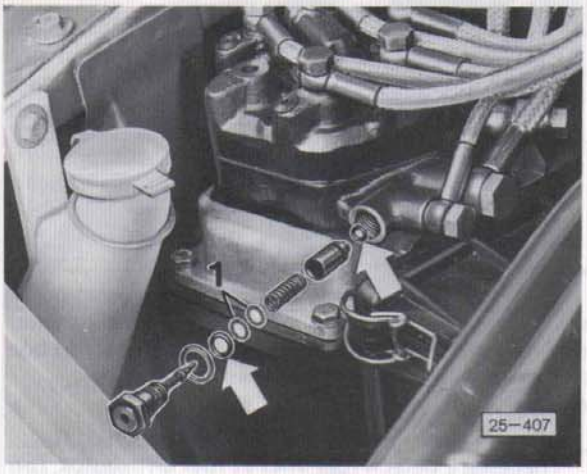
(only in case of extreme hot start problems)

- Engine oil temperature about 50°C.



- Connect pressure gauge – VW 1318 –.
- Set lever to – **valve closed** – position.
- Start engine and run at idle.
- System pressure must be within specified range, see page 66.
- Switch off ignition and watch pressure drop on gauge.
- Cutoff pressure must be within specified range, see page 66.

Note:
When the ignition is switched off the system pressure must drop immediately to max. 2.6 bar. Otherwise check the tension of the system pressure regulator as follows:



- Remove system pressure regulator/pressure relief valve by detaching return line or fuel distributor and bracket for frequency valve.
- Remove one of the factory-installed shims – 1 – and test the cutoff pressure again.

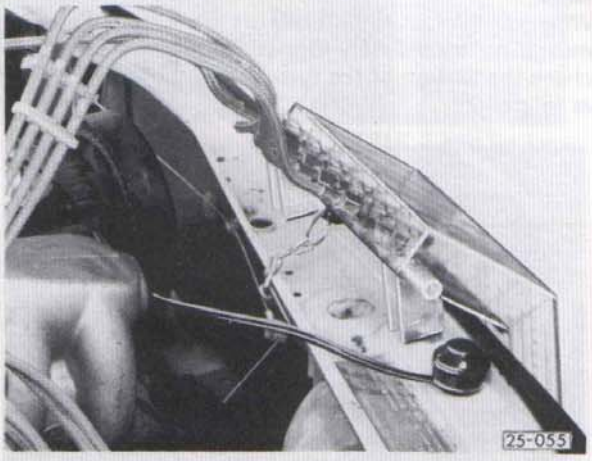
– If the cutoff pressure is still higher than the specified value – see page 66 – remove another shim – 1 –; if necessary remove all the shims.

Important
Renew all the O-rings (arrows).

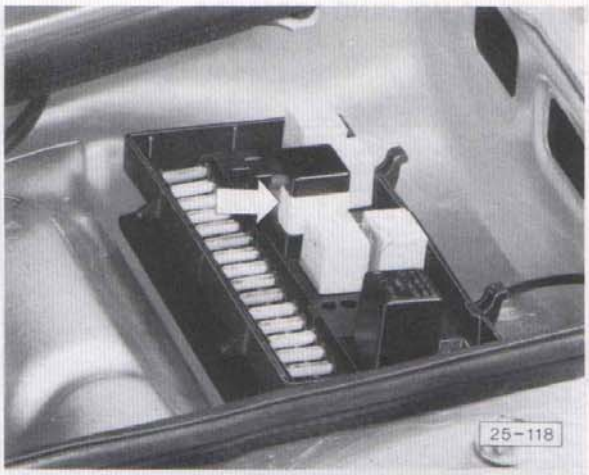
CHECKING INJECTORS

a) **Checking spray pattern and leakage**
Disconnect negative battery cable.

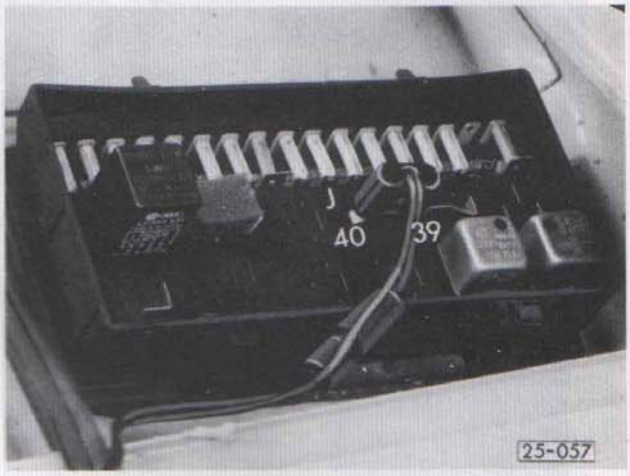
– Pull injectors out of their seats.



– Place measuring appliance on front panel and secure with chain.
– Insert injectors into measuring glasses. Position fuel lines so they are free of kinks, if necessary detach fuel lines at fuel distributor, run lines into measuring appliance and then secure lines again.

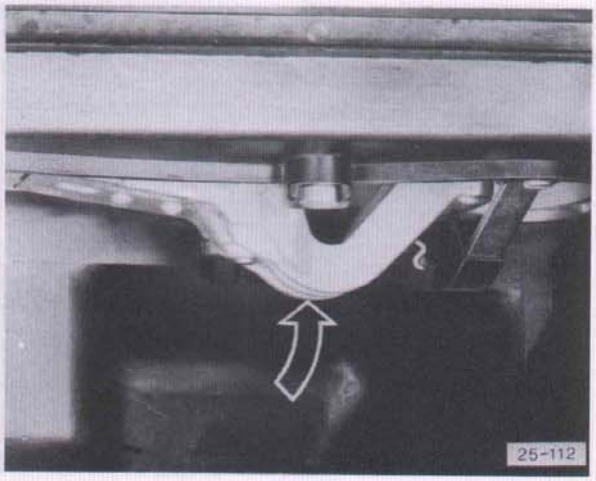


– Pull fuel pump relay out of socket.



– Insert plug of remote control switch into contacts J 39 and J 40 on relay plate in place of fuel pump relay.
– Position switch near measuring appliance on front panel (switch is held in place by a built-in magnet).

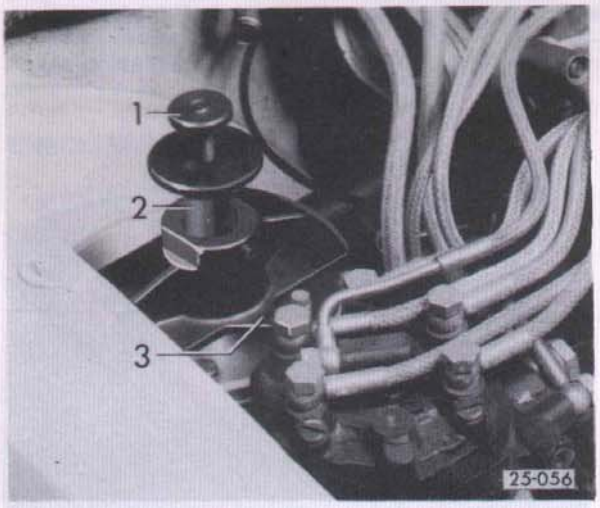
– Remove air cleaner cover and filter element.



– Lift adjusting lever by hand as far as it will go.
– Operate remote control switch – VW 1348/3 – (keep knob pressed).
– Injectors must inject with a cone-shaped spray.
– Dry off injector nozzles.
– Return sensor plate to rest position.
– Operate remote control switch – VW 1348/3 – (keep knob pressed).
– Injectors must not drip within a period of 2 minutes.

b) Checking variation in injection rates

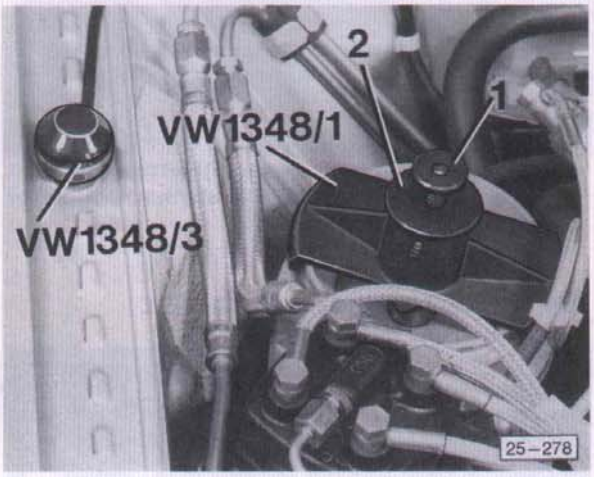
– Detach air intake duct from air flow meter.
– Check position of sensor plate and adjust if necessary – page 70.
– Leave sensor plate in rest position.
– Turn adjusting screw – 1 – and move slide – 2 – of adjusting appliance – VW 1348/1 – so that they are set as high as they will go.



– Place adjusting appliance – VW 1348/1 – centrally on rim of air flow meter with the point –3– on the appliance pointing towards the fuel distributor.
– Push in slide –2– as far as it will go.
– Screw in adjusting screw –1– until the magnet on the end contacts the retaining screw on the sensor plate.

Note:
If the magnet lifts up the sensor plate, screw in adjusting screw –1– until the magnet on the end contacts the retaining screw on the sensor plate.

– Operate remote control switch – VW 1348/3 – (keep knob pressed) and unscrew adjusting screw –1– until one of the injectors begins to spray out fuel.
– After completing this initial adjustment, empty out the measuring appliance – VW 1348/2 – (the injectors can be left in position).



– Pull up slide –2– on adjusting appliance to first detent position (for idle measurement) or second detent position (for full throttle measurement).
– Keep remote control switch – VW 1348/3 – pressed down until the fuel level on the scale of **one** measuring glass reaches the figure given in the table.

Measurement (engines with code letters WC, WE, WG)	Amount of fuel, ml per measuring glass	Switch left on for:	Maximum permissible variation of injection rate within one set, ml
Idle measurement in first detent position	20	at least 2 minutes	max. 3.0
Full throttle measurement in second detent position	80	max. 40 seconds	max. 8.0
Measurement (engines with code letters WJ)	Amount of fuel, ml per measuring glass	Switch left on for:	Maximum permissible variation of injection rate within one set, ml
Idle measurement in first detent position	27	at least 2 minutes	max. 3.0
Full throttle measurement in second detent position	50	max. 20 seconds	max. 8.0

– Compare the amounts of fuel delivered by the injectors (hold measuring appliance horizontal).

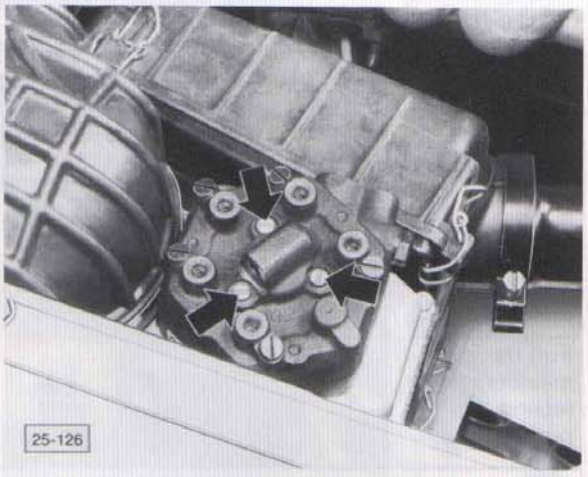
Note:

Before taking full throttle measurement, empty measuring appliance –VW 1348/2– (injectors can be left in position).

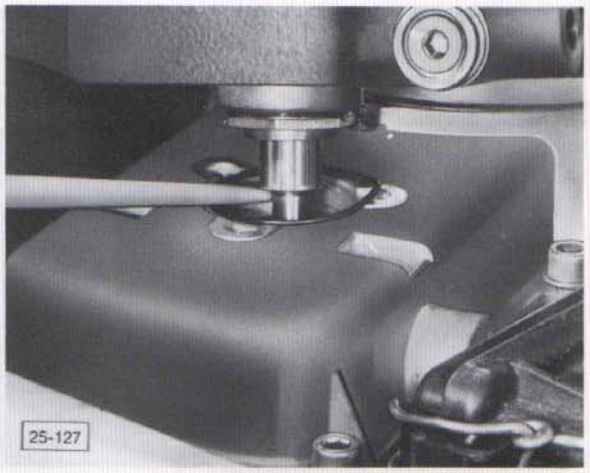
- If the difference between the largest and smallest amounts of fuel delivered exceeds the maximum permitted tolerances, change round the two injectors that delivered the largest and smallest amounts of fuel.
- Compare injection rates again by repeating measurement.
- If one injector still gives the same variation in injection rate after being changed round, this injector is defective and must be renewed.
- If the same variation in injection rate still occurs at the same cylinder this means either the injection line is defective (restricted) or the fuel distributor (metering unit) is defective.

REMOVING AND INSTALLING FUEL DISTRIBUTOR (METERING UNIT)

- To relieve pressure, loosen off control pressure line at warm-up valve (large union): place a cloth over the connection to prevent fuel spraying out.
- Clean connections and disconnect fuel lines.
- Unscrew connector for control pressure line in fuel distributor.
- Remove plug/lock cap from CO adjusting screw.



- Remove mounting screws.



- Remove fuel distributor (metering unit).

Caution
Do not let control plunger fall out when lifting fuel distributor. If the plunger is taken out, clean with petrol before reinstalling.

Installation note:
Always renew seal.

Resecure fuel line on warm-up valve.
Position of control plunger: chamfer faces downwards.

- Adjust idle speed and CO content.

REMOVING AND INSTALLING AIR FLOW METER

- To relieve pressure, loosen control pressure line at warm-up valve (large union): place a cloth over the connection to prevent fuel from spraying out.
- Clean fuel line connections on fuel distributor and disconnect fuel lines.
- Detach air intake duct.

- Remove air flow meter complete with fuel distributor (metering unit) from air cleaner housing.
- Unscrew connector for control pressure line on fuel distributor.

– Detach fuel distributor from air flow meter and remove.

> **Caution**
> Do not let control plunger fall out when lifting fuel distributor. If the plunger is taken out, clean with petrol before installing.

Installation note:
Always renew seals.
Resecure fuel line on warm-up valve.

– Adjust idle speed and CO content.

RENEWING SEALS (0-RINGS) ON PRESSURE REGULATOR/RELIEF VALVE

– To relieve pressure, loosen off control pressure line at warm-up valve (large union): place a cloth over the connection to prevent fuel spraying out.

– Remove pressure relief valve with plunger and renew seals (arrows). Do not change adjusting shims –1– set at the factory.

CHECKING VACUUM LIMITER

– Disconnect and plug hose.
– Start engine and increase engine speed to about 3000 rpm.

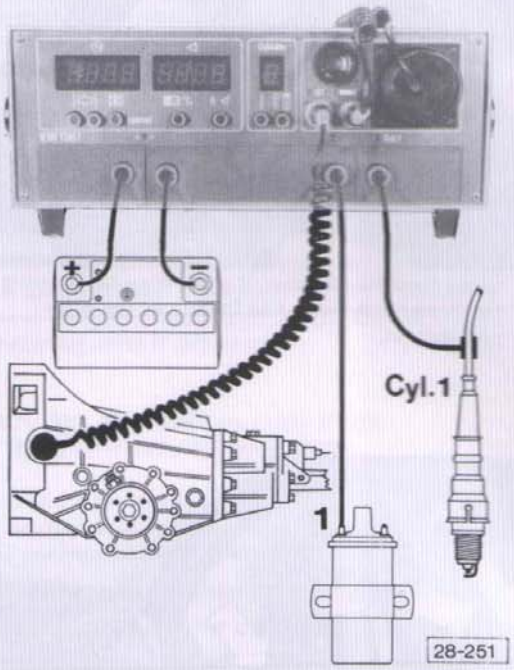
– Close throttle sharply: it must now be possible to feel a vacuum (with the finger) at the pipe connection.

– Pull off vacuum control hose and plug T-adaptor.
– Increase engine speed to about 3000 rpm, close throttle sharply: no vacuum should now be felt at the pipe connection.

CONNECTING REV COUNTER/TESTER

Observe safety precautions for TCI ignition system – page 105.

a) VW 1367



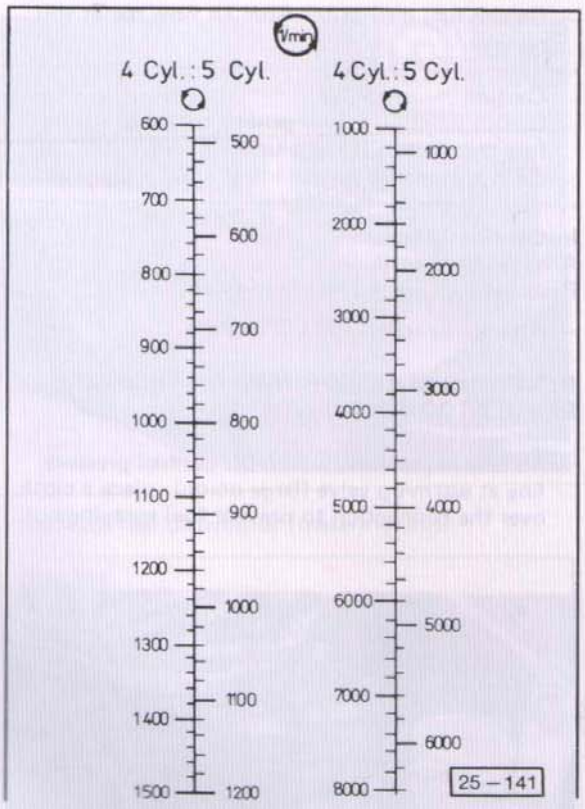
– Connect tester

Note:
On vehicles with air conditioner connect positive lead of tester to fuse no. 10, 11 (for brake lights).
Use adaptor for connection to terminal 1 on ignition coil.

> **Important**
> Make sure that the TDC sender is plugged into the gearbox housing as far as it will go.

b) Other commercial test equipment
Observe safety precautions for TCI ignition system – page 105.

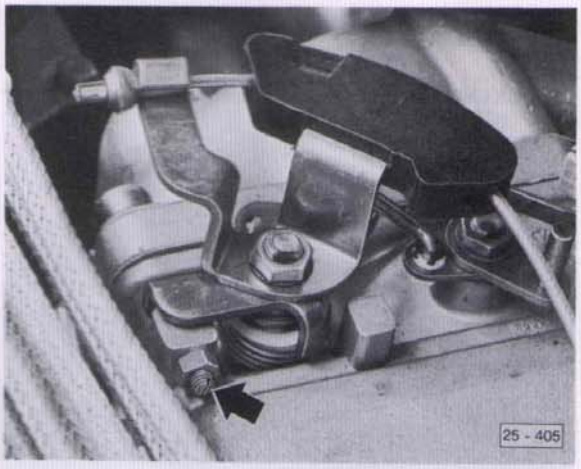
– Test equipment which registers the impulse from terminal 1 on the ignition coil as an rpm signal can only be used if it is designed by the manufacturer to respond to an input voltage of 2.0 V to give the zero reading. Consult the manufacturer if necessary.
– Set cylinder selector to four cylinders.
– Calculate actual engine speed by multiplying the indicated figure by 0.8 or reading it off the table.



– Table for converting engine speed.

BASIC THROTTLE SETTING

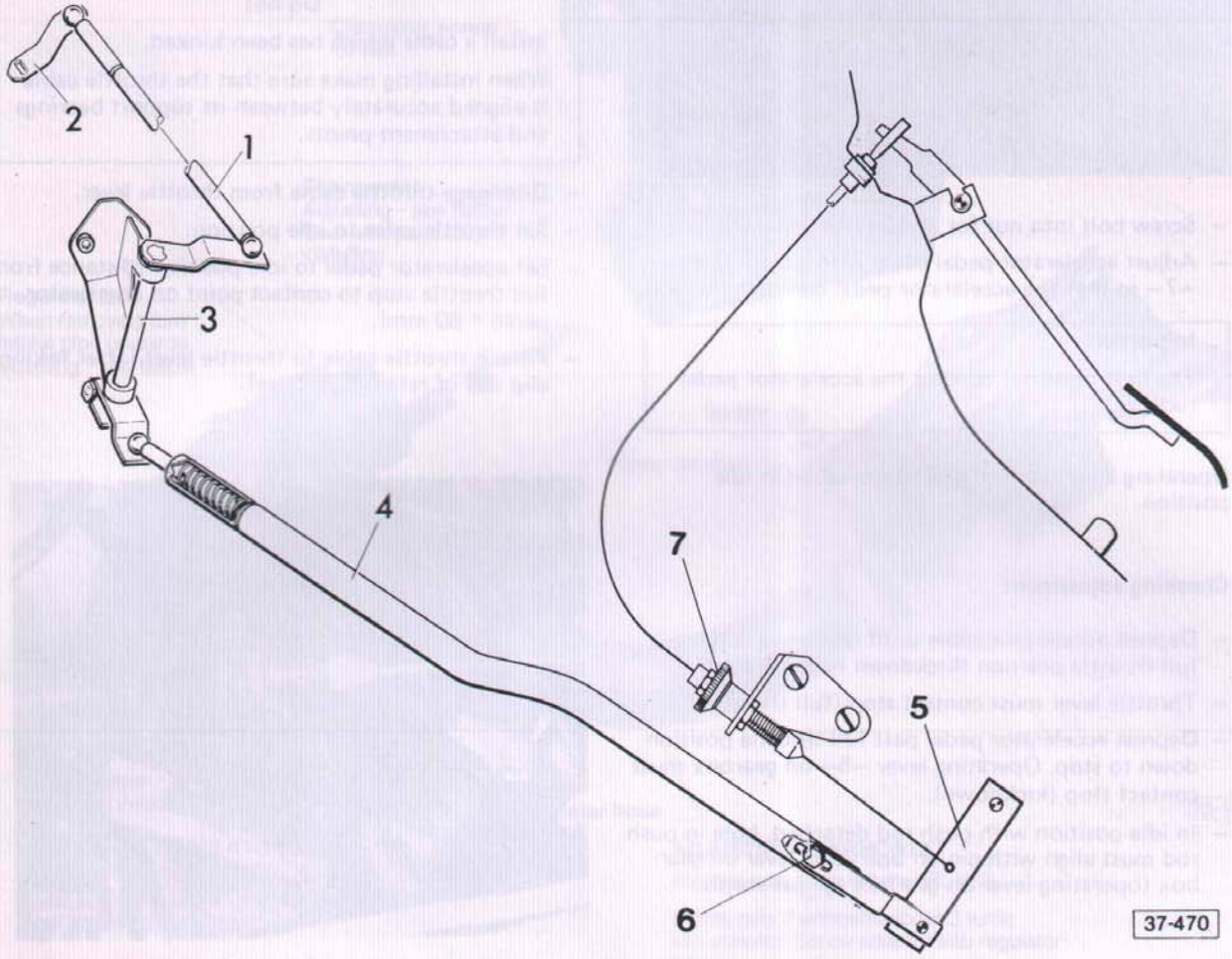
Note:
The limit screw is set at the factory and this setting must not be altered. If the screw is turned by mistake the correct setting can be found as follows:



– Unscrew limiting screw – arrow – until there is a gap between screw and stop.
– Screw in limiting screw until it contacts stop.
– From this point screw in another 1/2 turn and tighten lock nut.
– Adjust idle speed and CO content, se pages 68, 69.

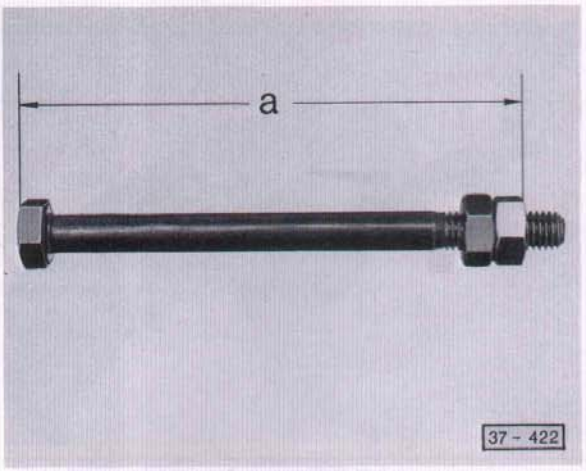
ADJUSTING ACCELERATOR LINKAGE

The accelerator linkage must be adjusted so that the operating lever on the gearbox is against the stop in the idle position when the throttle is closed (idle). If the adjustment is incorrect the gearbox will shift up too late at intermediate speeds. The main pressure reading at idle obtained in the pressure test will also be too high.



ADJUSTING ACCELERATOR LINKAGE AND ACCELERATOR PEDAL CABLE

- Engine at operating temperature.
- Check pull rod –1– for freedom of movement at ball joints on throttle lever –2– and rocker linkage –3–.
- Loosen clamping screw –6– on push rod –4–. Return throttle to idle position by pushing linkage, at the same time holding operating lever on gearbox –5– in idle position. Tighten clamping screw.
- Unscrew accelerator pedal stop.
- Remove intermediate plate.



- Screw two nuts onto a 135 mm long M 8 bolt so that distance a = 124 mm and lock the nuts.

– Screw bolt into nut for accelerator pedal stop.
– Adjust accelerator pedal cable with adjusting nut –7– so that the accelerator pedal contacts the bolt.

Important

The bolt must not contact the accelerator pedal rod.

Operating lever –5– on gearbox must be in idle position.

