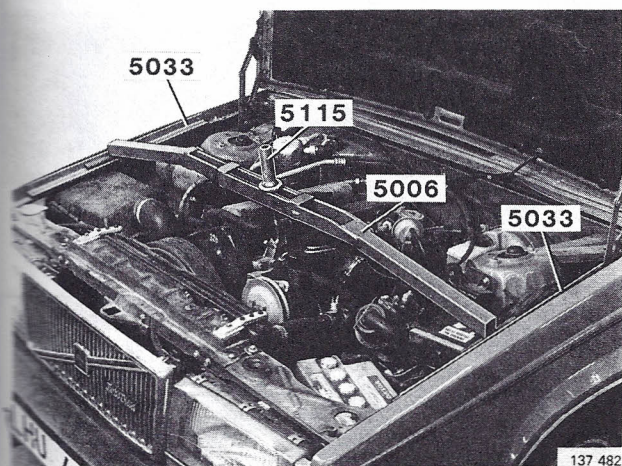


U. Engine mounts, replacement

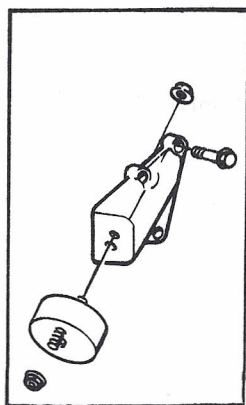
Special tools: 5006, 2 x 5033, 5155



U1

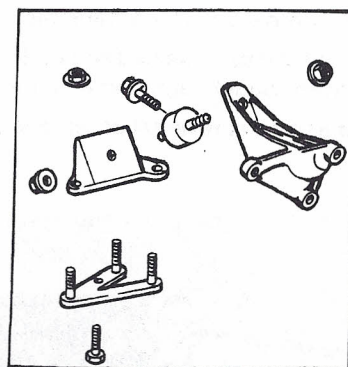
Front mount

Off-load mounts with cradle assembly **5033** (2x), lifting yoke **5006**, and lifting hook **5115**.



137 139

Left side

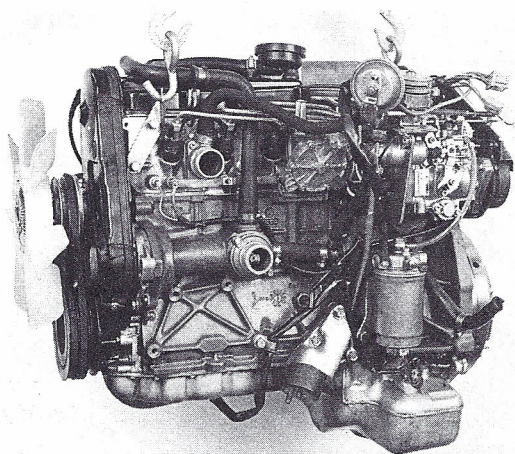


137 138

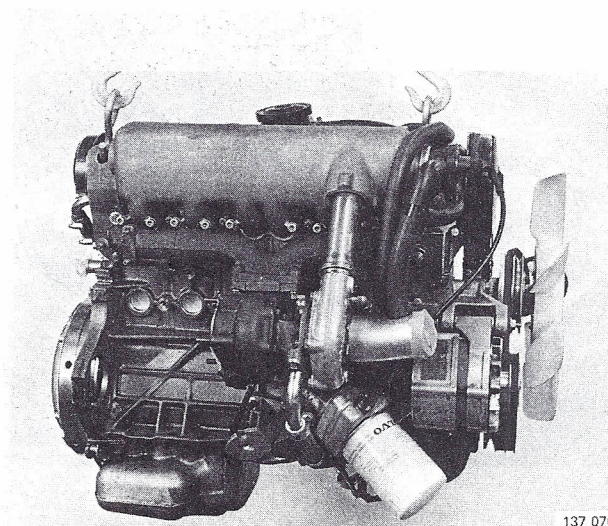
Right side

V. Engine, replacement

Special tools: 2810, 5185, 5186, 5267



137 069



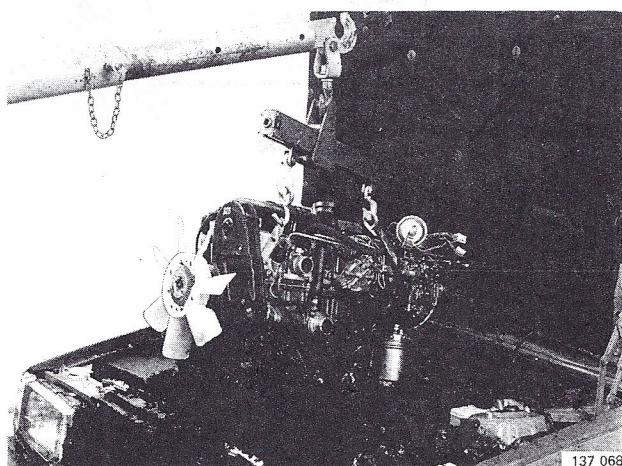
137 070

Important:

Engine can be removed without transmission.

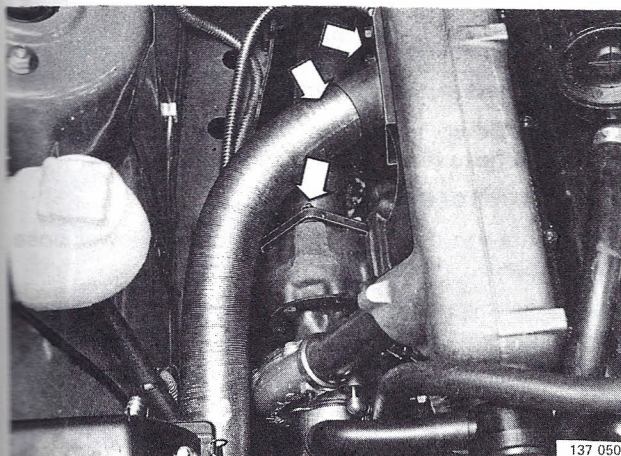
Starter motor should be detached and tied to control arm strut. Also power steering pump and AC compressor should be detached from mounts and tied in similar manner.

Installation of engine is reversal of removal procedures.



137 068

	Page
Removing parts.....	103
Lifting.....	105
Precautions.....	106
Filling oil and coolant	107
Adjustments.....	108



137 050

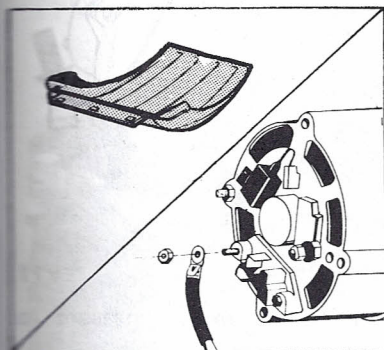
Clearing

V1

Remove/disconnect:

- battery earth (ground) lead
- upper retaining nut for exhaust pipe from turbocharger (D 24 T/TIC)
- air filter pre-heater hose
- rear pre-heat panel.

Beneath engine

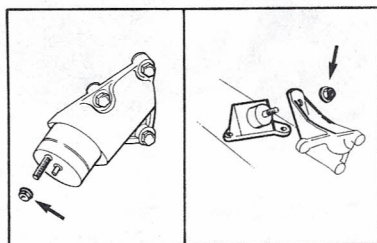


137 141

V2

Remove:

- any splashguard under the engine
- red lead from alternator

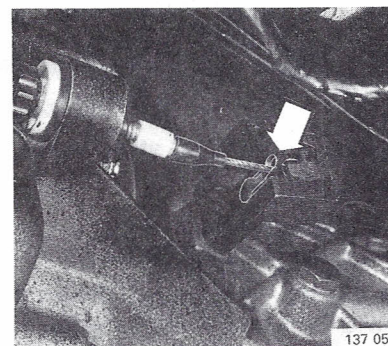


137 137

V3

Remove:

- retaining nuts from engine mounts (lower nut on left side, upper nut on right side)

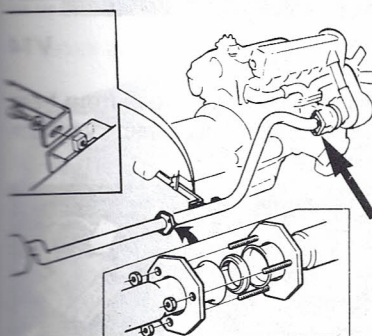


137 051

V4

Manual transmission

Detach cable from clutch fork

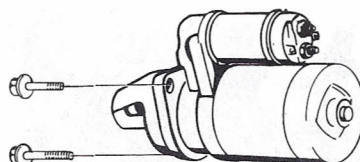


137 136

V5

Remove front exhaust pipe from:

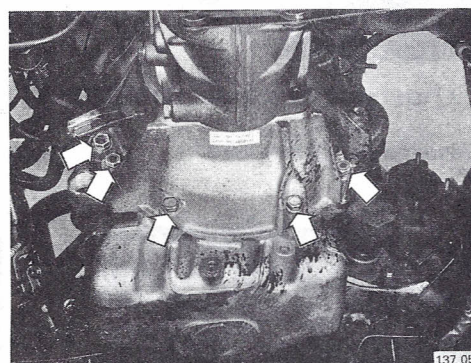
- turbocharger and branch pipe
- transmission crossmember
- coupling



137 140

V6

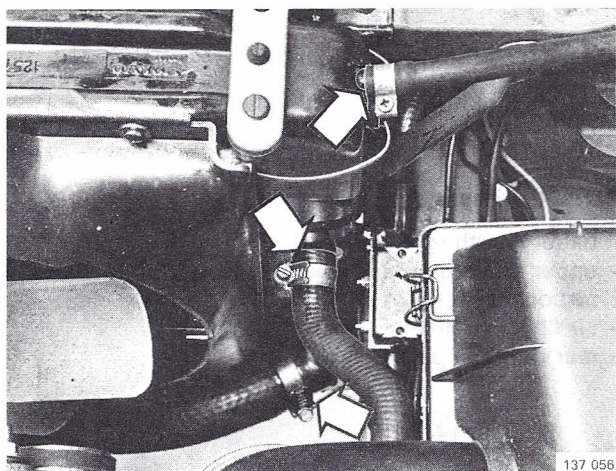
Detach starter motor and tie to control arm strut.



137 053

V7

Remove flywheel bolts. Leave 2-3 bolts to keep housing in position.



137 056

Unscrew expansion tank cap

Vehicles without drain tap:

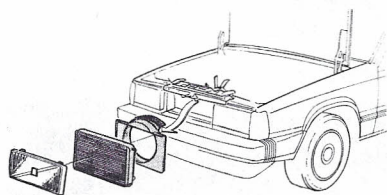
Disconnect lower hose from cold start device. Disconnect lower hose from radiator and drain coolant.

Vehicle with drain tap:

Unscrew tap to drain coolant. Disconnect lower hose from radiator.

Disconnect expansion tank hoses from radiator and upper radiator hose from engine.

D 24 TIC: Remove hoses to and from intercooler and oil cooler.



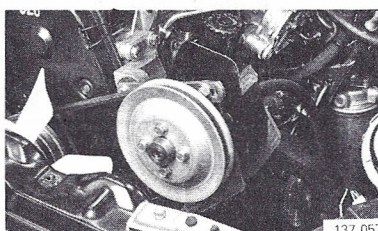
137 142
V9

Remove:

- grille, fan shroud
- radiator mounts and radiator

D 24 TIC: intercooler. Remove hose between intake manifold and solenoid and hose between solenoid and smoke limiter.

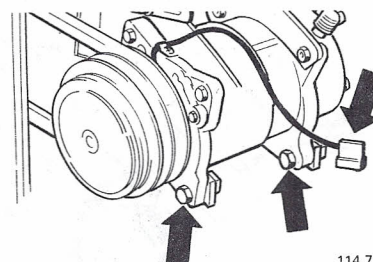
To remove engine



137 057

V10

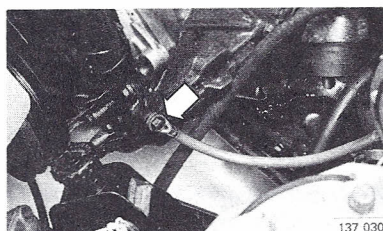
Detach power steering pump. Refit lift eyelet (use 20 mm screw).



114 796

V11

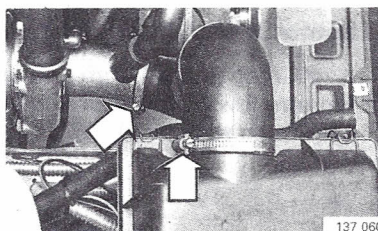
Detach and tie compressor to body.



137 030

V12

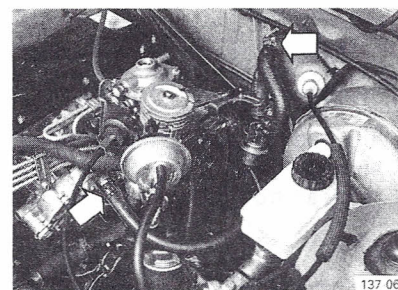
Disconnect battery lead.



137 060

V13

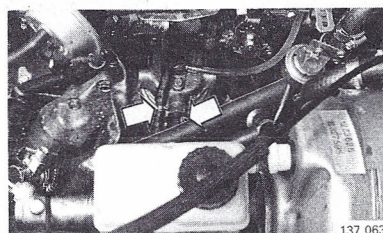
Disconnect air filter-turbocharger hose.



137 062

V14

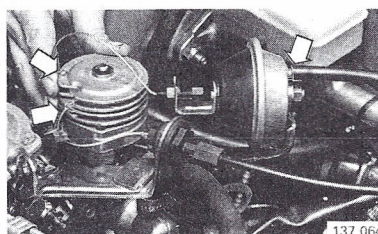
Disconnect upper hose from heat exchanger. Disconnect vacuum hose from pump.



137 063

V15

Disconnect fuel line from filter. Disconnect other fuel line at connector. Plug ends of fuel lines.



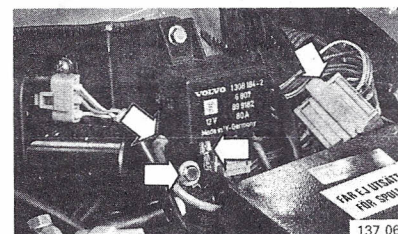
137 064

V16

Disconnect cable from throttle pulley. Also kick-down cable as applicable.

Vehicles with cruise control:

Disconnect throttle cable and vacuum hose.

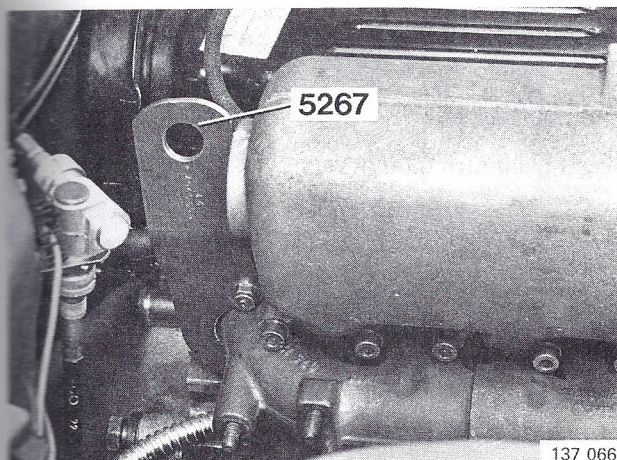


137 065

V17

Detach glow plug relay from wheel housing. Separate cable harnesses (2x). Disconnect spade terminal and (+) feed relay.

V18

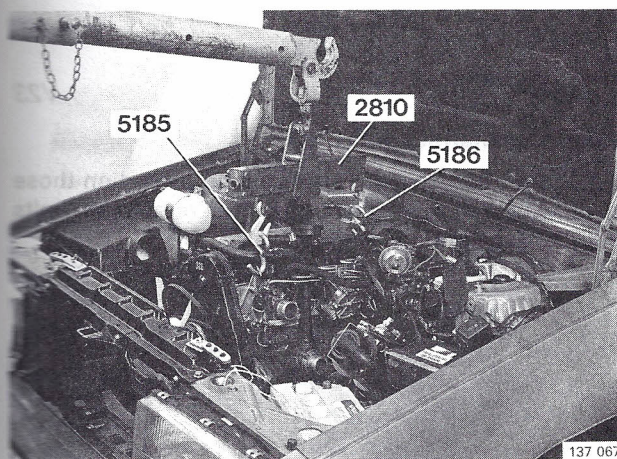


Lifting

Attach lifting eye **5267** to rearmost branch pipe screw (leave washers in place).

Note! Take care not to damage hose connected between intake manifold and smoke (fuel) limiter.

V19



Position crossbeam **2810** and hooks **5185** and **5186**

Support transmission with a jack.

Automatic transmission:

Remove torque converter bolts through opening for starter motor.

Manual and automatic transmission

V20

Remove remaining bolts from casing;

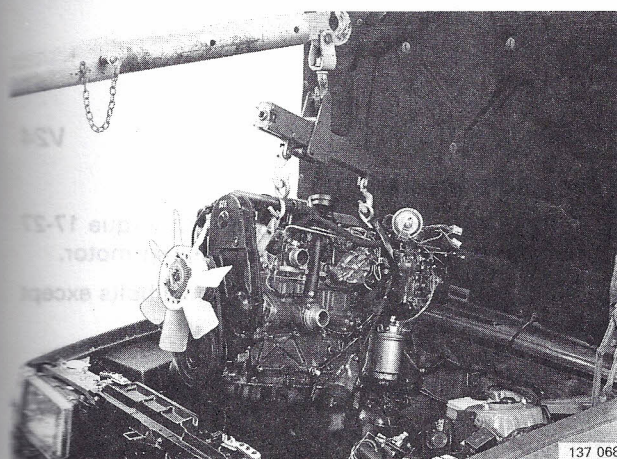
V21

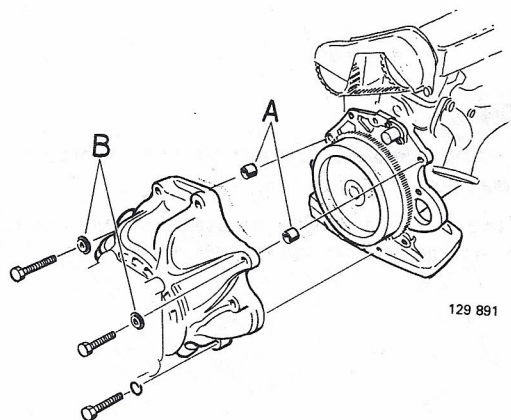
Lift engine

If automatic transmission is fitted; make sure that torque converter remains attached to transmission when engine is lifted.

V22

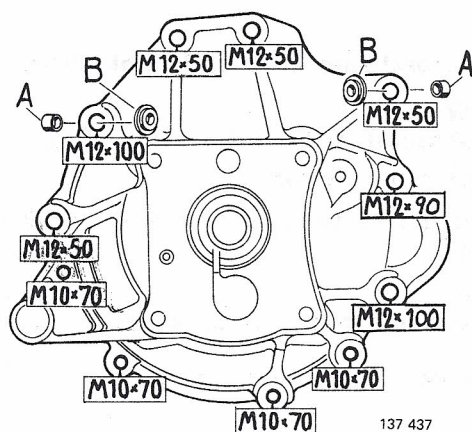
Transfer parts to new engine as appropriate





Precautions

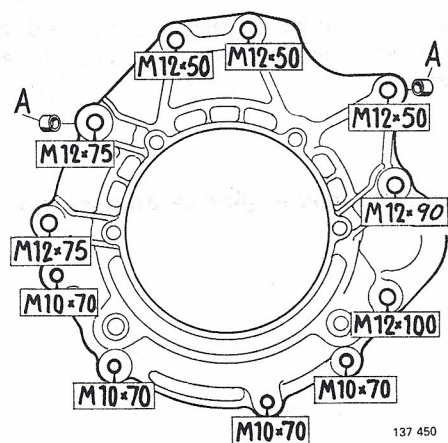
Size of bellhousing bolts vary.



V23

Manual transmission

A 4.5 mm thick washer (B) should be placed on those bolts which have spacers (A). The remaining bolts should have spring washers.



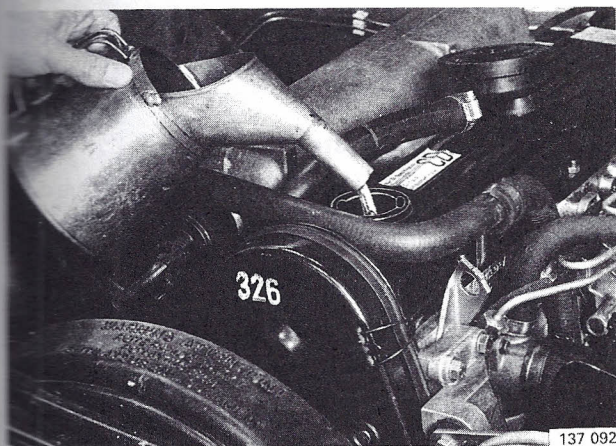
V24

Automatic transmission

Install torque converter bolts (tightening torque 17-27 Nm = 12-20 ft. lbs.) before attaching starter motor.

Spring washers should be installed on all bolts except dipstick tube bolts.

