

Service Manual

Repairs and Maintenance

Section 2 (excl.
group 23)

B 27, B 28
Engines

260 1975-1983

777 62 25 - 0

VOLVO

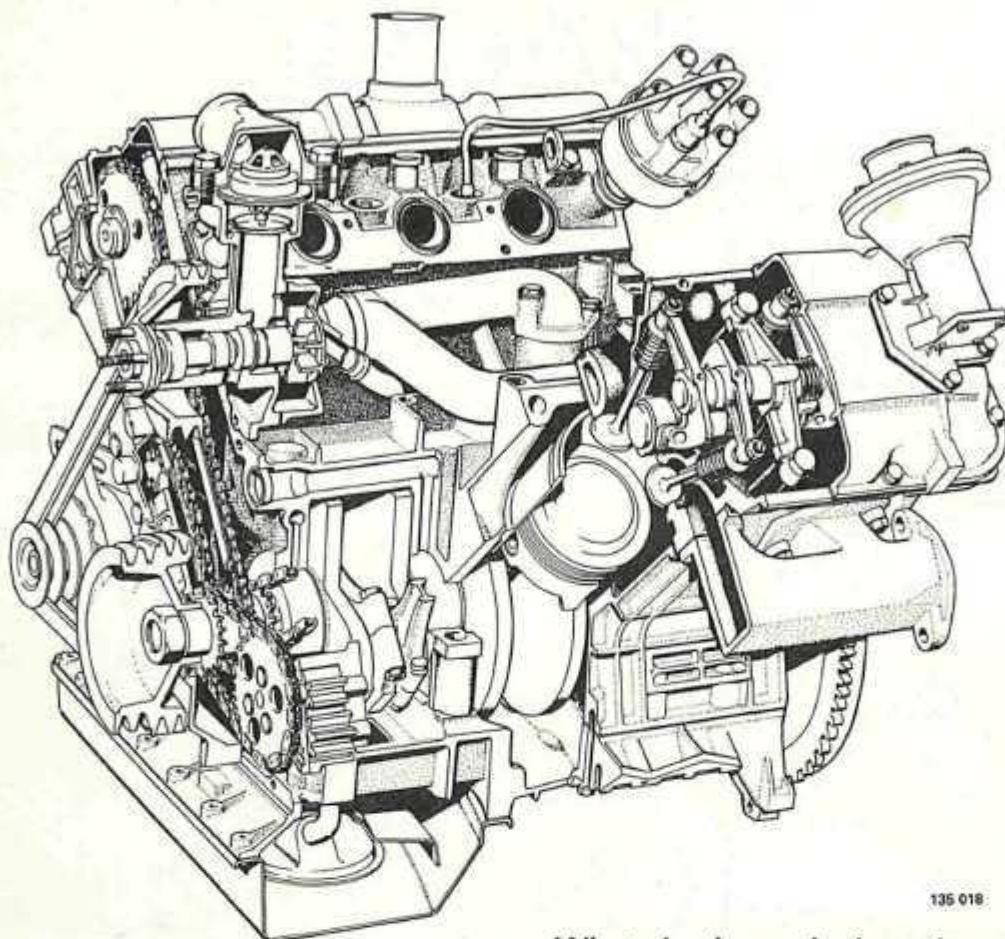


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1850 37th Avenue South

Seattle, WA 98148 U.S.A.

B 27A – B 27E – B 27F – B 28A – B 28E – B 28F



135 018

What do these designations mean?

B 28E

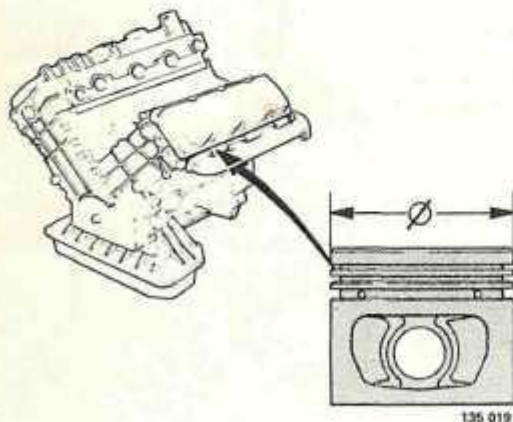
↓
A = carburetted engine

E = fuel injected engine

F = fuel injected engine "USA models"

↓
28(27) = capacity

↓
B = petrol (gasoline)



135 019

The B28 is in principle a B27 with a larger bore.

Engine type	Model year
B 27A	1976–1979
B 28A	1980–1982
B 27E	1975–1980
B 28E	1981–1983
B 27F	1976–1979
B 28F	1980–1982

Volvos are sold in versions adapted for different markets. These adaptations depend on many factors including legal, taxation and market requirements.

This manual may therefore show illustrations and text which do not apply to cars in your country.

A-12-07-C2 7776225-0
 VOR B27 B28 ENG R
 C14022
 429000000/074
 ORIGINAL PARTS **VOLVO** 1 PIÈCES D'ORIGINE

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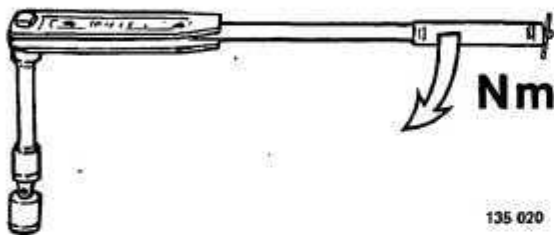
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ERICO'S AUTO TIRE & OIL LTD.
 1553 W. 3rd AVENUE
 VANCOUVER, B.C. V6J 3G3
 TELEPHONE 731-8171

Order number TP 30430/1

This manual together with Section 2 (21) supersedes service manual Section 2 Engine B27 with order number TP 11409.

Important information



135 020

Tightening torques

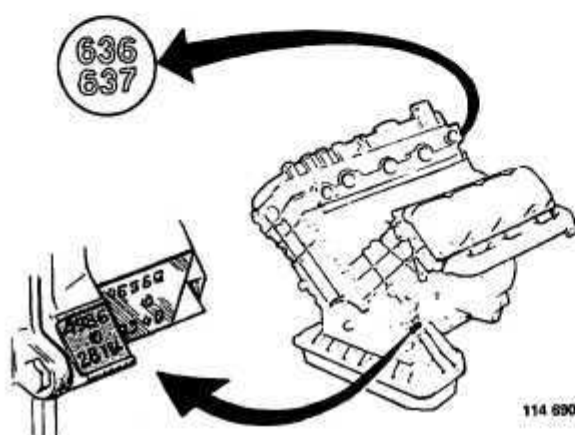
Nearly all of the B27/28 engine is made of aluminium alloy. The threads are tapped directly into the alloy. For this reason it is extremely important that all of the bolts are tightened to specified torque.

Two types of tightening torques are used in this manual:

- I. Tightening torque **40 Nm** (4 kpm) = a torque wrench must be used.
- II. Tightening torque **40 Nm** (4 kpm) = correct value, however it is not necessary to use a torque wrench.

Specifications

Group 20 General



Engine serial number and part number

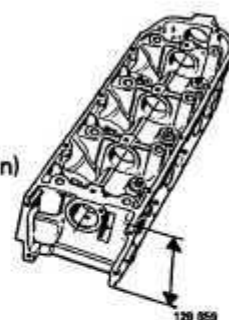
Located on a plate in front of the oil filter.

On B28E/F 1981- models: located on the rear of the right-hand cylinder head, shows the last three digits of the part number.

Group 21 Engine block

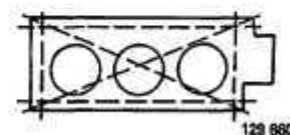
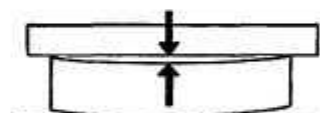
CYLINDER HEAD

Height New = 111.07 mm (4.373 in)



Max. warp is 0.05 mm over 100 mm.

NOTE! Do not level a warped cylinder head, replace it.