Checking adjustment

– Depress accelerator cable until resistance is felt a full throttle position (kickdown not operated).
– Throttle lever must contact stop (full throttle).
– Depress accelerator pedal past full throttle position down to stop. Operating lever –5– on gearbox must contact stop (kickdown).
– In idle position with push rod detached, hole in push rod must align with pin on operating lever on gearbox (operating lever on gearbox against stop).

ADJUSTING THROTTLE CABLE

(manual gearbox)

Caution

The throttle cable is liable to kink and so must be handled with particular care when installing.

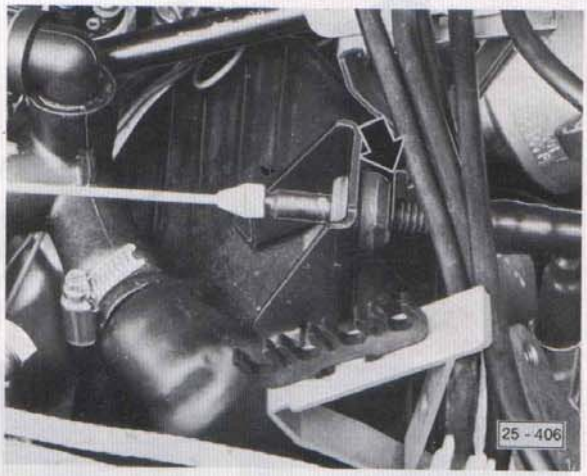
A single, slight kink can cause the cable to break in service.

Do not

install a cable which has been kinked.

When installing make sure that the throttle cable is aligned accurately between its support bearings and attachment points.

– Disengage throttle cable from throttle lever.
– Set throttle valve to idle position.
– Set accelerator pedal to idle position (distance from full throttle stop to contact point on accelerator pedal = 60 mm).
– Attach throttle cable to throttle lever (after taking clip out of retaining groove).



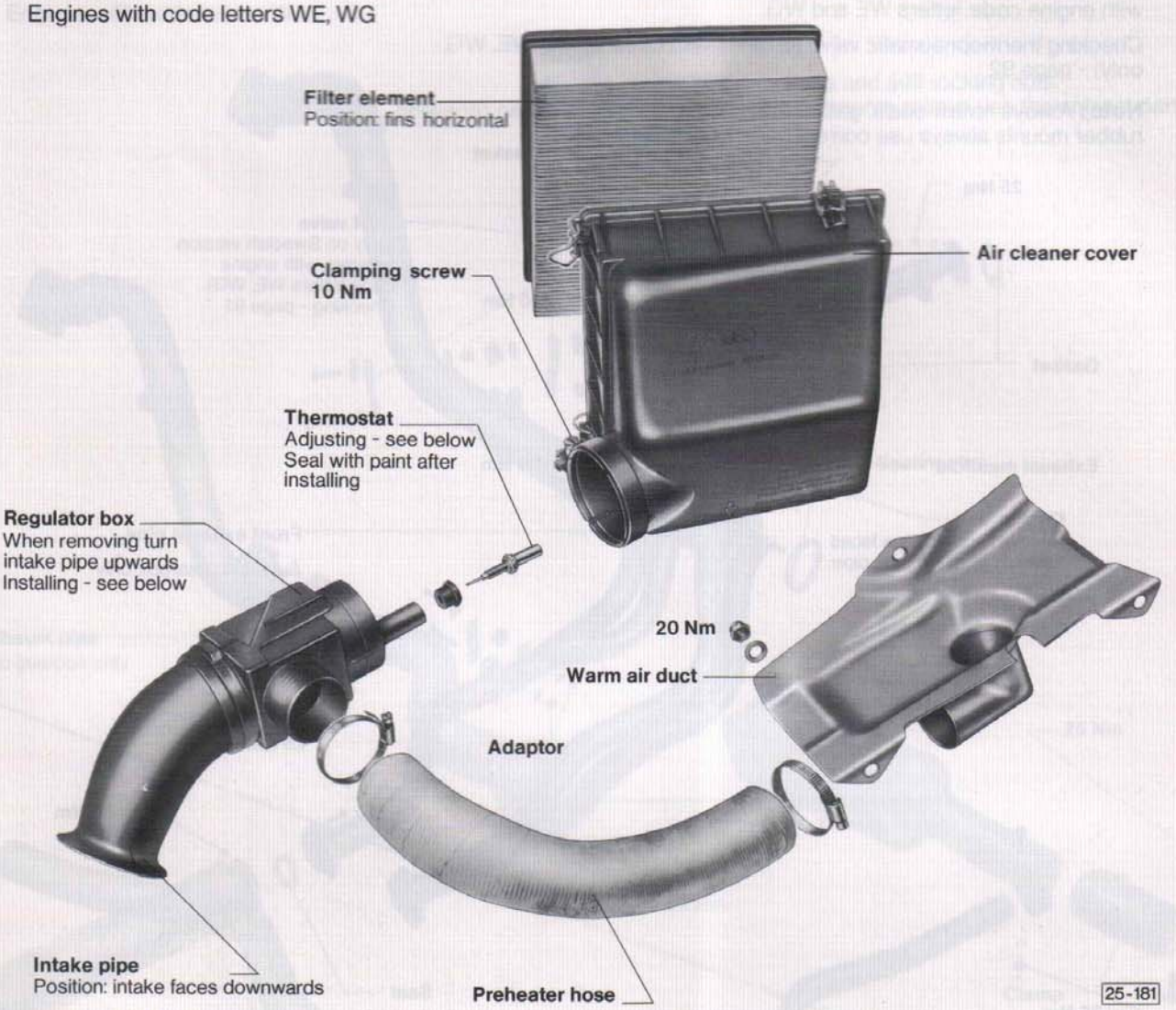
– Adjust throttle cable by pushing clip into appropriate retaining groove (accelerator pedal remains in idle position).

Checking adjustment:

With accelerator pedal at full throttle position there must be a clearance of not more than 1 mm between throttle lever and stop.

DISMANTLING AND ASSEMBLING AIR CLEANER/INTAKE AIR PREHEATING

Engines with code letters WE, WG



INSTALLING REGULATOR BOX

Engine with code letters WE, WG

Fit regulator box in air cleaner cover. Turn intake pipe downwards.

Rib –A– on regulator box must align with groove –B– on air cleaner cover.

ADJUSTING THERMOSTAT

Engines with code letters WE, WG

Screw new thermostat about 3 turns into adaptor. Screw adaptor into regulator box.

Hold thermostat in warm water (20° C) for about 2 minutes. Screw thermostat in until regulator flap just closes off cold air intake. Seal thermostat with paint.

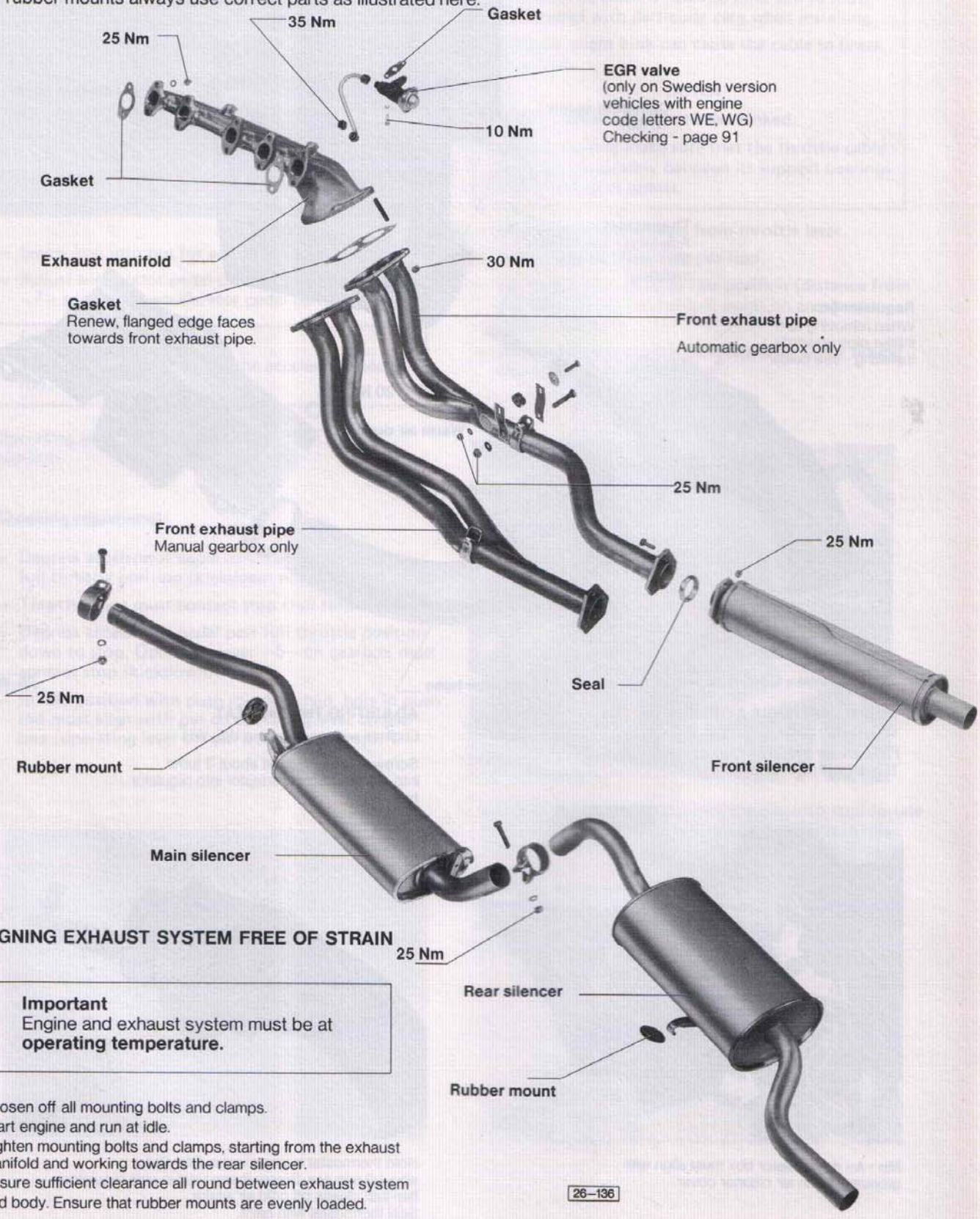
26 Exhaust system

REMOVING AND INSTALLING EXHAUST SYSTEM COMPONENTS

On engines with code letters WC and Swedish version vehicles with engine code letters WE and WG.

Checking thermopneumatic valve (engines with code letters WE, WG only) - page 92

Note : Always renew seals, gaskets and self-locking nuts. When renewing rubber mounts always use correct parts as illustrated here.



ALIGNING EXHAUST SYSTEM FREE OF STRAIN

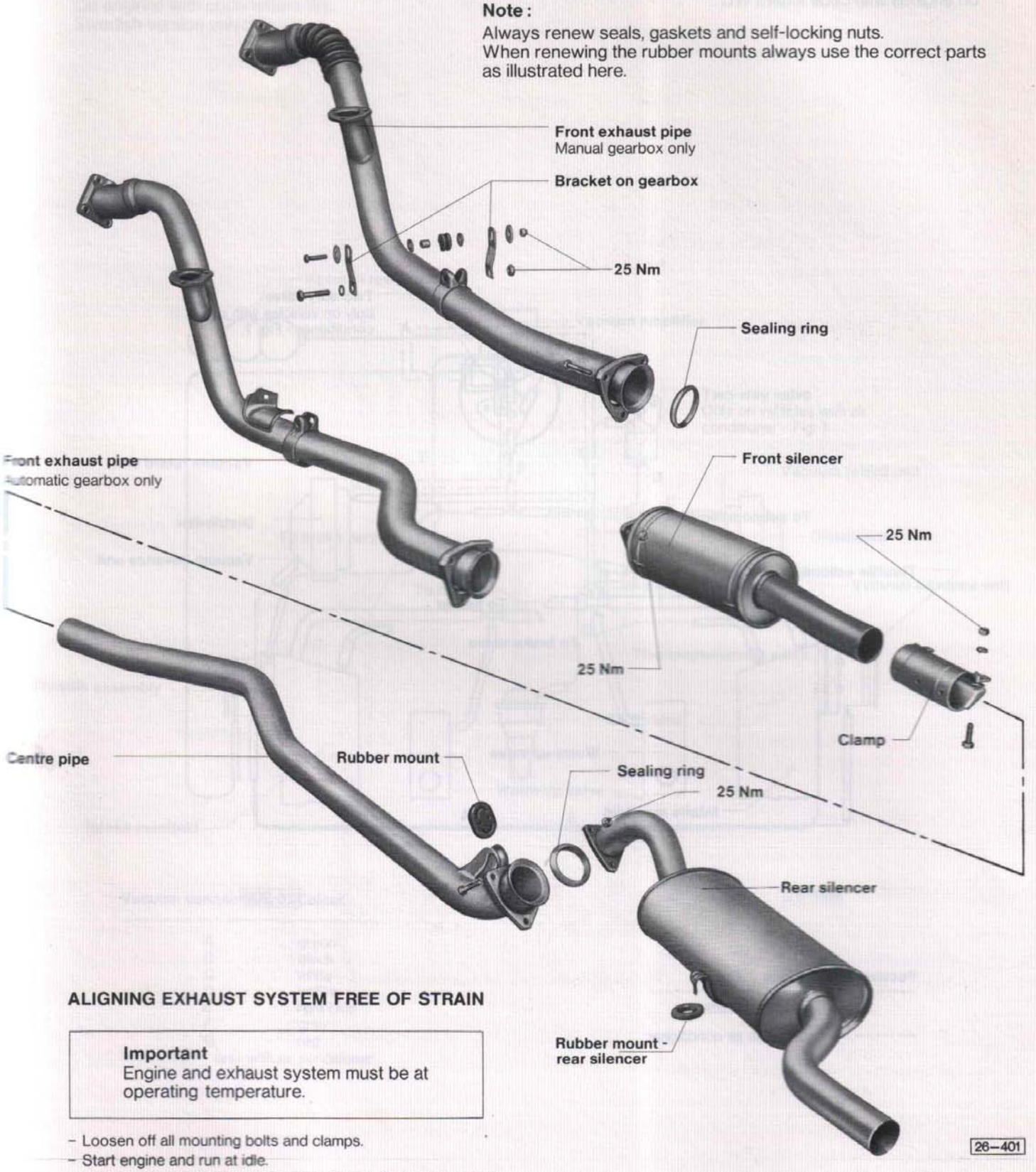
Important
Engine and exhaust system must be at **operating temperature.**

- Loosen off all mounting bolts and clamps.
- Start engine and run at idle.
- Tighten mounting bolts and clamps, starting from the exhaust manifold and working towards the rear silencer.
- Ensure sufficient clearance all round between exhaust system and body. Ensure that rubber mounts are evenly loaded.

REMOVING AND INSTALLING EXHAUST SYSTEM COMPONENTS

Engines with code letters WJ

Note :
Always renew seals, gaskets and self-locking nuts.
When renewing the rubber mounts always use the correct parts as illustrated here.

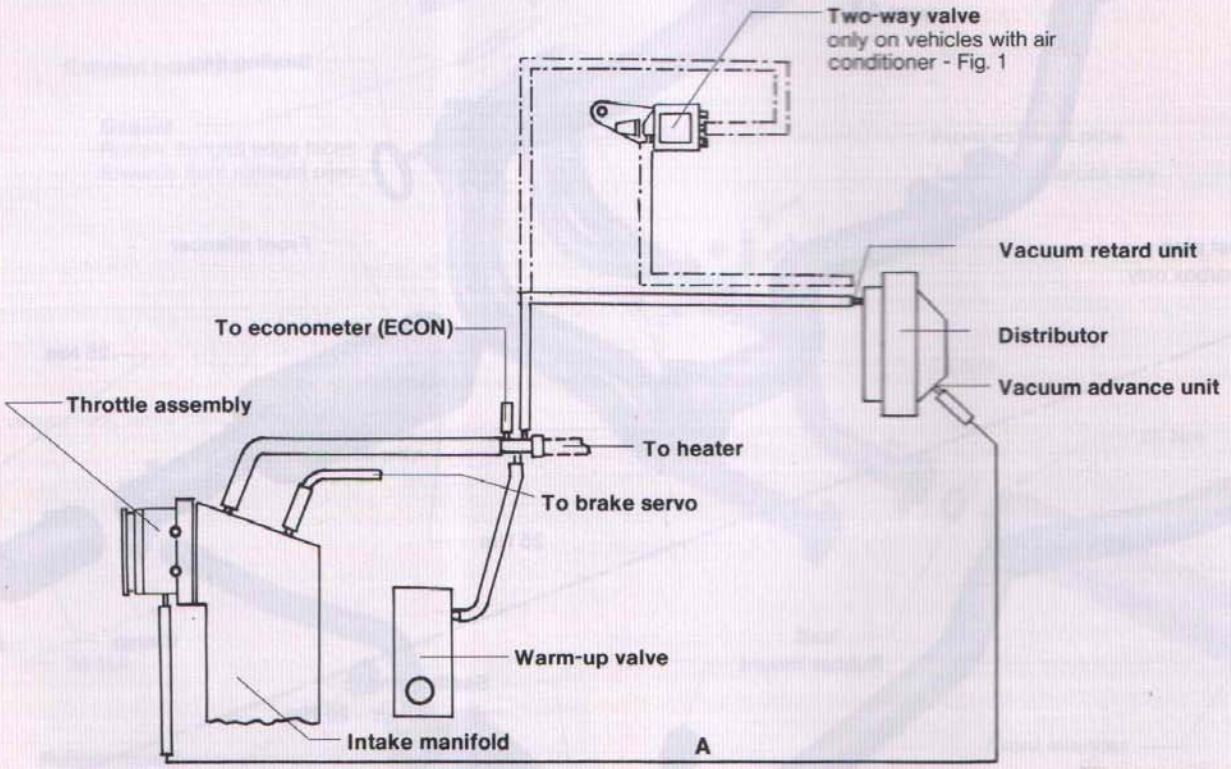


ALIGNING EXHAUST SYSTEM FREE OF STRAIN

Important
Engine and exhaust system must be at operating temperature.

- Loosen off all mounting bolts and clamps.
- Start engine and run at idle.
- Tighten mounting bolts and clamps, starting from the exhaust manifold and working towards the rear silencer.
  Ensure sufficient clearance all round between exhaust system and body. Ensure that rubber mounts are evenly loaded.

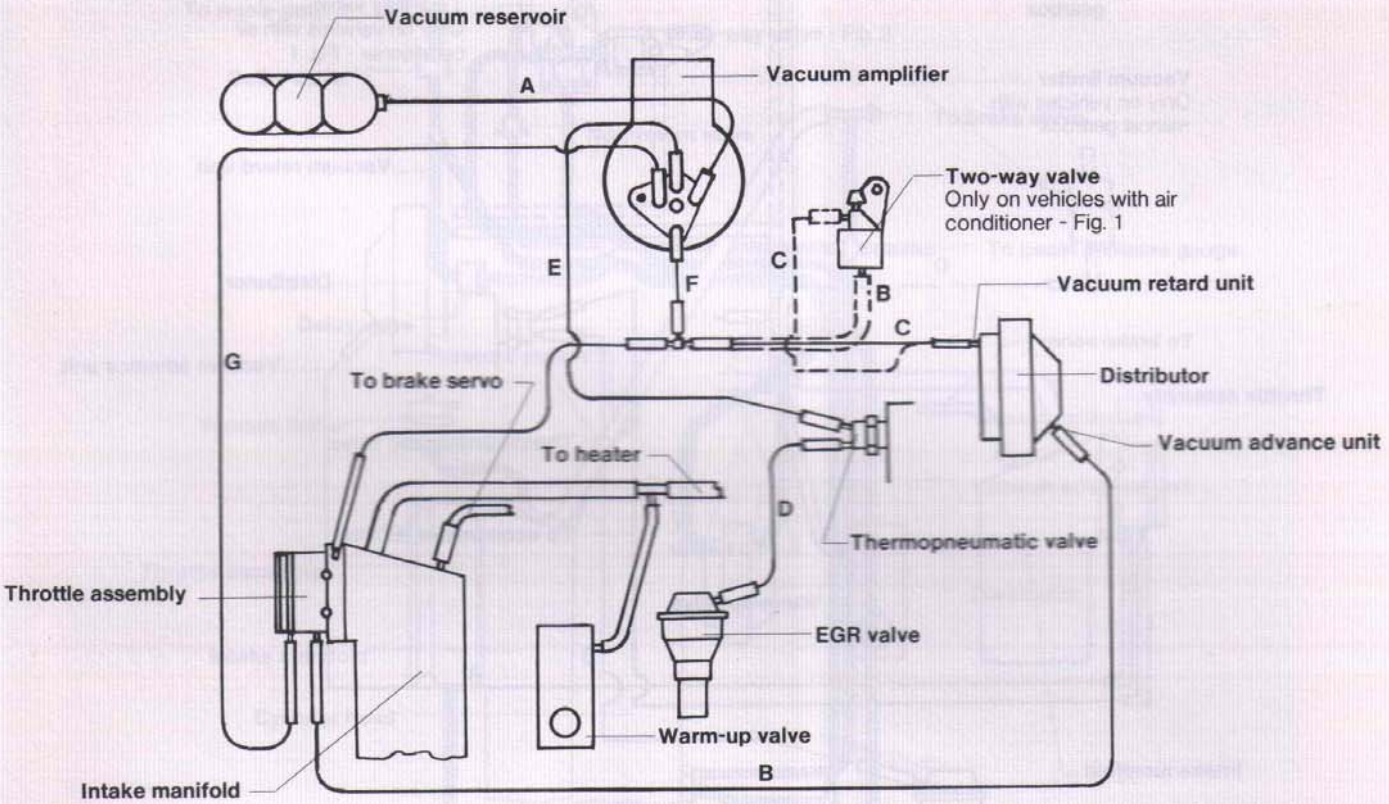
VACUUM CONNECTIONS
on engines with code letters WC



Vacuum connections	Colour
A	black
---.---.---.---	only with air conditioner

VACUUM CONNECTIONS

On engines with code letters WE
Swedish version vehicles

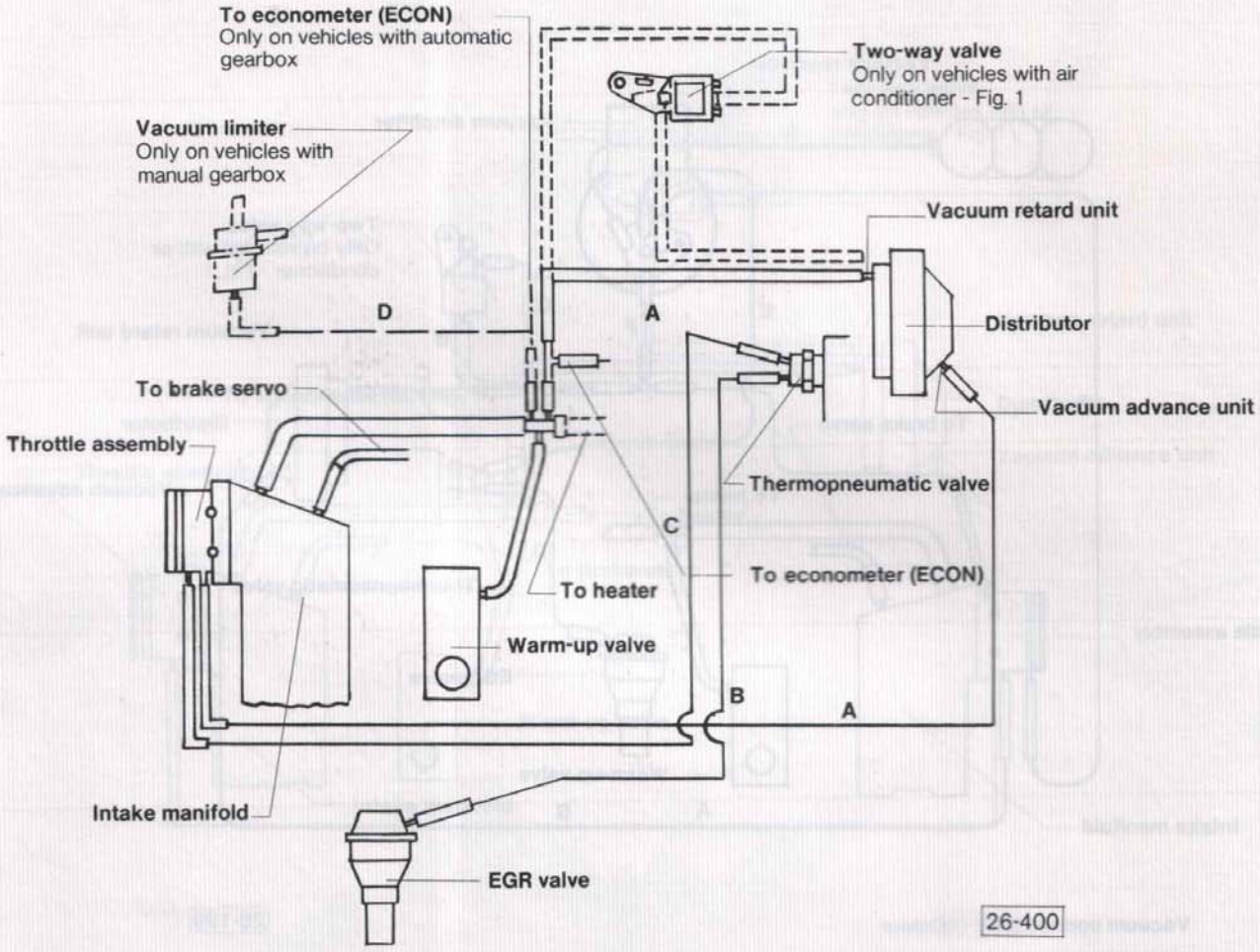


26-199

Vacuum connections	Colour
A	green
B	black
C	white
D	yellow
E	light blue
F	grey
G	red
---,---,---,---	only with air conditioner