V25



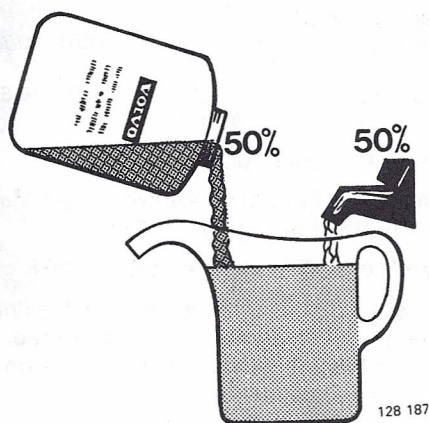
Fill with oil

Capacity incl filter. 6.0 litres (6.5 US qts)
excl filter. 5.0 litres (5.4 US qts)

Quality according to API at least **CD** according to CCMC class **D2/PD1**.

Oils designated SE/CD and SF/CD meet this requirement.

See page 11 for viscosity specifications.

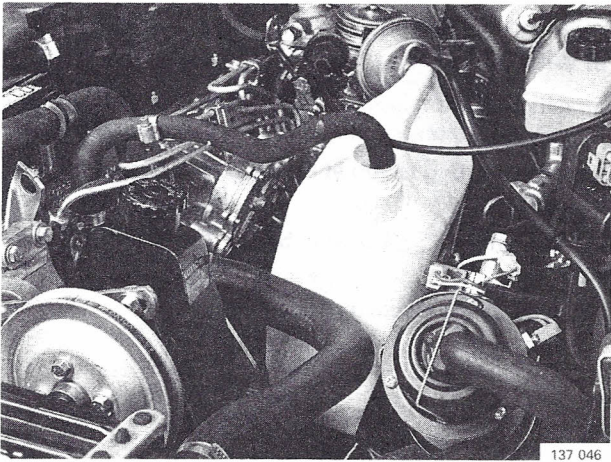


Coolant

Use genuine Volvo coolant **type C (blue-green)** diluted with **clean water** in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage. No other coolant is warranted by Volvo.

- Never top-up the cooling system with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- The coolant should be changed regularly since the corrosion-protective additives in the coolant lose their effect in time.

Important: Do not run engine when level of coolant is low, since high local temperatures can result which may cause the cylinder head to crack.



137 046

V26

Fill coolant

Prepare for cooling system bleeding

Disconnect upper hose from cold start device. Place drip pan beneath hose. Hold end of hose at approximately same level as expansion tank. (By following this method air locks in the cooling system will be avoided.)

27

Filling coolant:

	D24	D24 T	D24 TIC
Capacity, (approx. litres)			
with manual transm.....	9.4	11.0	10.7
with automatic transm.	9.2	10.9	10.6
(For tropical use add approx. 0.6 litres)			

Use only **type C** coolant (blue-green)

Vehicles with CU: Set heater control to get Max heat. Mode selector must not be set in Max.

Vehicles with ACC: Set mode selector in OFF.

Start engine and run at above idle for 5 minutes to warm-up engine. Add coolant during this time. Reconnect hose to cold start device. Top-up expansion tank to above max and screw on cap.

V28

Check/adjust injection timing

See page 139, group 23

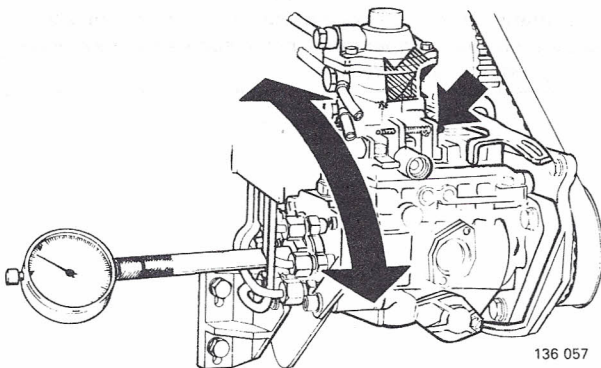
V29

Function check

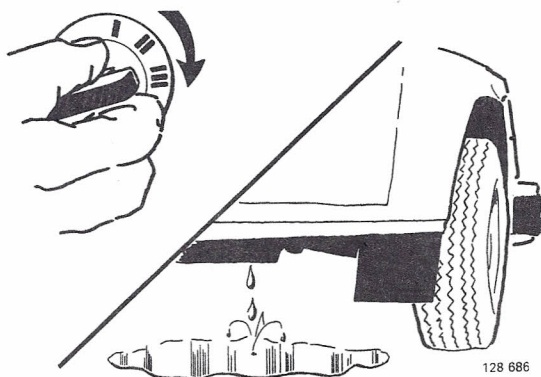
Start engine and run until warm.

Check for oil and coolant leakage. Top-up cooling system if necessary.

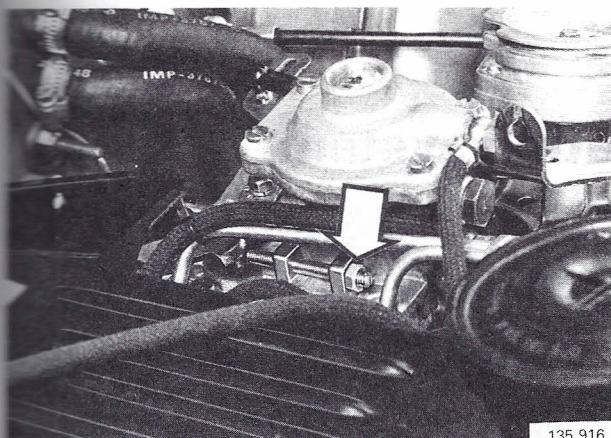
Refit engine splashguard.



136 057



128 686



135 916

V30

Check/adjust idle and max speed

D 24 S

Low idle = 12.5 ± 0.8 r/s (750 ± 50 rpm)

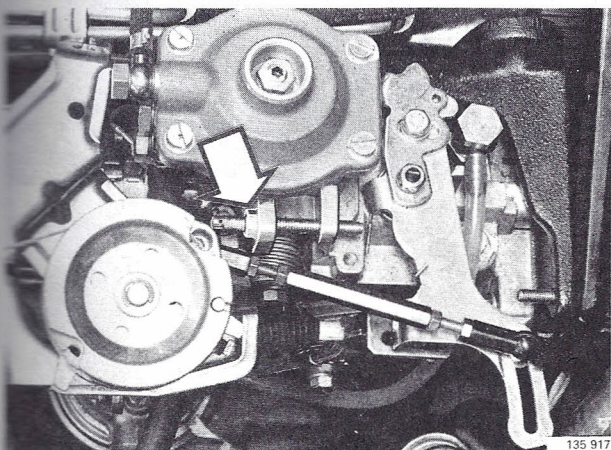
Max idle = 90.0 ± 1.7 r/s (5400 ± 100 rpm)

D 24 T/TIC

Low idle = 13.8 ± 0.8 r/s (830 ± 50 rpm)

Max idle = 90.0 ± 1.7 r/s (5400 ± 100 rpm)

Seal with paint after adjustment. Further information on page 131.



135 917

V31

Check/adjust engine controls and kick-down cable as applicable

Further information on page 216.

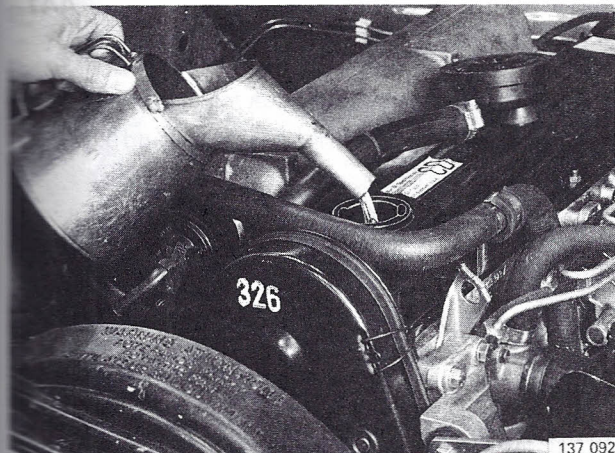
Group 22 Lubricating system

Contents

Engine oil, viscosity	111
Oil filter, replacement	112
Oil pressure, checking	112
Relief valve	112
Oil cooler, replacement, D 24 T	113
Oil adapter, replacement, D 24 T	114
Oil cooler, replacement, D 24 TIC	116
Oil adapter, replacement, D 24 TIC	117
Oil pump, replacement	118

AA. Engine oil

Special tool: 2903



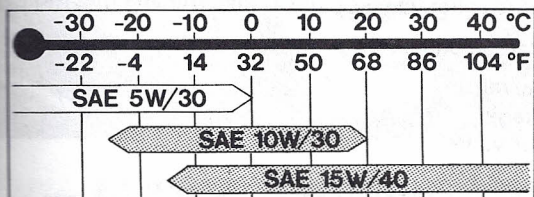
Oil capacity
 excluding filter 5.0 litres
 including filter 6.0 litres
 Difference in volume (max- 1.0 litre
 Oil pressure with an oil temperature
 of 80°C = 176°F and an engine speed of
 33.3 r/s (2,000 rpm, at least 200 kPa (2.0 kp/cm²)
 Oil quality according to API at least CD *
 according to CCMC class D2/PD1 *

* Oils with designations SE/CD and SF/CD fulfill this requirement.

Supplementary engine oil additives are not allowed because of potential damage to engine.

Viscosity

USA, Canada and Japan

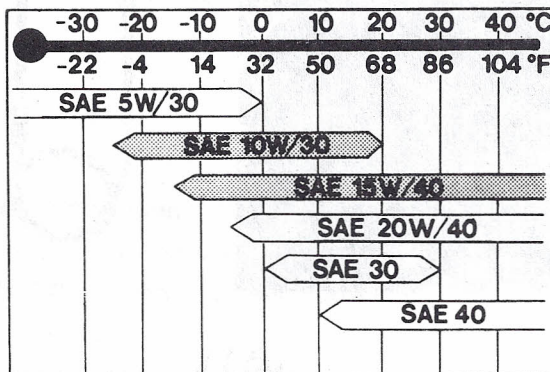


137 645

Note! SAE 15W/40 oil is recommended for use in extreme driving conditions that involve high temperature and high oil consumption, such as mountain driving with frequent decelerations or fast motorway driving. Note however the lower temperature limits.

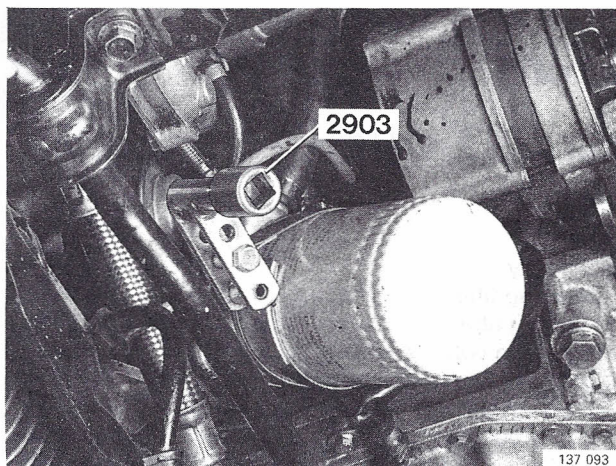
Other markets

(All others except USA, Canada and Japan)



137 643

Note! SAE 15W/40 or SAE 20W/40 oil is recommended for use in extreme driving conditions that involve high temperature and high oil consumption, such as mountain driving with frequent decelerations or fast motorway driving. Note however the lower temperature limits.



Oil filter, replacement

AA1

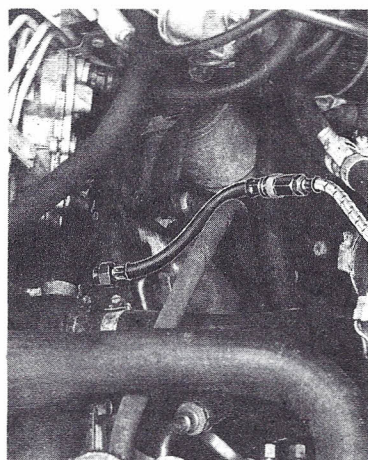
Use strap wrench **2903** to remove oil filter.

Refer to instructions on filter when installing.

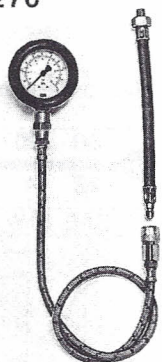
If only filter is replaced (without oil change) add 0.8 litres (0.9 US qt) engine oil.

Oil pressure, checking

Special tool: 5270



5270



137 073

AA2

Connect oil pressure gauge to adapter on side of engine. Oil pressure should be at least **200 kPa** (28 psi) at **33.3 r/s** (2000 r/min) and oil temperature +80°C.

Oil pump relief valve opens at **600-700 kPa** (85-100 psi).

If incorrect, check:

- oil level
- leakage
- relief valve.

Check/replace adapter seal if necessary.

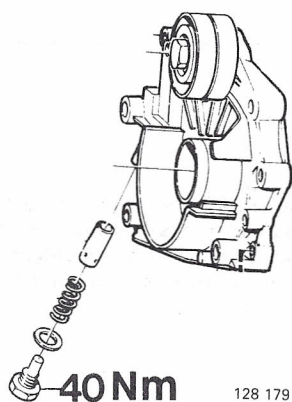
Oil pump relief valve

AA3

If oil pressure is not as specified, check for smooth operation of plunger and condition of springs.

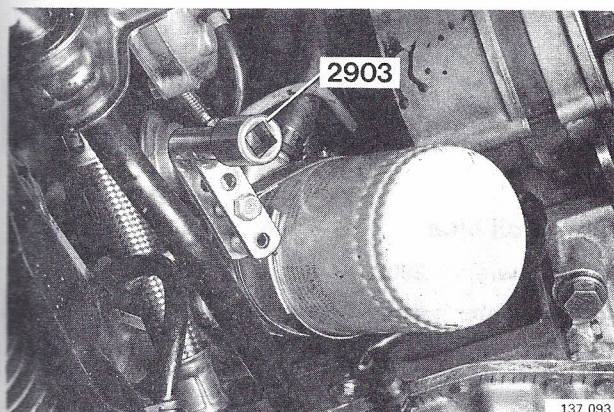
Relief valve can be reached from underside of pump (no need to remove pump).

Tightening torque 40 Nm (30 ft. lbs.).



AB. Oil cooler, replacement (D 24 T)

Special tool: 2903



AB1

Remove splashguard from underneath engine.

Remove filter

Place oil pan beneath filter.

Remove filter with strap wrench **2903**.

AB2

Remove oil cooler

Block hoses with clamping pliers to prevent leakage.

Disconnect hoses from oil cooler.

AB3

Identify position of oil cooler

Unscrew nut and remove oil cooler.

Clean O-ring mating face.

AB4

Install oil cooler

Smear new O-ring with oil.

Place O-ring and oil cooler in position.

Tighten nut.

Reconnect hoses.

Upper hose on oil cooler leads to thermostat housing.

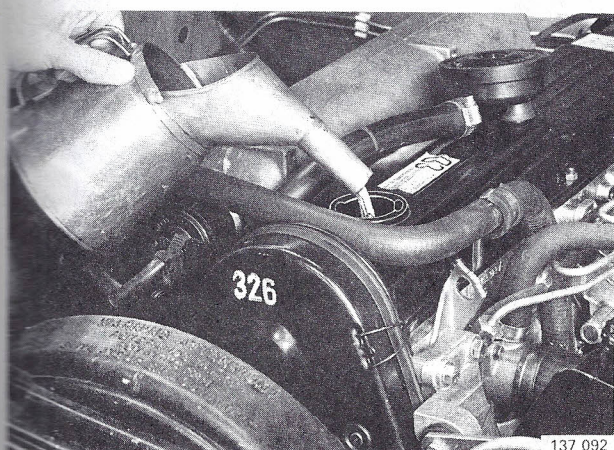
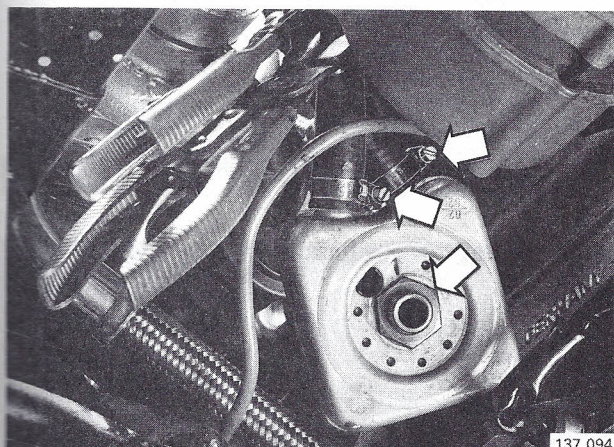
Remove clamping pliers.

Refit oil filter.

Start engine and check for leakage.

Top-up cooling system/lubricating system.

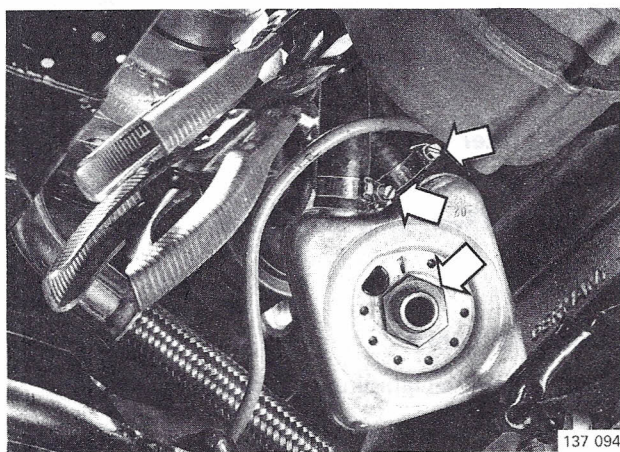
Refit engine splashguard.



AC. Oil adapter, replacement (D 24 T)

(Turbocharger must be removed, see page 193).

Special tool: 2903



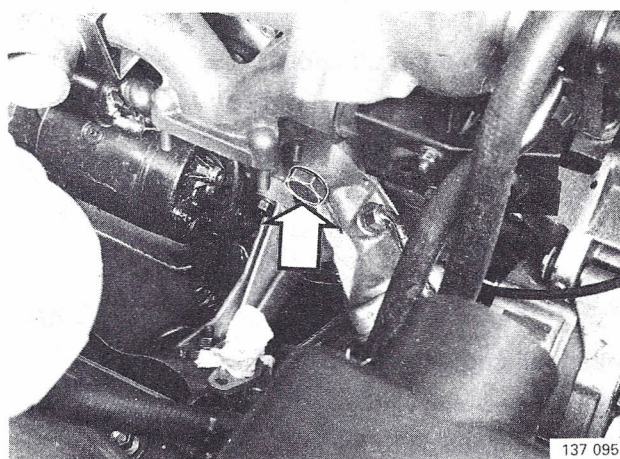
AC1

Remove oil filter

Use strap wrench **2903**.

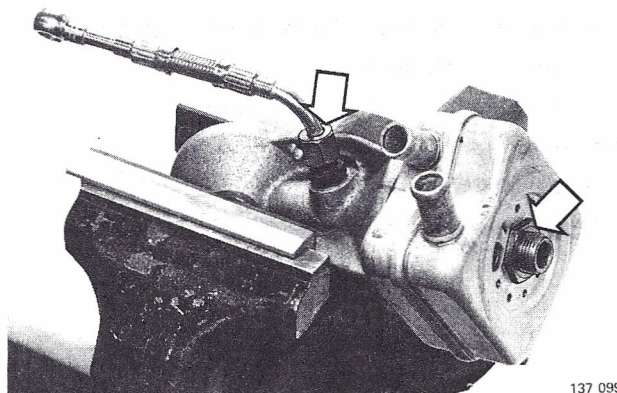
Block oil cooler hoses with crimping pliers.

Disconnect hoses from oil cooler.



AC2

Remove adapter + oil cooler



AC3

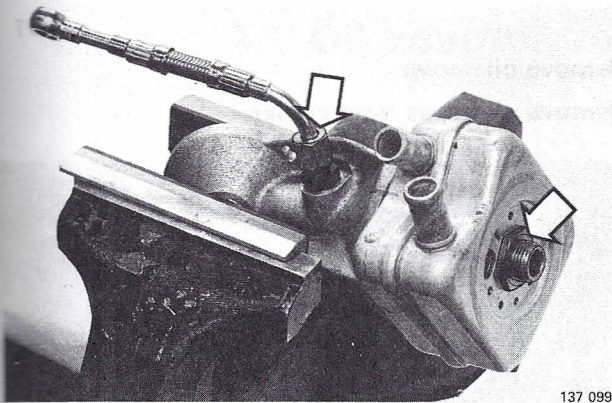
Mount adapter in a vice protected by soft jaws

Identify position of oil cooler

Remove:

- nut and oil cooler
- pipe and nipple
- screw

Clean all parts and replace if necessary.



137 099

AC4

Install adapter:

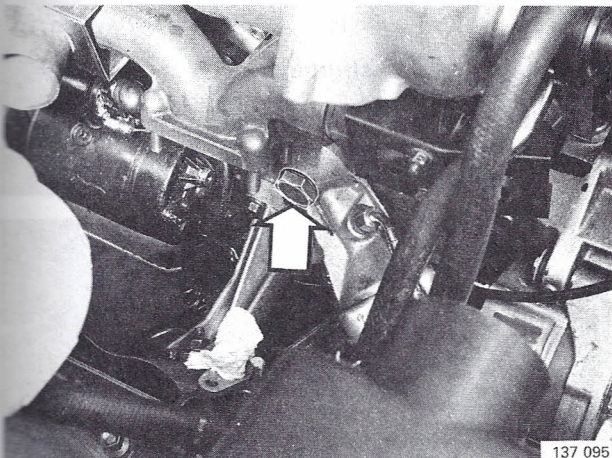
- pipe + nipple (hand-tight at this stage)
- screw.