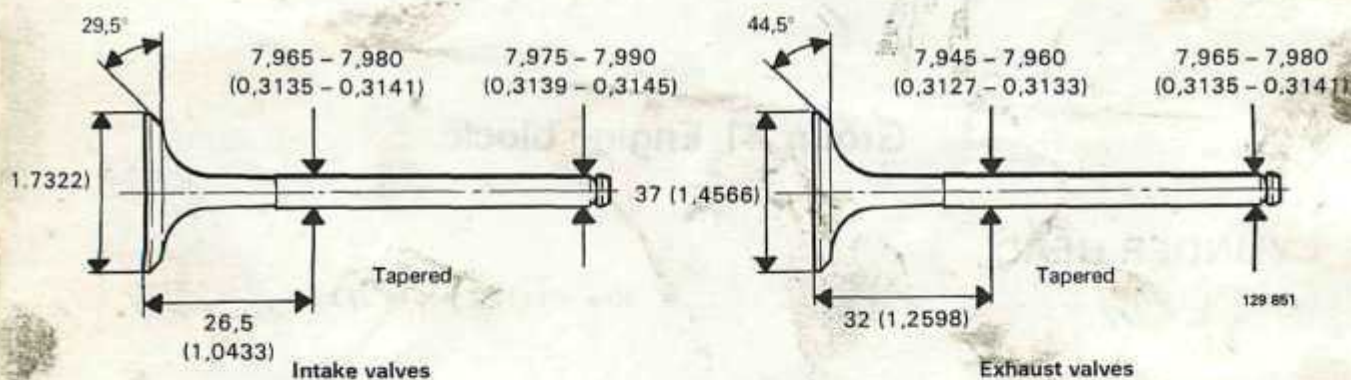
Cylinder head gasket thickness 1.14–1.50 mm (0.045 – 0.059 in)

VALVE SYSTEM

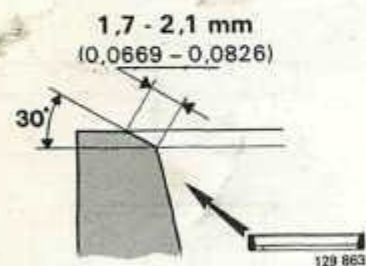
Valve clearances (varies with engine type)

Valve clearance mm (in)	Type 1	Type 2
Intake valves, cold engine	0.10–0.15 (0.004–0.006)	0.20–0.25 (0.008–0.010)
warm engine	0.15–0.20 (0.006–0.008)	0.25–0.30 (0.010–0.012)
Exhaust valves, cold engine	0.25–0.30 (0.010–0.012)	0.30–0.35 (0.012–0.014)
warm engine	0.30–0.35 (0.012–0.014)	0.35–0.40 (0.014–0.016)
Engine type – model year		
B27A 1976–1979	X	
B28A 1980		X
1981–1982	X	
B27E 1975–1978	X	
1979–1980 Sweden + Australia	X	
1979–1980 Other markets		X
B28E 1981–1983	X	
B27F 1976–1979	X	
B28F 1980		X
1981–1982	X	

Valves	mm (in)
Intake	25.4 (1.00)
Exhaust	25.4 (1.00)

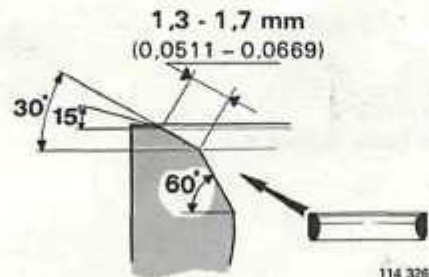


Valve seats mm (in)

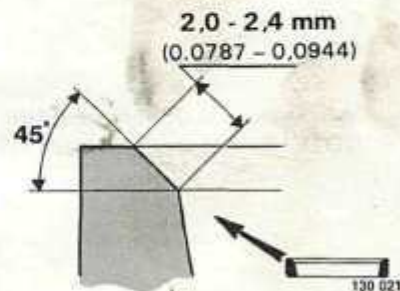


Intake valve seat

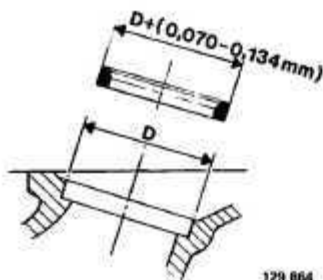
Early types



Intake valve seat
Late types (venturi seat): 15° and 60° are correct angles to reduce seat width.



Exhaust valve seat



129 864

Note! When replacing valve seats: the interference between the valve seat and its bore in the cylinder head must be 0.070–0.134 mm, (0.0027–0.0052 in), i.e. the valve seat diameter must be 0.070–0.134 mm greater than the diameter of the bore in the cylinder head.

Valve seats are available in three oversizes.

Valve guides mm (in)

Length	50.1–51.3 (1.2725–1.3030)
Inner diameter	8.000–8.022 (0.3149–0.3158)
Press-in measurement to cylinder head contact surface against block:	
intake	39.5–40.5 (1.5551–1.5944)
exhaust	36.9–37.9 (1.4527–1.4921)



129 865

Valve guides are available in three oversizes, and are marked with grooves.

	Marking	Reamer for seat
Standard	No groove	—
Over size 1	1 groove	5166
2	2 grooves	5167
3	3 grooves	5168

Valve springs

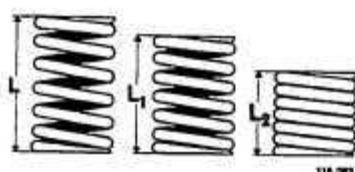
Two types of valve springs are in use. The springs are colour coded as follows:

Grey springs:

B27A	1976–1979
B27E	1975–1978
	1979–1980 Sweden + Australia
B27F	1976–1979

Green springs:

B28A	— 1980–1982
B27E	1979–1980 (excluding Sweden, Australia)
B28E	1981–1983
B28F	1980–1982



116 263

Grey springs:

Length mm	in	Load N (kp)	lbs.
47.2	1.86	0	0
40.0	1.57	233–268 (23.3–26.8)	52–60
32.2	1.27	521–585 (52.1–58.5)	116–131

Green springs:

Length mm	in	Load N (kp)	lbs.
47.1	1.85	0	0
40.0	1.57	230–266 (23.0–26.6)	51–59
30.0	1.18	613–689 (61.3–68.9)	137–154

Rocker arm mechanism

The rocker arm contact surface against the camshaft is surface-hardened and must not be ground.

Diameter, rocker arm shaft	19.959–19.980 mm 0.7857–0.7866 in
Hole diameter, rocker arm	19.992–20.013 mm 0.7870–0.7879 in
Clearance, shaft-rocker arm	0.012–0.054 mm 0.0005–0.0021 in

TIMING GEARS

Camshaft



Three types of camshafts with different lift heights are in use. The part number is marked on the front end.

Camshaft	Type 1	Type 2	Type 3
Marking (part number), left	79 10 245 522 (-143 or -144)	74 01 269 138	74 01 269 615
..... right	79 10 245 412	74 01 269 139	74 01 269 616
Max. lift height, left	5.144	6.004	5.96
..... right	(0.202 in)	(0.236 in)	(0.234 in)
Check of camshaft setting (cold engine):			
Adjust valve clearance on 1st and 6th intake valves to 0.7 mm (0.027 in), the intake valves should then open at,	5.059	6.004	5.96
1st	(0.199 in)	(0.236 in)	(0.234 in)
6th	9°±3°	9°±3°	8°±3°
..... BTDC	7°±3°	9°±3°	8°±3°
Engine type			
B27A 1976–1979	X		
B28A 1980		X	
1981–1982			X
B27E 1975–1978	X		
1979–1980 Sweden + Australia	X		
1979–1980 Other markets		X	
B28E 1981–1982			X
B27F 1976–1979	X		
B28F 1980		X	
1981–1982			X

Journal diameter, counting from front (all types): mm (in)

1st	40.440–40.465 (1.5921–1.5931)
2nd	41.040–41.065 (1.6157–1.6167)
3rd	41.640–41.665 (1.6393–1.6403)
4th	42.240–42.265 (1.6629–1.6639)
Radial play	0.035–0.085 (0.0013–0.0033)
End float, new	0.070–0.144 (0.0027–0.0056)
max.	0.5 (0.0196)

CRANK MECHANISM

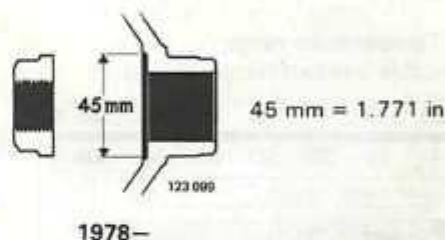
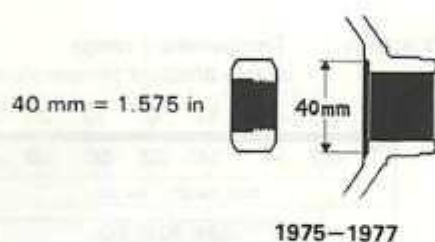
Flywheel