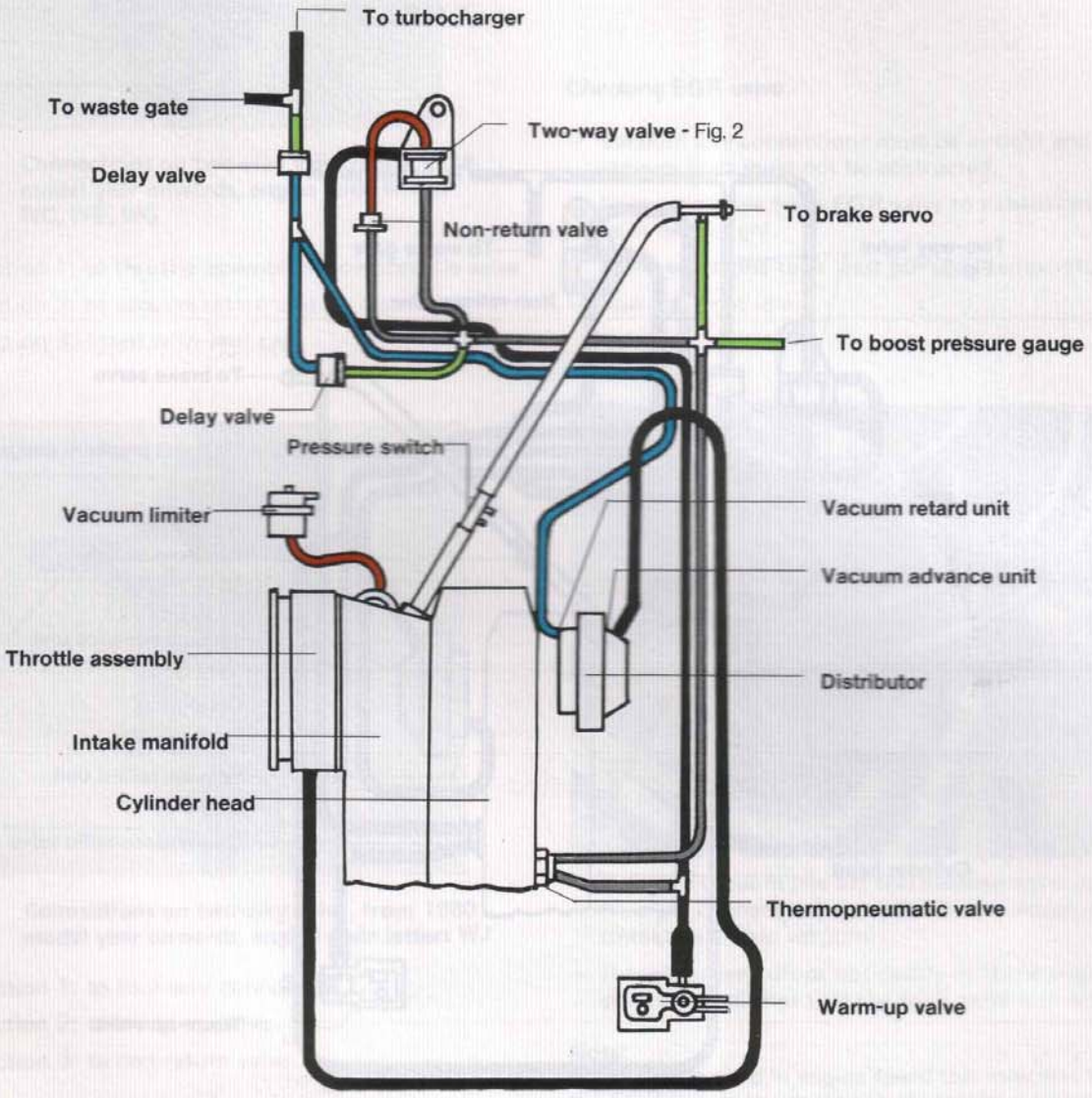
VACUUM CONNECTIONS

on engines with code letters WG
Swedish version vehicles



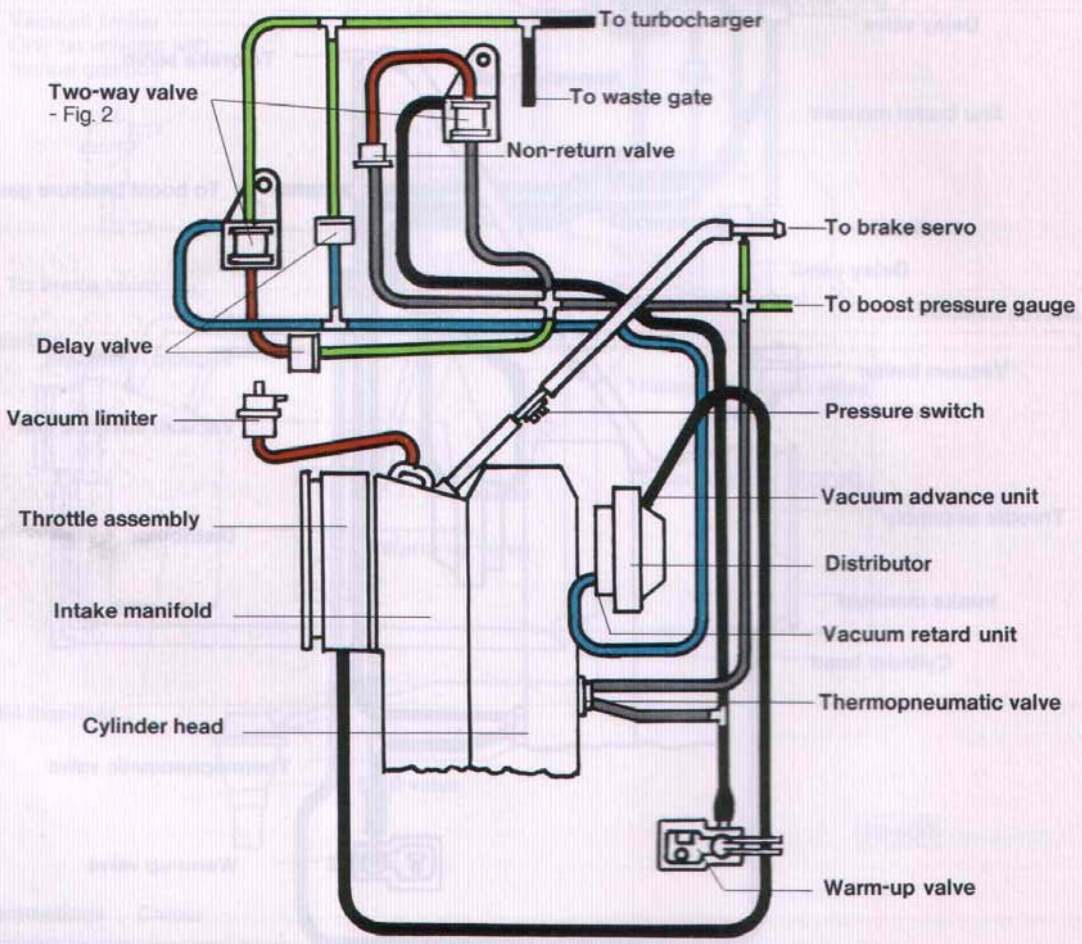
Vacuum connections	Colour
A	black
B	yellow
C	light blue
D	white
═ ═══ ═	only with air conditioner

VACUUM CONNECTIONS
on engines with code letters WJ
Vehicles without air conditioner



VACUUM CONNECTIONS

on engines with code letters WJ
Vehicles with air conditioner



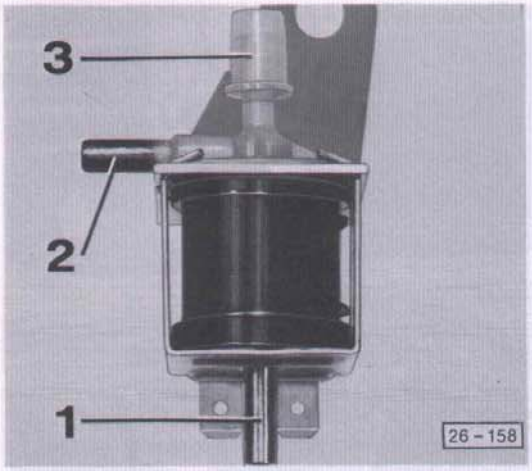


Fig. 1: Connections on two-way valve, from 1978 model year onwards, engine code letters WC, WE, WG

Connection 1: to throttle assembly below throttle valve

Connection 2: to vacuum retard unit on distributor

Connection 3: fitted with vent cap.

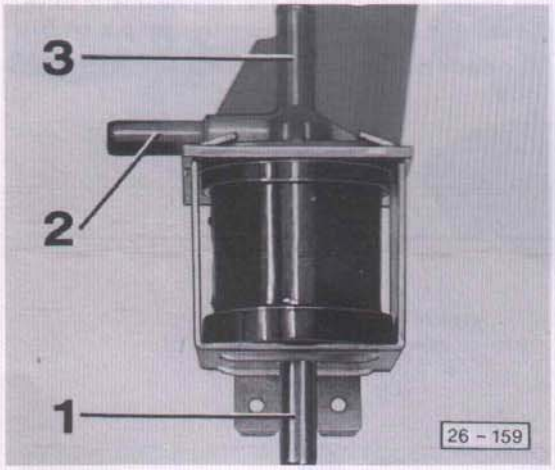


Fig. 2: Connections on two-way valve, from 1980 model year onwards, engine code letters WJ

Connection 1: to four-way connector

Connection 2: to warm-up valve

Connection 3: to non-return valve

Vehicles with air conditioner have two two-way valves, see vacuum connections – page 90.

CHECKING EXHAUST GAS RECIRCULATION

Engines with code letters WE, WG

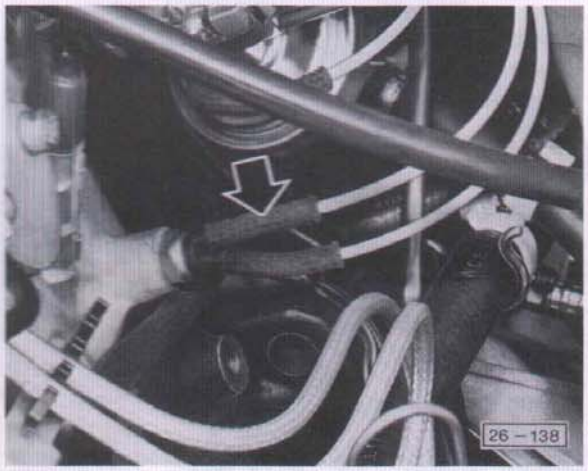
Operation

To minimise the NO_x content (oxides of nitrogen) in the exhaust, exhaust gas is recirculated into the intake air in the part throttle range when the engine is warm.

At temperatures above approx. 61°C exhaust gases are recirculated continuously except when idling or at full throttle. Below approx. 45°C a thermopneumatic valve interrupts the vacuum and the EGR valve closes.

Checking EGR valve

- Vacuum line connections must be airtight and vacuum lines must not be obstructed.
- Connecting line from EGR valve to exhaust manifold must be gastight.
- Warm up engine to at least 50°C oil temperature.
- Run engine at idle.



- Pull grey vacuum line off thermopneumatic valve (straight connection) and push it onto adaptor (intake manifold vacuum).
- If engine speed drops noticeably or if the engine stalls this indicates that the EGR valve is in order.

Note:
If there is no drop in engine speed this indicates that the EGR line or the drilling in the intake manifold are blocked, or that the EGR valve is defective and must be renewed.

CHECKING THERMOPNEUMATIC VALVE

Engines with code letters WE, WG

Pull vacuum line off angled connection on thermopneumatic valve.

– Pull vacuum line off EGR valve and blow through with the mouth.

o Valve must be closed below approx. +45°C,

o valve must be open above approx. +61°C.

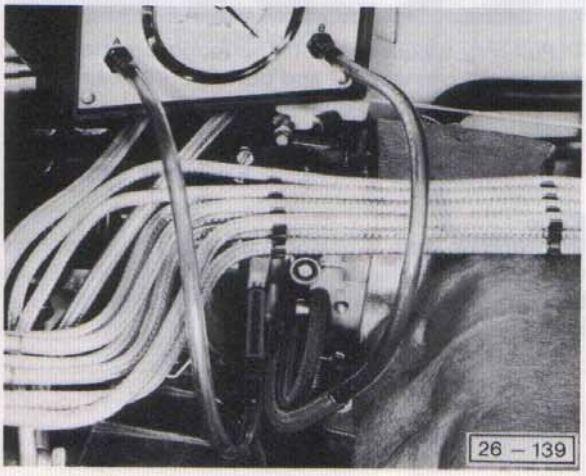
If necessary, remove thermopneumatic valve and put it in hot or cold water.

CHECKING VACUUM AMPLIFIER

Engines with code letters WE, WG

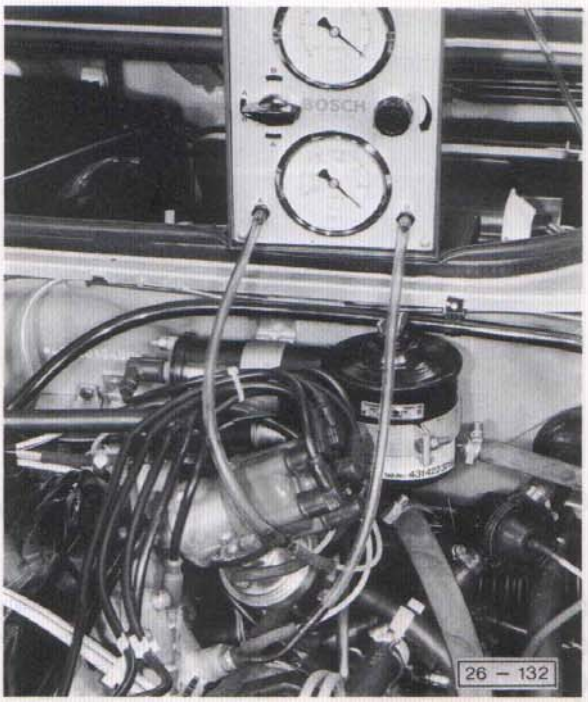
– Engine warm.

– Run engine at idle.



– Connect vacuum gauge between vacuum amplifier and throttle assembly (connection above throttle valve). Set vacuum gauge for vacuum throughput (A.B).

Specified reading: approx. 15 mbar

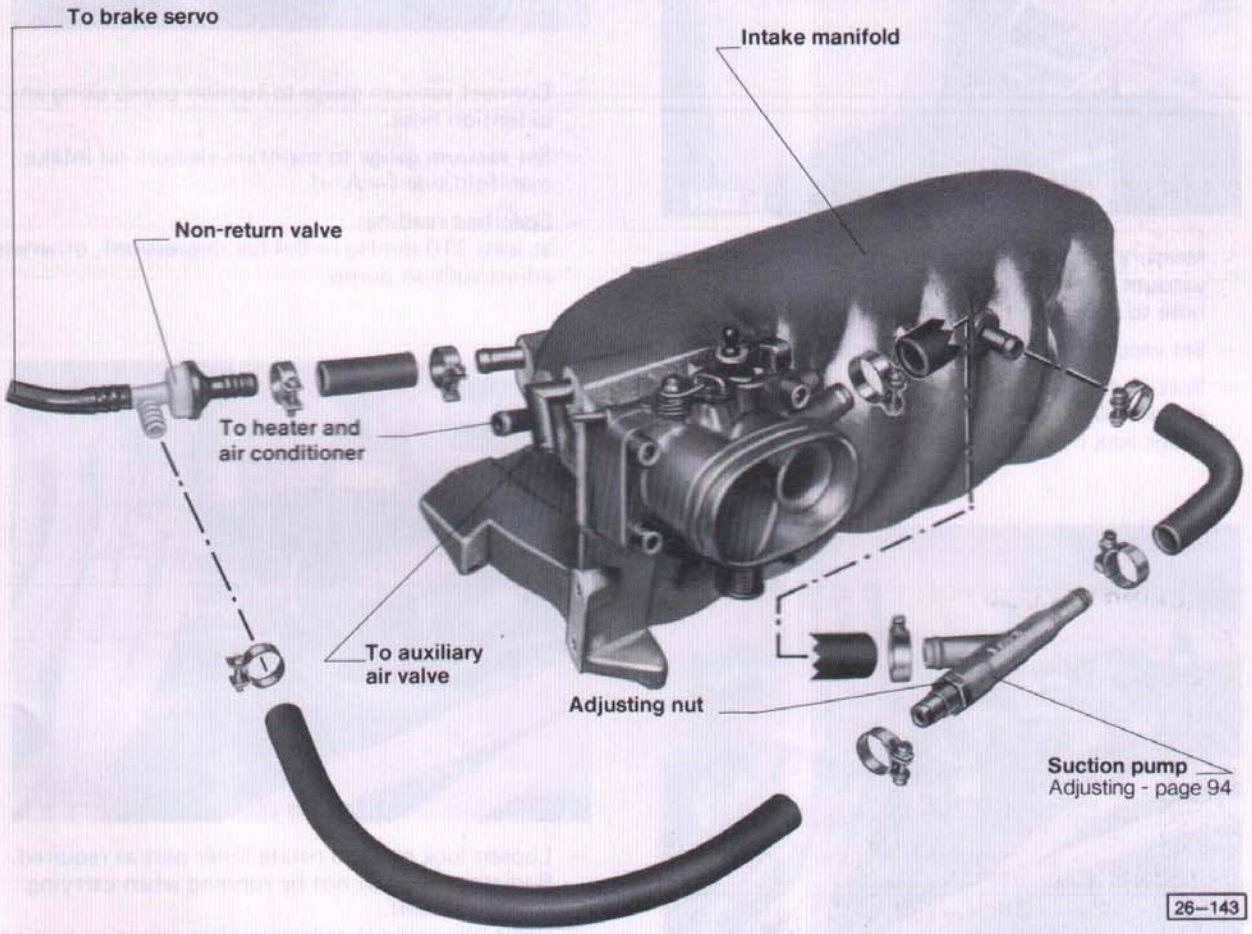


– Connect vacuum gauge between vacuum amplifier and angled connector on thermopneumatic valve. Set vacuum gauge for vacuum throughput (A.B).

Specified reading: approx. 50–90 mbar

VACUUM CONNECTIONS - SUCTION PUMP

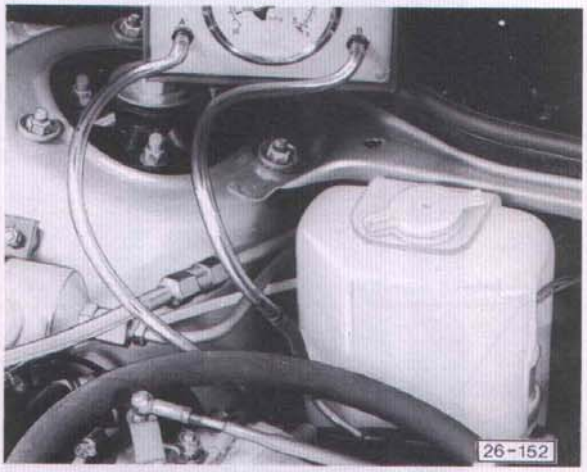
- 1978 model year -
From 1979 model year onwards suction pump is not adjustable



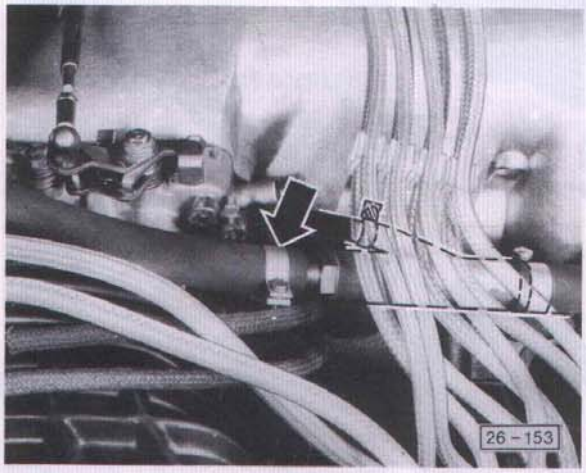
ADJUSTING SUCTION PUMP

Up to and including 1978 model year

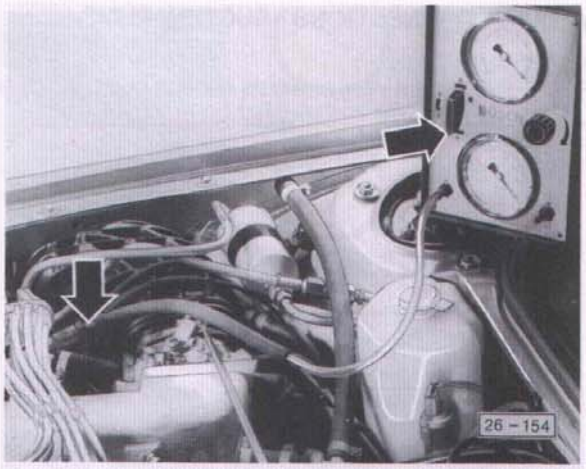
- Engine oil temperature at least 50°C.
- Start engine and run at idle.



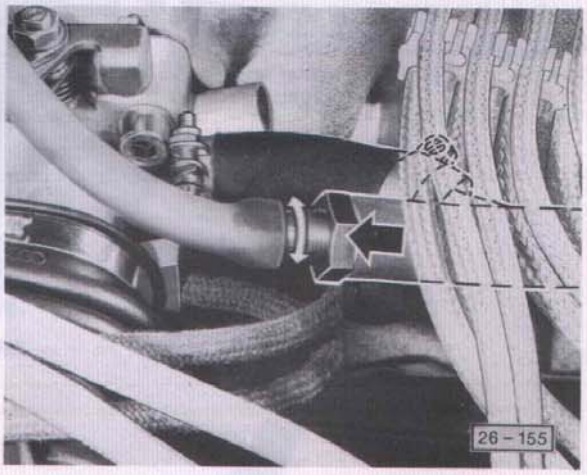
- Measure vacuum at intake manifold by connecting vacuum gauge between intake manifold and vacuum hose to retard unit on distributor.
- Set vacuum gauge to vacuum throughput (A.B).
- Specified reading:
  at least 200 mmHg (= 0.25 bar depression, otherwise repair leak in induction system).



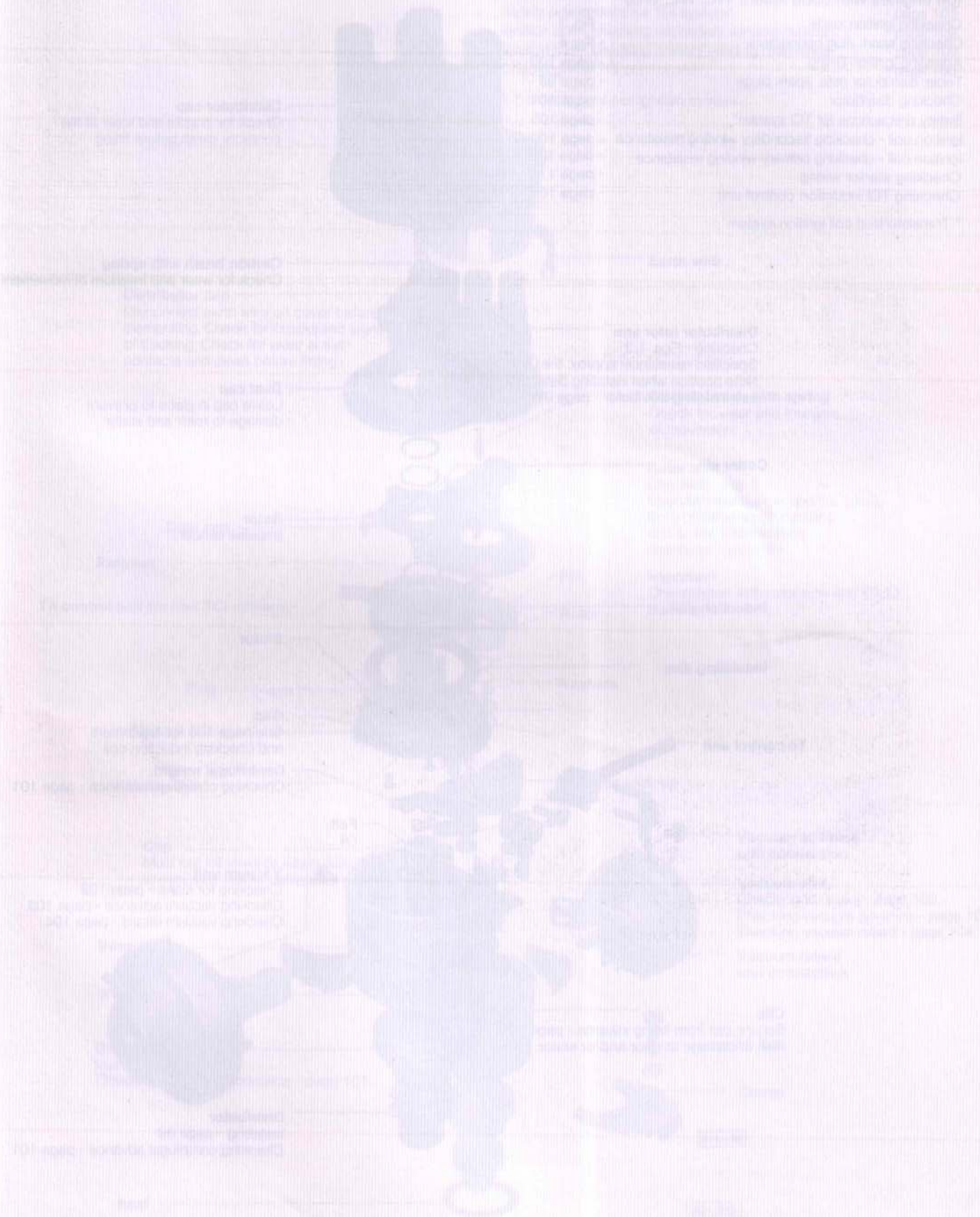
- Pull hose to brake servo off suction pump and plug hose.