AC5

Install oil cooler

Install a new, lubricated O-ring.

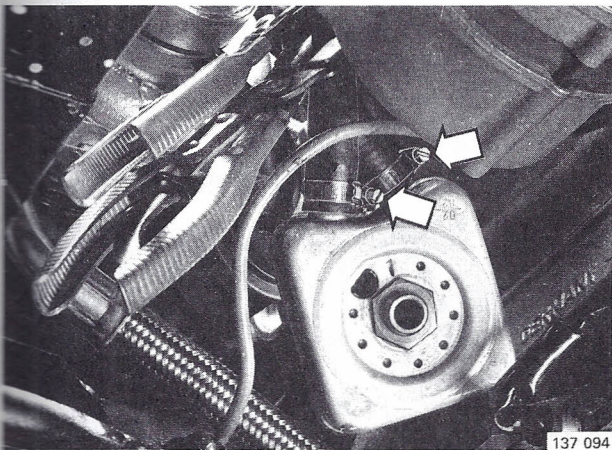
Make sure that oil cooler takes up correct position.



137 095

AC6

Install adapter



137 094

AC7

Reconnect hoses

Upper hose on oil cooler leads to thermostat housing.
Remove crimping pliers.

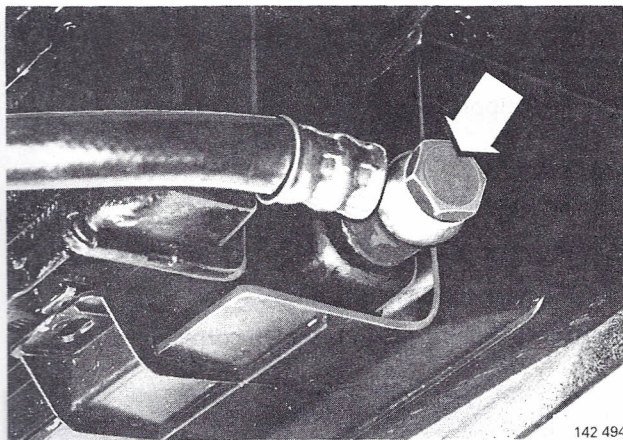
AC8

Refit oil filter

AC9

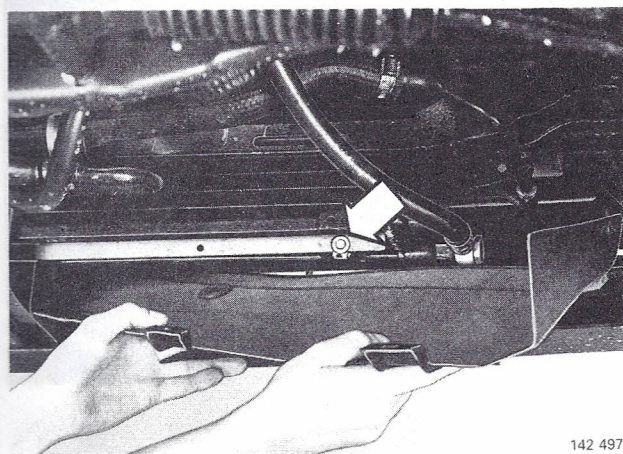
Tighten delivery pipe on adapter after installing turbocharger.

AD. Oil cooler, replacement (D 24 TIC)



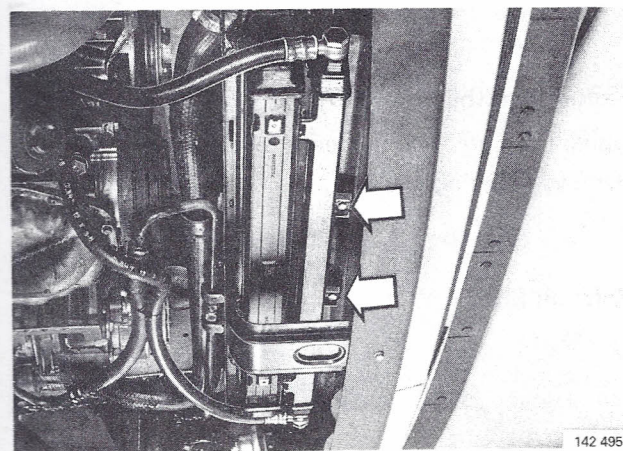
AD1

Remove oil cooler
Remove oil hoses from cooler



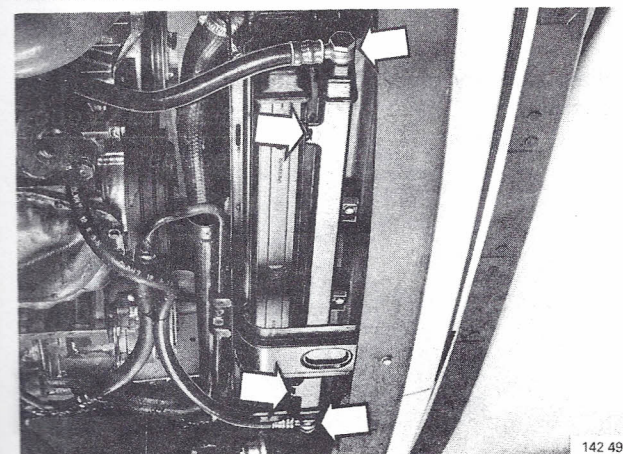
AD2

Remove engine splashguard
Remove mounting bolts inside splashguard



AD3

Remove the front mounting bolts
Remove oil cooler



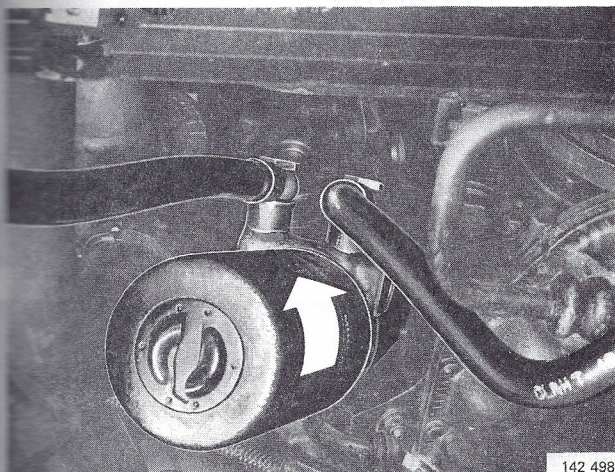
AD4

Installation

Support oil cooler and fasten front mounting bolts
Fasten the lower bolts and install splashguard
Install oil hoses

AE. Oil adapter, replacement (D 24 TIC)

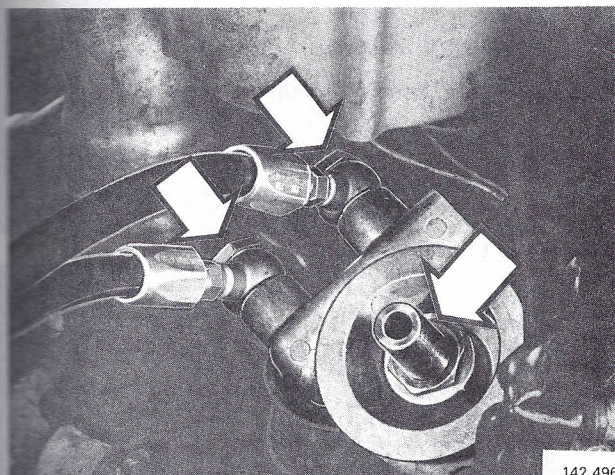
Special tool: 2903



Remove oil filter

Use tool 2903

AE1

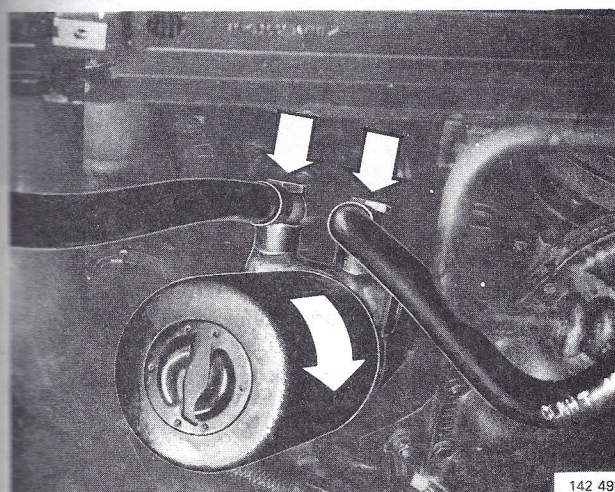


Remove oil hoses and the adapter's centre bolt

Remove adapter

Remove O-ring

AE2



Install adapter

Install new O-ring

Tighten centre bolt

Install oil hoses and oil filter

AE3

AF. Oil pump, replacement

Repair procedures include replacement of sump.
(Oil pump and sump can be removed without removing the engine.
In such a case the engine is suspended from lifting tool 5006).

Special tools: 5006, 2 x 5033, 5115, 5187, 5188, 5197, 5202, 5205

Removal

AF1

Disconnect battery and remove the engine splashguard.

AF2

Drain coolant

Remove expansion tank cap

Vehicles without drain tap:

Disconnect lower hose from radiator and drain coolant.

Vehicles with drain tap:

Unscrew tap to drain coolant.

AF3

Remove:

- high placed alternator
- power steering pump and bracket

AF4

Attach lifting eyelet with a short bolt

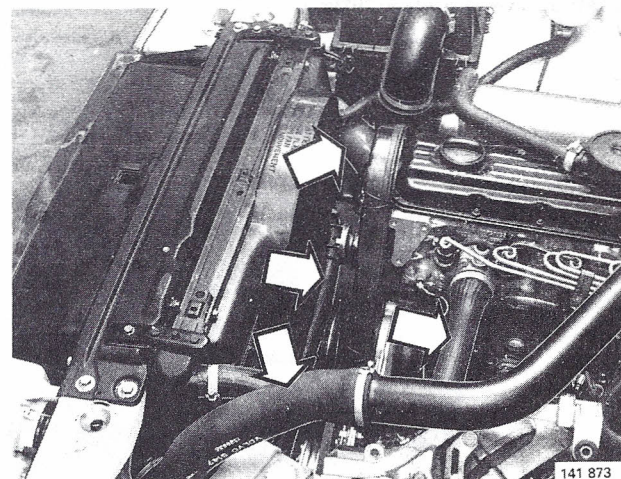
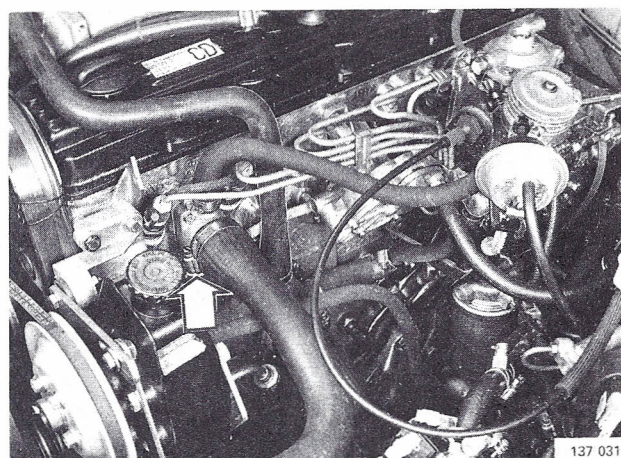
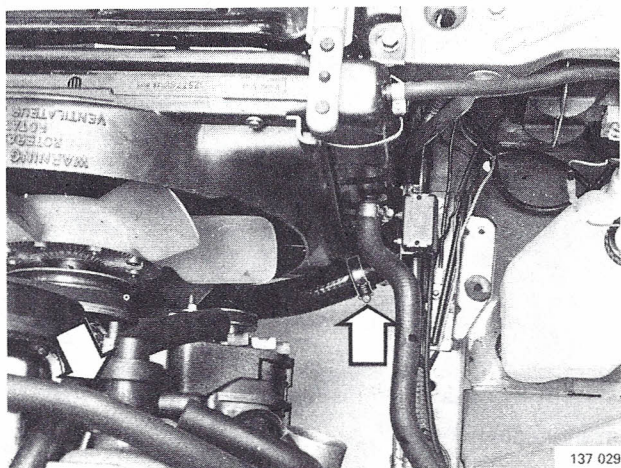
AF5

Remove:

- radiator fan with spacer and pulley
- radiator hoses
- electrical connections to radiator fan thermostat

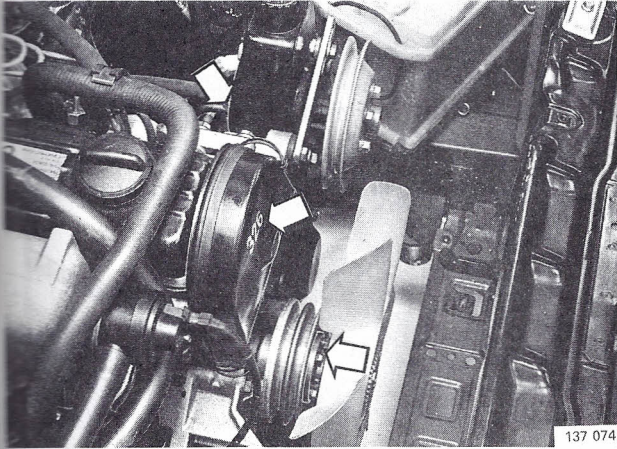
Note! D 24 TIC: Do not remove intercooler.

Lift out radiator.



AF6

Remove front timing gear cover

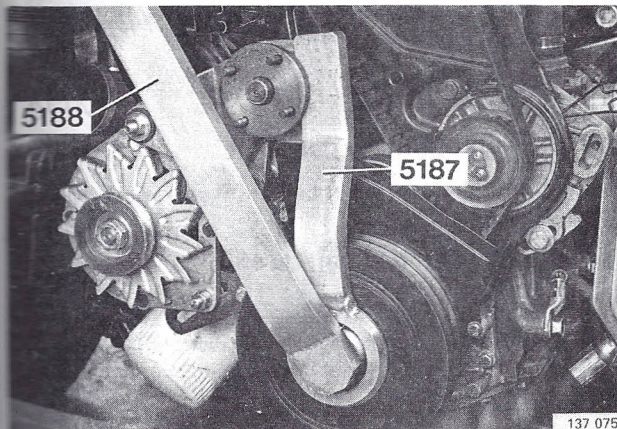


AF7

Remove vibration damper centre bolt

Use **5187** to prevent pulley from rotating and socket **5187** to unscrew bolt. It may be necessary to turn engine slightly so that 5187 rests on fan bearing.

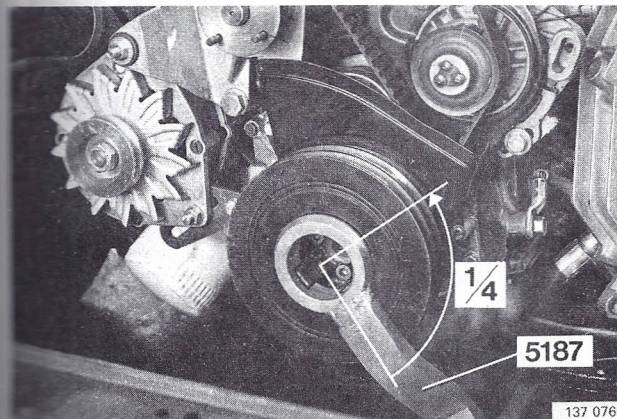
Turn engine so that O-mark on flywheel is passed by approx. 1/4 turn.



Then turn engine turn backwards so that flywheel O-mark is opposite arrow in casing.

Use **5187**

By turning engine anti-clockwise, sag in the belt will move to the driving side, making it easier to remove and install belt.

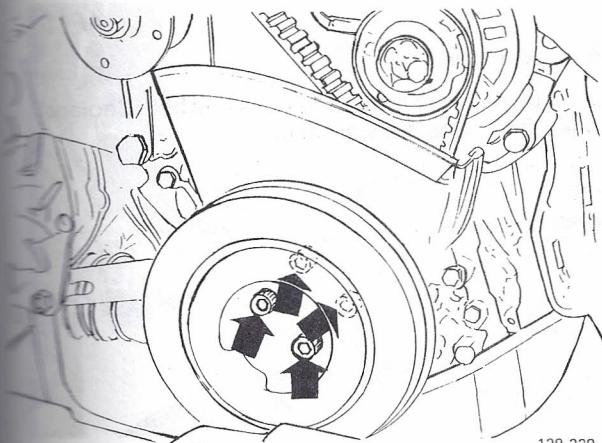


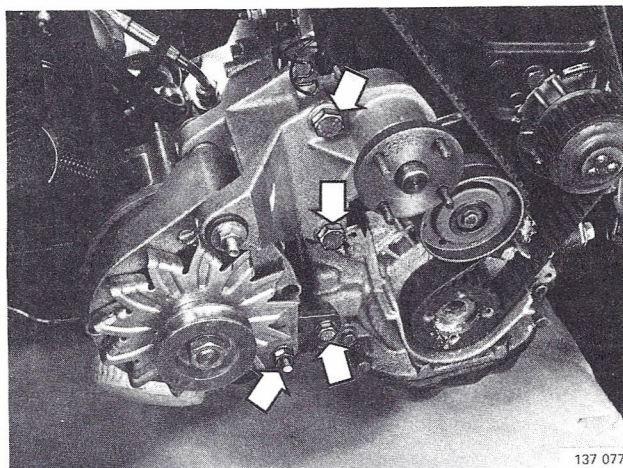
AF8

Remove vibration damper and lower timing gear cover

Inhex screws = 6mm.

On some engines it may be necessary to tap the damper free from crankshaft.





AF9

Detach alternator/fan mounting bracket and tie to suitable point

Remove 3x retaining screws and adjustment arm screw (arrowed).

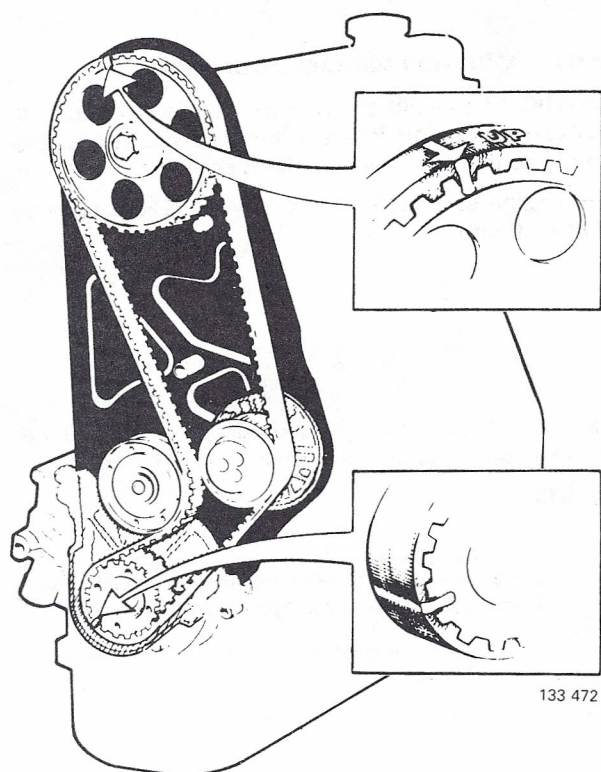
AF10

Mark position of timing gear belt

Mark belt, camshaft sprocket and crankshaft gear. Mark in front of a cog.

Also identify **outside** and **topside** of gear belt.

Important Belt must be installed in its exact original position otherwise valves may contact pistons and cause serious damage.



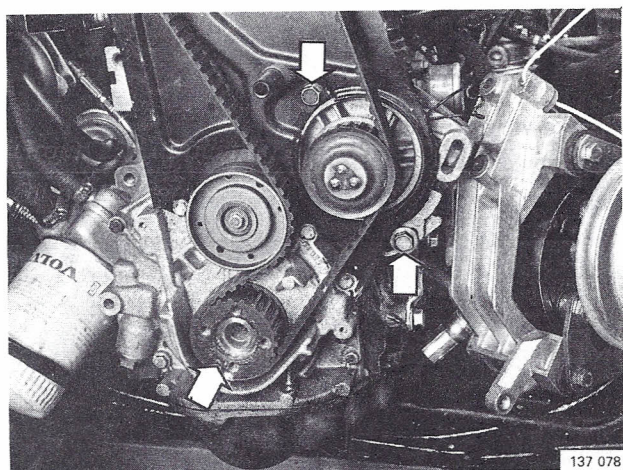
AF11

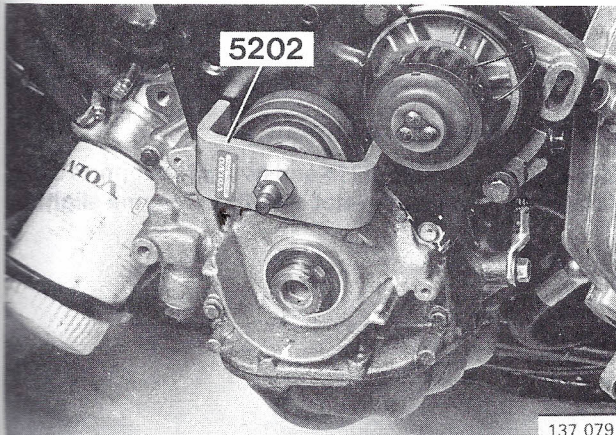
Remove gear belt

Slacken coolant pump mounting bolts and belt. Coolant may leak when bolts are slackened.