Run-out, max.	0.05 mm (0.0019 in)
Radial throw, max. (measured at $\varnothing$ 282.4 mm = 11.118 in) ..	0.15 mm (0.0059 in)

TIGHTENING TORQUES

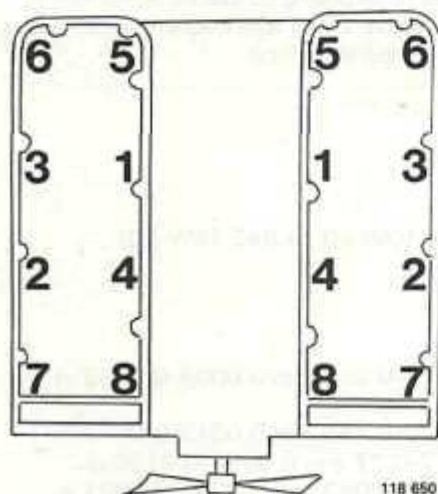
The tightening torques shown below apply to oiled nuts and bolts.
Degreased (washed) parts must be oiled prior to assembly,

	Nm	kpm	ft. lbs
Cylinder head (see below)	45-50	4.5-5.0	33-37
Big end bearings	160-180	16-18	118-133
Crankshaft front end, 1975-1977	240-280	24-28	177-207
1978-			



Camshaft sprocket	
Flywheel (always use new bolts)	
Spark plugs (do not oil)	
Valve cover	

Nm	Kpm	ft. lbs
70-90	7-9	52-66
45-50	4.5-5.0	33-37
12±2	1.2±0.2	9±1.5
15	1.5	11



Tightening order for cylinder head bolts

Tighten all bolts in stages according to below:

- 1 = 10 Nm (1 kpm = 7 ft. lbs)
- 2 = 30 Nm (3 kpm = 22 ft. lbs)
- 3 = 60 Nm (6 kpm = 44 ft. lbs)
- 4 = Wait 10-15 minutes
- 5 = Slacken bolts
- 6 = 15-20 Nm (1.5-2.0 kpm = 11-15 ft. lbs)
- 7 = Angle-tighten to 113-117°
- 8 = Warm-up engine to operating temperature
- 9 = Cool block 30 minutes
- 10 = Slacken and then retighten bolts one at a time in specified tightening order.
Retighten according to stages 6 and 7.

Group 22 Lubricating system

OIL CAPACITY litres (US qts)

Excluding oil filter	6.0 (6.3)
Including oil filter	6.5 (6.9)
Difference, max-min approx.	1.0 (1.0)

OIL PRESSURE

Warm engine and new oil filter

at 15 r/s (900 r/min) min	0.1 MPa (1.0 kp/cm ² = 14.2 psi)
50 r/s (3 000 r/min)	0.4 MPa (4.0 kp/cm ² = 57 psi)

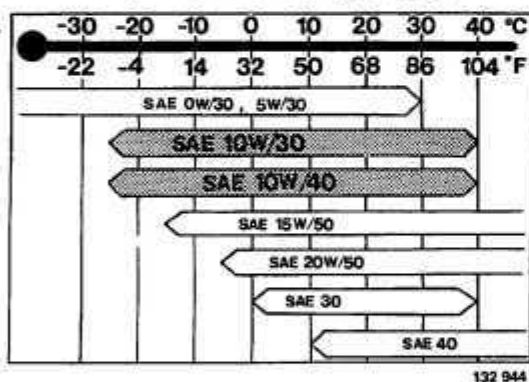
ENGINE OIL

USA and Canada

Quality according to API Service – SF/CC

Note! Under no circumstances may SE/CD oils be used.

Viscosity: Temperature range
(stable ambient temperatures)

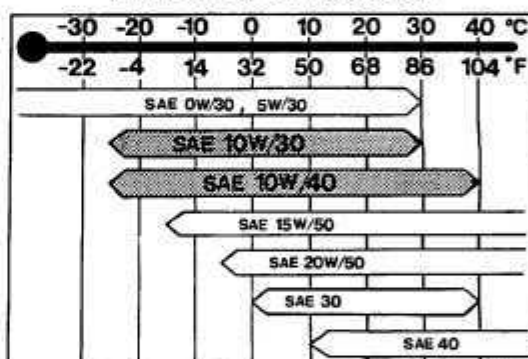


132 944

Other markets (excl. USA and Canada)

Quality .. according to API Service – SE/CC or SF/CC

Viscosity: Temperature range
(stable ambient temperatures)



132 901

SAE 15W/50 or 20W/50 oils are recommended for use in extreme driving conditions which involve high oil consumption and high oil temperatures e.g. mountain driving with frequent decelerations or fast motorway driving. Note however the lower temperature limit.

CARBURETTOR

Oil for damper cylinder SAE 10W-40 (or SAE 10W-50)

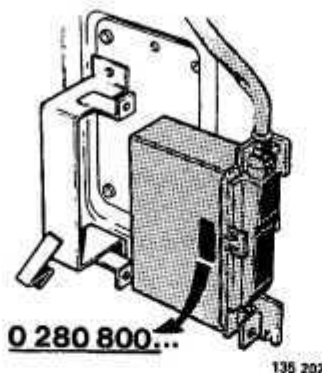
OIL PUMP

End float	0.025–0.084 mm 0.0009–0.0033 in
Radial play between cog tip and pump housing wall (excl. bearing play)	0.110–0.185 mm 0.0043–0.0072 in
Backlash (excl. bearing play)	0.17–0.27 mm 0.0066–0.0106 in
Bearing play, drive shaft	0.015–0.053 mm 0.0006–0.0021 in
idler shaft	0.015–0.051 mm 0.0059–0.0020 in
Relief valve spring, length at various loads:	
unloaded	89.5 mm 3.52 in
loaded to 88.3 N (8.83 kp = 20 lbs)	56.5–60.5 mm 2.22–2.33 in

Group 25 Intake and exhaust systems

LAMBDA-SOND SYSTEM

Control unit



Type of control unit fitted to vehicle depends on model year and engine type.
Identification number stamped on side of unit (last three digits).

Engine type	B 27 F		B 28 F			
	1978	1979	1980	1981 Calif+Japan	1981 Fed+Canada	1982
Control unit						
Volvo no.	464443-1 ¹⁾	464958-8	1274143-5	1274143-5	1274219-3	1274368-9
Bosch no (last three digits)	... 003	... 005	... 023	... 023	... 031	... 050
Duty cycle						
disengaged lambda-sond	42-48°	42-48°	42-48°	42-48°	42-48°	42-48°
earthed thermal switch	73-80°	73-80°	51-57°	51-57°	51-57°	51-57°
earthed microswitch ²⁾	-	-	51-57°	51-57°	51-57°	51-57°
earthed pressure differential switch ³⁾	-	-	(82°→)	(82°→)	(82°→)	82°→

Remarks:

¹⁾ Superseded by P/N 464958-8 (... 005)

²⁾ B28 F USA 1980-1982 models designed for high altitude use: microswitch must be disconnected, see page 64.

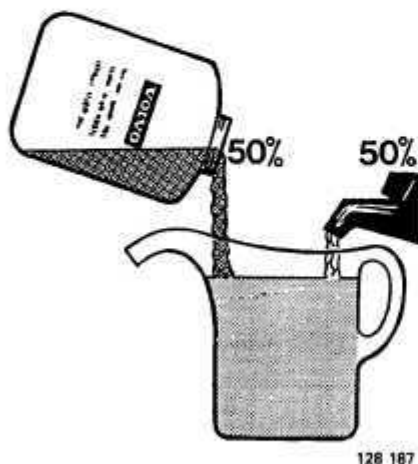
³⁾ Pressure differential switch introduced in 1982 on USA+Canada (not Japan) but may have been fitted to 1980-1981 USA+Canada.

TIGHTENING TORQUES

Lambda-sond 55 Nm (40 ft.lbs)
Apply "Never Seez" (P/N 1 161 035-9) to threaded section.

Group 26 Cooling system

GENERAL



Coolant – composition

Since we use aluminium in our engines, active corrosion protection is necessary in the coolant to help prevent corrosion damage.

Use genuine Volvo coolant, **type C**, diluted with clean water in proportions of 50/50.