- Connect vacuum gauge to suction pump using an extension hose.
- Set vacuum gauge to maintain vacuum on intake manifold side (– A –).
- Specified reading:
  at least 310 mmHg (= 0.4 bar depression), otherwise adjust suction pump.



- Loosen lock nut and rotate inner part as required. Radiator fan must not be running when carrying out adjustment.
  Reset idle speed if necessary after adjusting suction pump.

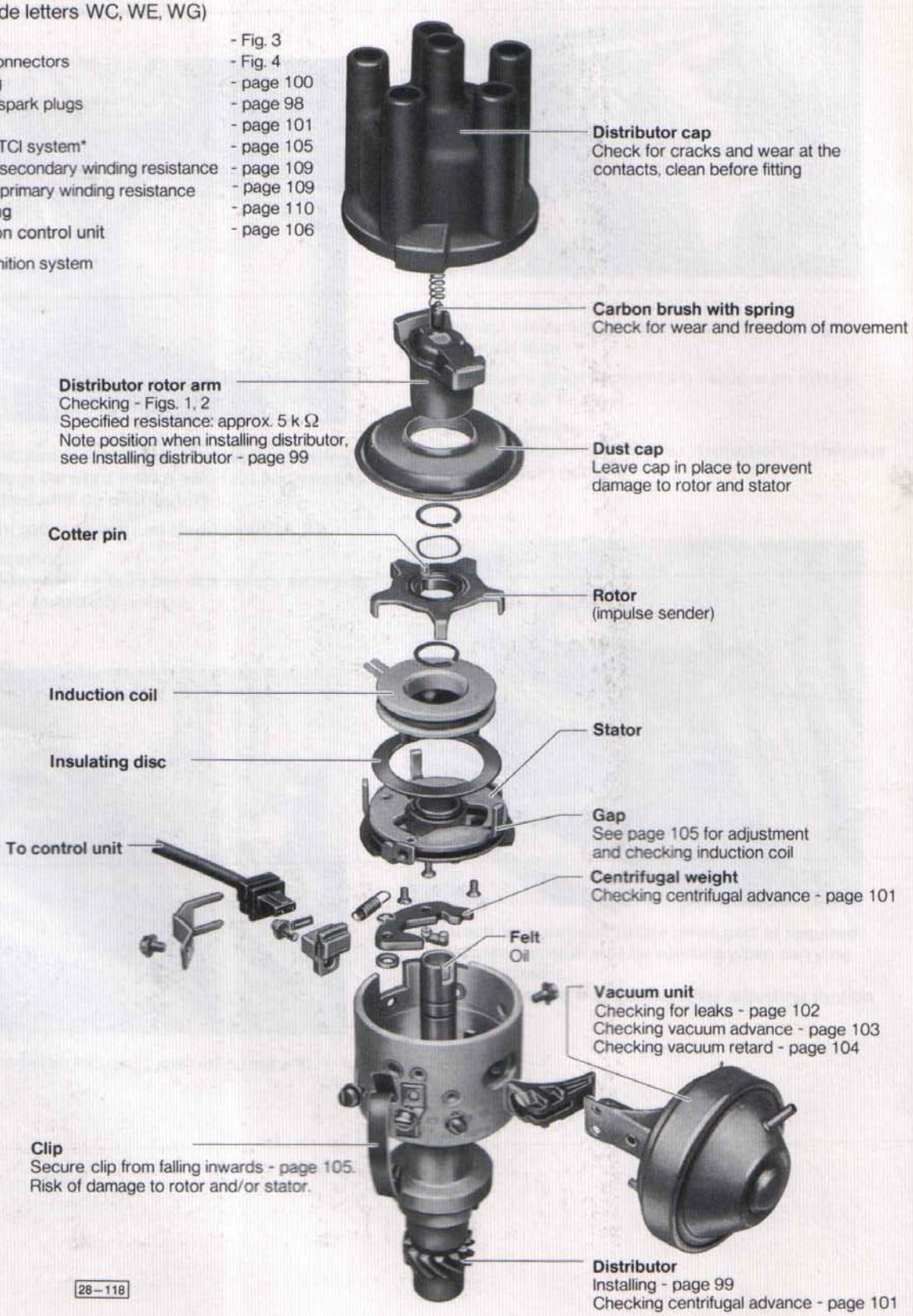


REPAIRING IGNITION SYSTEM

Distributor with induction sender
(on engines with code letters WC, WE, WG)

Checking ignition leads	- Fig. 3
Checking spark plug connectors	- Fig. 4
Adjusting ignition timing	- page 100
Table: distributor data, spark plugs	- page 98
Checking distributor	- page 101
Safety precautions for TCI system*	- page 105
Ignition coil - checking secondary winding resistance	- page 109
Ignition coil - checking primary winding resistance	- page 109
Checking starter wiring	- page 110
Checking TCI induction control unit	- page 106

* Transistorized coil ignition system

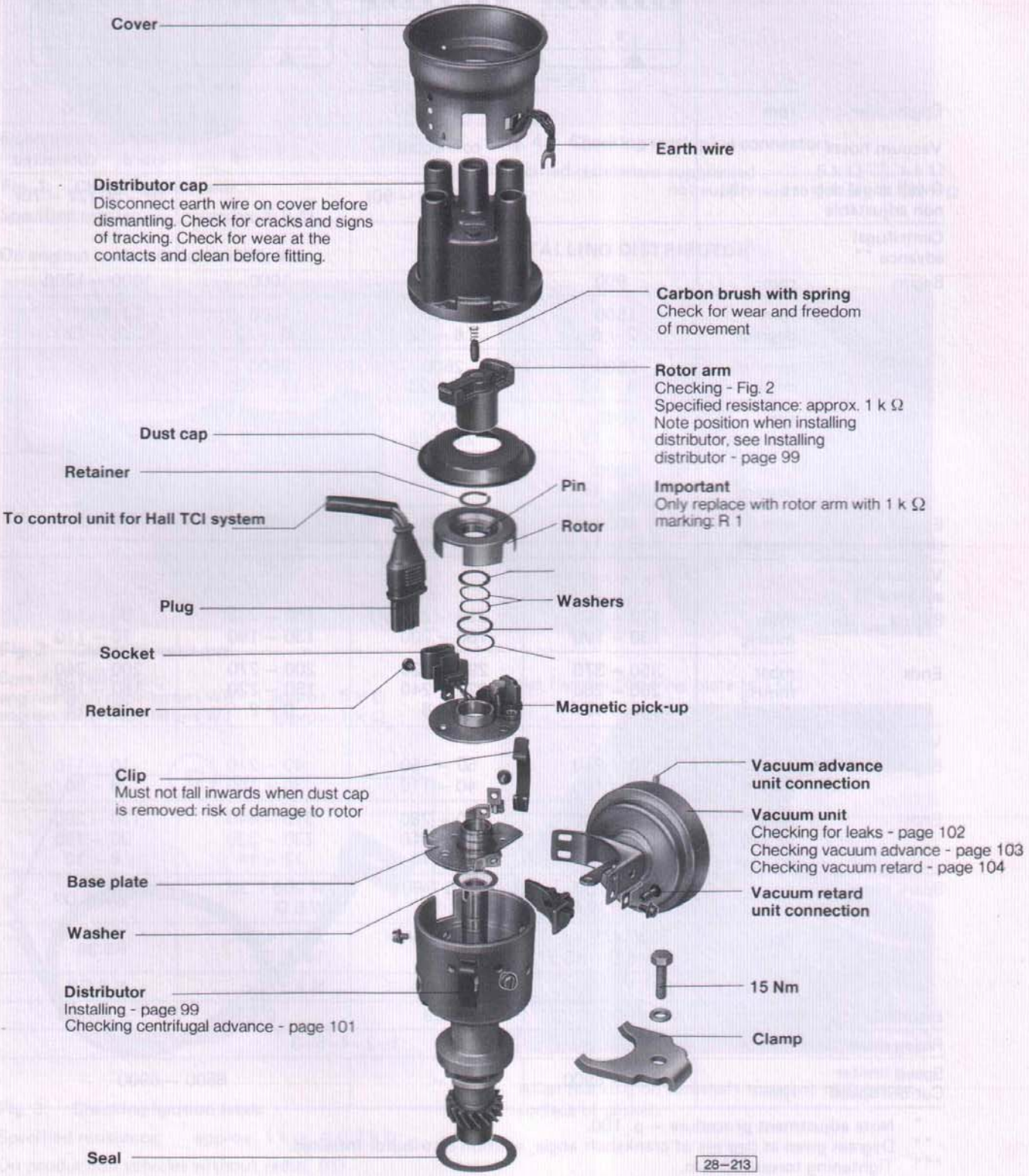


REPAIRING IGNITION SYSTEM

Repairing distributor with Hall generator (on engines with code letters WJ)

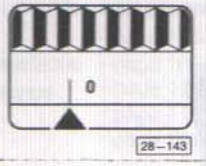
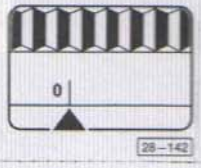
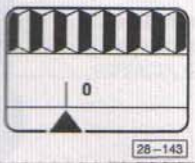
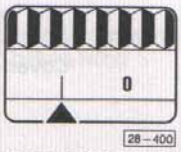
Checking ignition leads	- Fig. 3
Checking spark plug connectors	- Fig. 4
Adjusting ignition timing	- page 100
Table: distributor data, spark plugs	- page 98
Checking distributor	- page 101
Safety precautions for TCI system*	- page 105
Ignition coil - checking secondary winding resistance	- page 109
Ignition coil - checking primary winding resistance	- page 109
Checking Hall TCI control unit	- page 108

* Transistorized coil ignition system



28 Ignition system

TECHNICAL DATA – DISTRIBUTOR, SPARK PLUGS

Engine code letters		WC	WE	WG	WJ
Gearbox version		manual / automatic			
Distributor	Part No.	035 905 205	035 905 205 B	035 905 205 C	035 905 205 F
Ignition timing *		Up to '79: 5° btdc from '80: 6° btdc	3° after tdc	5° btdc	21° btdc
Marking		 28-143	 28-142	 28-143	 28-400
Engine speed	rpm	900 ± 50			3000
Vacuum hoses		connected			advance: disconnected retard: connected
Dwell angle degrees (%) non adjustable		43 – 65 (62 – 90)			15 – 50 (22 – 70)
Centrifugal advance **					
Begins	rpm	900	1000	1000	1000 – 1200
	rpm degrees	1500 2 – 6	1600 6 – 12	1600 6 – 12	1500 6 – 12
	rpm degrees	2500 9 – 13	2500 17 – 23	2500 17 – 23	– –
	rpm degrees	4000 11 – 15	3000 22 – 26	3000 22 – 26	– –
	rpm degrees	5000 10 – 14	– –	– –	– –
End of check	rpm degrees	6000 12 – 17	4500 21 – 25	4500 21 – 25	2200 13 – 17
Vacuum advance **					
Begins	mbar mmHg	170 – 260 130 – 190	210 – 260 160 – 200	180 – 245 130 – 190	90 – 140 70 – 110
Ends	mbar mmHg degrees	350 – 370 260 – 280 8 – 12	290 – 320 220 – 240 4 – 8	200 – 270 150 – 220 0 – 2	200 – 240 150 – 180 10 – 14
Vacuum retard **					
Begins	mbar mmHg	80 – 210 60 – 160	50 – 150 40 – 110	40 – 210 30 – 160	10 – 110 8 – 80
Ends	mbar mmHg degrees	300 – 430 230 – 320 12 – 14	190 – 280 140 – 210 8 – 10	310 – 440 230 – 330 12 – 14	120 – 200 90 – 150 8 – 10
Spark plugs ***	Bosch	W 200 T 30 W 6 D / W 6 DC	W 175 T 30 W 7 C	W 200 T 30 W 6 D	WR 5 DS
	Beru	200/14/3 A 14–6 D / RS 37	175/14/3 A 14–7 D	200/14/3 A 14–6 D	RS 39
	Champion	N 7 Y	N 8 Y	N 7 Y	N 6 GY
Electrode gap	mm	0.7	0.9	0.7	0.8 + 0.1
Firing order		1–2–4–5–3			
Speed limiter Cut-out speed	rpm	6500 – 6900	–	6500 – 6900	

* Note adjustment procedure – p. 100.
** Degrees given as degrees of crankshaft angle, ignition distributor installed.
*** Tightening torque 30 Nm.

On engines with code letters WC, WG

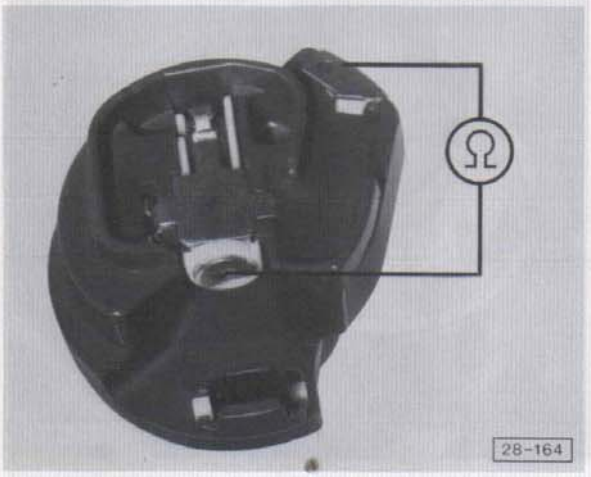


Fig. 1: Checking rotor arm

Specified resistance: approx. 5 k Ω

On engines with code letters WE, WJ

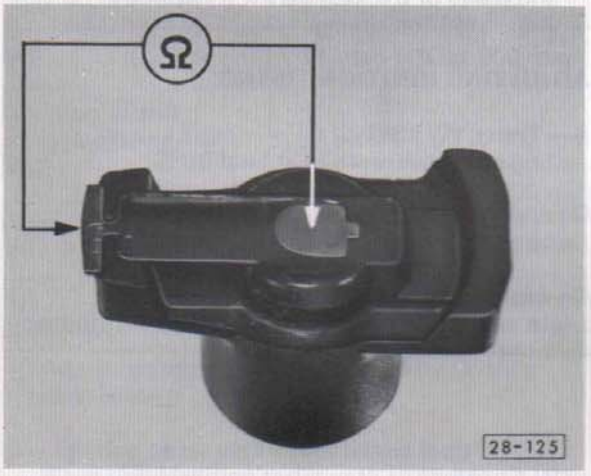


Fig. 2 Checking rotor arm

Specified resistance:
engines with code letters WE approx. 5 k Ω
engines with code letters WJ approx. 1 k Ω

Fig. 3: Checking ignition leads

Specified resistance: approx. 1 k Ω ± 0.2 k Ω

On production vehicles without radio: 0 Ω

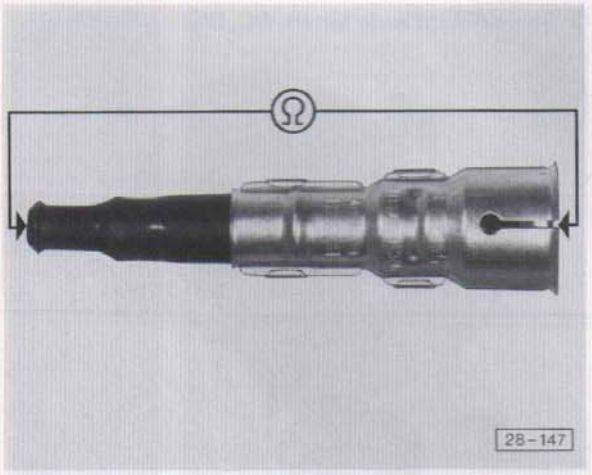
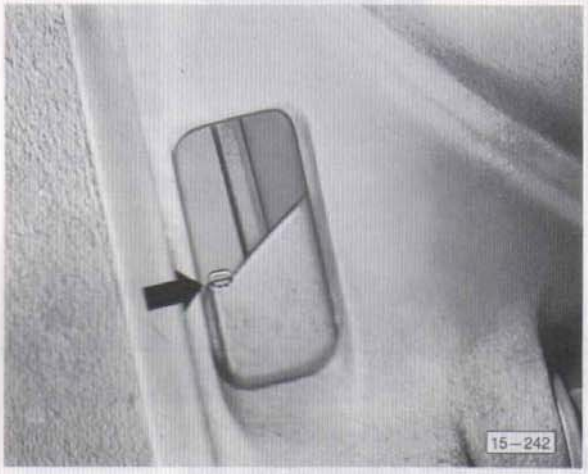


Fig. 4: Checking spark plug connectors

Specified resistance: suppressed 5 k Ω ± 1 k Ω
not suppressed 1 k Ω ± 0.2 k Ω

INSTALLING DISTRIBUTOR



– Set flywheel or drive plate to TDC

– Align marking on camshaft sprocket with upper surface of gasket.

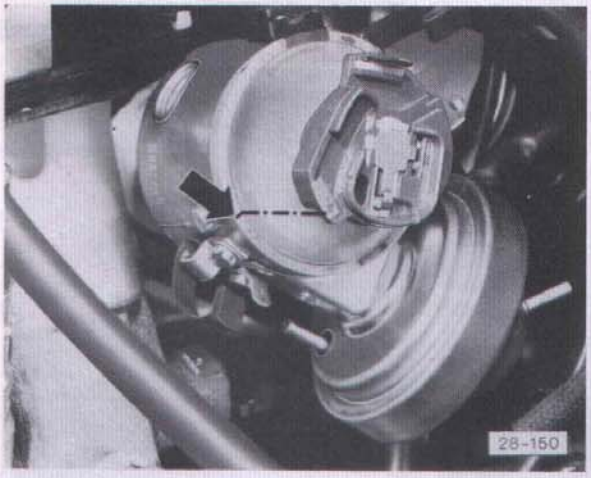
On engines with code letters WC, WG

– Align rotor arm as shown.

On engines with code letters WE, WJ

– Align rotor arm as shown.

On engines with code letters WC, WG



– Install distributor. With the distributor in place the rotor arm must point to the marking for no. 1 cylinder on the distributor housing. If necessary rotate distributor and then clamp in position.
– Clean distributor cap before fitting, check for cracks and traces of tracking, renew if necessary.
– Adjust ignition timing.

On engines with code letters WE, WJ

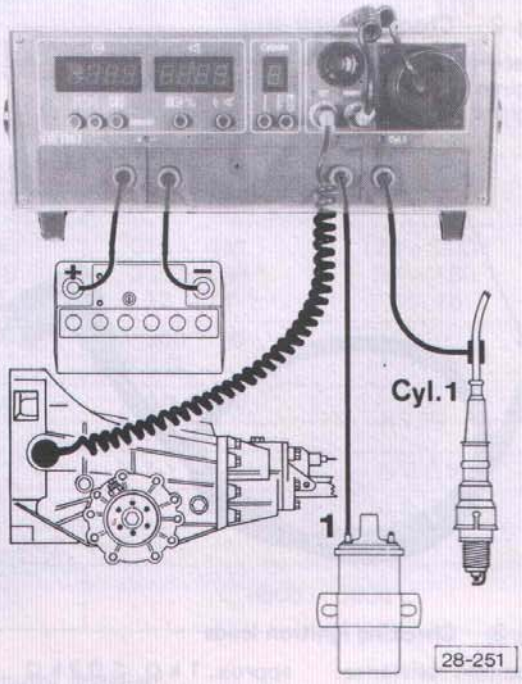
– Install distributor. With the distributor in place the rotor arm must point to the marking for no. 1 cylinder on the distributor housing. If necessary rotate distributor and then clamp in position.
– Clean distributor cap before fitting, check for cracks and traces of tracking, renew if necessary.
– Adjust ignition timing.

ADJUSTING IGNITION TIMING

a – Tester VW 1367
– Engine oil temperature at least 30°C.

On engines with code letters WC, WE, WG
Leave vacuum hoses connected on distributor.

On engines with code letters WJ
Leave vacuum retard hose connected on distributor, disconnect vacuum advance hose.



– Connect tester according to operating instructions.

Note:
Use adaptor for connection to terminal 1 on ignition coil.

> **Important**
> Make sure that the TDC sender is pusned fully home in the gearbox housing.

Note:
On vehicles with air conditioner connect the positive connection of the tester to fuse no. 10, 11 (for brake lights). Switch off the air conditioner (press ECON button).

– Start engine and run at idle, or increase rpm: specifications – page 68.

Note:

The ignition timing is indicated directly on the tester; it is not necessary to flash the timing notch.

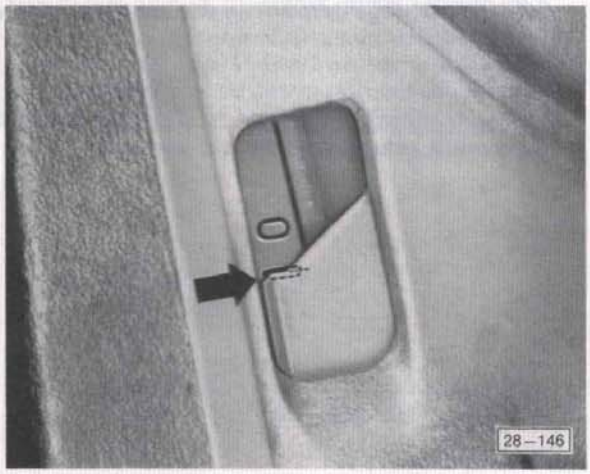
Specified timing settings:

Engine code letters		Ignition timing	
		Manual	Auto
WE		3° after TDC at 900 rpm	
WC	up to and including 1979	5° before TDC at 900 rpm	
	from 1980	6° before TDC at 900 rpm	
WG		5° before TDC at 900 rpm	
WJ		21° before TDC at 3000 rpm	

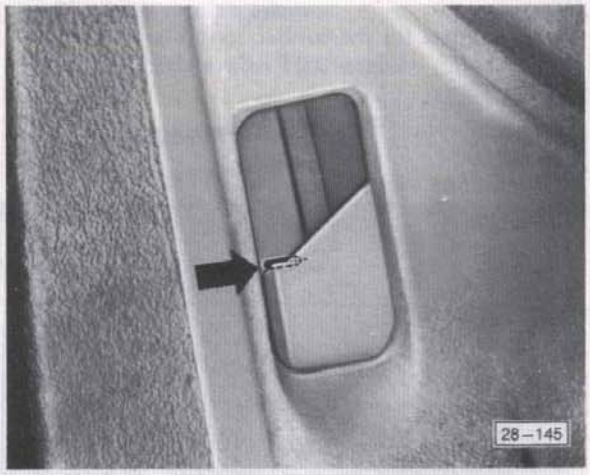
– Adjust ignition timing as required by rotating distributor.

b – Ignition tester with stroboscopic lamp

– When using ignition tester with stroboscopic lamp, flash timing notch:



– On engines with code letters WC/WG.
– The timing notch must be in line with the reference edge on the bellhousing: rotate distributor as required.



On engines with code letters WE, WJ

– The timing notch must be in line with the reference edge on the bellhousing: rotate distributor as required.

Ignition tester with stroboscopic lamp

> **Important**
> When using ignition tester with stroboscopic lamp, flash the timing notch at the different test rpm ("bring the notch back" with the adjuster control).
> Align the timing notch with the reference edge on the bellhousing.

CHECKING DISTRIBUTOR

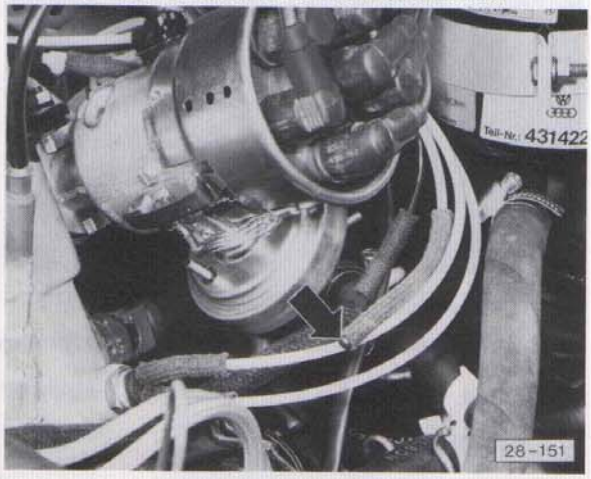
Test procedure with TDC sender

a – Checking centrifugal advance

– Connect tester according to operating instructions.

Note:
Use an adaptor for the connection to terminal 1 on ignition coil.