Remove:

- belt
- crankshaft pulley.

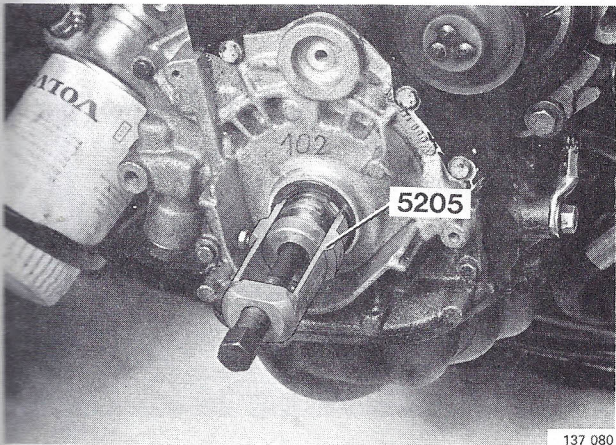




AF12

Remove idler pulley

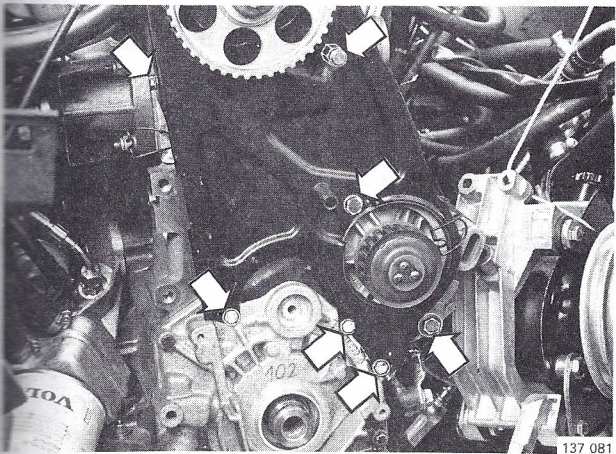
Use puller **5202**.



AF13

Remove seal from pump

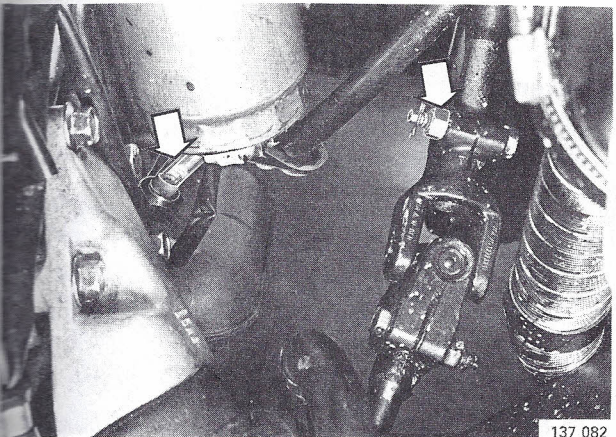
Use puller **5205**.



AF14

Remove all retaining screws from cover

Do not remove cover.



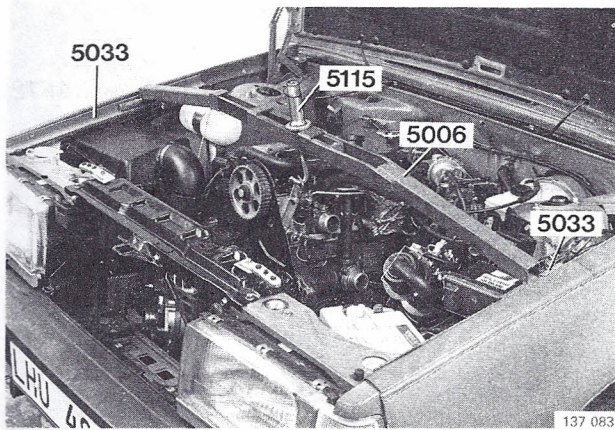
AF15

Lift up dipstick approx. 100 mm (2.5 in)

Remove:

- upper retaining bolt from steering joint
- wire from oil level transmitter.

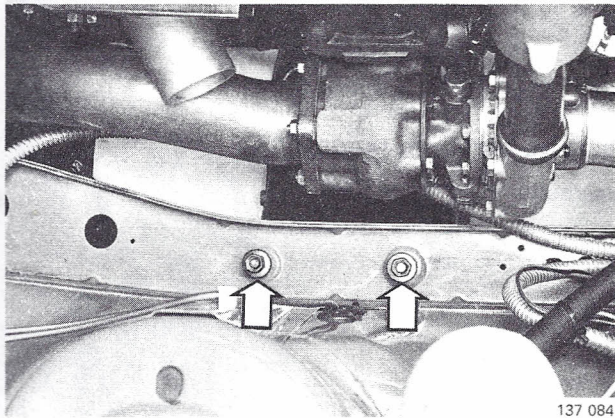
Oil pump, removal



AF16

Assemble lifting equipment

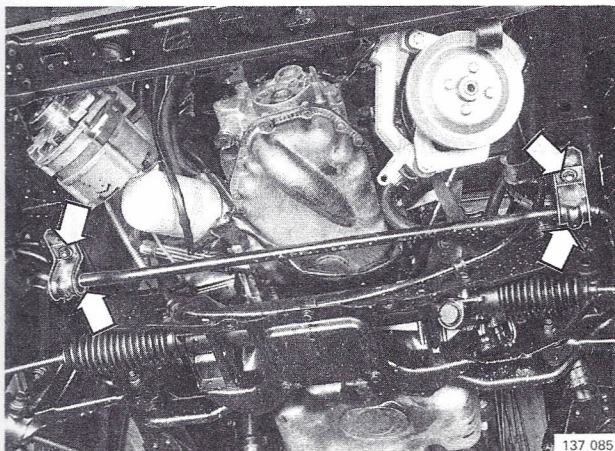
Use crossbeam 5006, 5115 and two side supports 5003. Attach hook to front eyelet and lift up engine slightly.



AF17

Slacken bolts securing front axle crossmember to sidemembers (both sides)

Let the bolts remain in the holes.



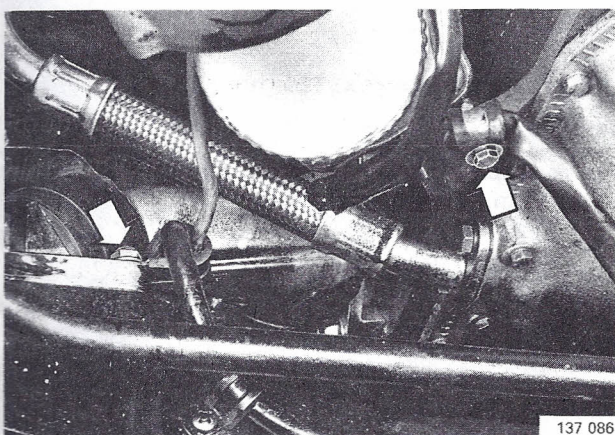
AF18

Drain oil

Refit plug after draining.

AF19

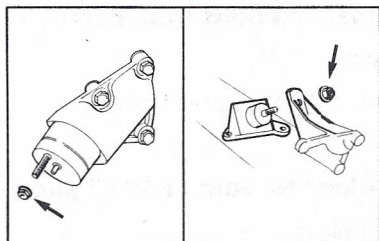
Remove anti-roll bar retaining screws from side members



AF20

Slacken:

- wiring harness clamp on engine right side
- clamp securing battery lead near right engine mount.
- clamp for wire harness on left side.



137 137

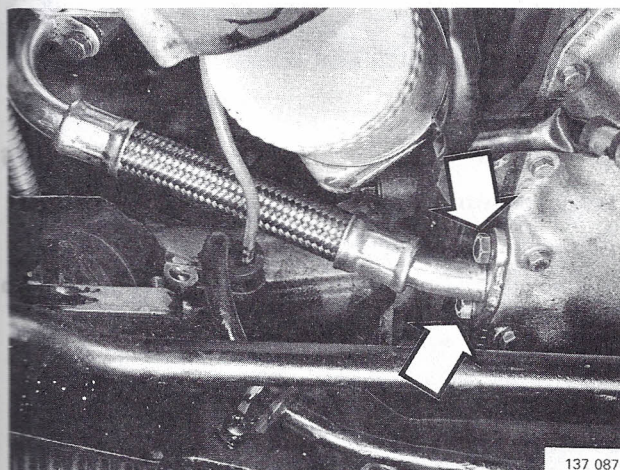
AF21

Remove retaining nuts from engine mounts

Lower nut on left side.

Upper nut on right side.

Lower side member and detach steering column from joint.

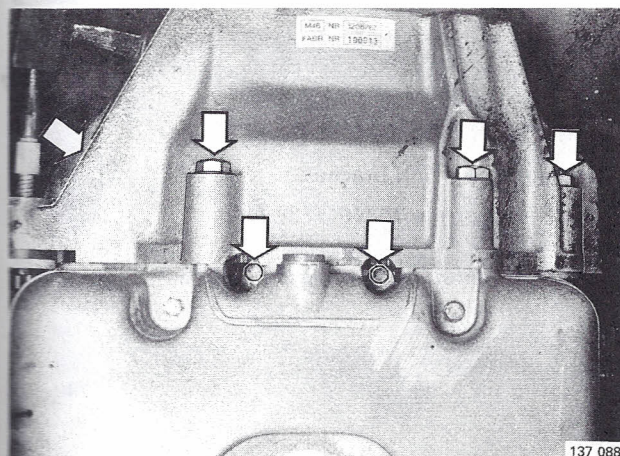


137 087

AF22

Disconnect return oil line from sump

Remove wires to oil level transmitter and the clamp on the clutch-cylinder hose.



137 088

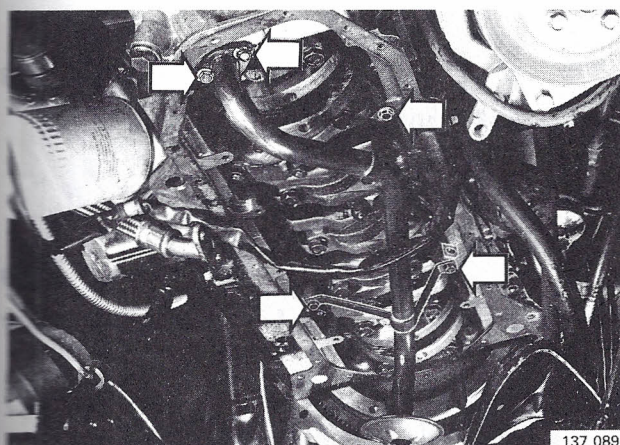
AF23

Remove sump

Remove retaining bolts.

Note! Rear and centre bolts can only be reached through opening in flywheel.

Remove four bolts from flywheel casing (see arrows).

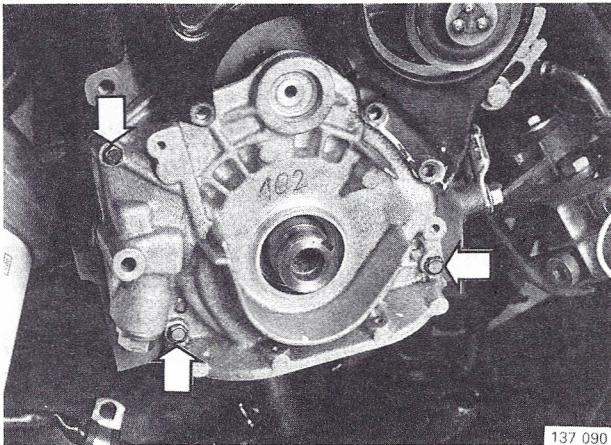


137 089

AF24

Remove oil tube retaining bolts from pump

Slacken tube retaining bolts from engine.



AF25

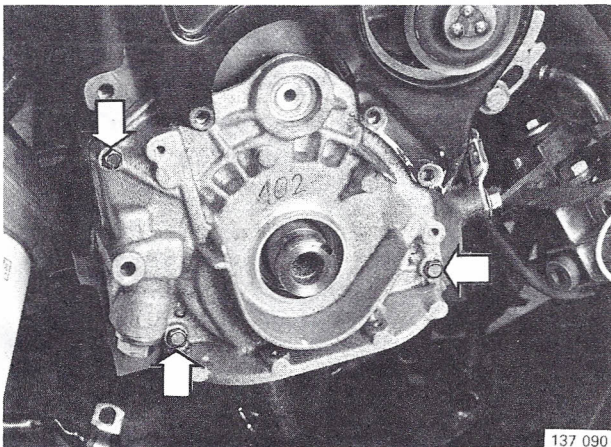
Remove remaining bolts from pump

Remove pump

Take care not to damage pump body.

Remove gaskets for sump and oil pump

Clean mating faces.



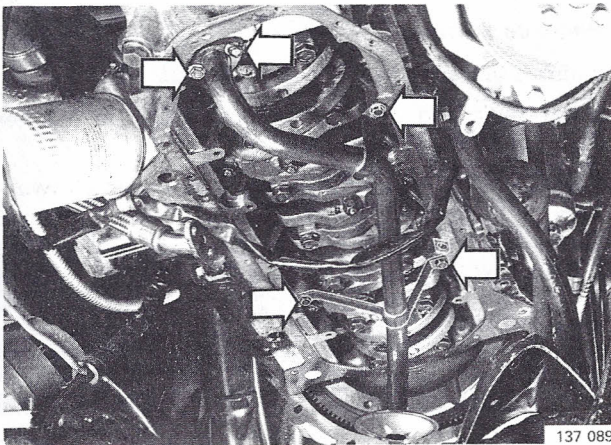
Installation

AF26

Install pump + new gasket

Align pump gear to crankshaft flange.

Secure pump with three bolts (arrowed), longest bolt to the right.



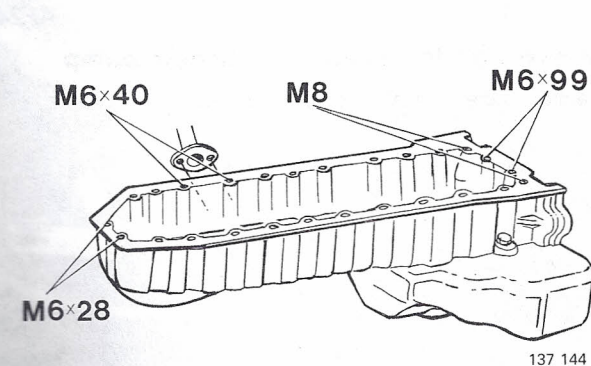
AF27

Connect oil tube to pump

Use a new seal and bracket.

Tightening torque 10 Nm (7 ft. lbs.).

Tighten tube retaining bolts on engine.



AF28

Install gasket and sump

Keep gasket in position with grease.

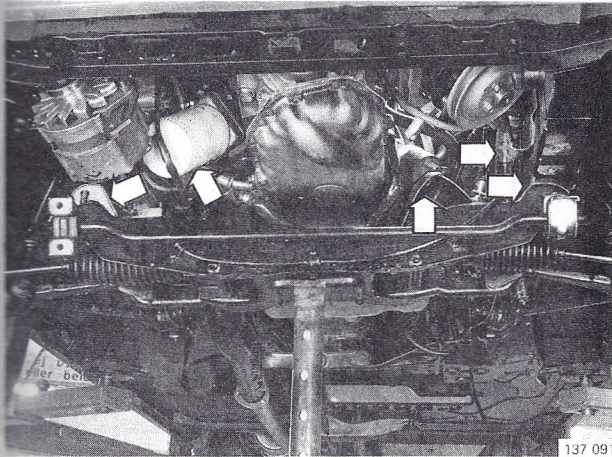
Note that bolt sizes vary.

AF29

Reconnect return oil line between turbocharger and sump

Install a new gasket.

Other bolts = M6 x 18

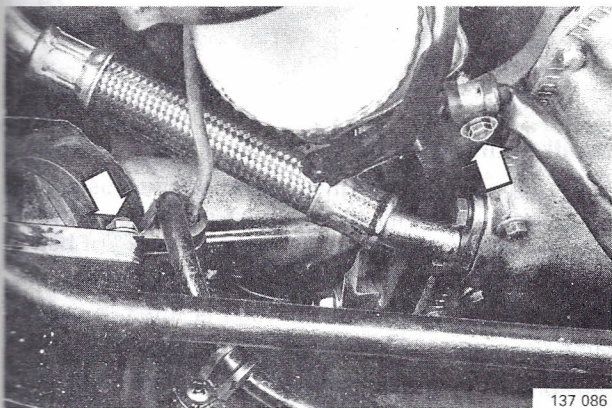


Raise front axle crossmember with a jack and position steering shaft joint and guide engine mounts into position.

Loosely fit front axle crossmember bolts.

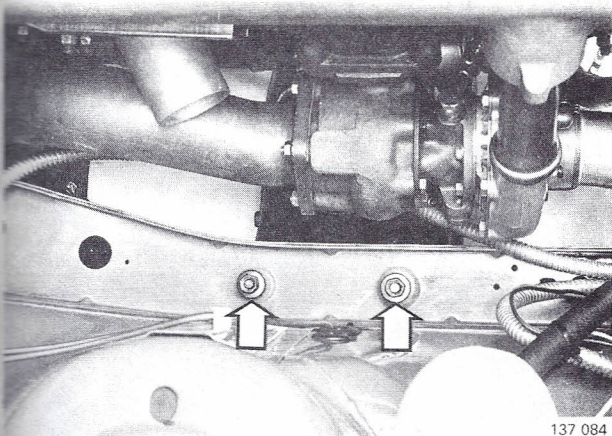
Attach nuts to engine mounts

Remove jack.



Connect:

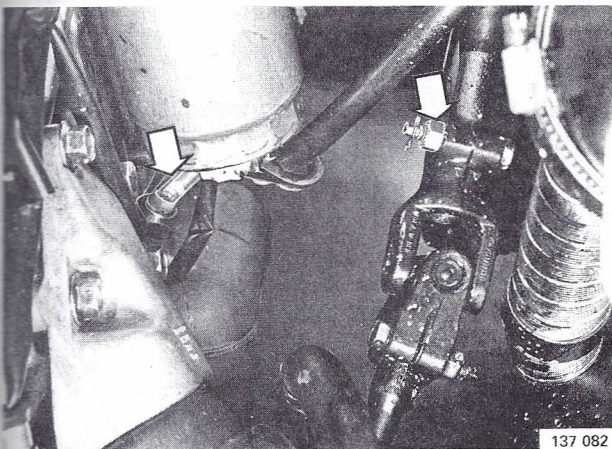
- wiring harness and battery lead
- anti-roll bar.



Tighten bolts on front axle crossmember

Tightening torque 85 Nm (60 ft. lbs.).

Remove lifting equipment from engine.



Secure steering shaft joint

Insert cotter pin.

Reconnect wire to oil level transmitter.

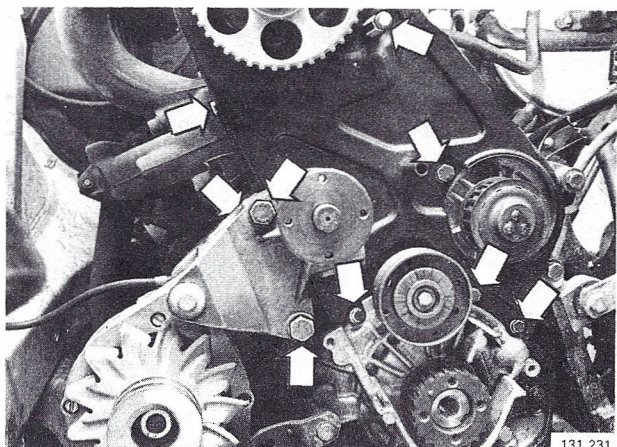
Push in dipstick.

AF30

AF31

AF32

AF33

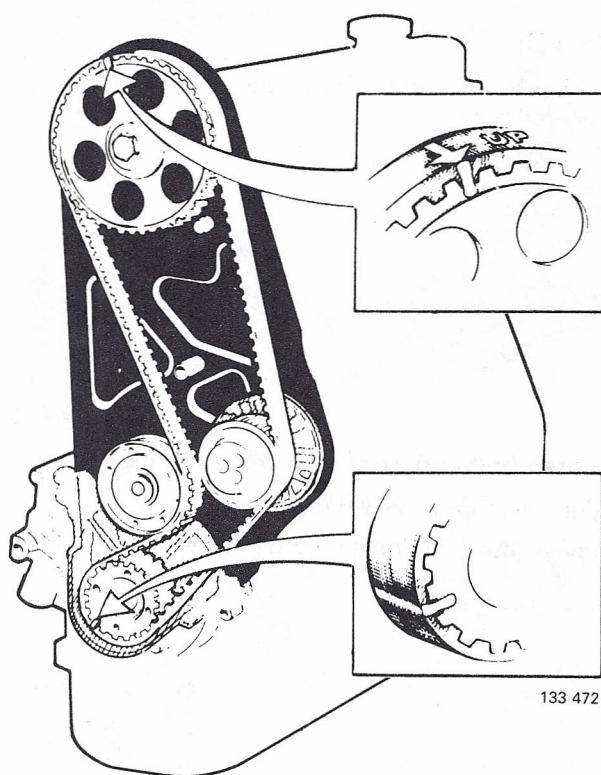


It is advisable on high mileage vehicles to replace the coolant pump O-ring. See page 213 operations BJ11-14.