The mixture helps to prevent corrosion and frost damage.

- Never fill 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.

Capacity Approx 11 litres (11.5 US qts)

EXPANSION TANK

Pressure valve in cap opens at:

overpressure 65–85 kPa (9.2–12.0 psi)

underpressure 7 kPa (1.0 psi)

THERMOSTAT

Marking

Starts to open at

Fully open at

Type 1

82
81–83°C
(178–181°F)
90–94°C
(194–201°F)

Type 2

87
86–88°C
(187–190°F)
95–99°C
(203–210°F)

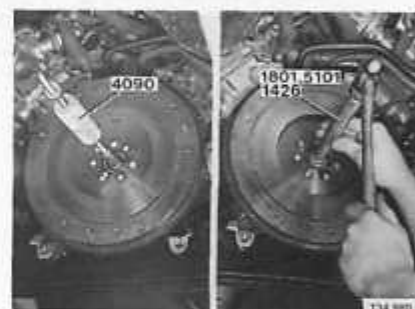
Type 3

92
91–93°C
(196–199°F)
100–104°C
(212–219°F)

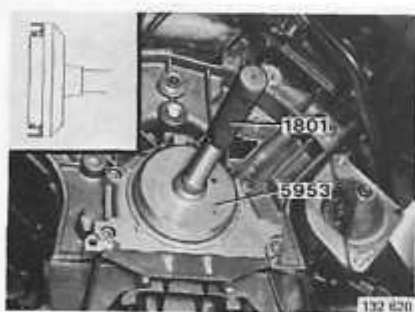
Special tools

999	Description - use
1426-9	Drift: installing pilot bearing
1801-3	Standard handle: used with 5101 and 5953
2484-7	Centering drift: clutch, M45/46 gearboxes (early types)
2520-8	General stand: used with fixture 5099
2810-3	Beam: for hoisting engine. Used with 2 x cradle 5100
2903-6	Oil filter wrench
4090-0	Extractor: for removing pilot bearing

Continued on page 12.



1426



1801



2484



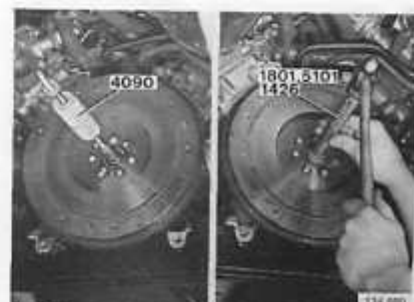
2520



2810



2903



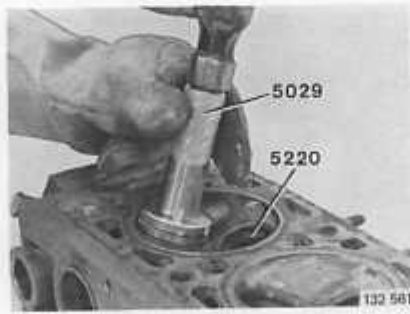
4090

999	Description – use
5006-5	Lifting tool: replacing engine mounts. Used with 2 × 5115 and 2 × 5033
5029-7	Drift: installing intake valve seats
5033-9	Support: two, used with 5006 and 2 × 5115
5093-3	Holder: four, for cylinder liners
5098-2	Protractor: for angle-tightening cylinder head bolts
5099-0	Fixture: for engines. Used with 2520
5100-6	Hoist beam: two, hoisting engines. Used with 2810
5101-4	Drift: installing pilot bearing (early types). Used with 1801
5103-0	Drift: installing crankshaft front seal
5105-5	Support bracket: retaining camshaft sprocket
5108-9	Drift: installing intake valve guides
5109-7	Drift: installing exhaust valve guides
5111-3	Centering drift: clutch, M45/46 gearboxes, late types
5112-1	Gear sector: blocking flywheel
5113-9	Centering drift: clutch, M50/51 gearboxes
5115-4	Hook: two. Used with 5006 and 2 × 5033
5165-9	Reamer kit: valve guides, contains 5164 (early types), 5224 (late types), 5166, 5167, 5168
5166-7	Reamer: for valve guide seat OS 1
5167-5	Reamer: valve guide seat OS 2
5168-3	Reamer: valve guide seat OS 3
5213-7	Reamer: camshaft sprocket, removing/installing cylinder head
5218-6	Drift: removing valve guides. Installing seal in valve guide
5220-2	Drift: installing exhaust valve seats
5224-4	Reamer: reaming of guides. 5164 can also be used.
5953-8	Drift: installing crankshaft rear seal. Used with 1801

Continued on page 14.



5006



5029



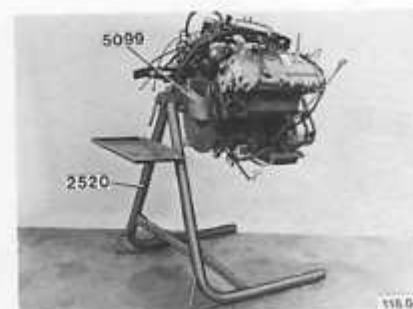
5033



5093



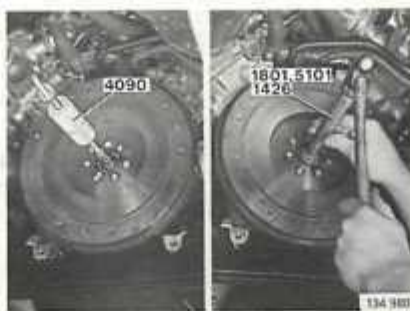
5098



5099



5100



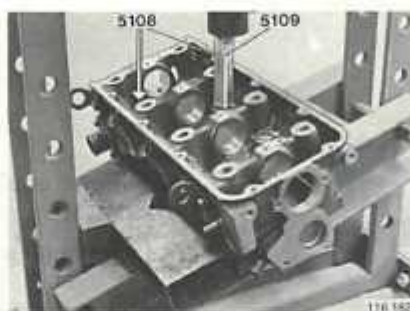
5101



5103



5105



5108, 5109



5111



5112



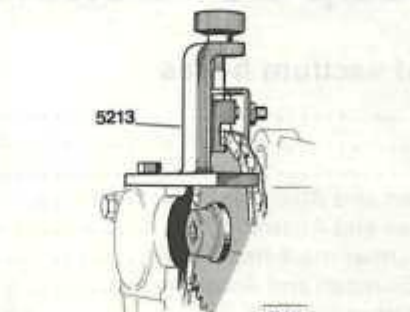
5113



5115



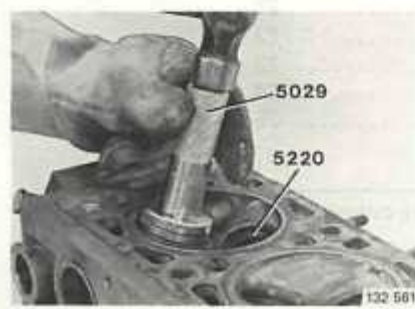
5165 (5166, 5167, 5168)



5213



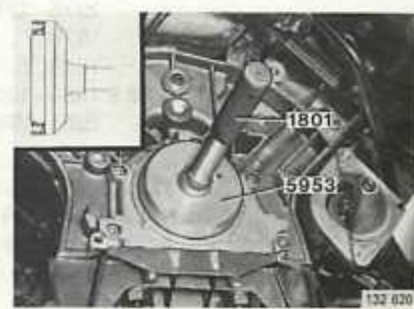
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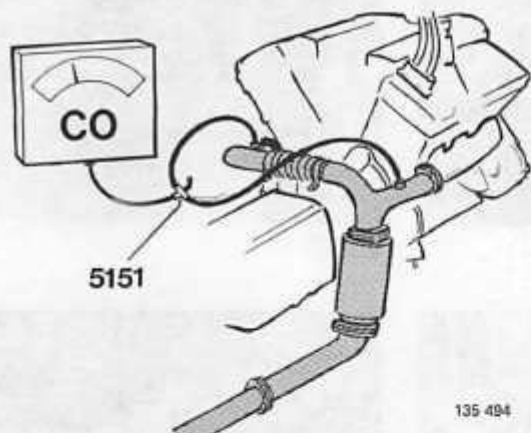
5220



5224



5953



999 5151-9 Adapter: connected to CO gauge when trouble shooting Lambda-sond system.