- Start engine and run at idle.
- Check ignition timing and adjust as required – page 100.
- Disconnect vacuum hoses from distributor.



- Plug vacuum retard hose on intake manifold side.
- Correct the increased engine speed back to idle speed – page 67.

Note:
The ignition timing is indicated directly on the tester. It is not necessary to flash the timing notch.

- Note advance angle indicated on tester (= basic angle).
- Slowly increase engine speed to test rpm for beginning of centrifugal advance – page 98.

Note:
The beginning of centrifugal advance is the point where the reading (degrees) starts to increase.

- Increase engine speed to next test rpm – page 98.
- Read off the advance angle now indicated on the tester.

Note:
To obtain the centrifugal advance angle, subtract the previously noted basic angle from the angle measured last, e.g.

angle measured last:	20°
minus noted basic angle:	14°
centrifugal advance:	6°

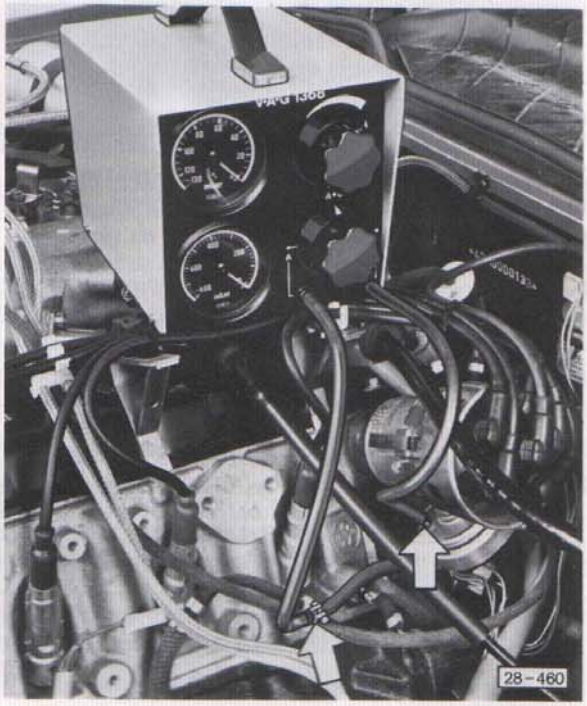
- Compare calculated centrifugal advance with specified value – page 98. Renew distributor if it does not meet specifications.

Note:
The test should be repeated for the other test rpm given in the chart on page 98. If the other distributor tests (described under –b– page 102; –c– page 103; –d– page 104;) are not required, reconnect both vacuum hoses on distributor and adjust idle speed – page 67.

Ignition tester with stroboscopic lamp

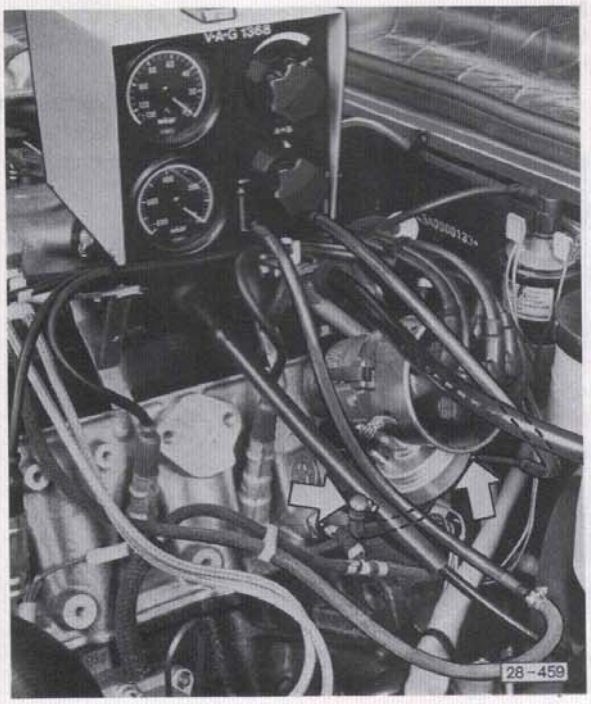
Important
When using ignition tester with stroboscopic lamp, flash the timing notch at the different test steps ("bring the notch back" with the adjuster control). Align the timing notch with the reference edge on the bellhousing.

b – Checking vacuum unit for leaks



- Connect vacuum gauge between intake manifold and vacuum retard unit, and set gauge for vacuum throughput (A.B).
- Start engine and run at idle.
- Detach vacuum hose from vacuum advance unit.
- Set vacuum gauge to maintain vacuum on the vacuum unit side (B).

Note:
The vacuum indicated must not drop by more than 10% in one minute, otherwise renew vacuum unit.



– Connect vacuum gauge between throttle assembly and vacuum advance unit. Set vacuum gauge to vacuum throughput (A.B).
– Disconnect vacuum hose from vacuum retard unit and plug hose on intake manifold side.
– Increase engine speed so that the vacuum indicated on the vacuum gauge is higher than the figure shown for end of vacuum advance – page 98.

Note:
If no vacuum is indicated on the vacuum gauge, this means that the vacuum take-off on the throttle assembly is blocked.

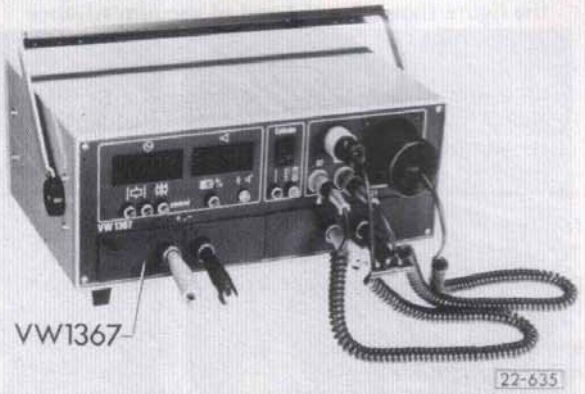
– Set vacuum gauge to maintain vacuum on the vacuum unit side (B).

Note:
The vacuum indicated must not drop by more than 10% in one minute, otherwise renew vacuum unit.

If the other distributor tests (described under –c– page 103; –d– page 104) are not required, reconnect both vacuum hoses to distributor and adjust idle speed – page 67.

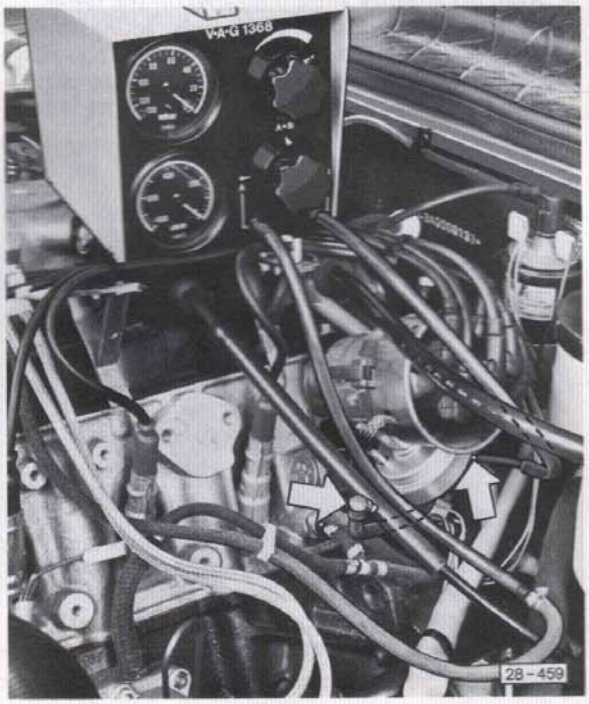
c – Checking vacuum advance

Test procedure with TDC sender



– Connect tester according to operating instructions.

Note:
Use an adaptor for the connection to terminal 1 on ignition coil.



– Connect vacuum gauge between throttle assembly and vacuum advance unit, set vacuum gauge for vacuum throughput (A.B).
– Disconnect vacuum hose from vacuum retard unit and plug hose on intake manifold side.
– Start engine and run at idle.
– Reduce the increased engine speed down to idle speed – page 67.

Note:
The ignition timing is indicated directly on the tester, it is not necessary to flash the timing notch.

– Note advance angle indicated on tester (= basic angle).
– Increase engine speed so that the vacuum indicated on the vacuum gauge is higher than the figure shown for the end of vacuum advance – page 98.
– Set vacuum gauge to maintain vacuum on vacuum unit side (B).
– Adjust vacuum on vacuum gauge to figure given for end of vacuum advance – page 98.
– Read off indicated advance angle.

Note:
To obtain the vacuum advance angle, subtract the previously noted basic angle from the angle measured last, for example

angle measured last:	31°
minus noted basic angle:	19°
vacuum advance:	12°

– Compare calculated value with specification – page 98.
– Adjust vacuum on vacuum gauge to test value for beginning of vacuum advance – page 98.
– Read off advance angle indicated on the tester.
– Calculate vacuum advance (by subtracting noted basic angle from angle measured last).
– Compare calculated vacuum advance angle with specification – page 98. Renew distributor if it does not meet specifications.

Note:
If the other distributor test (described under –d– page 104) is not required, reconnect both vacuum hoses to distributor and adjust idle speed – page 67.

d – Checking vacuum retard

Test procedure with TDC sender

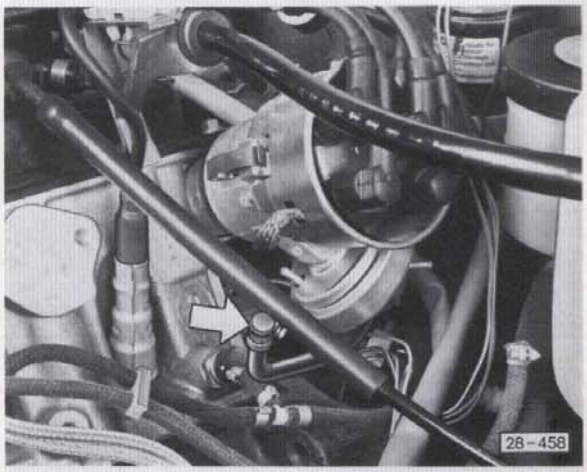
Ignition tester with stroboscopic lamp

Important
When using ignition tester with stroboscopic lamp, flash the timing notch at the different test steps ("bring the notch back" with the adjuster control). Align the timing notch with the reference edge on the bellhousing.

– Connect tester according to operating instructions.

Note:
Use an adaptor for the connection to terminal 1 on ignition coil.

– Disconnect vacuum hose from vacuum advance unit.



– Disconnect vacuum hose from vacuum retard unit and plug hose on intake manifold side.
– Start engine and run at idle.
– Reduce the increased engine speed down to idle speed – page 67.

Note:
The timing is indicated directly on the tester, so it is not necessary to flash the timing notch.

– Read off angle indicated on tester; it must correspond to the value given for the end of vacuum retard – page 98. Renew the distributor if it does not meet specifications.

Note:
After completing distributor tests, reconnect both vacuum hoses on the distributor and adjust idle speed – page 67.

SAFETY PRECAUTIONS FOR TCI IGNITION SYSTEM

When working on vehicles with the Hall TCI system observe the following precautions to prevent injury and/or serious damage to the ignition system:

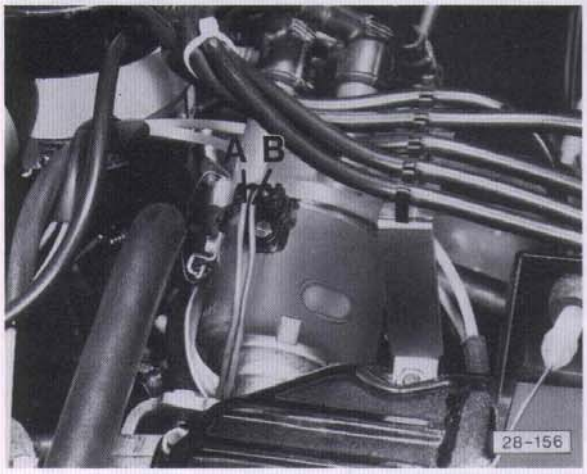
- Do not touch or disconnect ignition leads when the engine is running or being cranked by the starter.
- Always switch off the ignition before disconnecting ignition leads.
- Always switch off the ignition before hooking up or disconnecting test equipment (rpm/ignition tester).
- There can be up to 400 volts on terminal 1 (–); do not connect a suppressor condenser or test lamp to this terminal.
- When the high tension lead (terminal 4) is disconnected from the distributor, always connect it directly to earth using an extension wire, otherwise the engine must not be turned at starter speed (e.g. for testing compression or the TCI control unit).
- A fast charger can only be used to boost starter current for up to 15 seconds at a maximum of 16.5 volts. Wait for at least 1 minute between each starting attempt.
- Do not replace the ignition coil with a conventional type coil.
- Disconnect both sides of the battery before using arc or spot welding equipment.
- If the vehicle is heated to more than 80°C. (e.g. paint drying oven, steam cleaning) wait for it to cool down before starting the engine.
- Switch off the engine before washing it down.
- Do not disconnect the battery when the engine is running.
- The HT circuit must be suppressed with at least 2 k Ω , and the rotor arm must have a resistance of at least 1 k Ω .
- If the ignition system is defective the plug on the Hall TCI control unit must be disconnected before the vehicle is towed.

  If it is not certain whether the ignition system is the cause of the failure, disconnect the plug from the Hall TCI control unit as a precaution before towing the vehicle.

CHECKING DISTRIBUTOR, INDUCTION SENDER

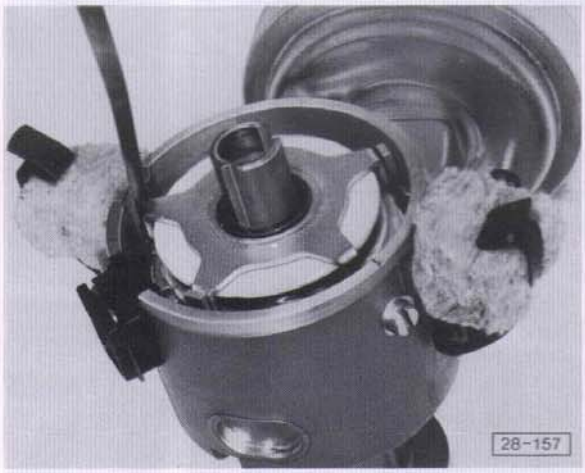
On engines with code letters WC, WE, WG

- Engine cold, ambient temperature not more than 40°C.



- Ensure that distributor is connected correctly

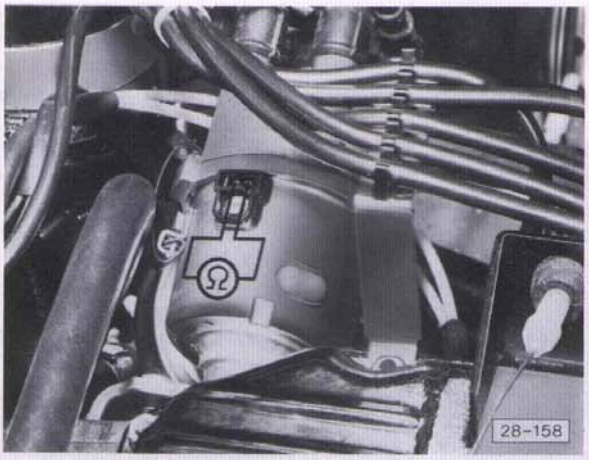
  A = green lead
  B = brown lead
- Check that connecting plug makes good contact (contacts in plug and socket must not be damaged, loose or pushed out of place).



- Check the minimum gap between rotor and stator at all contact lugs.

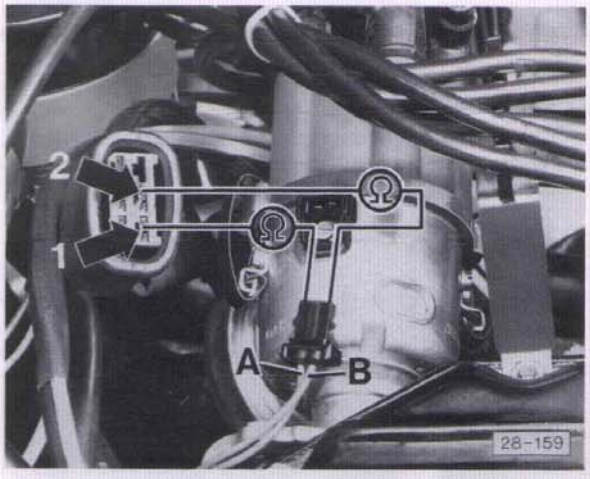
  Specified value: 0.25 mm

  If necessary adjust the gap by aligning the rotor or stator lugs.
- Disconnect plug from distributor.



– Measure resistance of induction coil
Specified value: 890 – 1300 Ω
Renew distributor if resistance is not correct.

– Disconnect plug from control unit.



– Check continuity between connection –1– on control unit and connection –A– on distributor, and between connection –2– on control unit and connection –B– on distributor.

Specified value: 0 Ω
Renew distributor if resistance is not correct.

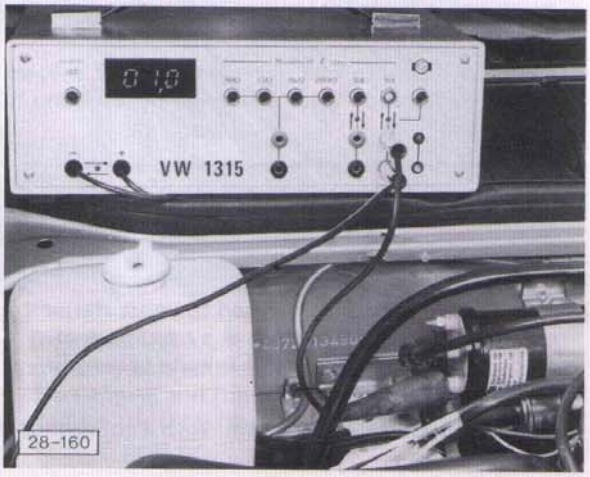
CHECKING TCI INDUCTION CONTROL UNIT

On engines with code letters WC, WE, WG

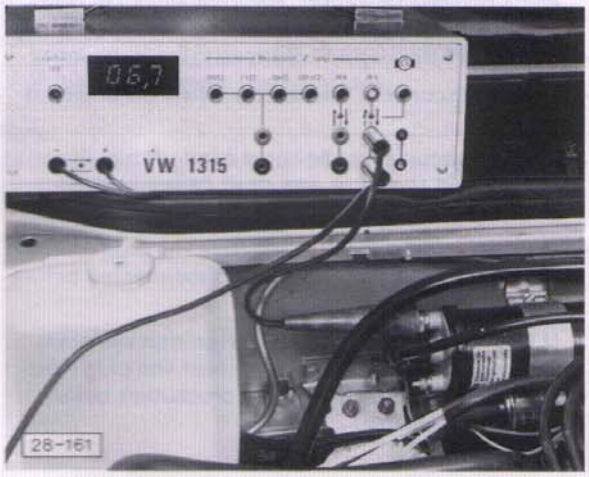
Check before testing: battery o.k. and fully charged
distributor o.k.

– Wiring and plug connectors must be connected.

– Switch on ignition.

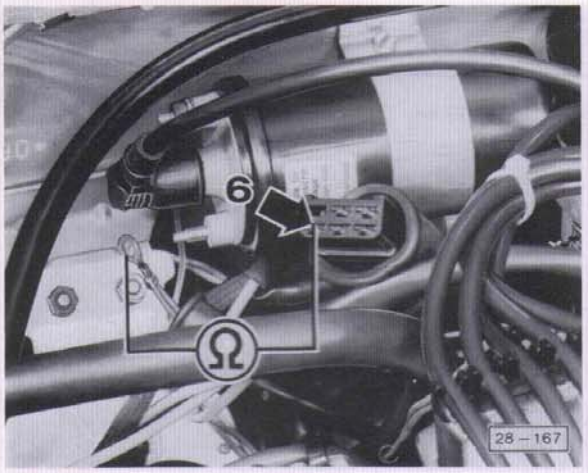


– Measure voltage at ignition coil terminal 1 (–).
Specified voltage: up to 2 V



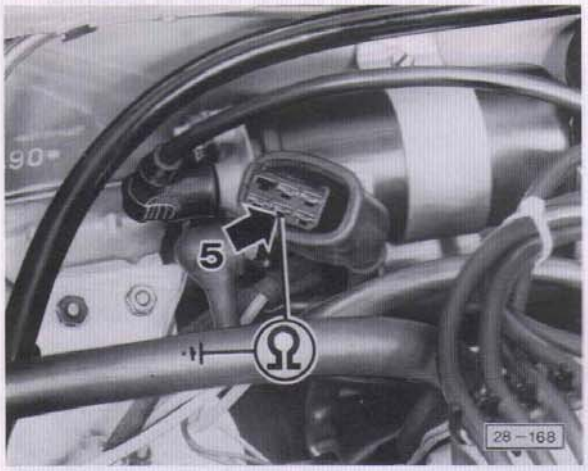
– Measure voltage at ignition coil terminal 15 (+).
Specified voltage: in excess of 5 V

Note:
If 12 volts are measured at terminals 15 and 1, carry out next test steps.
If 12 volts are measured at terminal 15 and zero volts at terminal 1, the ignition coil is defective.



– Measure resistance between wire disconnected from ignition coil terminal 1 and contact 6 in control unit plug.

Specified resistance: 0 Ω
Renew TCI control unit if resistance is not correct.



– Check resistance between contact 5 in control unit plug and earthing point.

Specified resistance: 0 Ω
Renew TCI control unit if resistance is not correct.

– Connect all leads.
– Connect voltmeter between terminal 1 on ignition coil and earth.
– Pull the HT lead out of the distributor (terminal 4) and connect it direct to earth.
– Operate starter motor.
– The voltage indicated must oscillate between

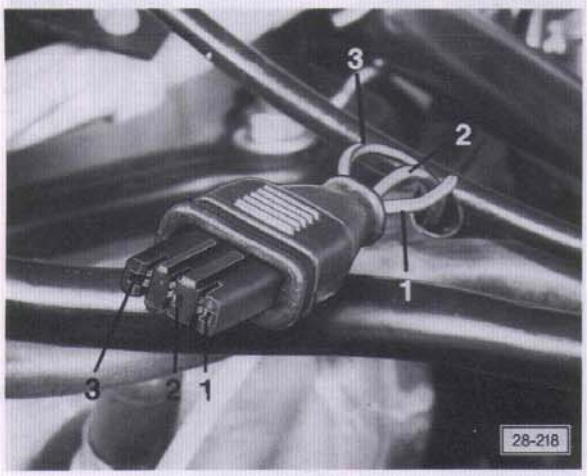
1 and 12 volts.

otherwise renew TCI control unit.

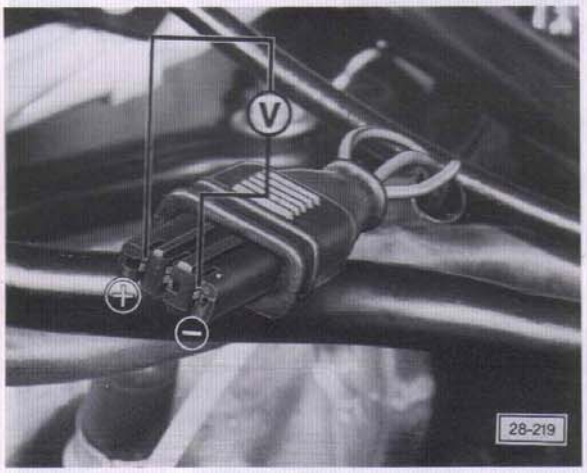
Note:
The voltage reading and the variation in the indicated voltage depend on the state of the battery, the cranking speed and the response of the voltmeter needle.

CHECKING DISTRIBUTOR, HALL GENERATOR

On engines with code letters WJ

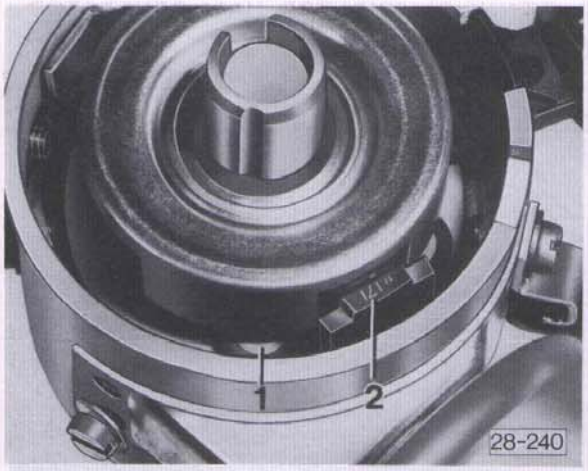


– Check that connecting plug for Hall generator on distributor is wired correctly.
1 = brown/white (–)
2 = green (o)
3 = red/black (+)
– Check that plug makes good contact (contacts in plug and socket must not be damaged, loose or pushed out of place).



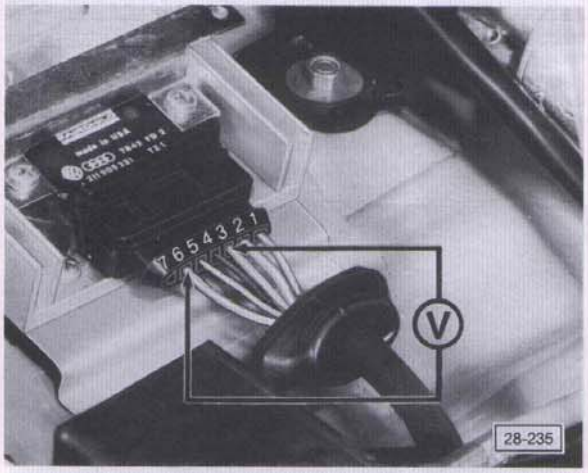
– Measure voltage at plug for Hall generator between plus and minus terminals with voltmeter.
– Switch on ignition, switch off ignition after test.
Specified voltage: about the same as battery voltage, otherwise trace break in wiring using current flow diagram.
– Detach distributor cap, rotor arm and dust cap.