AF34

Install:

- cover retaining bolts
- idler pulley
- oil pump seal
- crankshaft pulley
- fan/alternator bracket
- alternator mounting bracket (low placed alternator).



AF35

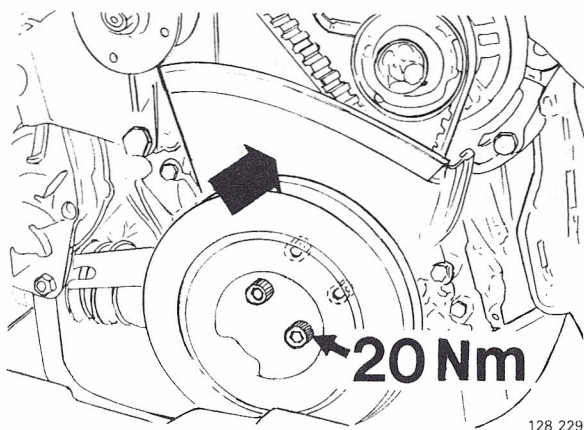
Install timing gear belt

Make sure that it is fitted in exactly the same position as found. Align identification marks on belt, camshaft sprocket and crankshaft gear. Make certain that belt is installed with correct side **forward** and **upward**.

It is extremely important that belt is fitted in exactly same position as before.

Tension belt by moving coolant pump (by hand).

Tighten pump mounting bolts.

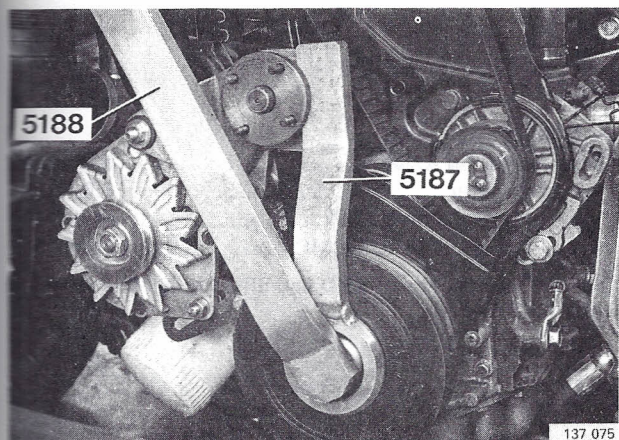


AF36

Install lower timing gear cover and vibration damper

Damper can only be fitted in one way. Pin on crankshaft gear must fit in vibration damper.

Torque inhex bolt to **20 Nm** (15 ft. lbs.).



Smear threads and mating surface of the centre bolt with sealer P/N 277 961-9.

Install and torque centre bolt to **350 Nm** (255 ft. lbs.) using wrench **5188** and wrench **5187** to hold vibration damper in position. (Rest 5187 on cooling fan bearing.)

Important: Torque 350 Nm applies only if 5188 is used. Also torque wrench must be in line with wrench 5188.

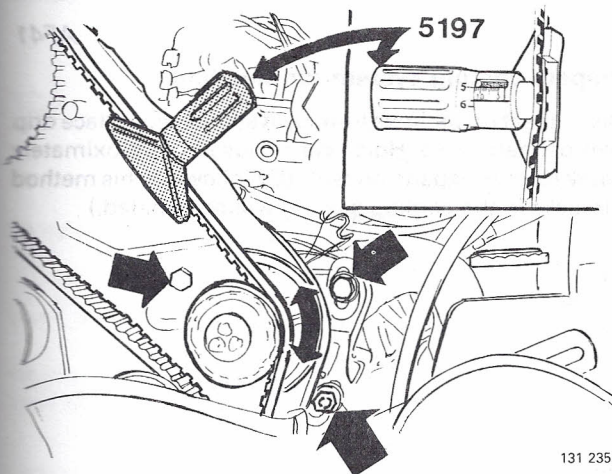
AF37

Set belt tension

Turn engine approx. $\frac{1}{4}$ turn anti-clockwise so that belt slack moves to drive side.

Attach gauge **5197** to belt and set to **12.5** units. Move coolant pump until correct setting is obtained. Tighten retaining bolts.

Depress belt strongly with hand and recheck/adjust tension.

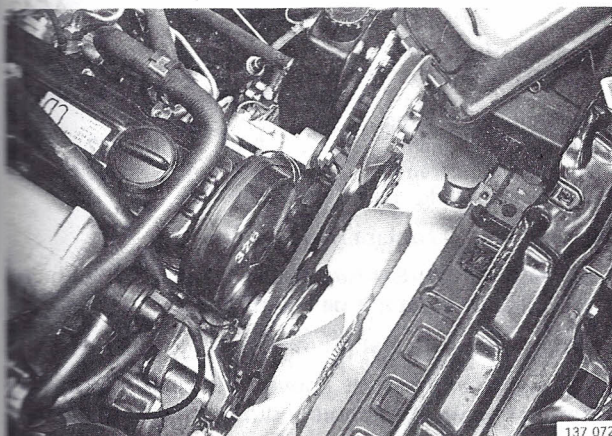


AF38

Install:

- AC-belt
- timing gear cover
- radiator fan with spacer and pulley
- power steering pump and bracket (remove lifting eyelet and refit it again)
- high placed alternator

Install and tighten all belts. It should be possible to depress belts 5-10 mm in the middle of one of runs.



AF39

Install:

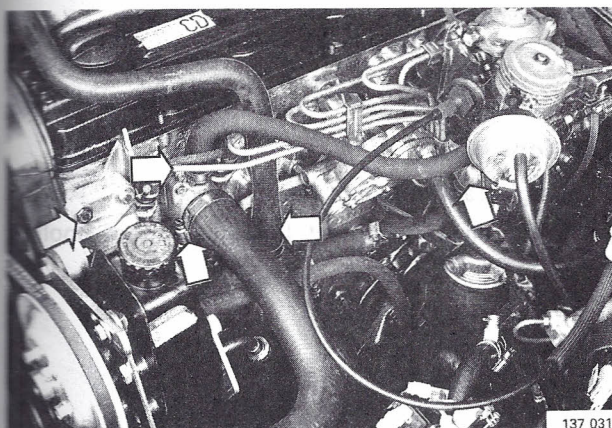
- radiator
- fan shroud
- radiator hoses
- electrical connections to radiator fan thermostat

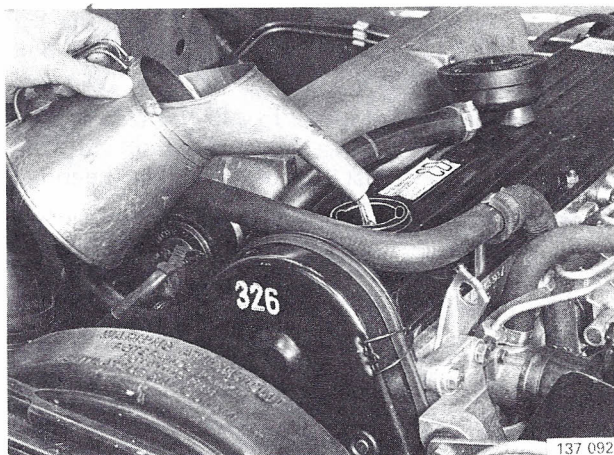
Close the drain tap as applicable

Install:

- engine splashguard

Reconnect battery



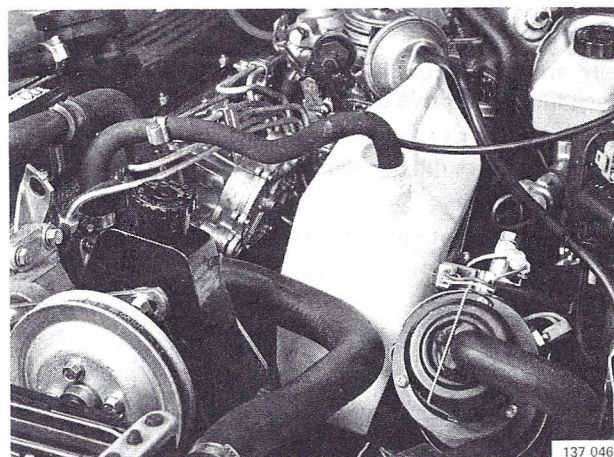


AF40

Fill oil

Oil capacity
 excluding filter 5.0 litres
 including filter 6.0 litres
 Oil quality according to API at least CD*
 according to CCMC class D2/PD1*

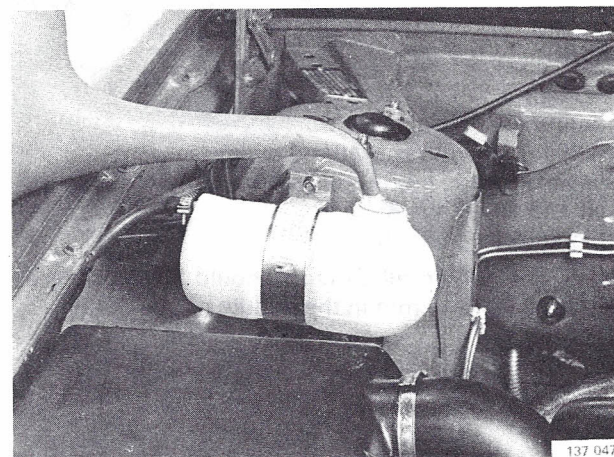
* Oils with designations SE/CD and SF/CD fulfill this requirement.



AF41

Prepare cooling system for bleeding

Disconnect upper hose from cold start device. Place drip pan beneath hose. Hold end of hose at approximately same level as expansion tank. (By following this method air locks in the cooling system will be avoided.)



AF42

Filling coolant:

	D 24	D 24 T	D 24 TIC
Capacity, (approx. litres)			
with manual transm.....	9.4	11.0	10.7
with automatic transm.	9.2	10.9	10.6

(For tropical use add approx. 0.6 litres)

Use only **type C** coolant (blue-green).

Vehicles with CU: Set heater control to get Max heat. Mode selector must not be set in Max.

Vehicles with ACC: Set mode selector in OFF.

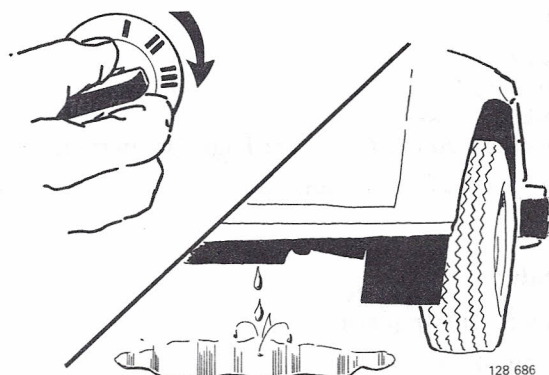
Start engine and run at above idle for 5 minutes to warm-up engine. Add coolant during this time. Reconnect hose to cold start device. Top-up expansion tank to above max and screw on cap.

AF43

Function check

Start engine and run until warm.

Check for oil and coolant leakage. Top-up cooling system if necessary.



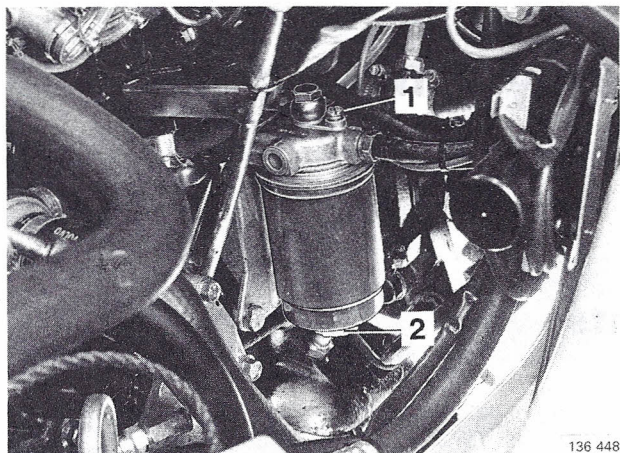
Group 23 Fuel system

Contents

Fuel filter, draining water	130
replacement	130
Fuel tank	130
Injection pump, general	131
idle + max speed	131
altitude adjustment USA/Can. 1982-1983	132
1984-	133
checking/adj. exhaust gas recirculation EGR	134
checking air leakage	138
checking solenoid	138
installation	139
general exhaust gas smoke density	142
checking/adj. exhaust gas smoke density	143
belt replacement	147
Removal of injection pump	151
Pump axle seals, replacement	154
Injection pump, installation	156
Delivery pipes, removal/installation	160
changing one or more pipes	161
Injectors, malfunctions, checking	163
removal	164
installation	164
reconditioning (incl. testing)	165
Cold start device, checking and installation	168
Pre-heating system (glow plugs)	
wiring diagram 1982-1983	172
1984	174
1985	176
function	178
inspection	179

AG. Fuel filter

AG1

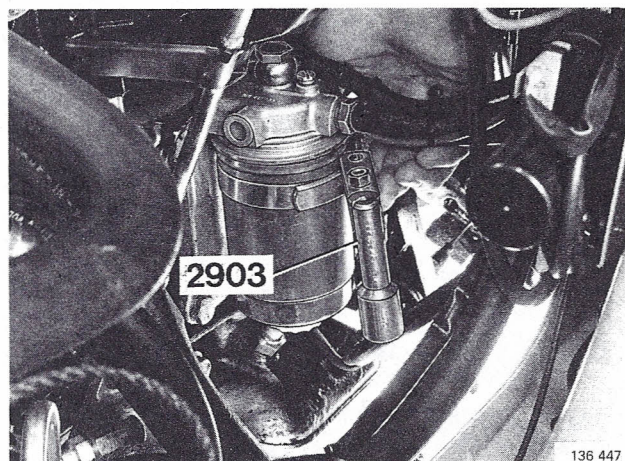


136 448

Drain water from fuel filter

- place a drip pan underneath drain screws (2)
- slacken bleed screw (1) a couple of turns
- slacken drain screw (2) and retighten when clean fuel flows through.
- retighten bleed screw.

AG2



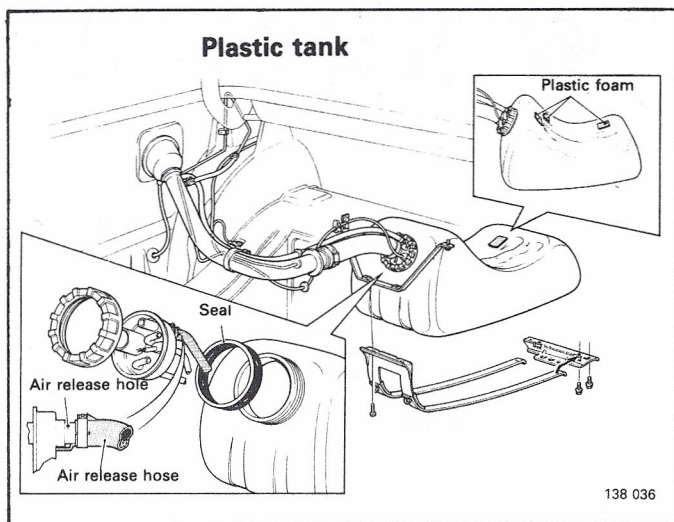
136 447

Replacement

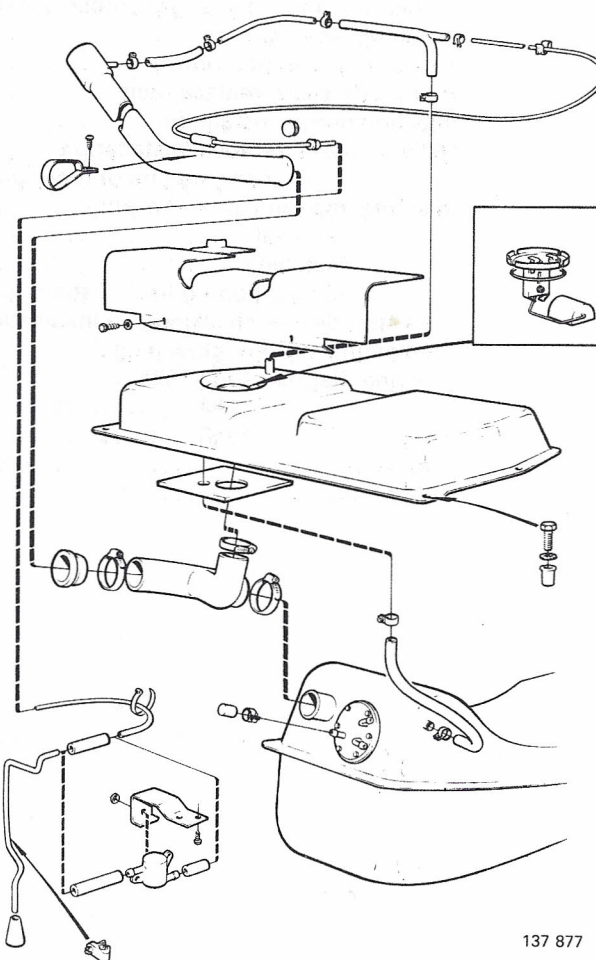
Special tool: 2903

- Use strap wrench 2903 to remove filter. Place strap as near as possible to base of filter, see fig.
- smear diesel oil on new filter seal
- tighten filter by hand until seal contacts body. Then tighten a further turn.
- start engine and check for leaks. If seal is not tight air will be drawn into fuel system and cause poor running.

Fuel tank

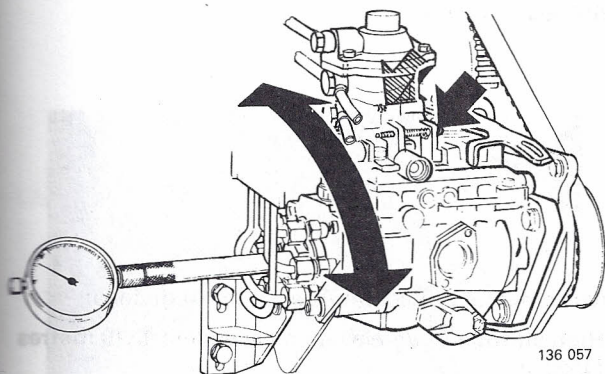


138 036



137 877

Injection pump, general



Adjustments which can be carried out on an installed injection pump are limited to the following:

- adjusting idle and max speed
- adjusting EGR (exhaust gas recirculation)
- adjusting injection timing
- adjusting fuel flow
- adjusting cold start device

All other work has to be done by trained personnel on special test bench.

A1. Idle + max speed

Special tool: 9950

A11

Connect tachometer

Use Volvo Monotester and adapter **9950**.

Monotester is not available use photo-electric rev counter (999 9795-9).

A12

Warm-up engine

A13

Check/adjust idle

D 24 S 12.5 r/s (750 rpm)
D 24 T/TIC 13.8 r/s (830 rpm)

Seal adjustment screw and lock nut with paint after adjustment.

A14

Check/adjust max speed

90 ± 1.7 r/s (5400 ± 100 rpm)

Seal adjustment screw and lock nut with paint after adjustment.

Do not race engine longer than necessary.

A15

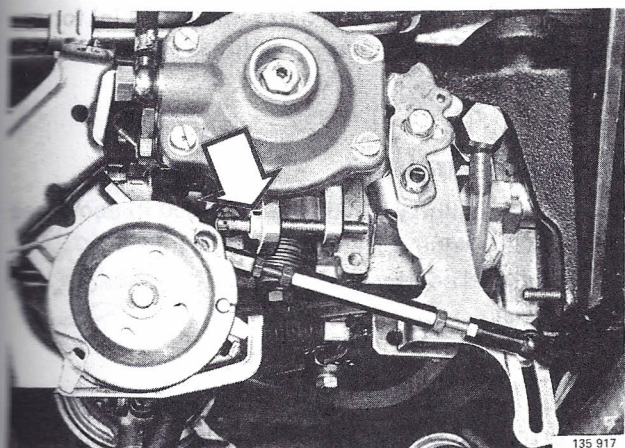
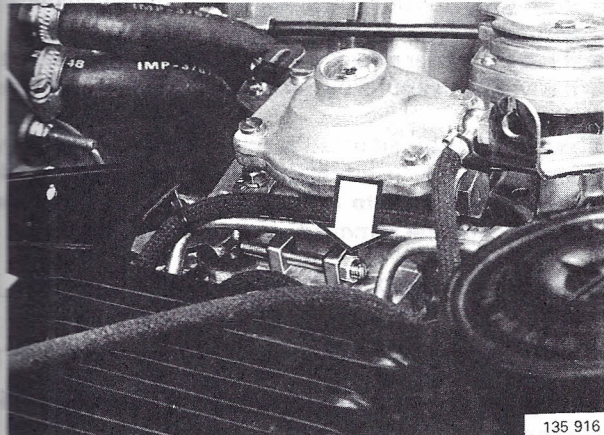
Disconnect tachometer

A16

Check/adjust engine controls

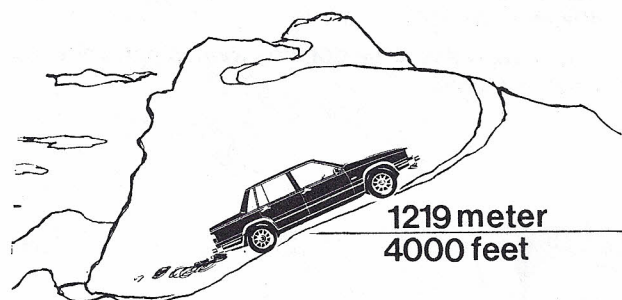
Always check/adjust engine controls after adjusting idle speed.