Additional equipment required when testing Lambda-sond system:

- tachometer and dwell meter e.g. Volvo Mono-Tester 999 9921-1
- ohmmeter e.g. Volvo ohm-diode meter 999 9724-0
- test lamp or voltmeter e.g. Volvo Volt-Amp meter 999 6450-4.

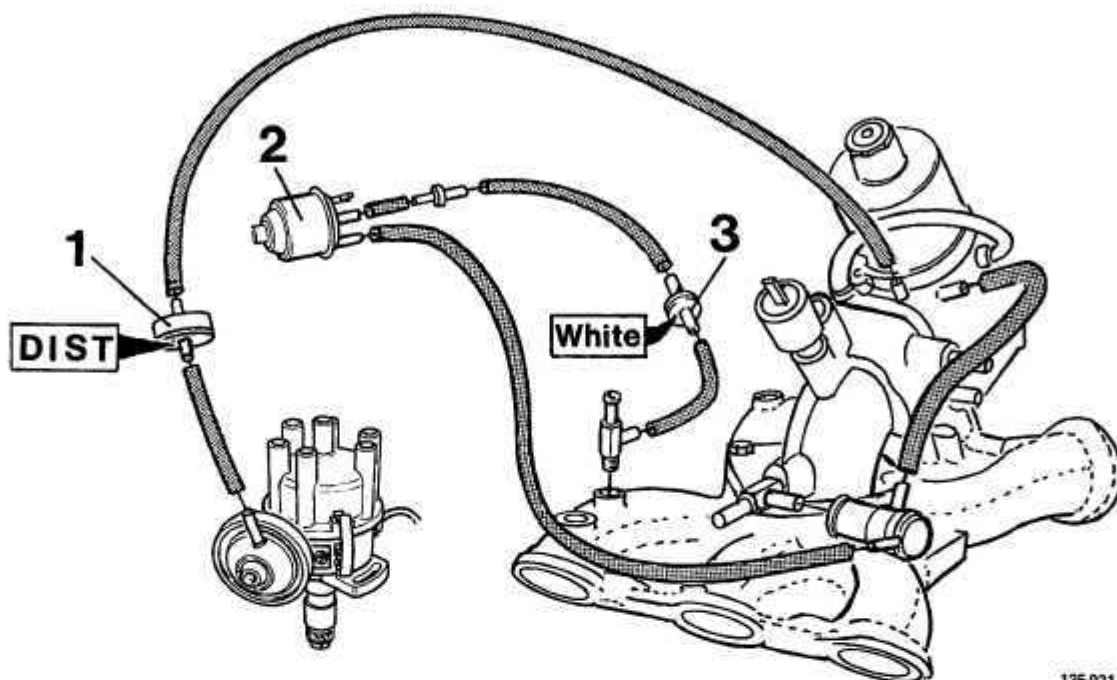
Group 20 General

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B 27 F 1976-1977 type 1	19
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B 28 F 1980-1981	24
1981-1982	25

The illustrations in this section show where the vacuum hoses are connected. The exact routing of the hoses is not however shown.

B27 A, B28 A

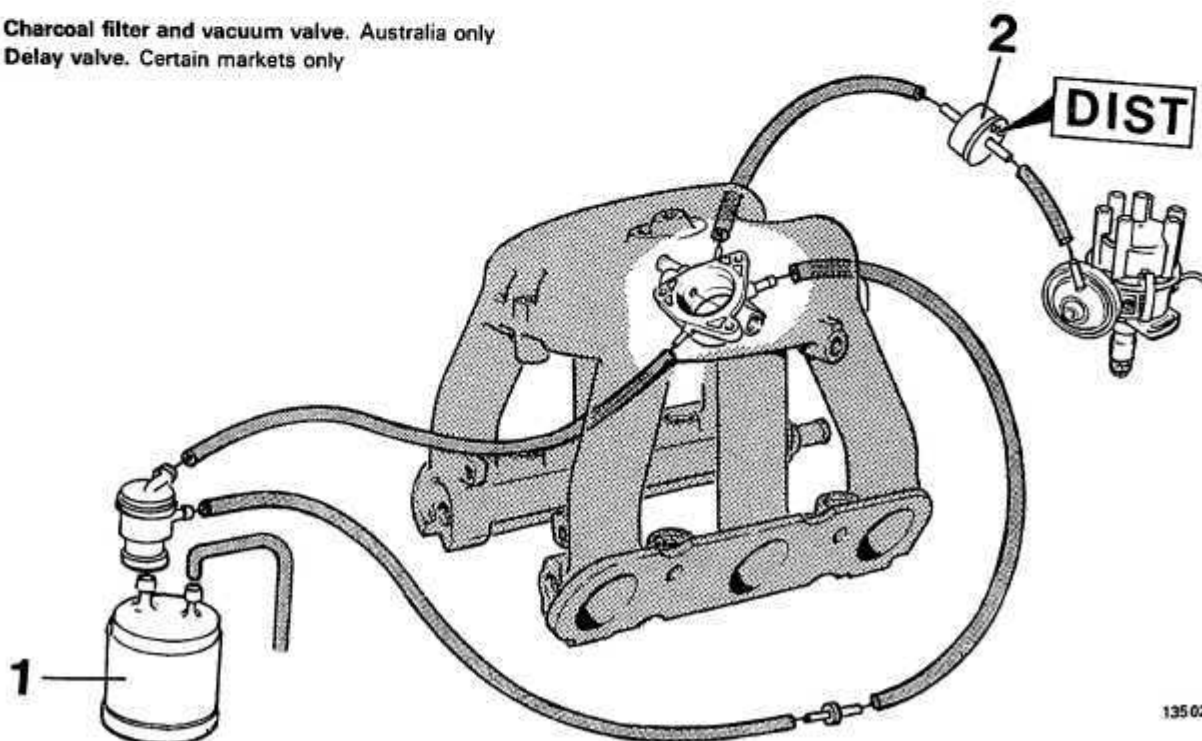
1. Delay valve
2. Solenoid valve: only 1979–1982 models with AC
3. Non-return valve: white side facing intake manifold



135 021

B27 E 1975–1977

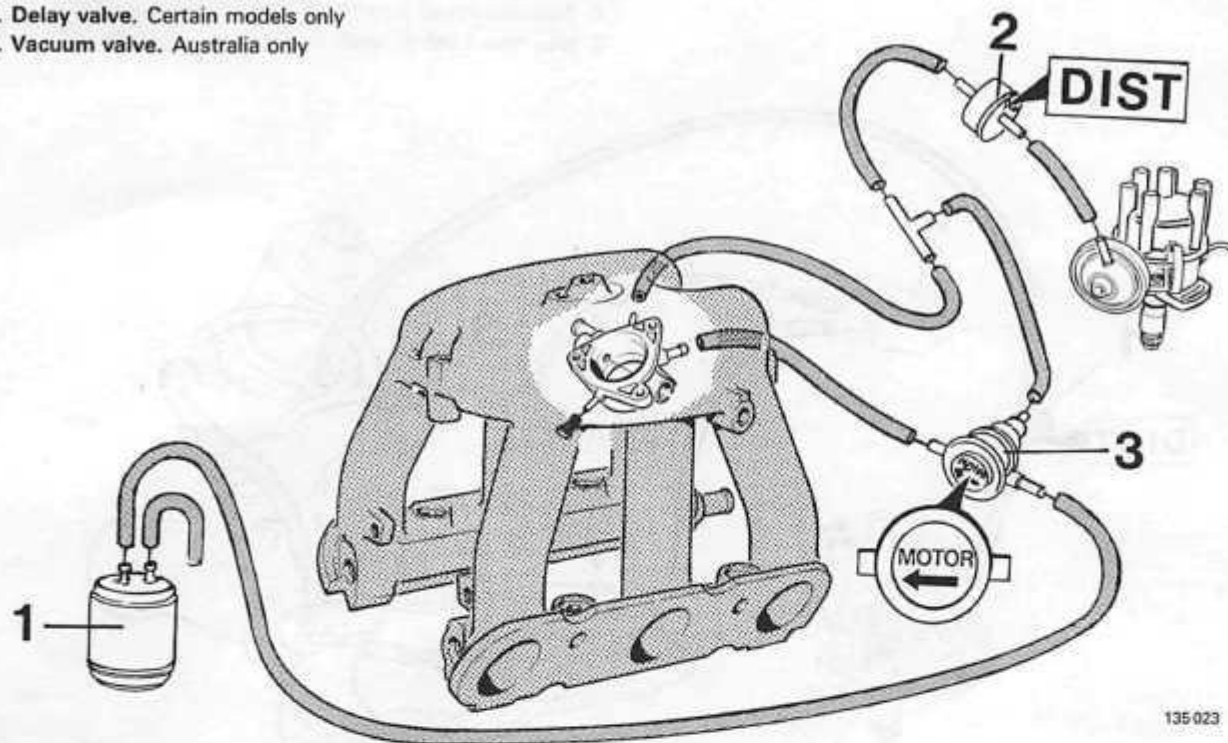
1. Charcoal filter and vacuum valve. Australia only
2. Delay valve. Certain markets only