Caution
Do not allow retaining clip for distributor cap to fall inwards onto pick-up system.



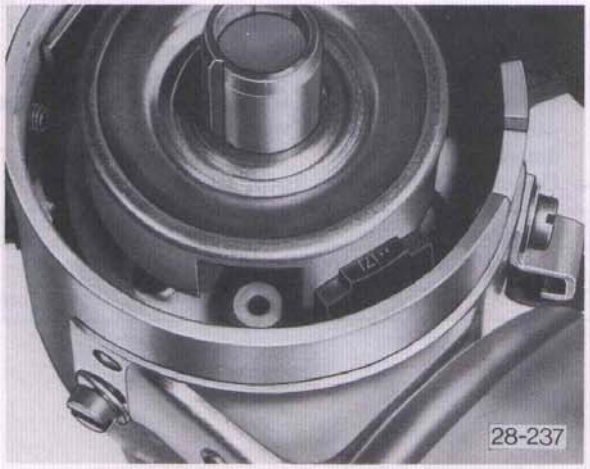
– Turn crankshaft so that rotor –1– is **clear of air gap** for magnetic pick-up.

– Pull off rubber grommet on connecting plug for Hall TCI control unit.

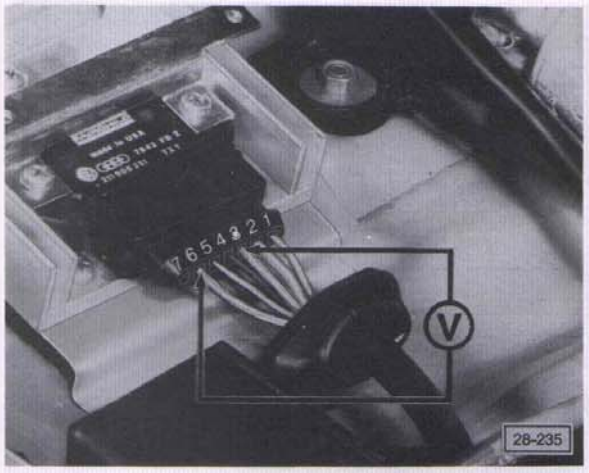


– Measure voltage between terminal 6 and terminal 3 on connecting plug for Hall TCI control unit.

– Switch on ignition; switch off ignition after testing.
Specified voltage: not more than 0.4 V.
Otherwise continue testing as follows.



– Turn crankshaft so that rotor is **fully aligned with air gap** for magnetic pick-up.



– Measure voltage between terminal 6 and terminal 3 on connecting plug for Hall TCI control unit.

– Switch on ignition; switch off ignition after testing.
Specified voltage: at least 7.5 V.
Renew distributor if voltage is not as specified.

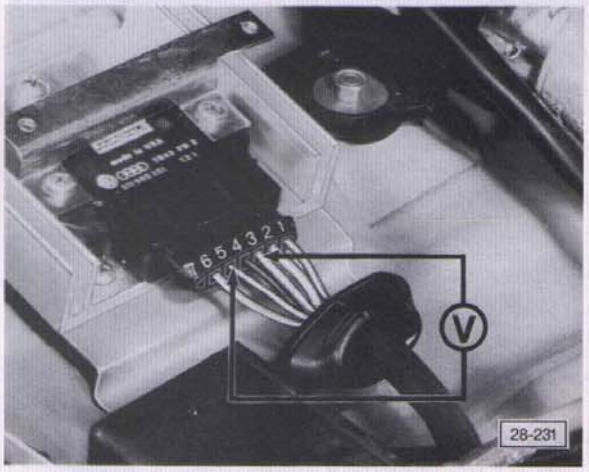
CHECKING HALL TCI CONTROL UNIT

On engines with code letters WJ

Note:
Cover and DIS (digital idle stabilizer) unit have only been removed to give a clear photograph.

– Pull rubber grommet off connecting plug for Hall TCI control unit.

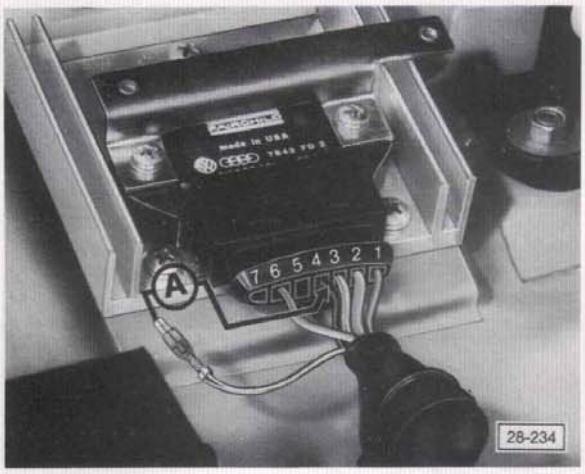
– Connect plug to Hall TCI control unit.



– Measure voltage between terminals 5 and 3.

– Switch on ignition; switch off ignition after testing.
Specified voltage: not more than 3.5 V.
Otherwise continue testing as follows.

– Disconnect plug from Hall TCI control unit, remove terminal 5 wire from plug for Hall TCI control unit.
– Reconnect plug to Hall TCI control unit.



– Connect ammeter (mA range) to disconnected terminal 5 wire and terminal 4 of plug with test probe.
– Switch on ignition.

Test results:

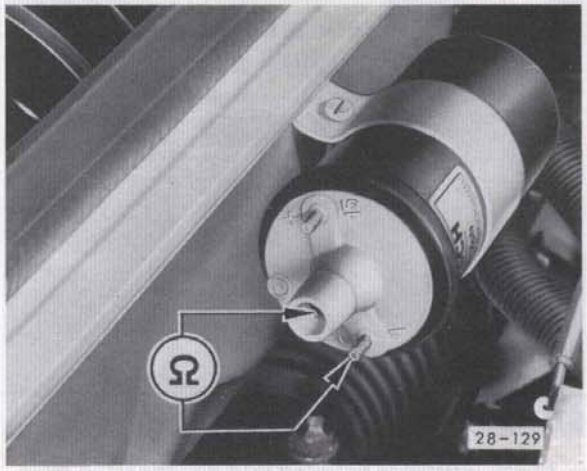
If the current measured is between 3 and 20 mA, renew the Hall TCI control unit.

If the current measured is 0 mA or higher than 20 mA, renew the distributor.

IGNITION COIL – MEASURING SECONDARY WINDING RESISTANCE

Note:
If there are traces of sealing compound coming out of the ignition coil, renew the ignition coil and the TCI control unit.

– Disconnect all wiring from ignition coil.



– Connect ohmmeter between terminal 1 (–) and terminal 4 on coil.
– Measure resistance.

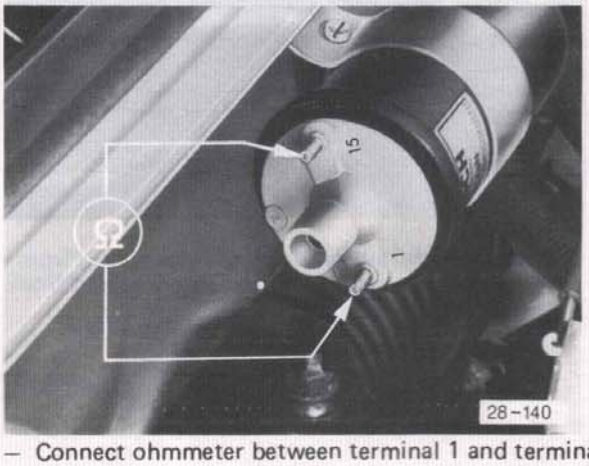
Specified resistance: on engines with code letters WC, WE, WG
5.5 – 8 k Ω

Specified resistance: on engines with code letters WJ
2.4 – 3.5 k Ω

Renew ignition coil if resistance is not as specified.

CHECKING IGNITION COIL – PRIMARY WINDING RESISTANCE

– Disconnect all wiring from coil.



– Connect ohmmeter between terminal 1 and terminal 15 on coil.
– Measure resistance.

Specified resistance: on engines with code letters WC, WE, WG
0.95 – 1.4 Ω

Specified resistance: on engines with code letters WJ
0.52 – 0.76 Ω

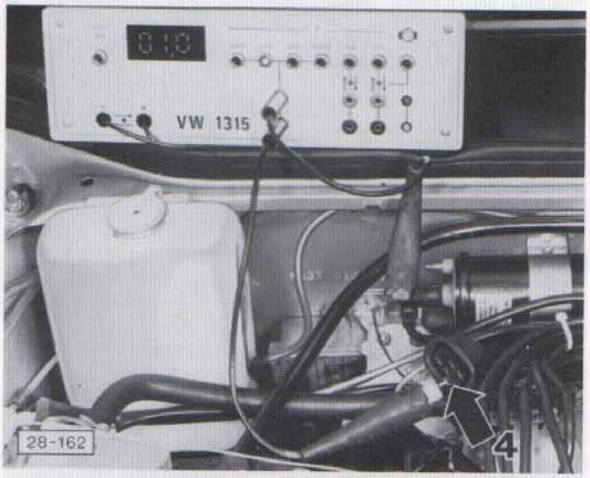
Renew ignition coil if resistance is not as specified.

CHECKING STARTER WIRING

On engines with code letters WC, WE, WG

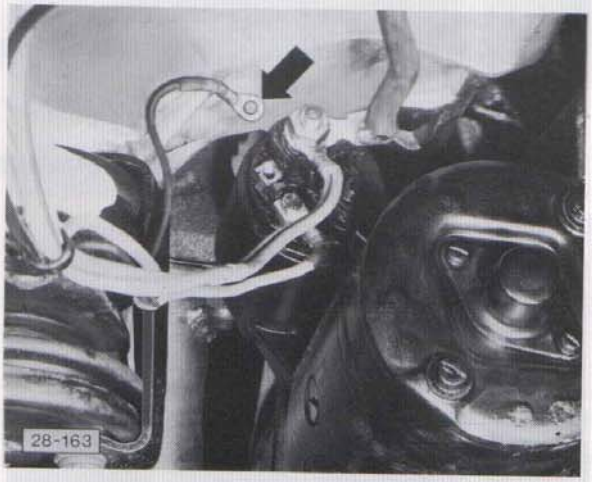
Check before testing: battery and starter motor o.k.

- Disconnect lead from ignition coil terminal 15 (+).
- Disconnect plug from TCI control unit.



- Check resistance between lead disconnected from terminal 15 on ignition coil and contact 4 on control unit plug.

  Specified resistance: approx. 1 Ω
- Disconnect lead from terminal 16 on starter.



- Check resistance between lead disconnected from terminal 16 on starter and lead disconnected from terminal 15 on ignition coil.

  Specified resistance: approx. 0.5 Ω

Workshop Bulletin.
Audi 100, Audi 200

No. 1
of 8/80

File in booklet: 2.2 l fuel injection engine, May 1980 edition

Page to be marked: A: 1; B: 25; C: 98; D: 97

1981 model year

From 1981 models onwards the 2.2 litre fuel injection engine - engine code letters WS, WE and WC - has the following modifications.

Repairs and adjustments on the components affected are described in this bulletin where special notes and instructions are required.

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C - Idle speed changed	2
D - Hall TCI ignition system	
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Engine code letters WE	4
Engine code letters WC	5
How the Hall TCI system works	6
Safety precautions for the Hall TCI system	7
Checking distributor rotor arm	8
Checking secondary resistance of ignition coil	8
Checking primary resistance of ignition coil	8
Checking Hall TCI control unit	8
Checking Hall generator	9

Printed in Germany 0.97.597.701.20

A - List of engine data

Code letters		WS
Engine data		
Manufactured	from	8.80
	to	
Capacity	litres	2.2
Power output	kw at rpm	125/5300
Torque	Nm at rpm	265/3300
Bore	mm	79.5
Stroke	mm	86.4
Compression ratio		7.0
Valve timing at 1 mm valve lift and 0 valve clearance		
	intake opens before TDC	3°
	intake closes after BDC	47°
	exhaust opens before BDC	43°
	exhaust closes after TDC	7°
RON	min.	98
Fuel injection		K-Jetronic
Distributor		035 905 206 K
EGR		x
Catalytic converter		-
Lambda closed loop system		-
Turbocharger		x

B - Shorter cylinder head and camshaft

The length of the cylinder head and camshaft has been reduced. The valve timing remains unaltered.

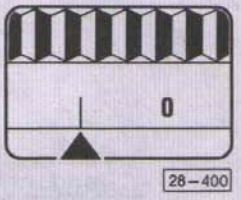
C - Idle speed changed

The idle speed has been reduced from 900 $\pm$ 50 to 800 $\pm$ 50. This does not affect other settings.

Hall TCI ignition system

Follow the same procedure for checking and adjusting ignition timing and advance/ retard as described in the Workshop Manual on pages 100 and 101, but note the different figures listed in the following table.

DISTRIBUTOR DATA, SPARK PLUGS

Engine code letters		WS
Gearbox version		Manual / Automatic
Distributor	Part No.	035 905 206 K
Ignition timing*		21° before TDC
	Marking	
	at engine speed rpm	3000
	Vacuum hoses	disconnected early / connected late
Dwell angle	degrees %	not adjustable
Centrifugal advance**		
Begins	rpm	1000 - 1200
	rpm	1400
	degrees	3 - 10
	rpm	1600
	degrees	8 - 14
Ends	rpm	2200
	degrees	13 - 17
Vacuum advance**		
Begins	mbar	80 - 140
	mmHg	60 - 100
Ends	mbar	140 - 180
	mmHg	140 - 180
	degrees	3 - 7
Vacuum retard**		
Begins	mbar	0 - 120
	mmHg	0 - 90
Ends	mbar	120 - 200
	mmHg	90 - 150
	degrees	8 - 10
Spark plugs***	Bosch	WR 5 DS
	Beru	RS 39
	Champion	-
Electrode gap	mm	0.7 ± 0.1
Firing order		1 - 2 - 4 - 5 - 3
Speed limiter	Cut-out speed rpm	6500 - 6900

* Note adjustment procedures - see Workshop Manual, page 96

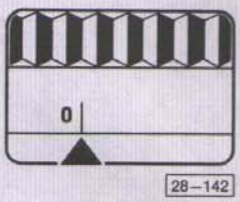
** Degrees given as degrees of crankshaft, ignition distributor installed

*** Tightening torque 30 Nm

Hall TCI ignition system

Follow the same procedure for checking and adjusting ignition timing and advance/ retard as described in the Workshop Manual on pages 96 and 101, but note the different figures listed in the following table.

DISTRIBUTOR DATA, SPARK PLUGS

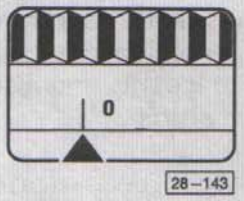
Engine code letters			WE
Gearbox version			Manual Automatic
Distributor		Part No.	035 905 205 L
Ignition timing*			3° after TDC
	Marking		
	at engine speed	rpm	900 ± 50
	Vacuum hoses		connected
Dwell angle		degrees %	not adjustable
Centrifugal advance**			
Begins	rpm		1000 - 1200
	rpm		1800
	degrees		17 - 22
	rpm		2500
	degrees		17 - 22
	rpm		3200
	degrees		22 - 26
Ends	rpm		6100
	degrees		23 - 28
Vacuum advance**			
Begins	mbar		260 - 320
	mmHg		190 - 240
Ends	mbar		350 - 380
	mmHg		260 - 290
	degrees		4 - 8
Vacuum retard**			
Begins	mbar		110 - 240
	mmHg		80 - 180
Ends	mbar		270 - 360
	mmHg		200 - 260
	degrees		8 - 10
Spark plugs***	Bosch		W 7 D (W 175 T 30)
	Beru		14 7 D (175/14/3A)
	Champion		N 8 Y
Electrode gap		mm	0.7 ± 0.1
Firing order			1 - 2 - 4 - 5 - 3
Speed limiter	Cut-out speed	rpm	6500/6900

* Note adjustment procedures - see Workshop Manual, page 96
** Degrees given as degrees of crankshaft, ignition distributor installed
*** Tightening torque 30 Nm

Hall TCI ignition system

Follow the same procedure for checking and adjusting ignition timing and advance/ retard as described in the Workshop Manual on pages 100 and 101, but note the different figures listed in the following table.

DISTRIBUTOR DATA, SPARK PLUGS

Engine code letters		WC
Gearbox version		Manual / Automatic
Distributor	Part No.	035 905 206
Ignition timing*		6° before TDC
	Marking	
	at engine speed rpm	800 ± 50
	Vacuum hoses	connected
Dwell angle	degrees %	not adjustable
Centrifugal advance**		
Begins	rpm	900 - 1200
	rpm	1800
	degrees	4 - 8
	rpm	2600
	degrees	10 - 14
Ends	rpm	6000
	degrees	12 - 17
Vacuum advance**		
Begins	mbar	160 - 240
	mmHg	120 - 180
Ends	mbar	340 - 380
	mmHg	250 - 280
	degrees	8 - 12
Vacuum retard**		
Begins	mbar	60 - 200
	mmHg	45 - 150
Ends	mbar	300 - 460
	mmHg	230 - 345
	degrees	12 - 14
Spark plugs***	Bosch	W 6 D (W 200 T 30)
	Beru	14 - 6 D (200/14/3 A)
	Champion	N 7 Y
Electrode gap	mm	0.7 ± 0.1
Firing order		1 - 2 - 4 - 5 - 3
Speed limiter	Cut-out speed rpm	6500/6900

* Note adjustment procedures - see Workshop Manual, page 96

** Degrees given as degrees of crankshaft, ignition distributor installed

*** Tightening torque 30 Nm

HOW THE HALL TCI* SYSTEM WORKS

(*transistorized coil ignition)

The Hall TCI system is a breakerless ignition system.

The distributor has a maintenance-free Hall generator instead of contact breakers.

This is why there is no ignition condenser in the distributor.

The Hall generator consists of a magnetic sensor with no moving contacts (a permanent magnet with integrated semi-conductor circuits - Hall IC) and a rotor mounted on the distributor shaft.

The Hall generator feeds a signal to the TCI control unit which controls the point at which the coil circuit is energized and interrupted.

The ignition timing is thus determined by the Hall generator.

When the rotor moves into the air gap of the magnetic sensor it causes the magnetic field to pass the Hall IC and the Hall generator switches on the current to the coil.

When the rotor moves out of the air gap of the magnetic sensor, coil current is interrupted and ignition takes place.

The Hall TCI control unit regulates coil current to the required value of about 7.5 A and maintains this current constant under all operating conditions.

The dwell angle is also controlled, so that the secondary voltage is maintained virtually constant.

The Hall TCI control unit regulates the dwell angle by only energizing the ignition coil for the time which is necessary to charge the primary windings. This minimises power loss in the control unit and ignition coil.

When the ignition is switched on with the engine not running the control unit switches off the current to the ignition coil after about 1 second to prevent the control unit and ignition coil from overheating.

As a safety precaution the ignition coil has a 5.5 mm opening with a plug. This allows the sealing compound in the ignition coil to escape in a controlled manner should a fault develop in the Hall TCI control unit circuitry.

SAFETY PRECAUTIONS FOR HALL TCI SYSTEM

When working on vehicles with Hall TCI system observe the following precautions to prevent injury and/or serious damage to the ignition system.

- Always switch off the ignition before disconnecting or connecting ignition leads - including HT leads and leads from test equipment.
- If the engine has to be cranked on the starter motor without actually starting (e.g. for the compression test), first disconnect the HT lead (terminal 4) from the distributor and earth it.
- A fast charger may only be used to assist starting for up to 1 minute with a maximum of 16.5 volts.
- Switch off the ignition when washing down the engine.
- Disconnect both sides of the battery before using arc or spot welding equipment.
- If the ignition system is defective, or if a fault is suspected, disconnect the plug from the Hall TCI control unit before towing the vehicle.
- Connect no condensers to terminal 1 (-).
- Do not replace the 1 kΩ rotor arm (designation: R 1) with another type, even for radio suppression.
- For purposes of radio suppression, only connect 1 kΩ resistances on the HT leads and only use spark plug connectors from 1 to 5 kΩ .

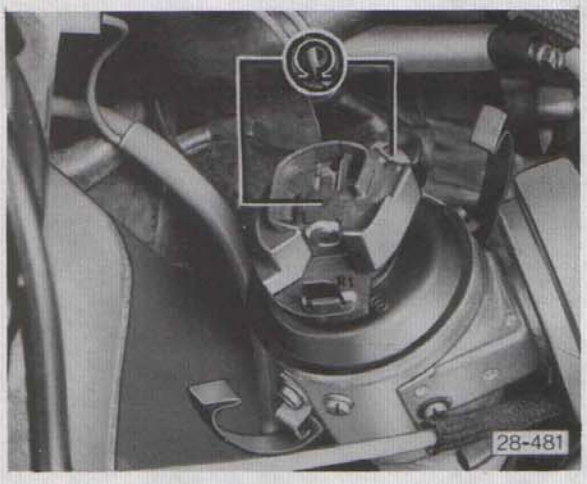


Fig. 1 Checking distributor rotor arm

Specified resistance: approx. 1 kΩ
Designation: R 1

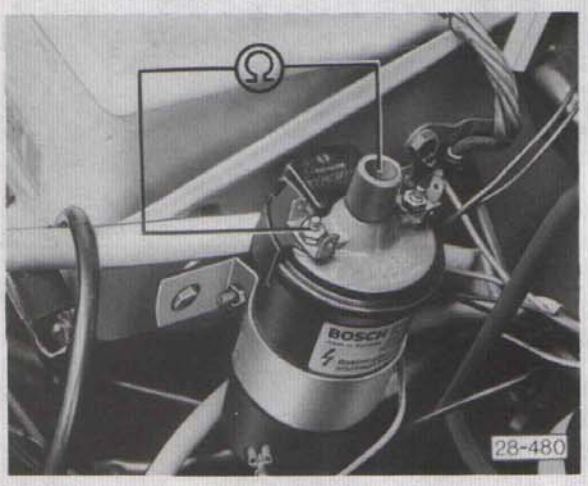


Fig. 2 Checking secondary resistance of ignition coil

- Disconnect all wiring from ignition coil.
- Connect ohmmeter between terminal 1 (-) and terminal 4 on coil.
- Measure resistance.
  Specified resistance: 2.4 - 3.5 kΩ

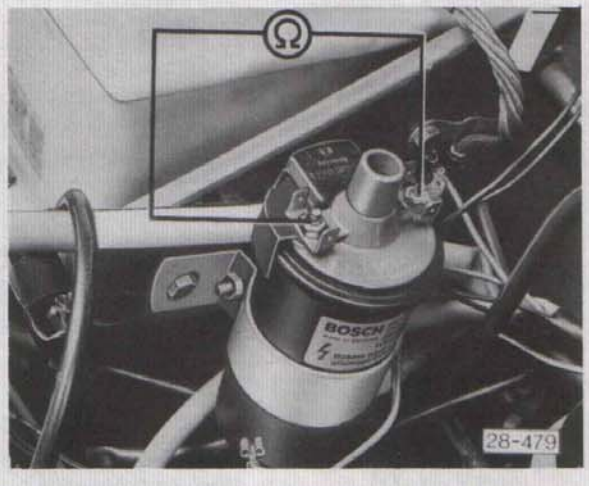
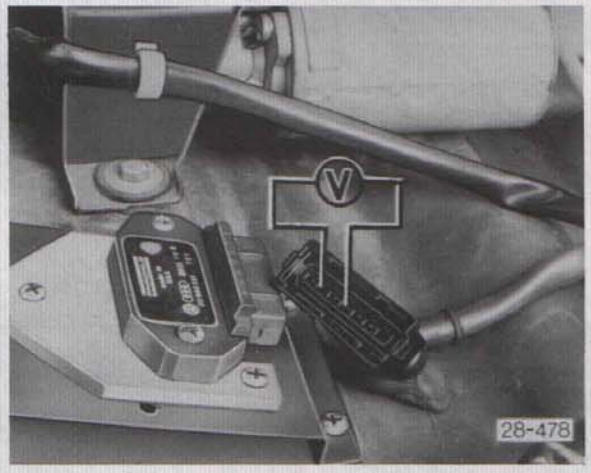


Fig. 3 Measuring primary resistance of ignition coil

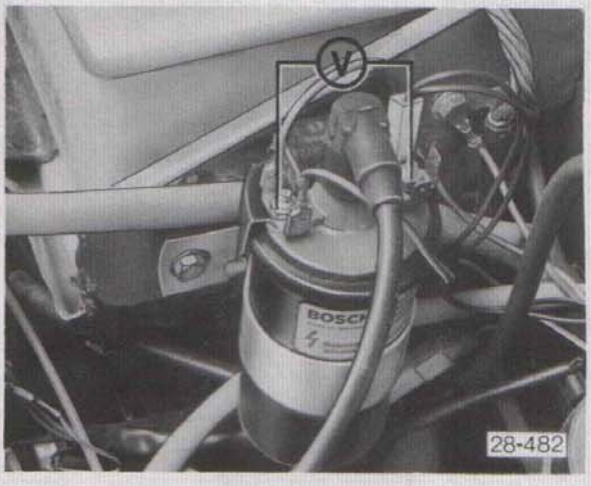
- Disconnect all wiring from ignition coil.
- Connect ohmmeter between terminal 1 (-) and terminal 15 (+) on coil.
- Measure resistance.
  Specified resistance: 0.52 - 0.76 Ω

CHECKING HALL TCI CONTROL UNIT

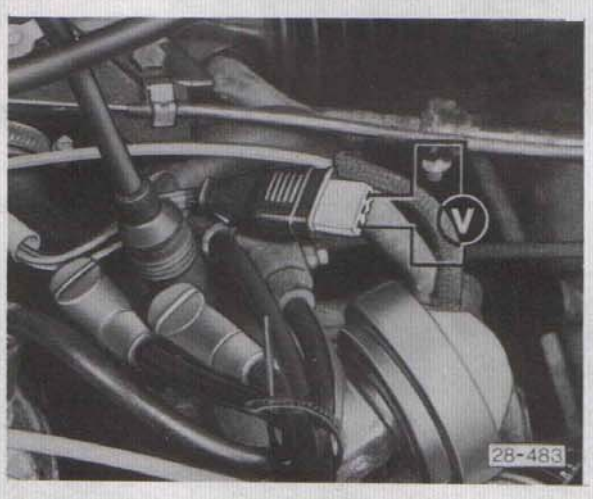
Ignition coil must be o.k.