See instructions on page 216.



AJ. High altitude adjustment (Legal requirement)

Only in USA and Canada (1987- also Austria)



Environmental Protection Agency (EPA) defines:

- **High altitude** as an elevation **exceeding 1219 metres (4000 ft)**
- **low altitude** as an elevation **lower than or equal to 1219 metres (4000 ft)**.

Up to and including 1983 models:

- On delivery from factory all vehicles are adjusted for low altitudes.
- New vehicles sold for principal use at high altitudes must be adjusted before being delivered to the customer. After adjustment a decal must be affixed to the firewall (beside the emissions information decal) and also to the injection pump.
- If vehicle owner moves from low to high altitude area, the vehicle should be readjusted for high altitude driving.
- Autos must be adjusted for the altitude where they are commonly used. **Note! When an auto is readjusted from high to low altitude, the high altitude decals must be removed.**

THIS VEHICLE IS MODIFIED FOR HIGH ALTITUDE DRIVING

AJ1

The following adjustment must be made to vehicle for use at high altitudes:

Injection timing: advanced 0.07 mm (0.0028 in) for every 1000 m (3300 ft) increase in altitudes above sea level.

Injection timing

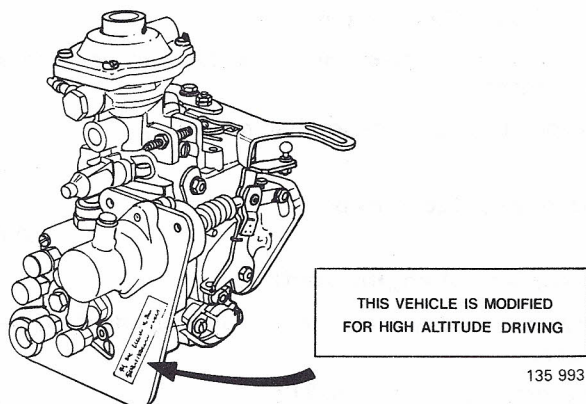
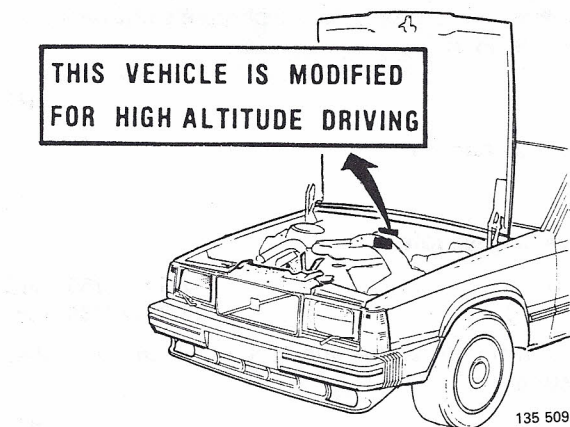
Example: If altitude is 2000 metres (6600 ft) above sea level the following calculations can be made:

0.80 is normal setting

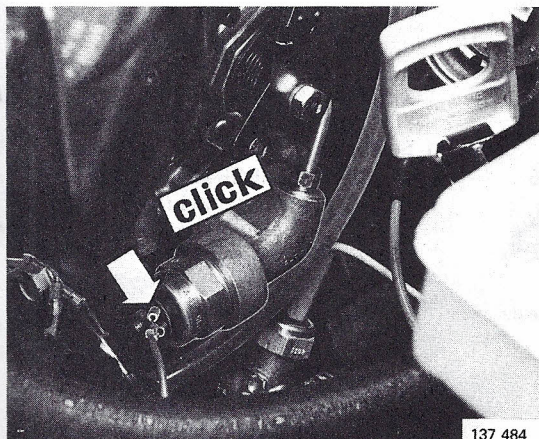
$$0.80 + \left(\frac{2000}{1000} \times 0.07 \right) = 0.94$$

High altitude setting is 0.94 mm.

THIS VEHICLE IS MODIFIED FOR HIGH ALTITUDE DRIVING



Altitude compensation 1984—



137 484

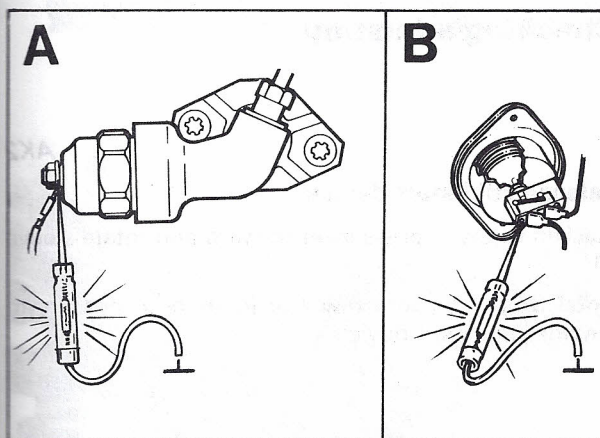
Note! Pressure switch should open at 900-1200 m (3000-4000 ft)

Check compensation system for low altitudes (below 900 m or 3000 ft)

AJ2

Turn on ignition

Pull off spade connector from solenoid and listen for a clicking sound. If click is heard, system is OK.



138 099

AJ3

If no click:

Check for voltage at solenoid using a test lamp.

(Test lamp between spade connector and solenoid)

A. If live = replace solenoid

B. No current = check for voltage at pressure switch. When both wires are connected to switch each wire should be live. If spade connector is pulled off only one of wires should be live.

Pressure switch is on same feed circuit as fuel valve therefore when engine running switch should be live.

AJ4

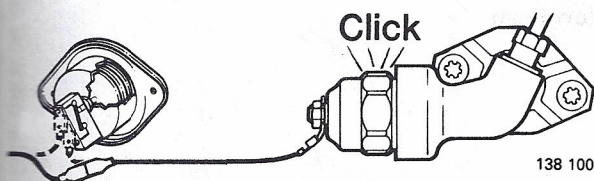
Checking at high altitudes above 900-1200 m (3000-4000ft) (Pressure switch should have disconnected circuit.)

Turn on ignition and join wires at pressure switch. If a click is heard the system is OK.

No click: check for voltage at solenoid.

Solenoid live: Replace solenoid.

No voltage: Check for voltage across injection pump fuel valve and ground. If circuit is live there is a break between the pressure switch and cable harness.



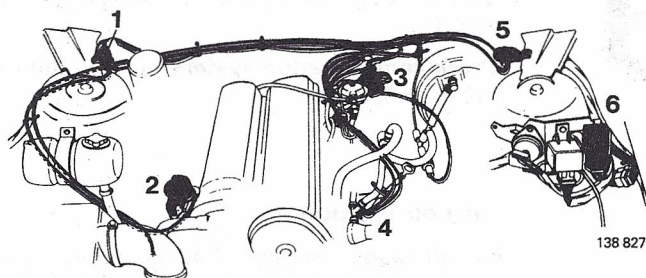
138 100

AK: Exhaust gas recirculation (EGR)

USA/Canada and Austria from 1987

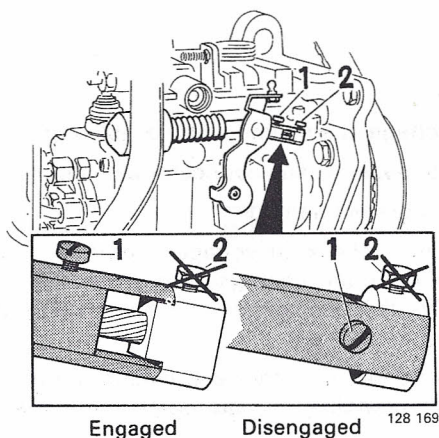
Check all hoses and contacts

Special tool 5285



AK1

- 1 Solenoid
- 2 Vacuum valve (EGR-valve)
- 3 Vacuum regulator and breaker
There is also an idle breaker
on pump (not in picture)
- 4 Thermostat valve
- 5 Relay



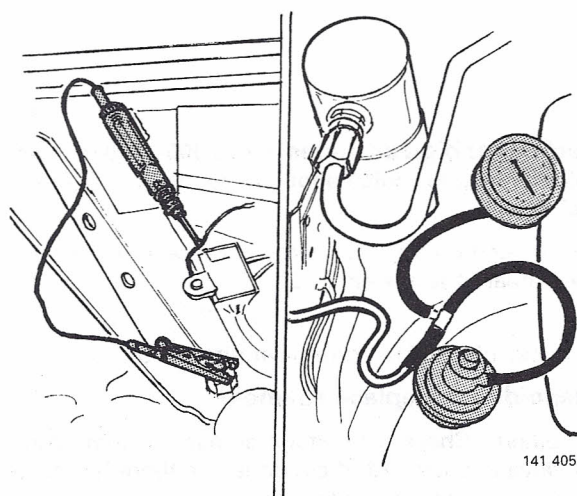
Checking/adjusting

AK2

Release cold start device

Slacken screw 1, press lever forward and rotate sleeve 90°.

Note! Do not touch screw 2 or it will be necessary to readjust cold start device.



AK3

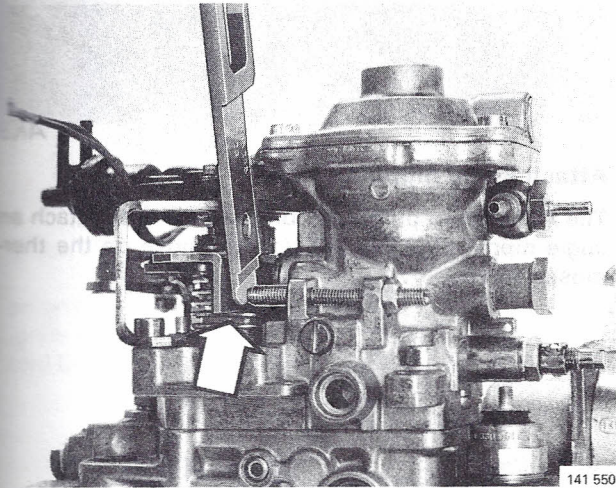
Connect a testlamp between the positive lead on the solenoid and the frame.

Connect a vacuum meter between EGR-valve and the yellow hose.

AK4

Check idle connection

Turn on ignition. Test lamp should light when the pump lever rests against its stop. If not, check fuse 11.



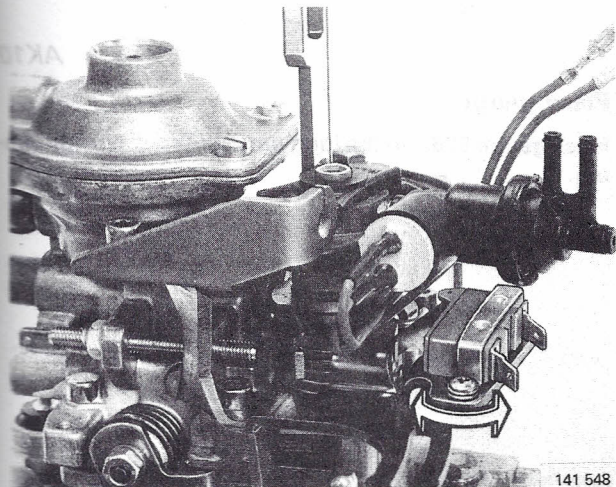
AK5

Turn the pump lever until the test lamp goes out.

While holding the lever in that position, measure the play between the screw and the idlesstop.

Correct play: 2 - 4 mm

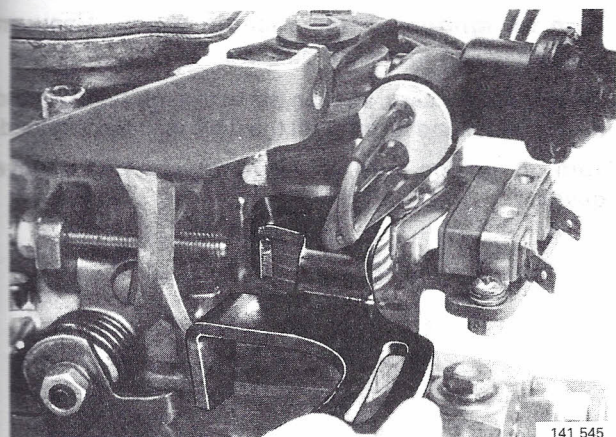
Use gauge 5285 for adjustments.



AK6

Adjust idle connection

Insert gauge (3 mm) between screw and stop for idle speed. Slacken screw holding idle connection and turn the connection until lamp goes out. Tighten screw and double check according to operation AK5.



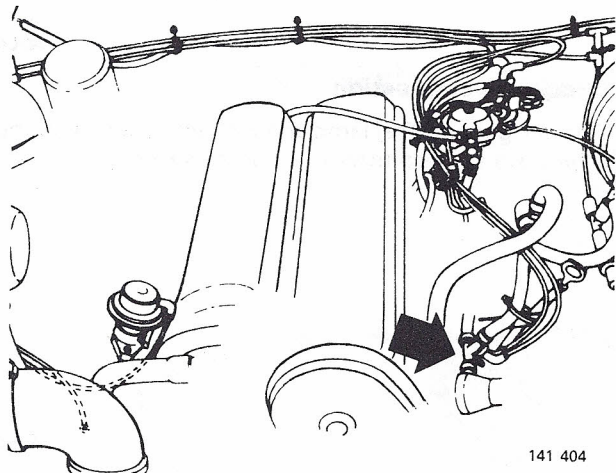
AK7

Check timing relay

Turn the pump lever until lamp goes out and hold lever in this position until lamp lights again. In cars with automatic transmission this should happen in approx. 4 sec., manual transmission - approx. 5 sec.

Check that lamp is off when transmission is in overdrive.

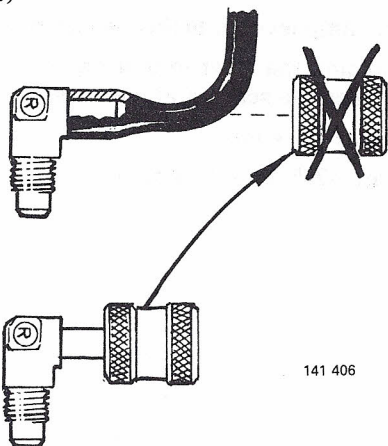
Turn off ignition.



AK8

Check vacuum regulator

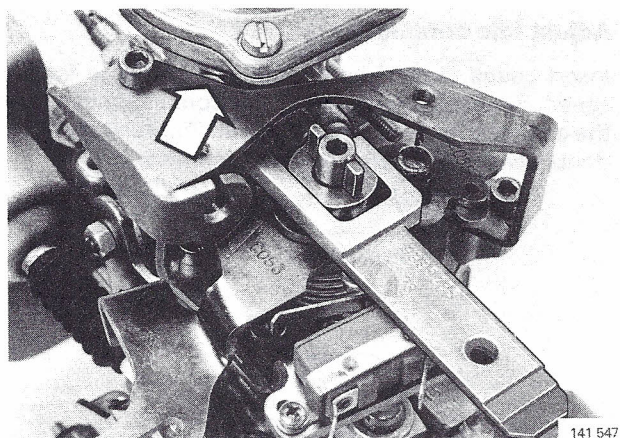
Take off gray hose to vacuum regulator at thermostat valve and attach a vacuum pump with at least 50 kPa capacity.



AK9

Attach angle nipple to hose

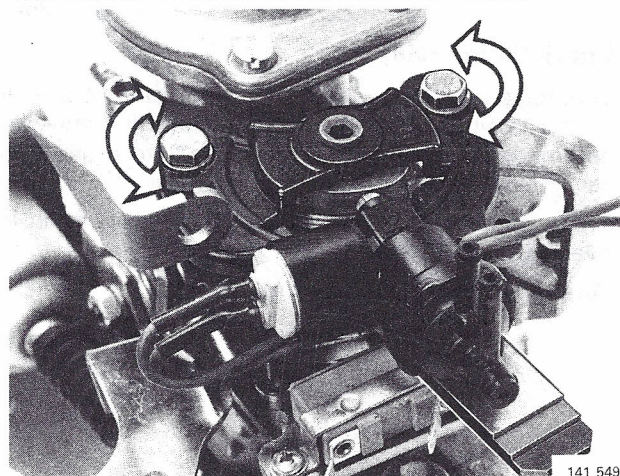
The AC vacuum pump can be used for this. Attach an angle nipple (P/N 999 9334) to the hose on the thermostat valve.



AK10

Place gauge

Place gauge 5285 so the long part abuts the pump housing.

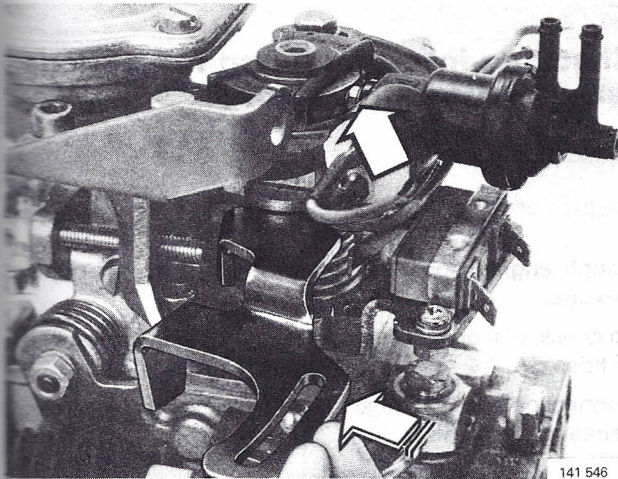


AK11

Turn on ignition. Start vacuum pump. Vacuum meter should show 38 ± 1 kPa.

If this is not the case, slacken the two screws which hold the regulator and turn it until the right value is obtained.

Turn off ignition, turn off vacuum pump and remove gauge.



AK12

Check breaker on regulator

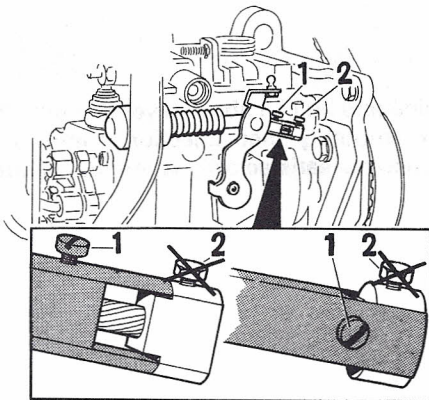
Turn on ignition.

Turn the pump lever and wait until lamp lights. Continue turning until lamp goes out (must happen within 5 sec.). Correct reading is 20 ± 2 kPa. If wrong, adjust with screw on breaker.

AK13

Connect cold start device

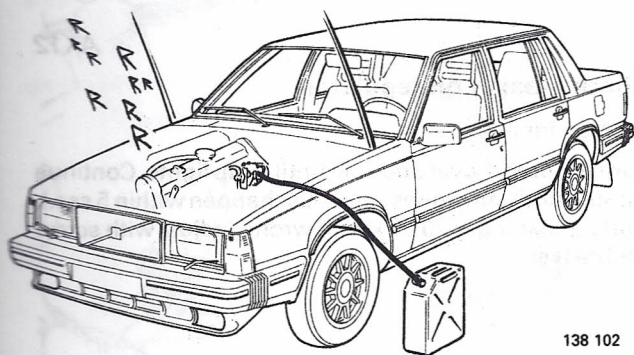
Push lever forward and rotate sleeve 90° . Tighten screw 1.



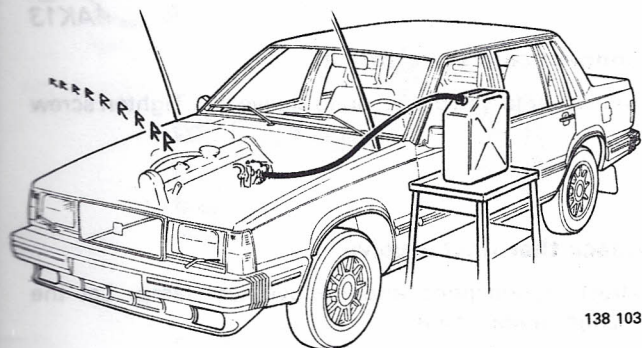
Check thermostat valve

Attach connections and remove test lamp. Let the vacuum meter remain.

Start engine. Vacuum meter should not register anything until the engine reaches running temperature (approx. 45°).



138 102



138 103

Checking injection pump for leakage (stuffing box drive shaft)

AK14

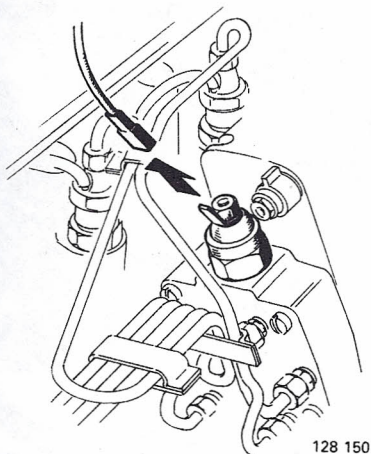
Rough engine operation can indicate injection pump leakage.