135 022

B 27 E 1978

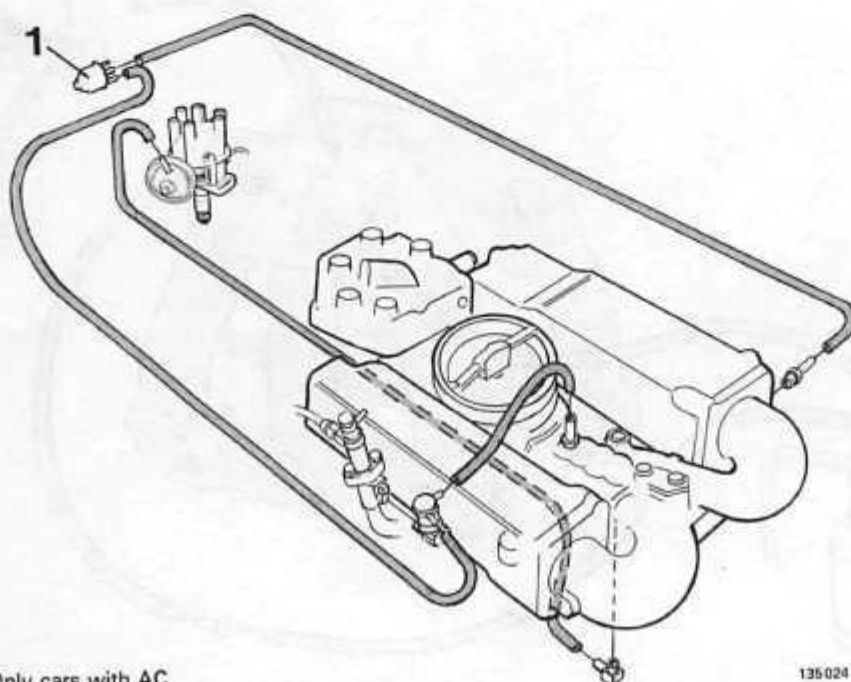
- 1. Charcoal filter. Australia only
- 2. Delay valve. Certain models only
- 3. Vacuum valve. Australia only