- Disconnect plug from Hall TCI control unit.
- Measure voltage between contacts 4 and 2 on plug with voltmeter.
- Switch on ignition.
  Specified voltage: approx. the same as battery voltage, otherwise trace interruption in wiring using current flow diagram and repair.
- Switch off ignition.



- Reconnect plug to Hall TCI control unit.
- Disconnect plug from Hall generator (on distributor).
- Connect voltmeter between terminal -1- (-) and terminal 15 (+) on ignition coil.
- Switch on ignition.
  Specified voltage:
  at least 5 volts; must drop to 0 after approx. 1-2 secs.
  Otherwise renew Hall TCI control unit and distributor.
- Switch off ignition.

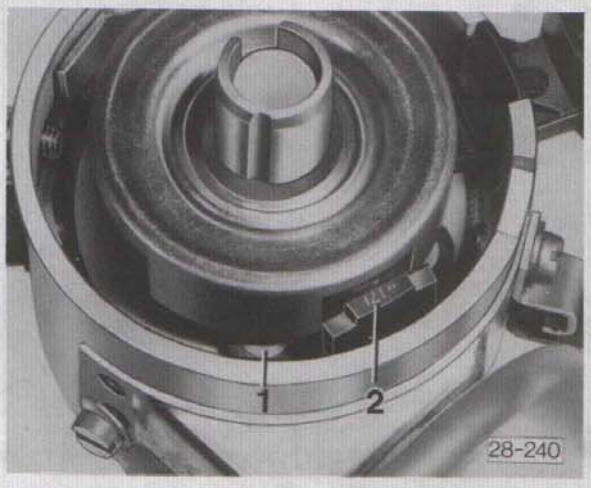


- Connect voltmeter to outside contacts on plug for Hall generator (distributor).
- Switch on ignition.
  Specified voltage: at least 5 volts
  If reading is not correct, trace and repair break in wiring between control unit and plug for Hall generator.

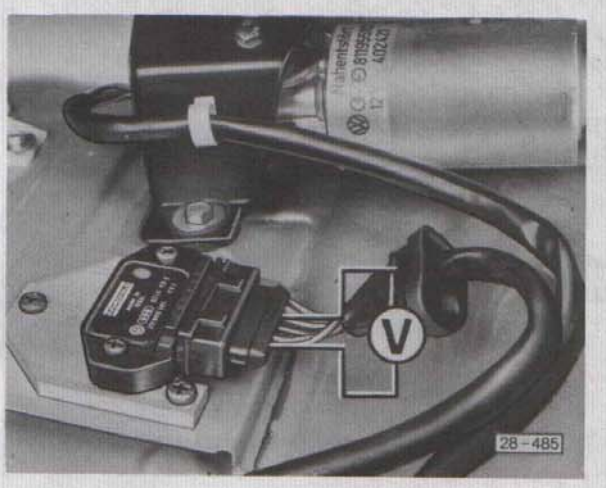
CHECKING HALL GENERATOR

Hall TCI control unit o.k.
Ignition coil o.k.
Lead between Hall TCI control unit and distributor o.k.

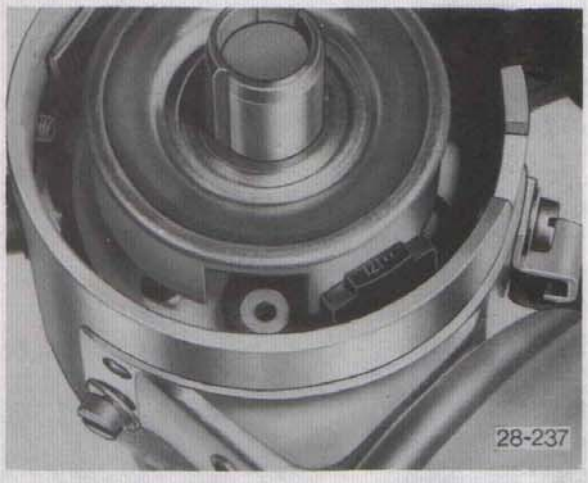
- Disconnect high tension lead from terminal 4 on distributor and earth it with an extension lead.
- Remove distributor cap.
- Remove distributor rotor arm and dust cap.



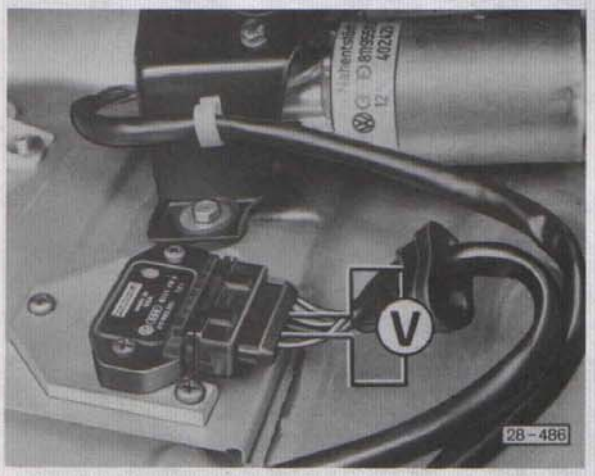
- Set rotor -1- clear of Hall generator -2- by turning crankshaft.
- Pull back rubber grommet on connecting plug to Hall TCI control unit. Leave plug connected to control unit.



- Connect voltmeter between contacts 6 and 3.
- Switch on ignition.
  Specified voltage: 0 to 0.4 volts.
- Switch off ignition.



- Align rotor -1- inside Hall generator -2- by turning crankshaft.
- Switch on ignition.
  Specified voltage: approx. 9 volts
- Switch off ignition.
  Set rotor -1- clear of Hall generator -2- by turning crankshaft.



- Connect voltmeter between contacts 5 and 3.
- Switch on ignition.
  Specified voltage: at least 7.5 volts

Renew distributor if one or all of the voltage readings are not as specified.

V.A.G Service.

V·A·G

Workshop Bulletin.

Audi 100, Audi 200

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of 10/80

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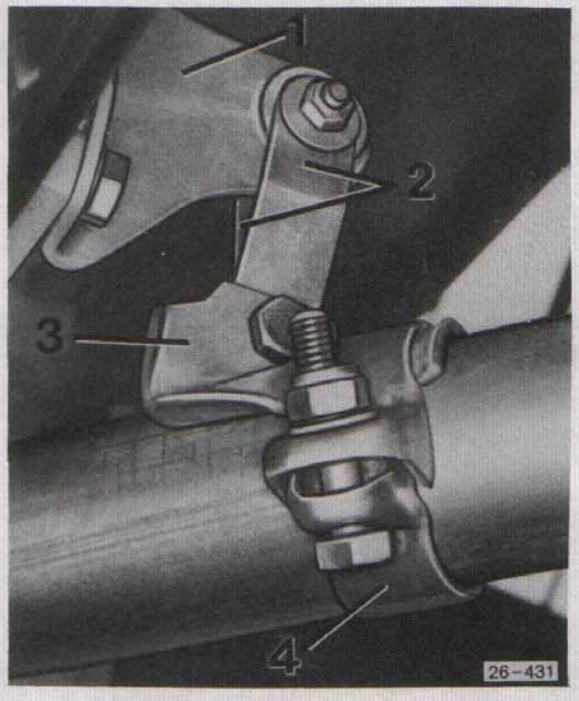
MOUNTING EXHAUST SYSTEM FREE OF STRAIN

On Audi 200 5T vehicles with automatic gearbox the exhaust system must be mounted on the gearbox as follows to prevent droning noises:



- Secure bracket -1- to gearbox: torque to 25 Nm.
- Secure plates -2- with stop pad and bracket -3- (bolt finger-tight, still free to move) to bracket -1-.

Note:
Complete surface of bracket -3- must be in contact with front exhaust pipe.

- Push clamp -4- over bracket -3- and torque to 25 Nm.
- Tighten bolt on bracket -1- to 25 Nm.
- Tighten bolt on plate -2- and bracket -3- to 25 Nm.

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Workshop Bulletin.

Audi 100, Audi 200

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File in booklet: 2.2 l fuel injection engine, May 1980 edition

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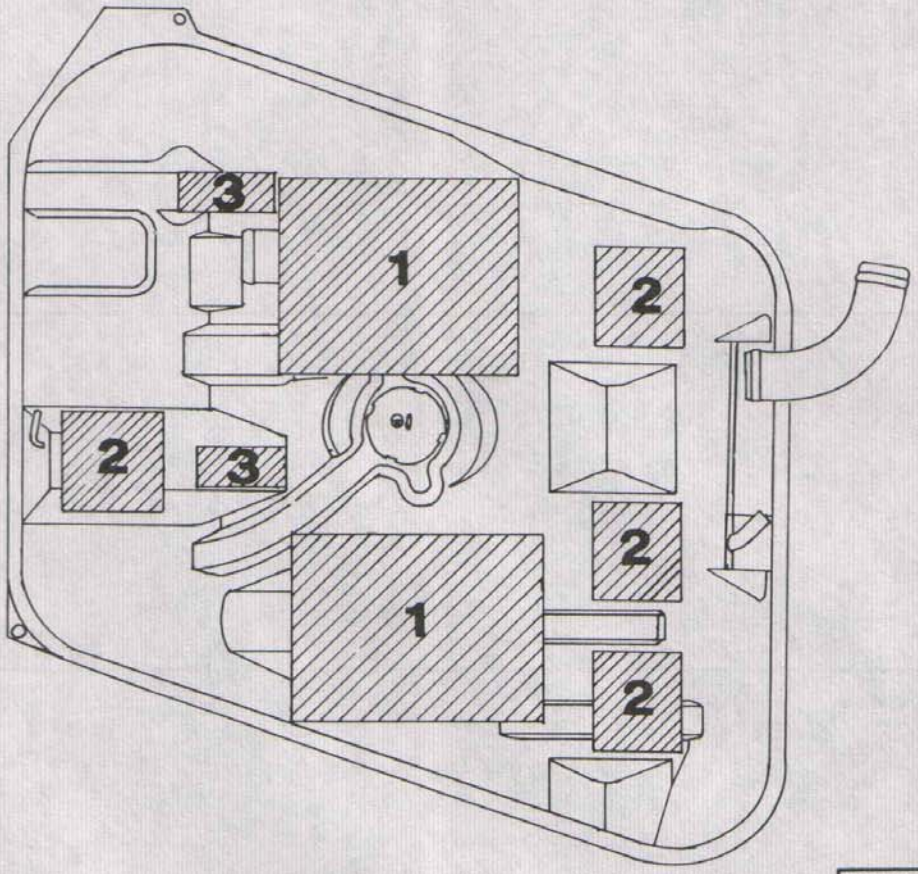
INSULATING PADS FOR FUEL TANK

When renewing the fuel tank ensure that the insulating pads glued on to prevent chafing and droning noises are fixed in the correct positions.



20-228

The insulating pads (repair kit), Part No. 431 201 365 A, size 230 x 250 mm, must be cut to the following dimensions: 200 x 250 mm (two), 100 x 100 mm (four) and 100 x 50 mm (two), and glued on as shown in the illustration.

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V.A.G Service.

V·A·G

Workshop Bulletin.
Audi 100, Audi 200

File in booklet: 2.2 l fuel injection engine (K-Jetronic/ turbocharger), May 1980 edition

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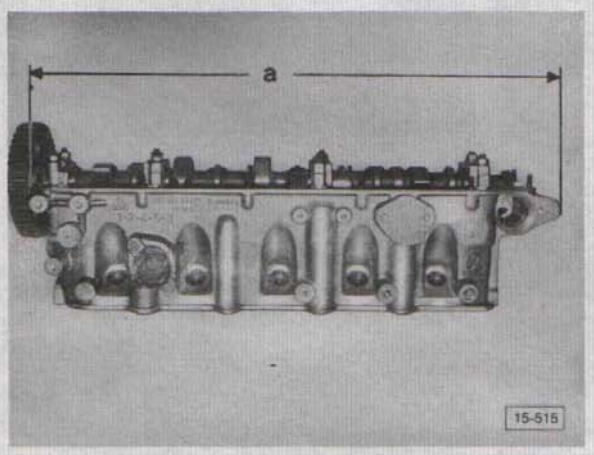
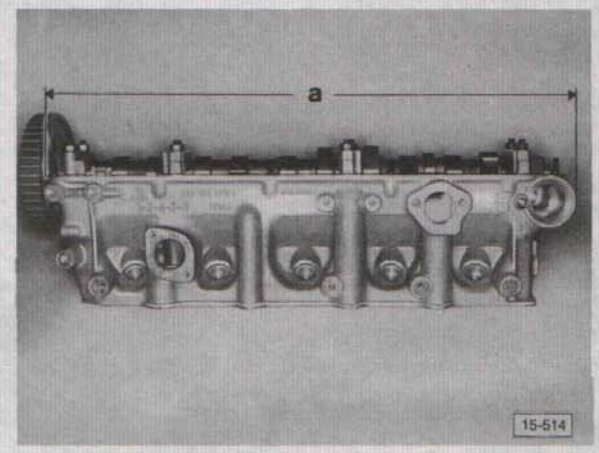
CYLINDER HEAD: SHORT VERSION

From 1981 models onwards a short cylinder head is installed in the Audi 100/ Audi 200; on engines with code letters WC the introduction in production will be gradual. This means that from the 1981 model year onwards there will still be engines with both long and short version cylinder heads.



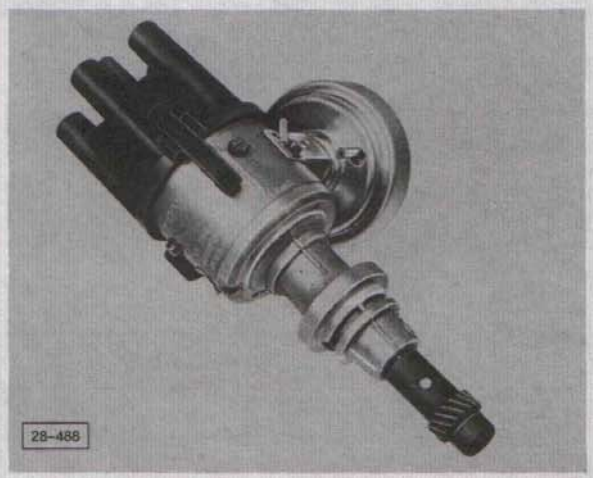
Long cylinder head
a = 583 mm



Short cylinder head
a = 540 mm

There will be two different Hall TCI distributors for the different cylinder heads.

Hall TCI distributor for long cylinder head: for engines with code letters WC, Part No. 035 905 206 M



Hall TCI distributor for short cylinder head: for engines with code letters WC, Part No. 035 905 206

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Workshop Bulletin.

Audi 100, Audi 200

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File in booklet: 2.2 l fuel injection engine (K-Jetronic/turbocharger), May 1980 edition

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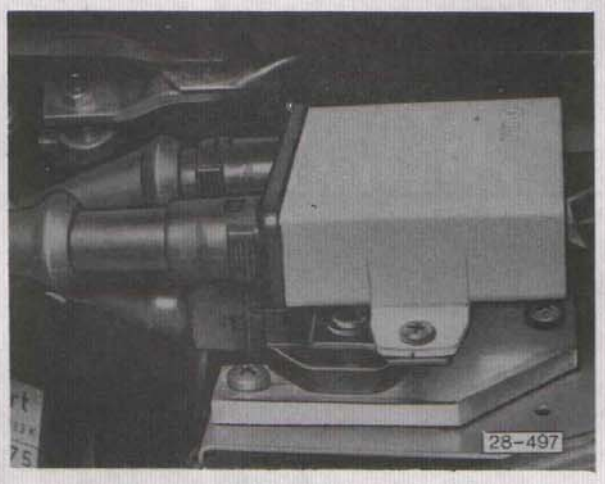
IMPEDANCE CONVERTER

Only applies to engines with Hall TCI system without DIS

From January 1981 onwards an impedance converter is installed to prevent sparkover or interference voltage (which could affect components such as the tachometer).



The impedance converter is mounted on the Hall TCI control unit and has a grey housing (the DIS has a black housing).

Do not disconnect the impedance converter when adjusting the ignition. It has no effect on the ignition timing or advance/retard function.

Before starting faultfinding work on the Hall TCI system, disconnect the impedance converter and connect the two plugs together.

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Workshop Bulletin.
Audi 100, Audi 200

File in booklet: 2.2 litre fuel injection engine (K-Jetronic/ turbocharger), May 1980 edition

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of 5/81

NEW INTAKE AND EXHAUST VALVES

From January 20th 1981 onwards

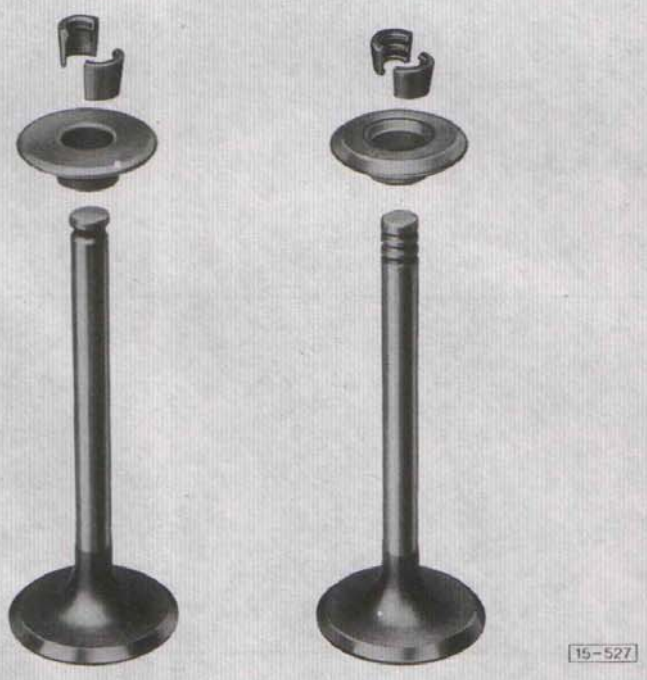
engine no. WC 144 303
engine no. WE 043 361

modified intake and exhaust valves are installed for improved durability.

Design changes to the valve stem, the valve cotters and the valve spring retainer have been introduced to make the valves start rotating even at low engine speeds.

Identification:

- valves with 3 grooves on stem (previously 1 groove)
- valve cotters with 3 beads (previously 1 bead)
- valve spring retainer with copper or yellow chrome-plated surface (previously steel grey)



Previous type: valve with 1 groove New: valve with 3 grooves

When carrying out repairs the different types of valve with 1 or 3 grooves can be installed in the same engine, but the appropriate cotters and spring retainers must be fitted according to which type of valve is installed.

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File in booklet: 2.2 l fuel injection engine (K-Jetronic/turbocharger), May 1980 edition
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CHECKING AND ADJUSTING SWITCH FOR FULL THROTTLE ENRICHMENT

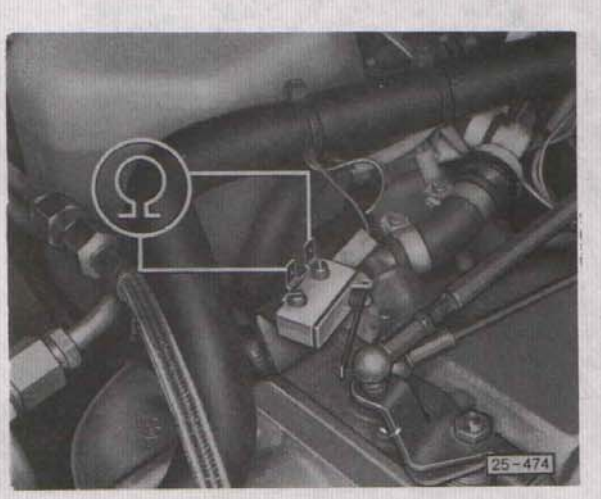
Only on engines with code letters WJ

When the full throttle switch on the throttle assembly is operated with the engine warm the mixture is enriched with additional fuel at full load. If the engine does not deliver full power, if fuel consumption is too high, or if the engine tends to knock, check the full throttle switch and adjust if necessary.

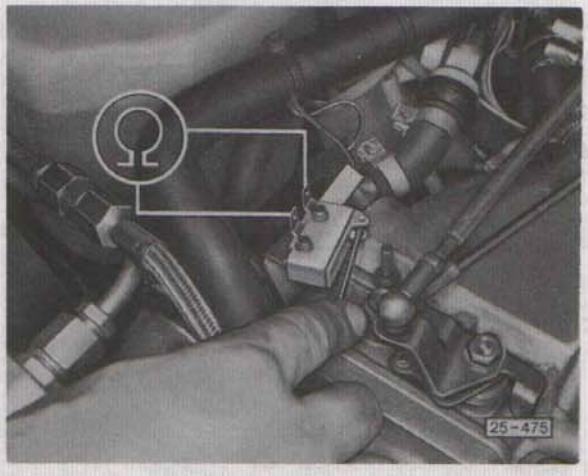
Checking switch for full throttle enrichment

- Two-way valve o.k.
- Warm-up valve o.k.

- Disconnect both plugs from switch for full throttle enrichment.

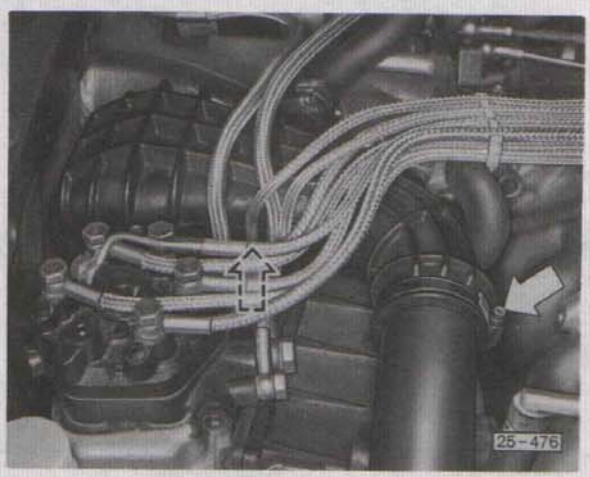


- Connect ohmmeter
- With throttle at idle position reading must be:
  0 ohm
  otherwise renew switch.

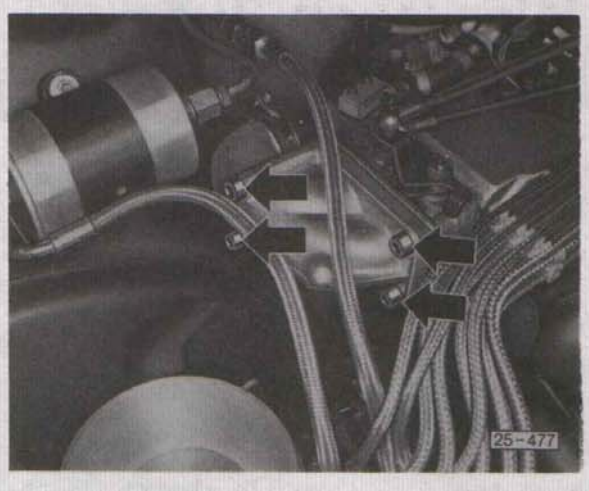


- Press switch for full throttle enrichment.
  Specified resistance: ∞ ohms otherwise renew switch.

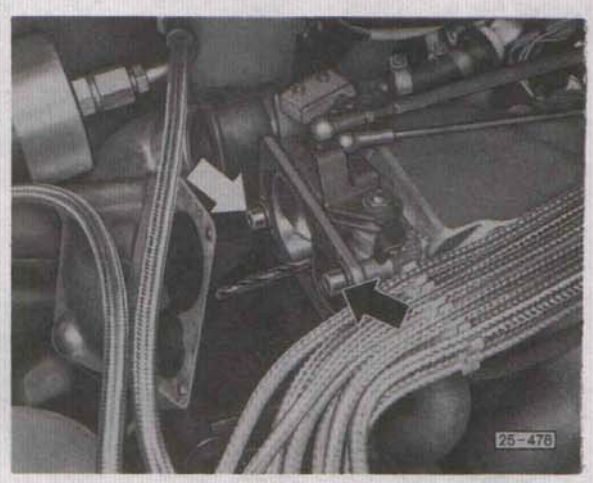
B - Adjusting switch for full throttle enrichment



- Remove air intake elbow.