To check, disconnect fuel line from pump and plug end of hose.

Connect one end of a hose to pump inlet and place a can beneath other end.

AK15

Start engine and lift can above level of pump. If engine now runs smoothly then injection pump is leaking. (engine operates satisfactorily when fuel is forced into pump).



128 150

Checking injection pump fuel valve

AK16

Turn on ignition.

Withdraw connector from fuel valve terminal.

A clicking sound should be heard.

No click: check for voltage at valve.

Live: Replace valve.

No voltage: check wiring.

AL. Injection pump, setting

Special tool: 5194

Altitude compensation, see page 132

AL1

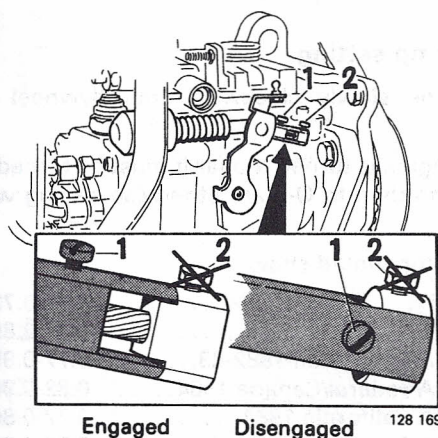
Remove rear timing gear cover

Disconnect cold start device

Slacken screw 1. Push lever for forward and rotate sleeve 90°.

Note! Do not turn screw 2, or it will be necessary to remove cold start device.

Push lever back against stop.

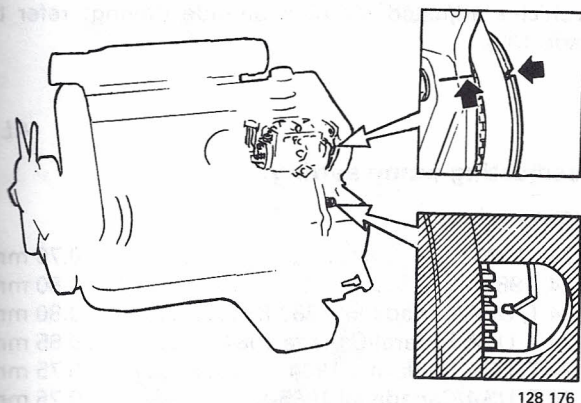


AL2

Turn engine until cyl. 1 is at T.D.C.-injection

Always use the vibration damper centre bolt to turn the engine. 27 mm socket.

Mark in pump gear should be opposite mark in mounting bracket. Flywheel at 0 mark.

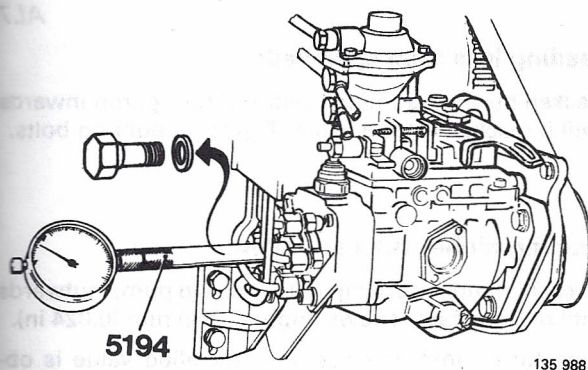


AL3

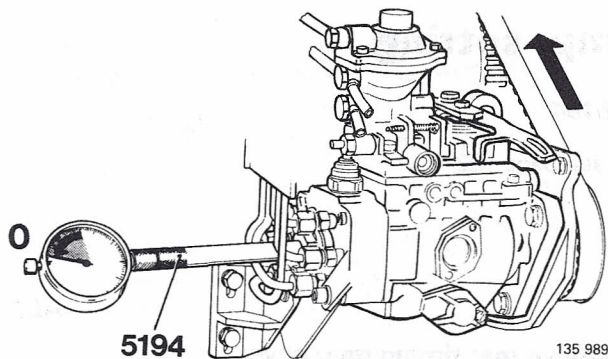
Place dial indicator in injection pump

Unscrew and remove plug from injection pump distributor.

Install holder 5194 and dial indicator (measuring range 0-3 mm or 0-0.12 in). Set gauge to approx. 2 mm (0.08 in).



AL4

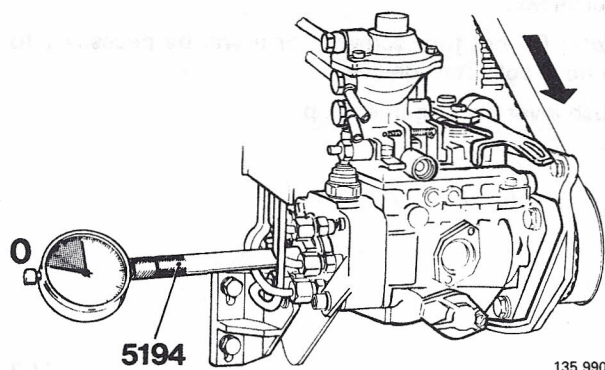


Set indicator to zero

Turn pump gear back slightly until min. reading registers on dial indicator.

Set indicator at zero.

AL5



Check pump setting

Turn engine slowly clockwise until flywheel is at O-mark.

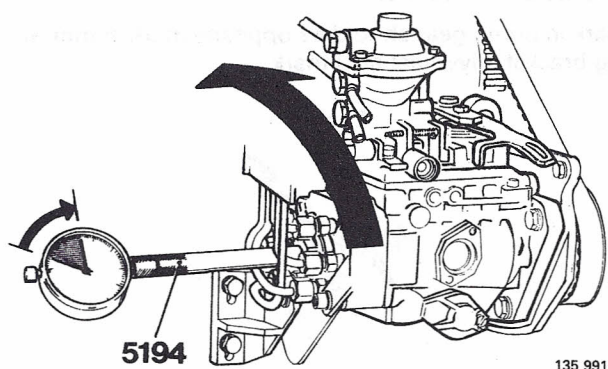
Note: If engine is turned too far it must be turned back approx. and then to O-mark otherwise setting will be incorrect.

Dial indicator should show:

D 24, -1986.....	0.65-0.73 mm
D 24, 1987-.....	0.77-0.85 mm
D 24 T, USA/Canada all 1982-83.....	0.77-0.85 mm
D 24 T, USA Federal/Canada 1984.....	0.82-0.90 mm
D 24 T, USA California 1984.....	0.72-0.80 mm
D 24 T, USA/Canada all 1985-.....	0.72-0.80 mm
D 24 T, Austria 1987-.....	0.72-0.80 mm
D 24 T, Other markets.....	0.87-0.95 mm
D 24 TIC.....	0.87-0.95 mm

(Vehicles adjusted for high altitude driving; refer to page 132).

AL6



Readjusting pump setting:

Setting values:

D 24, -1986.....	0.70 mm
D 24, 1987-.....	0.80 mm
D 24 T, USA/Canada all 1982-83.....	0.80 mm
D 24 T, USA Federal/Canada 1984.....	0.85 mm
D 24 T, USA California 1984.....	0.75 mm
D 24 T, USA/Canada all 1985-.....	0.75 mm
D 24 T, Austria 1987-.....	0.75 mm
D 24 T, Other markets.....	0.90 mm
D 24 TIC.....	0.90 mm

AL7

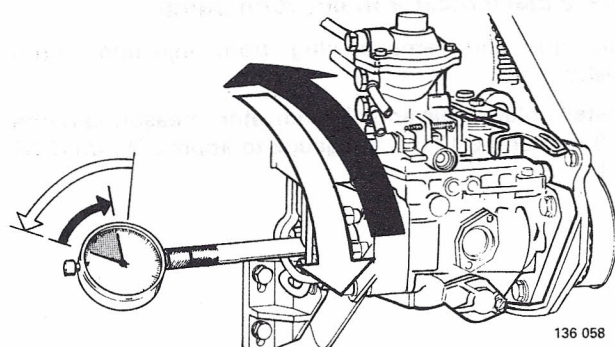
Reading less than specified:

Slacken pump mounting bolts and turn pump inwards until it reaches setting value. Tighten mounting bolts.

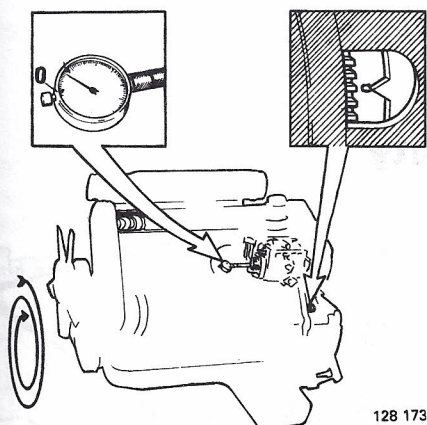
Reading higher than specified:

Slacken pump mounting bolts and turn pump outwards until dial indicator shows approx: 0.60 mm (0.024 in).

Then turn pump inwards until specified value is obtained. Tighten mounting bolts and recheck pump setting.



AL8

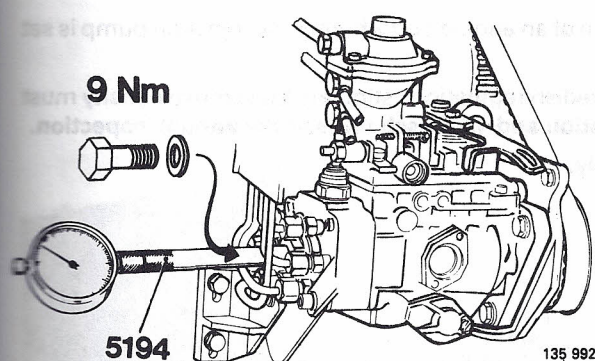


Important! injection pump must not be tapped or knocked as this will alter its setting.

Important! Also, if pump cannot be set to specification engine must be set again as camshaft is probably in wrong position in relation to crankshaft.

Check pump setting (if adjustments have been made)

Rotate engine twice and check setting. (AL5) Adjust if necessary and recheck.



AL9

Remove dial indicator and holder

Install plug with new seal

Tightening torque 9 Nm (6.5 ft lbs).

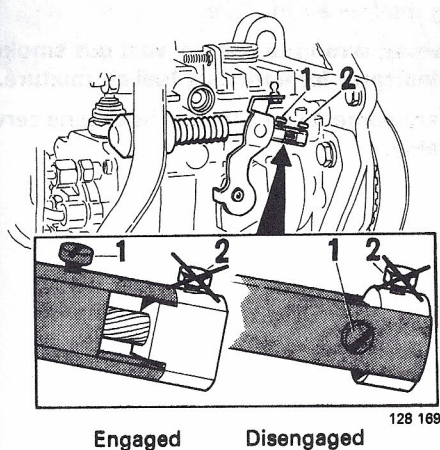
AL10

Install rear timing gear cover

Reconnect cold start device

Press lever forwards and turn sleeve 90°. Retighten screw 1.

Note: Do not turn screw 2, otherwise it will be necessary to remove cold start device and reset it.



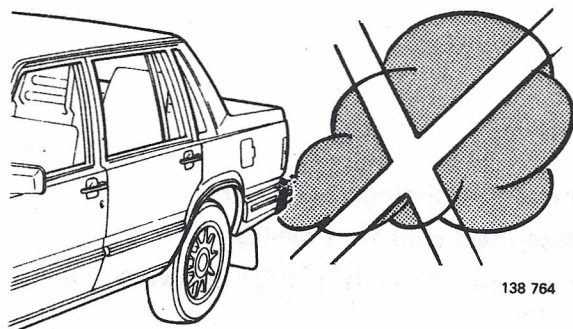
Exhaust gas density

General

Exhaust gas smoke density gives a good indication of the condition of an engine and whether the injection pump is set according to specification.

In some countries there are fixed limits to exhaust gas density. Swedish regulations stipulate that smoke density must not exceed 3.5 Bosch units for passenger cars at time of registration and 4.5 Bosch units at the annual inspection.

Excessive enrichment will reduce engine service life considerably.

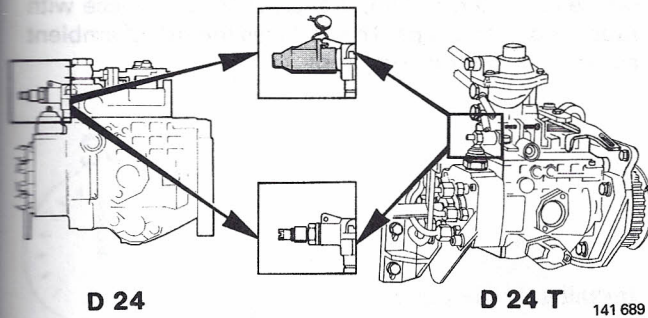


Since exhaust gas smoke emissions from Volvo diesels are generally lower than other vehicles it may be thought possible to increase engine performance by enriching the fuel air mixture.

It is, however, wrong to use exhaust gas smoke emissions as indicator for enriching fuel air mixture.

Such an adjustment can shorten the engine service life considerably.

Practical experience has shown that visible exhaust emissions can occur after only 20,000 km (12,500 miles). This can happen when the tolerances on the cam plate and pressure plunger of the injection pump are very close to allowable limits. The result can be a too rich fuel mixture and increased exhaust emissions.



Counter measure

It is necessary to adjust fuel mixture to lower exhaust emissions.

This is done using the fuel mixture adjusting screw on the injection pump without removing it from the car.

Note! Adjustments of the fuel mixture on the same injection pump may not be done more than twice without removing and checking on a test bench.

Since the paint seal is broken during adjusting, the screw must be resealed.

Available tools

Exhaust gas density meter

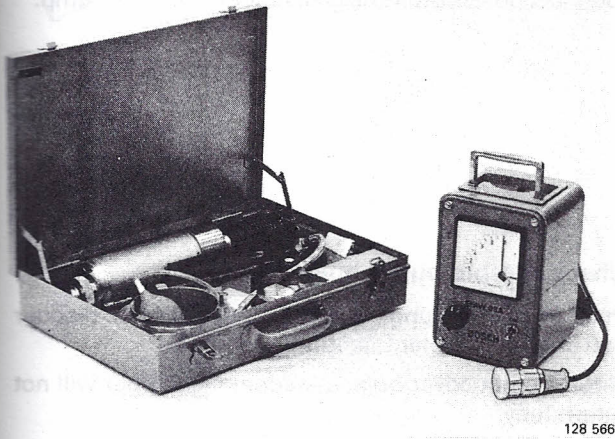
Pump 998 6530-5
Measuring instrument..... 998 6535-6

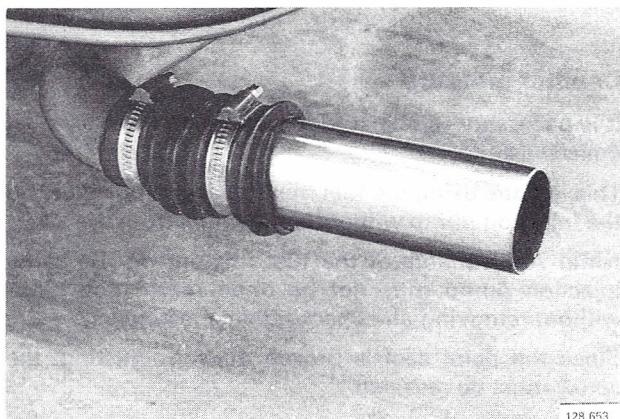
Sealing of the fuel mixture screw

Sealing pliers "VOLVO-VOLVO" – 998 6408-4

Probe materials

Probes (100) 998 5962-1
Probe hose (50 m)..... 998 5963-9
Probe sleeve 154 2407-0

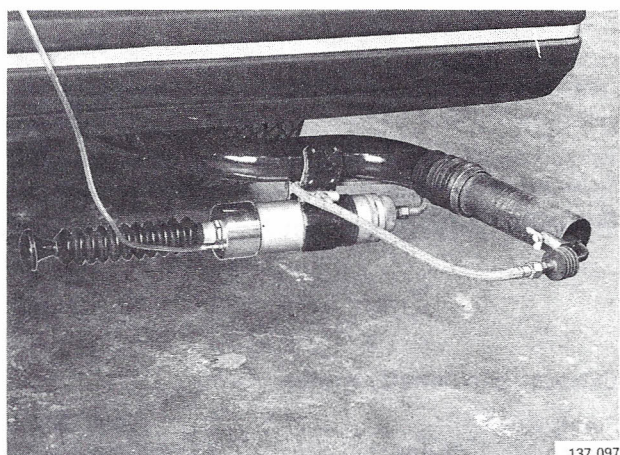




Attaching exhaust gas density meter

Connect extension piece to exhaust pipe

Pipe dimensions: length = 200 mm (8 in) internal diameter = 50 mm (2 in). Secure extension piece with rubber hose and clips. This reduces the risk of ambient air affecting instrument probe.

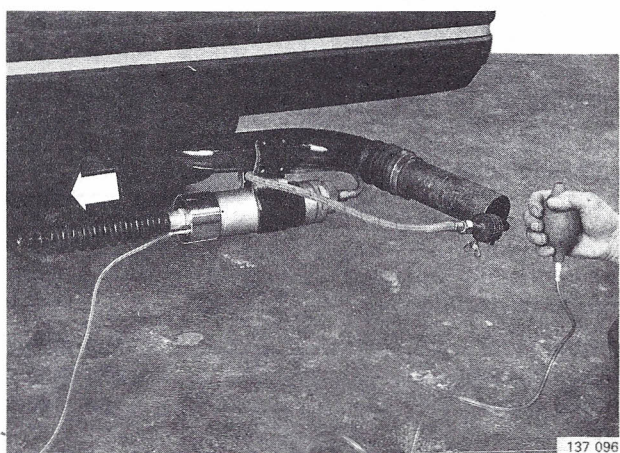


Install sample pump

Insert probe into exhaust pipe. Probe must be in center and inserted to a depth of not less than 200 mm (8 in), otherwise readings will be incorrect.

Hang flexible hose from clamp as illustrated.

Connect hose from rubber bladder to sample pump.

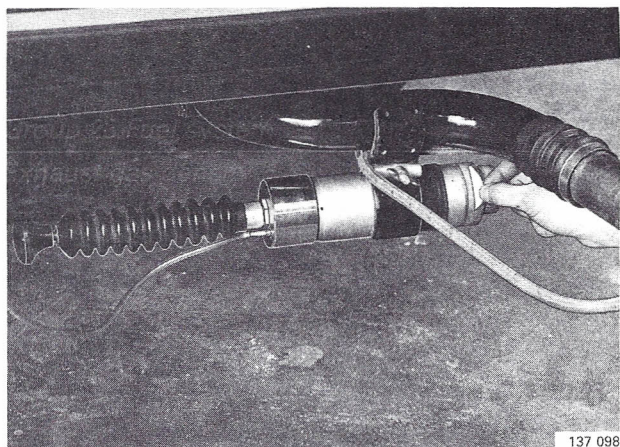


Check sample pump operation

Push in pump plunger fully. Squeeze rubber bladder and check movement of pump plunger.

Note! Do not cover hole in bladder as plunger will not return fully.

Push in plunger fully after checking.



Insert white filter paper in pump

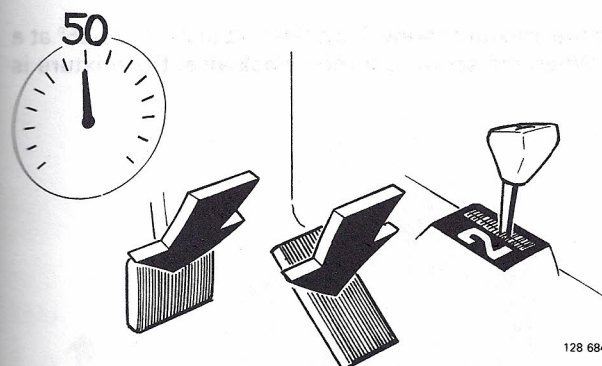
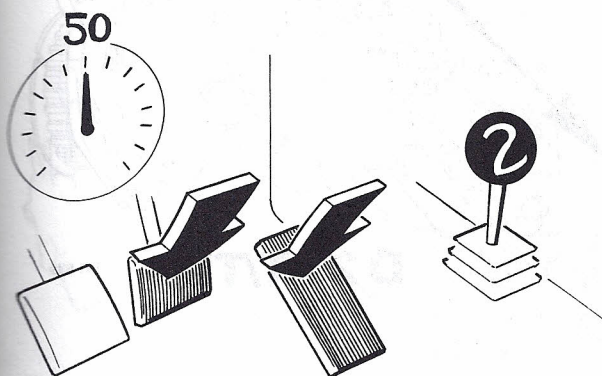
Unscrew cover and check that contact surfaces are clean.

Place filter paper in opening and tighten cover hand tight.

Position rubber seal over cover (to prevent dirt and moisture from affecting test).

Route hose with rubber bladder to drivers seat

Secure hose with tape.



128 684

Measure smoke density

Warm-up engine to normal operating temperature.

Manual transmission: Drive in second gear at 50 km/h (30 mph). Slowly push accelerator pedal to floor while applying footbrake to maintain constant 50 km/h.

Automatic transmission: Place gearshift in D2. **Note!** Do not depress accelerator pedal to such an extent that kick-down is engaged.

Maintain constant speed for a few seconds and squeeze rubber bladder to operate pump.