135 023

B 27 E 1979–1980, B 28 E 1981–1983

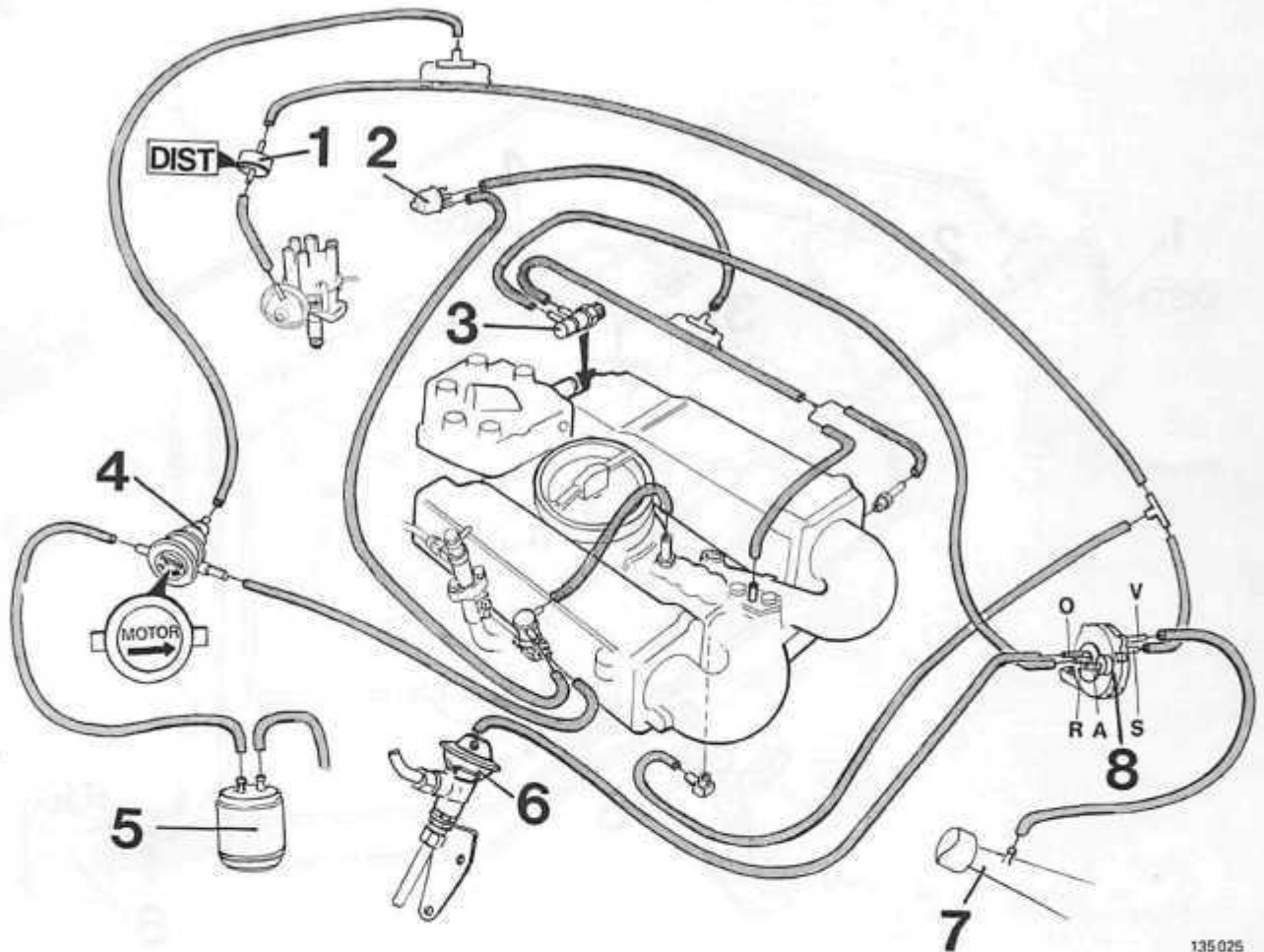
Excluding Sweden and Australia



- 1. Solenoid valve. Only cars with AC

135 024

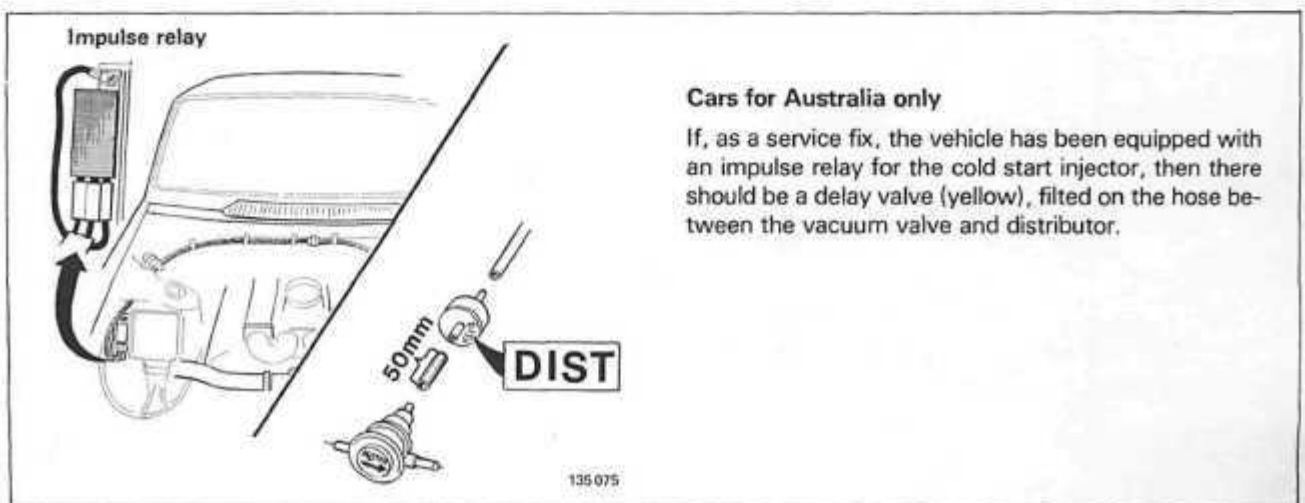
B 27E 1979 Sweden and Australia



135 025

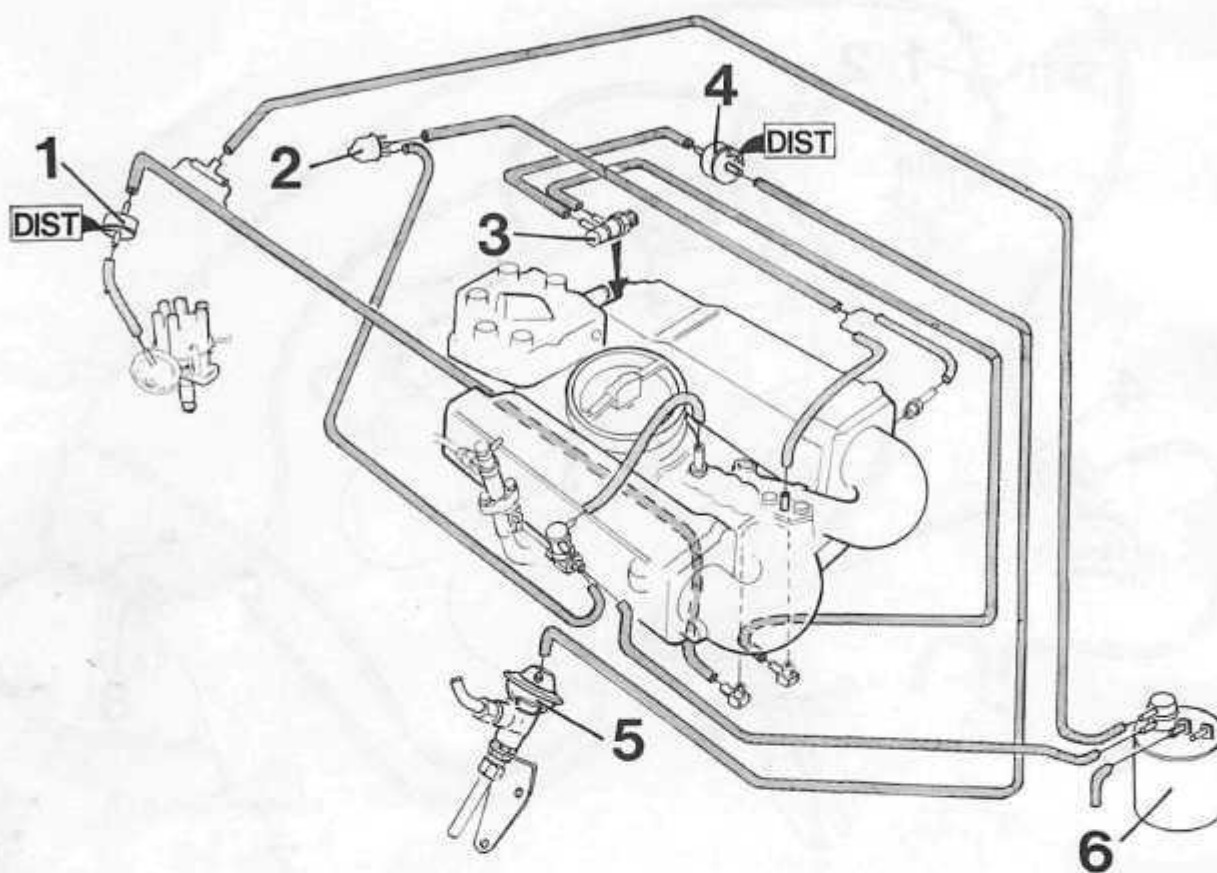
- 1. Delay valve. Certain models only
- 2. Solenoid valve. Only cars with AC
- 3. Thermostat valve
- 4. Vacuum valve. Australia only

- 5. Charcoal filter. Australia only
- 6. *EGR valve
- 7. Air inlet for filter
- 8. Vacuum amplifier
- *Exhaust gas recirculation



135 075

B 27 E 1980, B 28 E 1981–1982 Sweden and Australia

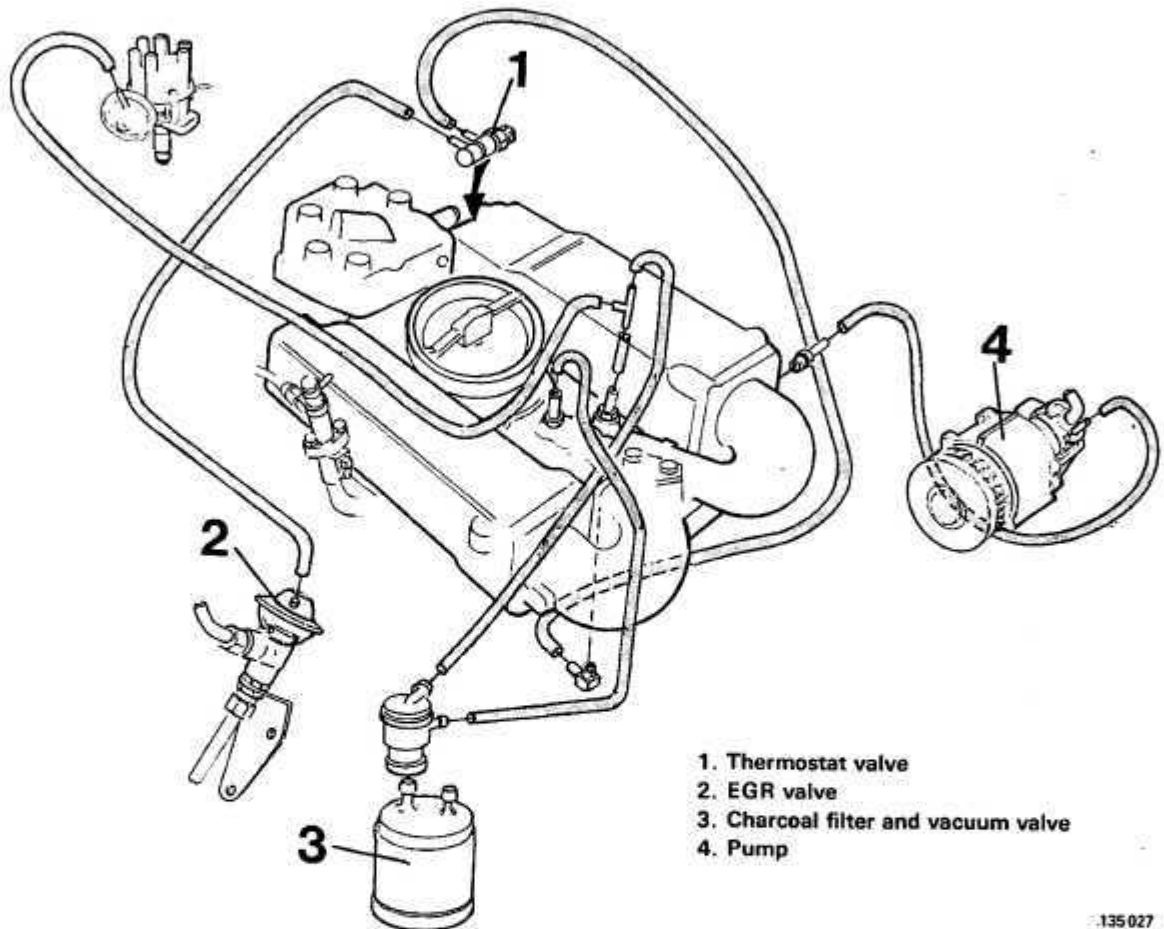


135026

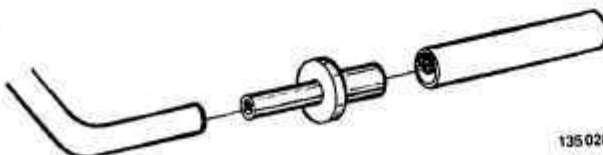
- 1. Delay valve. Certain models only
- 2. Solenoid valve. Only cars with AC
- 3. Thermostat valve
- 4. Delay valve
- 5. EGR valve
- 6. Charcoal filter. Australia only