- Detach manifold from throttle assembly.



- Attach throttle assembly back on intake manifold with two M 8 x 50 bolts.
- Insert a 7 mm dia. drill on the inside of the large throttle valve. Connect ohmmeter to switch. Adjust switch so that ohmmeter reads infinite resistance.

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File in booklet: 2.2 l fuel injection engine (K-Jetronic/turbo-charger), May 1980 edition

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SERVICE INSTALLATION OF COOLING SYSTEM FOR INJECTORS AND TWO-SPEED ELECTRIC RADIATOR FAN

Audi 200 Turbo, manual gearbox

When a towing bracket is service installed on Audi 200 Turbo vehicles with manual gearbox it is also necessary to install a cooling system for the injectors and a 2-speed electric radiator fan.

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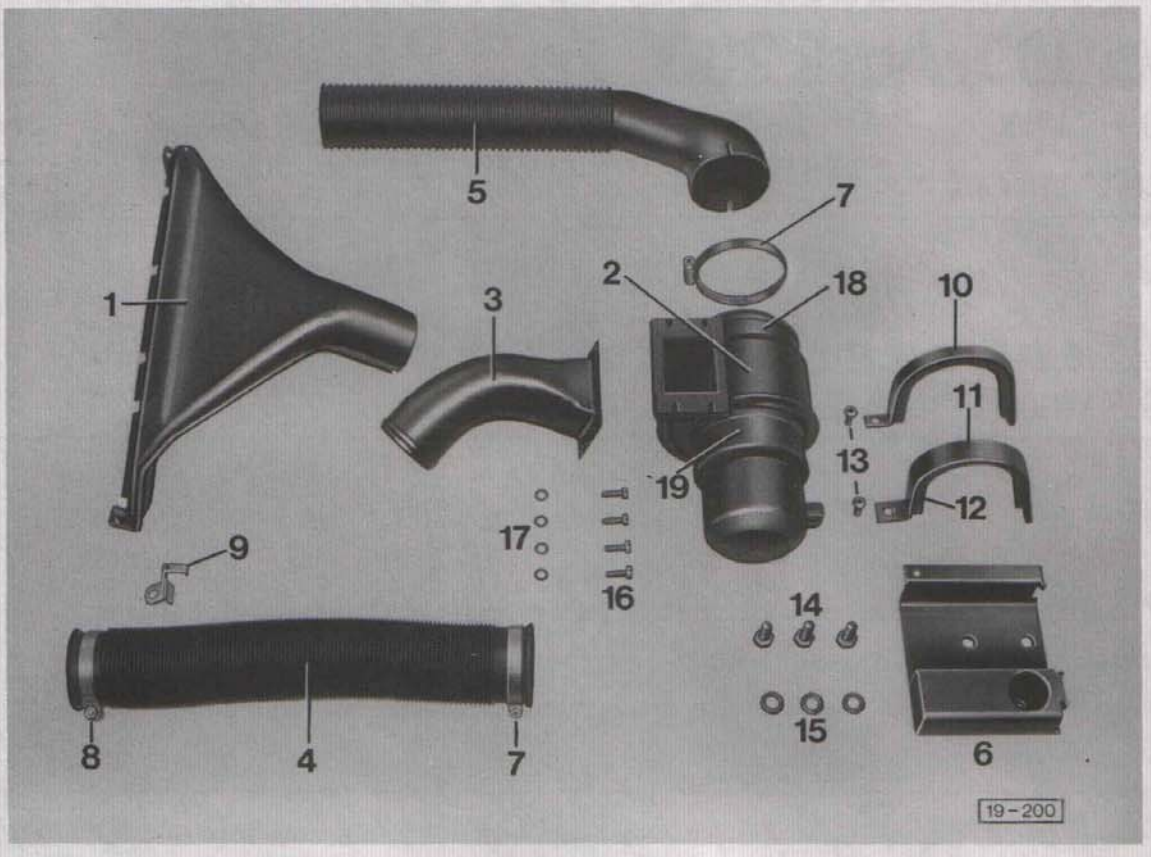
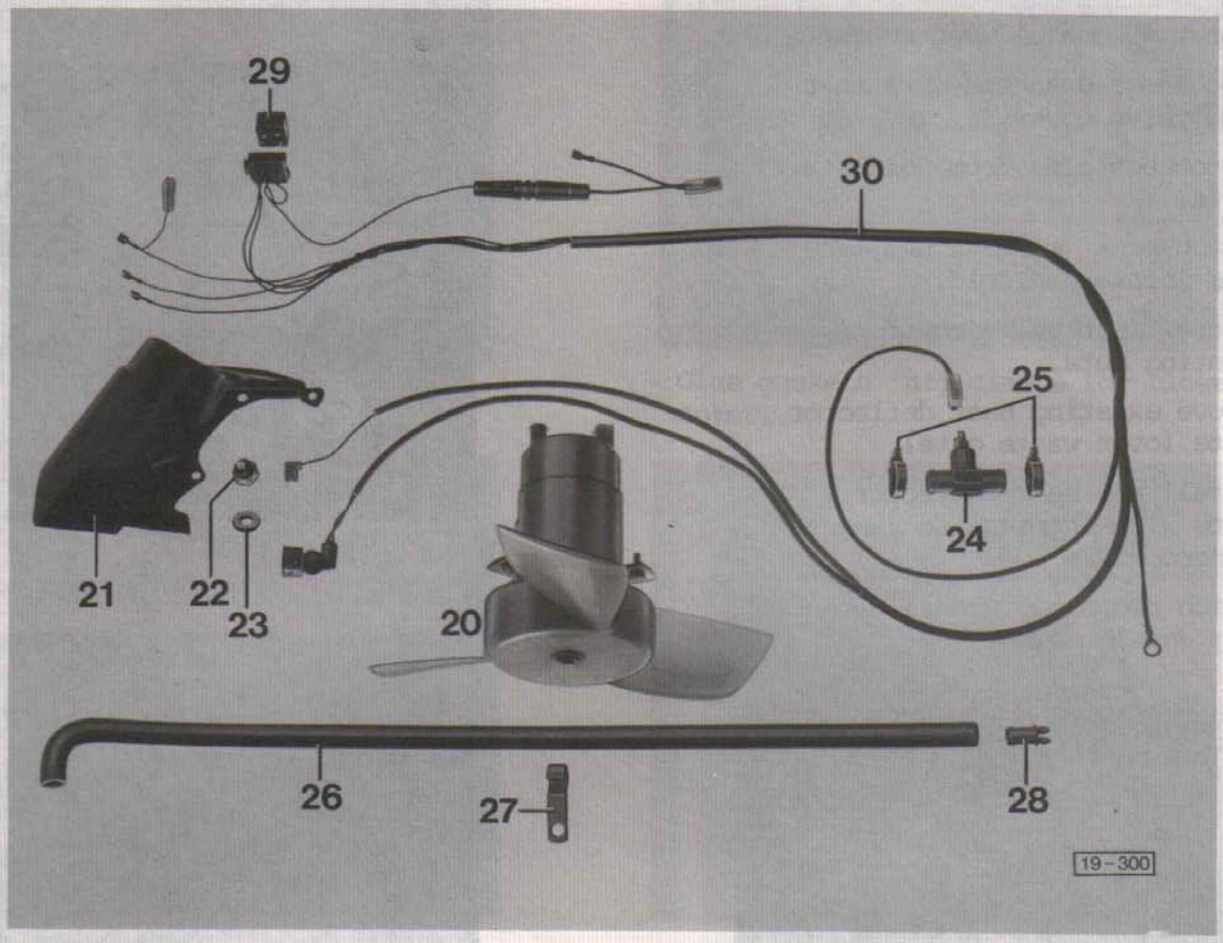
The following components are required for the installation:



Qty.	Designation	Part No.
1	1 = Air duct	035 133 903
1	2 = Blower motor	035 959 175 A
1	3 = Air pipe	035 133 933
1	4 = Air hose	035 903 655 B
1	5 = Intake hose	035 959 181 A
1	6 = Bracket for blower motor	035 959 189 A
2	7 = Clip LB 50 - 70	N 024 505 2
1	8 = Clip LC 40 - 60	N 024 504 4
1	9 = Bracket	035 133 825 A
1	10 = Clamp for blower motor	035 959 196
1	11 = Clamp for blower motor	035 959 195
1	12 = Gasket	321 819 019
2	13 = Oval head screw M 5 x 12	N 014 133 5
3	14 = Hex head bolt M 8 x 16	N 010 239 11
3	15 = Washer 8 x 16 x 12	N 015 278 3
4	16 = Oval head screw M 4 x 8	N 014 122 8
4	17 = Washer 4.3 x 8	N 011 555 5
1	18 = Rubber mount	035 959 209
	19 = Rubber mount (included with -2-)	

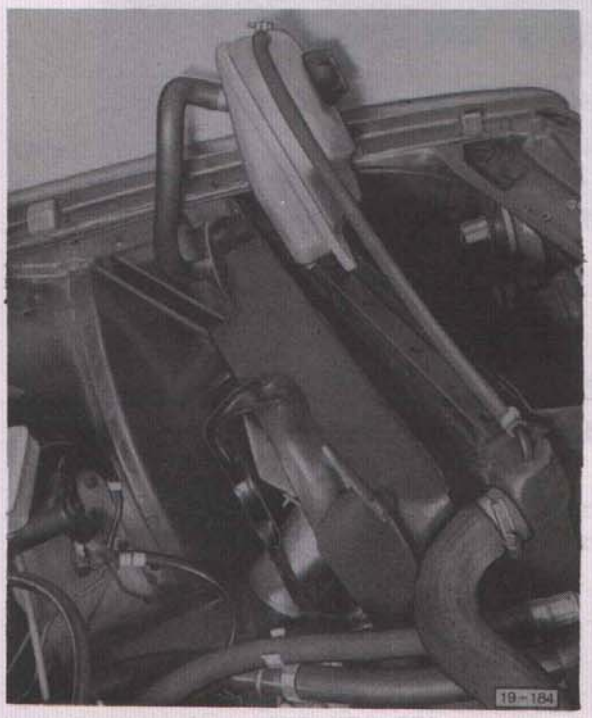
and



Qty.	Designation	Part No.
1	20 = Electric radiator fan, 2-speed	431 959 455 L
1	21 = Heat deflector plate	035 145 782 A
1	22 = Thermoswitch	035 959 481 B
1	23 = Washer 13 x 20 x 2	N 011 564 1
1	24 = Thermoswitch	321 959 481 A
2	25 = Clip LC 16 - 25	N 024 510 3
1	26 = Vent hose	431 959 475 A
1	27 = Bracket for hose	431 959 480
1	28 = Connector	431 959 491
1	29 = Relay	431 951 253 A
1	30 = Harness	437 972 094

Installation procedure:

- Disconnect battery earth strap.
- Remove windshield washer container.
- Disconnect crankcase breather from valve cover.
- Disconnect plug from cold start valve.
- Detach brake servovacuum line from intake manifold.
- Unscrew rear valve cover mounting nuts.
- Remove existing heat deflector plate (over waste gate).
- Install new heat deflector plate with thermoswitch and washer.
- Detach radiator expansion tank from wheelhousing.

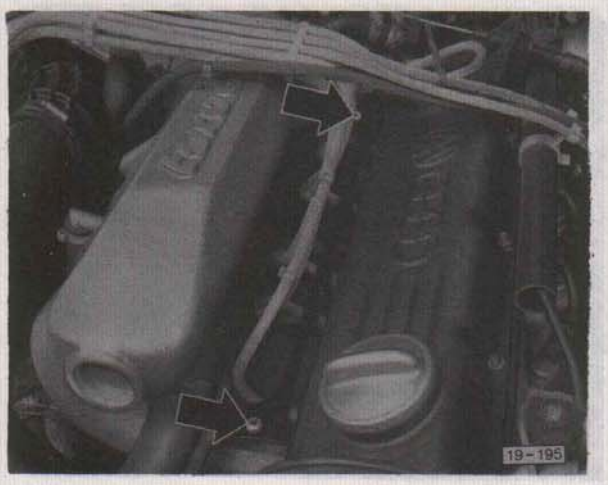


- Detach radiator cowl from radiator.
- Detach fan motor from radiator cowl.
- Release circlip from fan.
- Detach fan, take out fan motor.
- Install new fan motor with fan.
- Install radiator cowl and expansion tank.

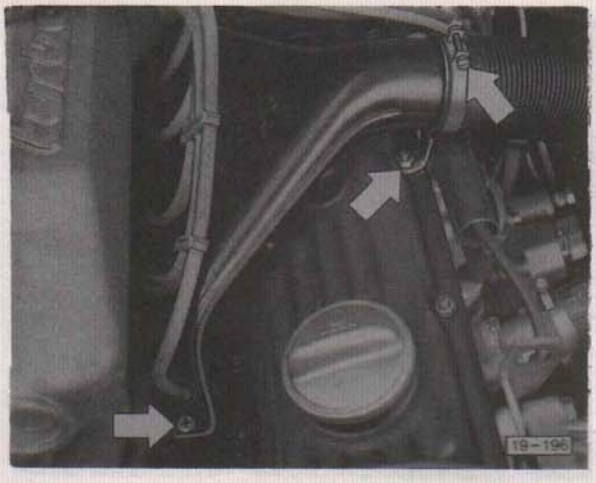
- Install vent hose with bracket.

- Remove existing rubber grommet from bulkhead, fit connector and push on hose.

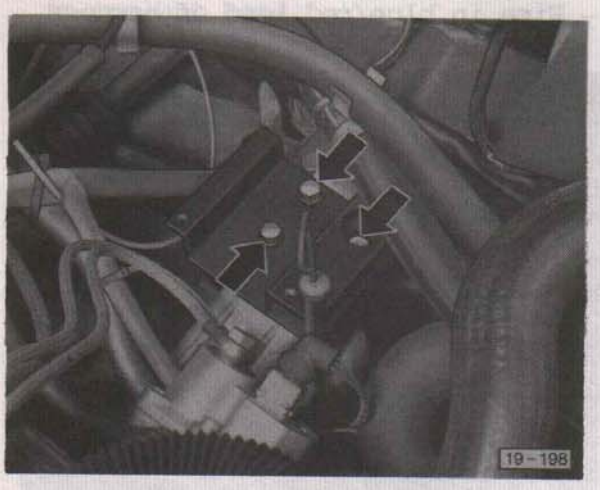
- Install thermoswitch in radiator hose.



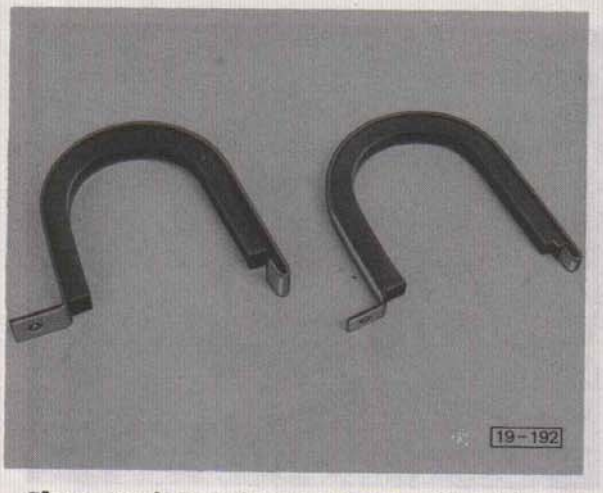
- Remove retainer for injectors.



- Install air duct with bracket and air hose.



- Mount bracket for blower motor on left engine support (M 8 x 16 bolts, 8 x 16 x 2 washers).
  Tightening torque: 25 Nm



- Glue gaskets into clamps for blower motor.

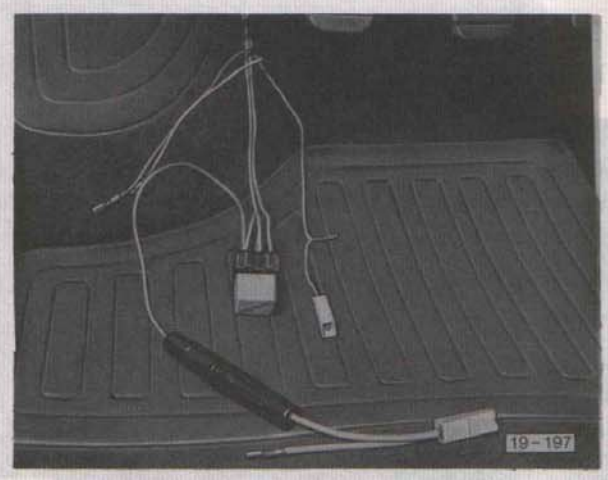
- Fit rubber mounts and clamps on blower motor.

- Install blower motor on bracket.
- Attach air hose and intake hose to blower motor.

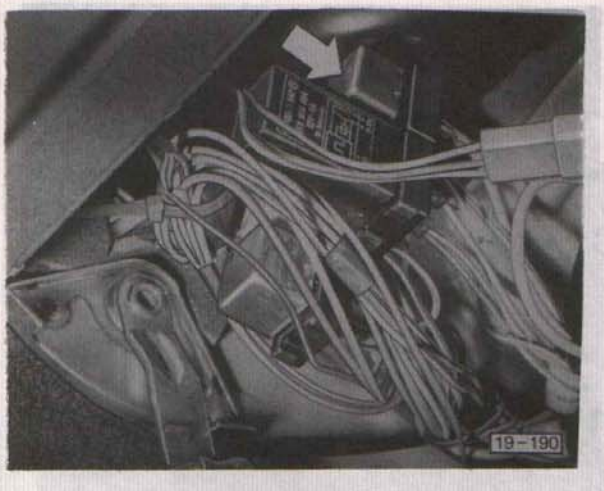
- Working from the passenger compartment, push a length of wire out through a free opening in the rubber grommet in the bulkhead.
- Prepare harness from service installation kit:

  disconnect lead from relay socket

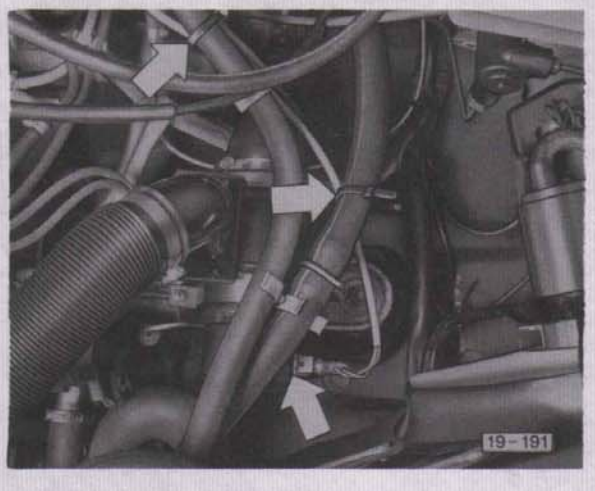
  disconnect lead from separate fuse
- Tape lead to be pulled through to wire already inserted and pull through into passenger compartment.



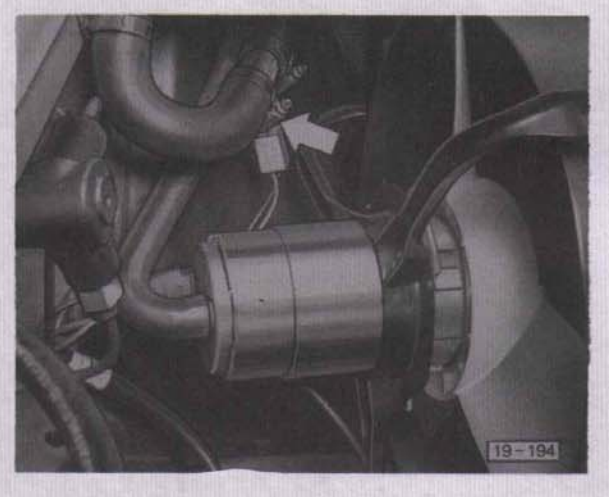
- Reconnect harness to relay socket and separate fuse (see current flow diagram).



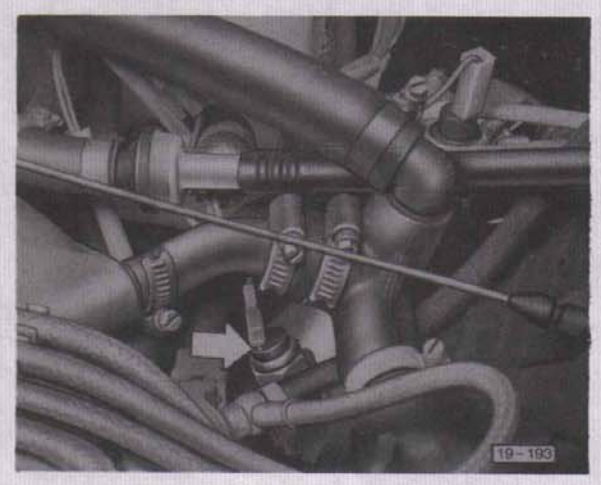
- Disconnect fan run-on relay.
- Pull red 0.5 mm dia. lead and brown/white 0.5 mm dia. lead out of holder and insulate.
- In their place connect brown lead from harness in installation kit instead of brown/white and green/blue lead instead of red into holder.
- Connect holder on harness from installation kit onto relay carrier.
- Lift relay plate with fuse holder out of its retainer.
- Disconnect yellow plug and take out blue/red lead.
- Wire in blue/red lead of harness from installation kit.
- Connect red connecting bridge from auxiliary fuse to relay plate, terminal 30.
- Reinstall relay plate with fuse holder.



- Connect plug to blower motor.



- Connect plug to thermoswitch in coolant hose.

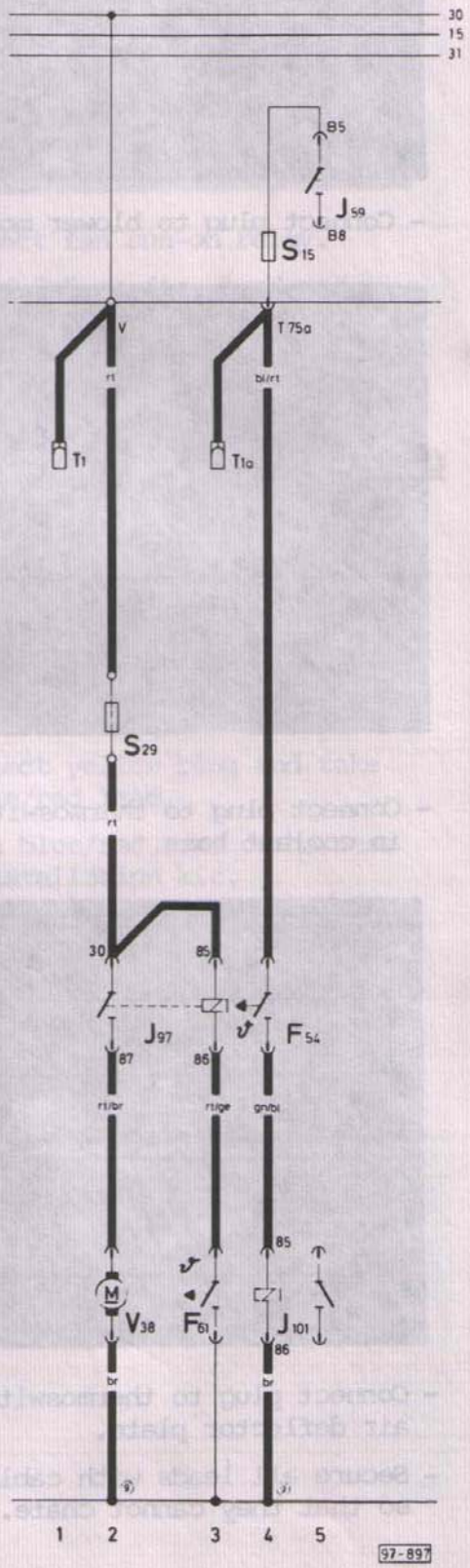


- Connect plug to thermoswitch on air deflector plate.
- Secure all leads with cable clips so that they cannot chafe.

CURRENT FLOW DIAGRAM AUDI 200 5T WITH MANUAL GEARBOX

SERVICE INSTALLATION OF COOLING SYSTEM FOR INJECTORS AND 2-SPEED ELECTRIC RADIATOR FAN

Designation	in current track
F 54 - Thermoswitch for radiator fan, 2-speed	5
F 61 - Thermoswitch for V 38	3
J 59 - Auxiliary relay	6
J 97 - Relay for V 38	2, 3
J101 - Relay for 2-speed radiator fan (previously relay for fan run-on)	5, 6
J 15 - Fuse in relay plate with fuse holder	
S 29 - Separate fuse for V 38	
T 1 - Connector, single-pole (behind dashboard)	
V 38 - Blower motor for cooling injectors	2
9 - Earthing point, engine compartment, left	



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Workshop Bulletin.
Audi 100, Audi 200

No. 10
of 9/81

File in booklet: 2.2 l fuel injection engine (K-Jetronic/turbocharger), May 1980 edition

Page to be marked: 67

ENGINE CODE LETTERS WJ — from 1981 model year onwards

DIFFERENT IDLE SETTING

On Audi 200 vehicles from 1981 model year onwards in the case of all engines with code letters WJ the idle speed must be set to

800 rpm

(previously 900 rpm).

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