Note! Squeeze rubber bladder hard for several seconds to ensure that sample pump has been filled. Do not cover hole in rubber bladder.

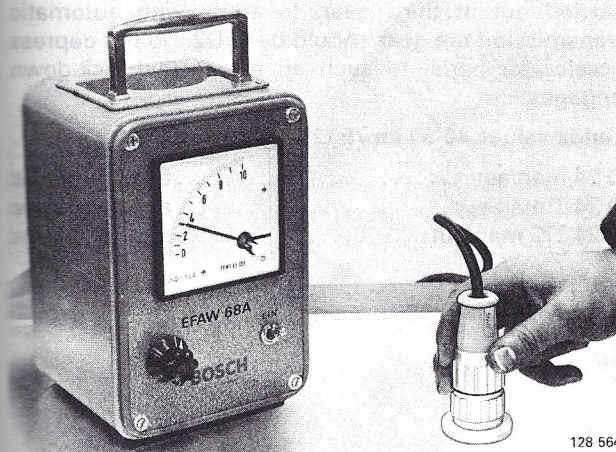
Note! Hold speed constant during pumping.

Repeat measurements

Remove filter paper from pump.

Depress pump plunger fully and place a new filter paper in pump. Reposition rubber cover.

Repeat measurements as above.



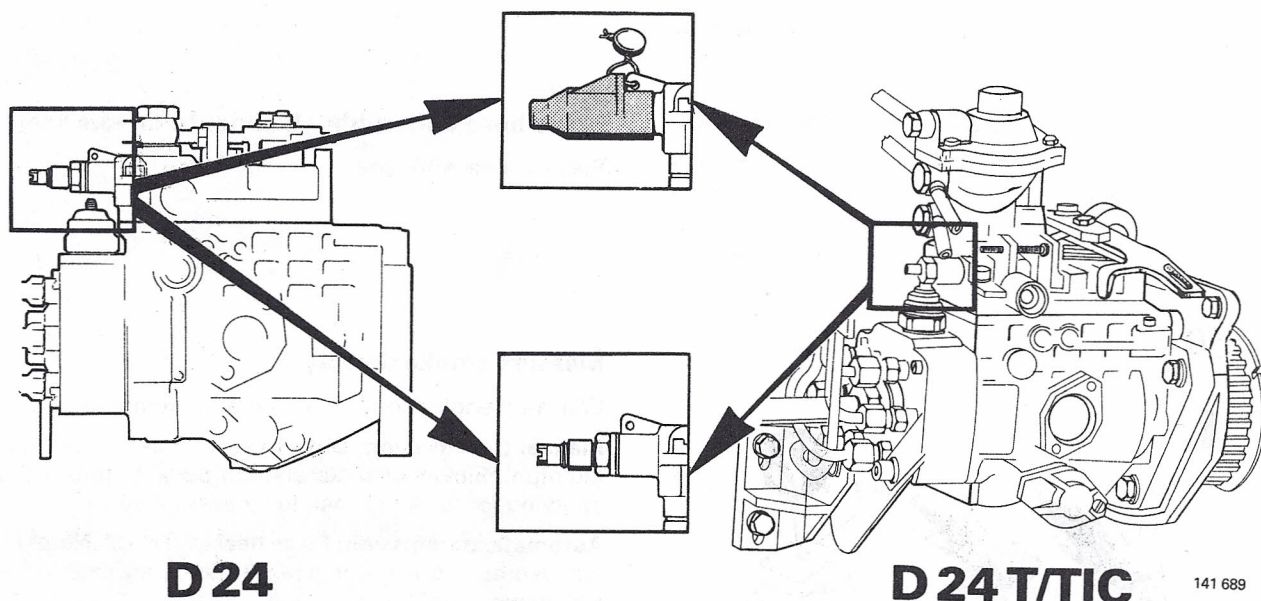
128 564

Evaluate results

Calibrate equipment according to manufacturer's instructions.

Smoke density for passenger cars in Sweden must not exceed 3.5 Bosch units at time of registration and 4.5 Bosch units at annual inspection.

Other countries: Check the regulations in respective country.

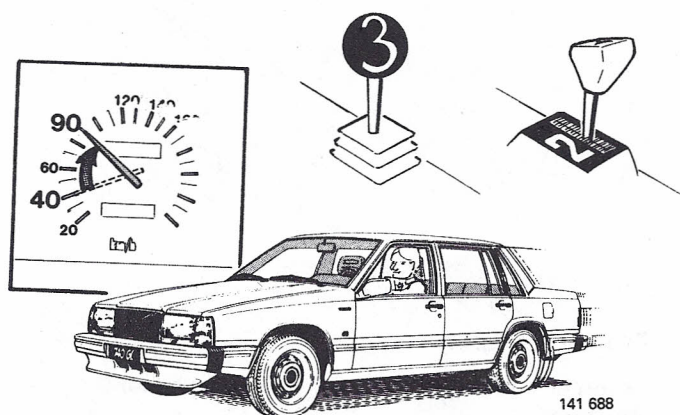


Fuel mixture adjustment

Adjust the fuel mixture by releasing the lock nut and turning the fuel mixture screw. Turn the bolt approx. 20-25° at a time. Measure the exhaust gas density after each adjustment. When the screw is turned **clockwise**, the mixture is **increased**; turning it **counter clockwise** decreases the mixture.

Note! After each adjustment torque the lock nut to **6 Nm (+3-0)**.

Acceptable exhaust gas density: 3.2 - 3.5 Bosch units.



Carry out acceleration test

An acceleration test should be carried out after correct exhaust gas density has been established. The initial speed should be 30 km/h (20 mph), while timing is done between 40 and 90 km/h (25-55 mph).

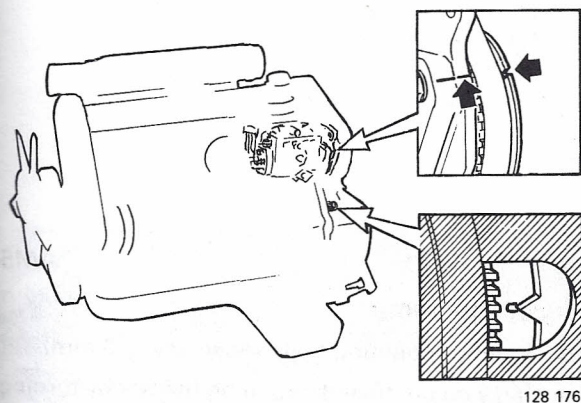
In autos with manual transmission, the test shall be carried out in third gear. In autos with automatic transmission the gear should be in D2. Do not depress accelerator pedal to such an extent that kick-down engages.

Guide values 40-90 km/h (25-55 mph):

D 24 man/aut.	approx. 16 sec
D 24 T man/aut.	approx. 12 sec
D 24 TIC man/aut.	approx. 11 sec

AM. Injection pump belt, replacement

Special tools: 5193, 5194, 5197, 5199, 5201



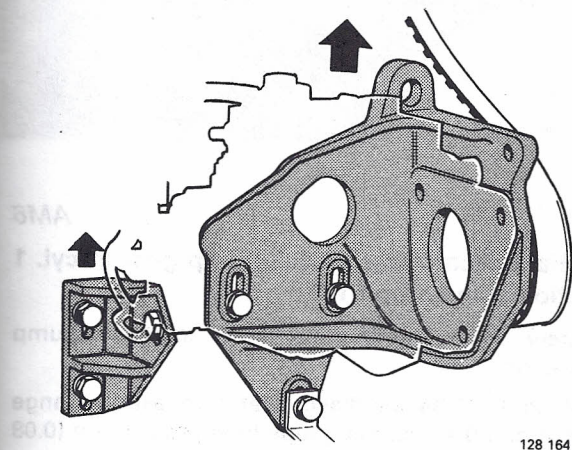
AM1

Remove rear timing gear cover

Turn engine until cyl. 1 is at T.D.C.-injection

Always use vibration damper centre bolt to turn engine.
27mm socket.

Mark in pump gear should be opposite mark in mounting bracket. Flywheel at "O".

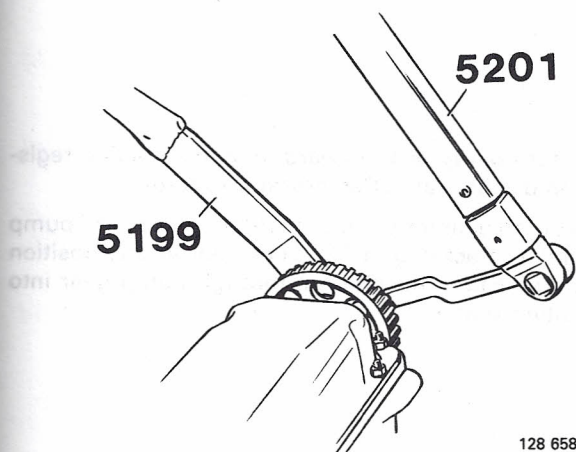


AM2

Lift off pump belt

Slacken injection pump mounting bolts to release belt tension. Tighten one bolt so that pump remains in position.

Lift off belt.



AM3

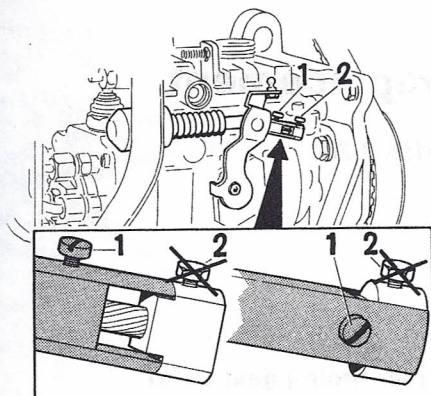
Remove camshaft rear sprocket

Hold sprocket in position with 5199 and unscrew sprocket with wrench 5201.

Note! Take care not to rotate camshaft.

Install center bolt, hand tight. It should be possible to turn sprocket on camshaft without camshaft rotating.

Injection pump belt, replacement



Engaged Disengaged

128 169

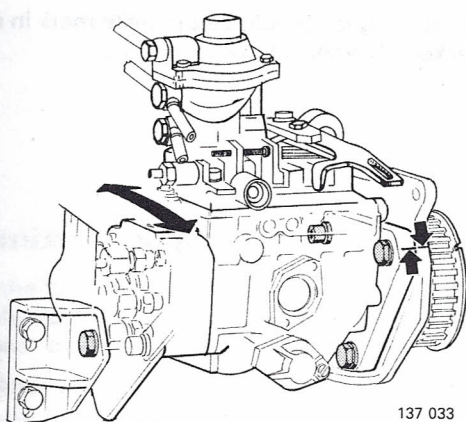
AM4

Disconnect cold start device

Slacken screw 1. Push lever forward and rotate sleeve 90°.

Note: Do not turn screw 2, otherwise it will be necessary to remove cold start device and reset it.

Press lever back against stop.



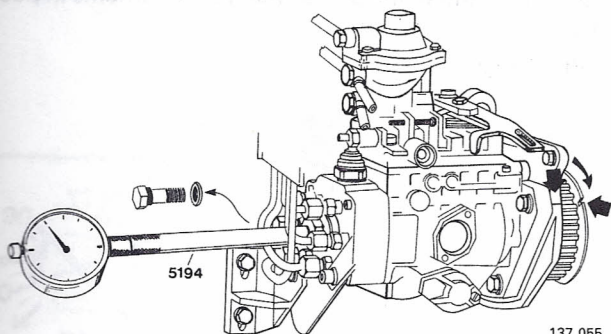
137 033

AM5

Set injection pump

Slacken pump mounting bolts (Allen key = 6 mm).

Align marks on pump and mounting bracket by turning pump. Retighten mounting bolts.



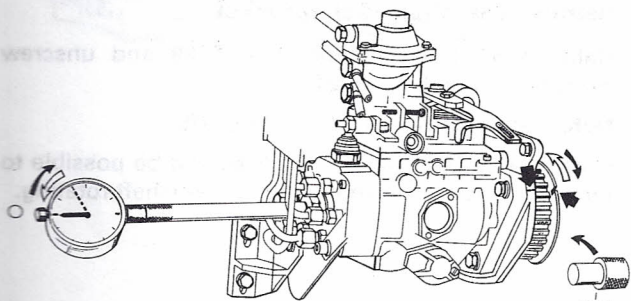
137 055

AM6

Set dial indicator zero. Lock pump gear at cyl. 1 injection using stop 5193

Unscrew and remove plug from injection pump distributor.

Install holder 5194 and dial indicator (measuring range 0-3 mm or 0-0.12 in). Set gauge to approx. 2 mm (0.08 in).

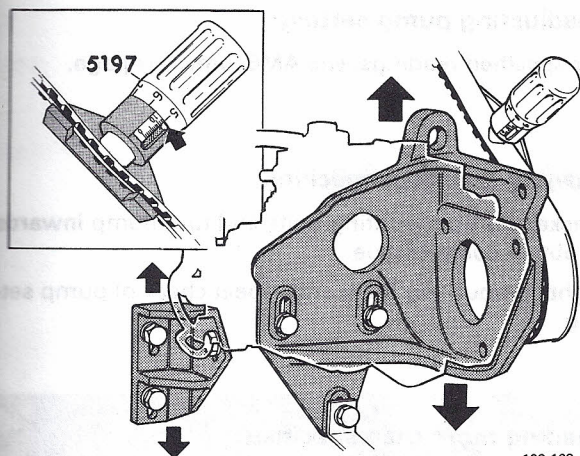


5193

137 058

Then turn pump gear forward until min reading registers on dial indicator. Set indicator to zero.

Turn pump gear forwards until mark on gear and pump mounting bracket coincide. Lock gear in this position with stop 5193. (Insert stop through pump gear into mounting bracket.)



128 168

Install belt

Adjust tension by moving pump mounting brackets.

Use gauge **5197** to check tension. Attach gauge to belt and set to 12.5 units. Stretch belt until mark on gauge plunger is flush with sleeve. Tighten retaining bolts.

Depress belt with strong hand pressure and recheck/adjust tension.

AM8

Set pump and tighten camshaft rear sprocket

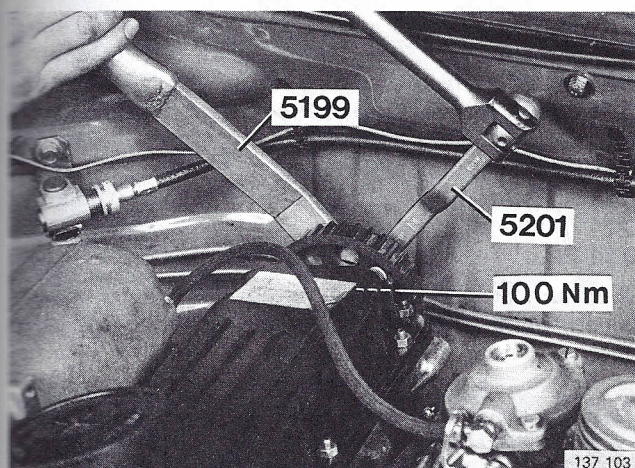
Use **5199** to hold sprocket. Torque wrench should be at right angles to wrench **5201** otherwise torque will be incorrect.

Using **5199**, turn sprocket slowly clockwise until dial indicator shows:

D 24, -1986	0.70 mm
D 24, 1987-	0.80 mm
D 24 T, USA/Canada all 1982-83	0.80 mm
D 24 T, USA Federal/Canada 1984	0.85 mm
D 24 T, USA California 1984	0.75 mm
D 24 T, USA/Canada all 1985-	0.75 mm
D 24 T, Austria 1987-	0.75 mm
D 24 T, Other markets	0.90 mm
D 24 TIC	0.90 mm

(Vehicles adjusted for high altitude driving: refer to page 132.)

Hold sprocket in this position and torque bolt to **100 Nm** (73 ft lbs). Take care that camshaft and sprocket do not move.



137 103

AM9

Remove stop 5193 from pump gear

AM10

Check pump setting

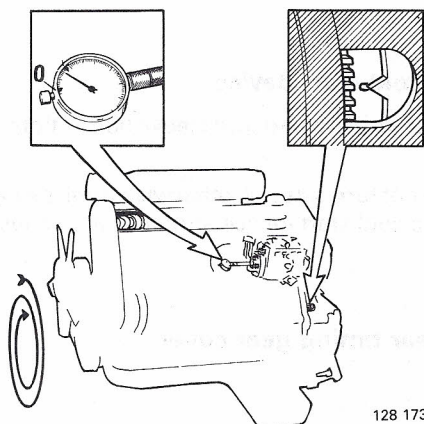
Turn engine two full turns until cyl. 1 is at T.D.C.-injection again. If engine is turned too far it must be turned back approx. turn and then to zero mark otherwise setting will be incorrect.

Dial indicator should show:

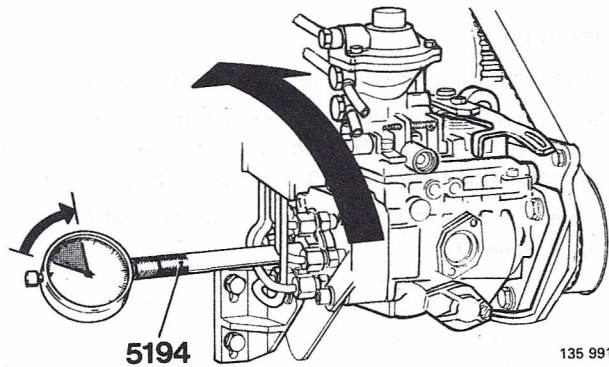
D 24, -1986	0.65-0.73 mm
D 24, 1987-	0.77-0.85 mm
D 24 T, USA/Canada all 1982-83	0.77-0.85 mm
D 24 T, USA Federal/Canada 1984	0.82-0.90 mm
D 24 T, USA California 1984	0.72-0.80 mm
D 24 T, USA/Canada all 1985-	0.72-0.80 mm
D 24 T, Austria 1987-	0.72-0.80 mm
D 24 T, Other markets	0.87-0.95 mm
D 24 TIC	0.87-0.95 mm

Correct reading: Tighten injection pump mounting bolts. proceed to AM12.

Incorrect reading: Readjust according to instructions on next page.



128 173



Readjusting pump setting:

For specified readings, see AM8, previous page.

Reading less than specified:

Slacken pump mounting bolts and turn pump **inwards** to obtain correct value.

Tighten mounting bolts and repeat check of pump setting.

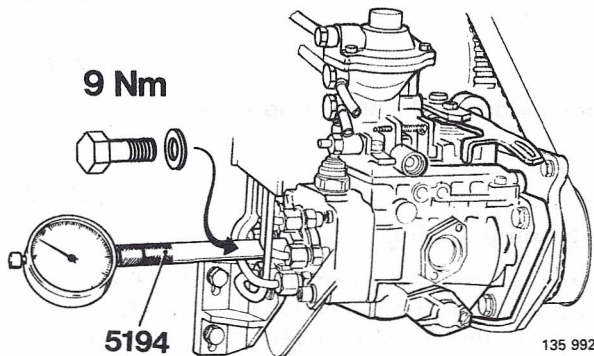
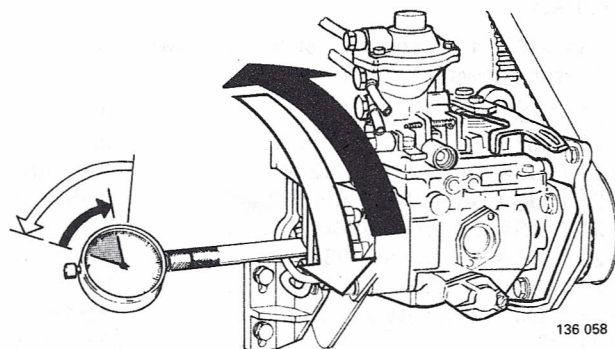
Reading more than specified:

Slacken pump mounting bolts and turn pump **outwards** until dial indicator shows **approx** :

D 24, -1986	0.60 mm
D 24, 1987-	0.70 mm
D 24 T, USA/Canada all 1982-83	0.70 mm
D 24 T, USA Federal/Canada 1984	0.75 mm
D 24 T, USA California 1984	0.65 mm
D 24 T, USA/Canada all 1985-	0.65 mm
D 24 T, Austria 1987-	0.65 mm
D 24 T, Other markets	0.80 mm
D 24 TIC	0.80 mm

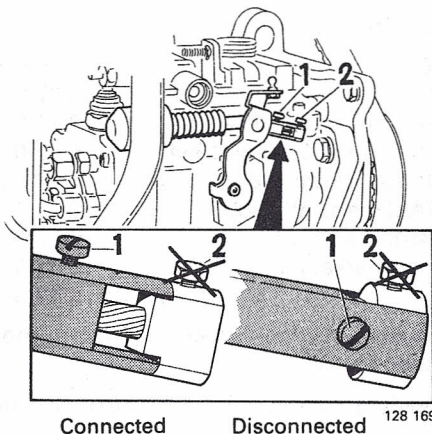
Then turn pump inwards until specified value is obtained. Tighten mounting bolts and recheck pump setting.

Important: Injection pump must not be tapped or knocked as this will alter its setting.



Remove dial indicator and holder 5194. Install plug with new seal

Tightening torque 9 Nm (6.5 ft lbs).



Engage cold start device

Press lever forward and turn sleeve 90°. Retighten screw 1.

Note: Do not turn screw 2, otherwise it will be necessary to remove cold start device and reset it on a test bench.

Install rear timing gear cover