B 27F 1976–1977 type 1

Market	Model year	Remarks
USA Federal	1976	Exhaust gas recirculation (EGR) automatics only
Canada	1976–1977	Exhaust gas recirculation (EGR) automatics only



135 027

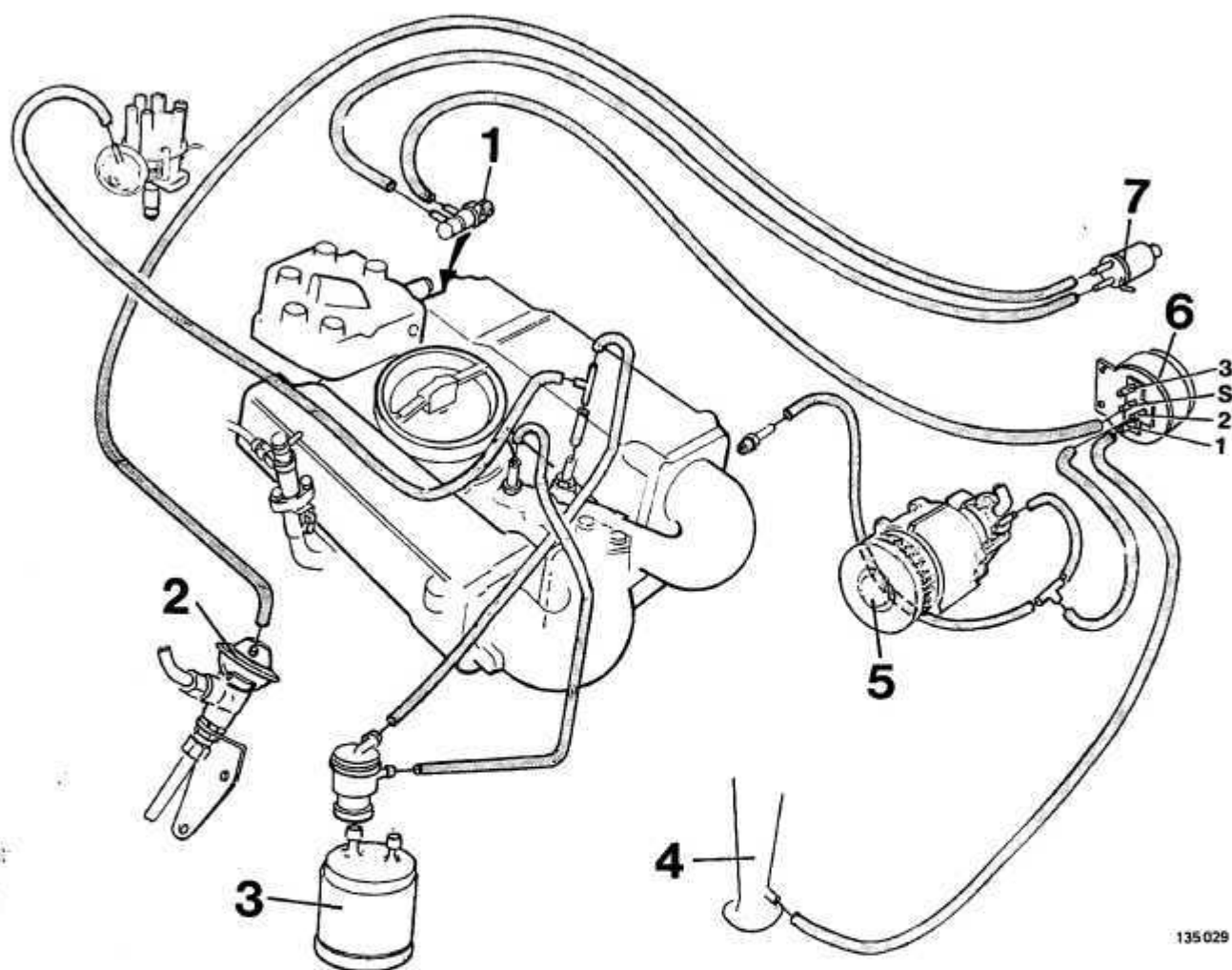


Some of the hoses are connected via an adapter and a short hose to the respective component

135 028

B 27F 1976-1977 type 2

Market	Model year
USA California	1976
Japan	1976-1977



135 029

- 1. Thermostat valve
- 2. EGR valve
- 3. Charcoal filter and vacuum valve
- 4. Air inlet, air filter

- 5. Pump
- 6. Vacuum amplifier
- 7. Solenoid valve

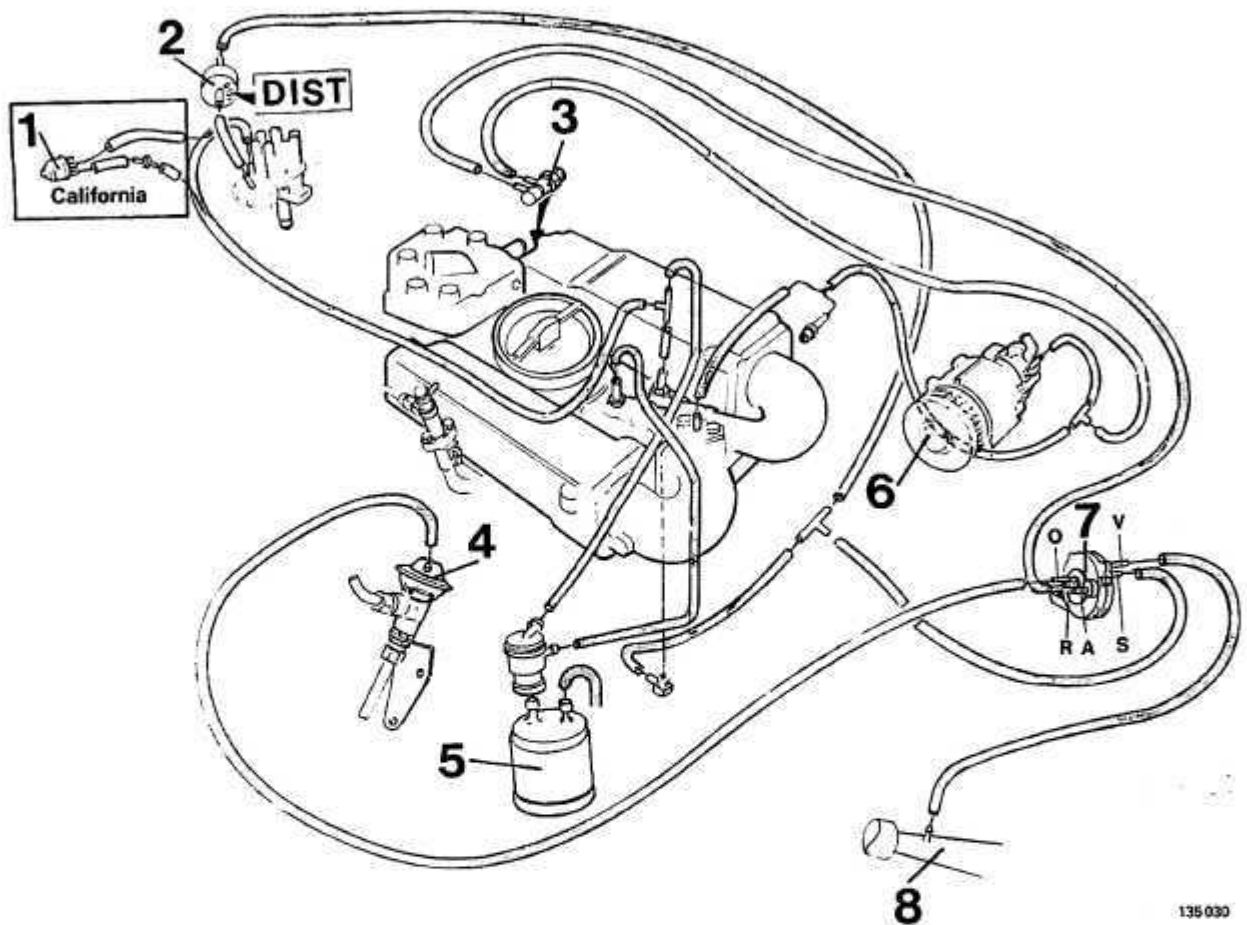


135 028

Some of the hoses are connected via an adapter and a short hose to the respective component.

B 27F 1976-1977 type 3

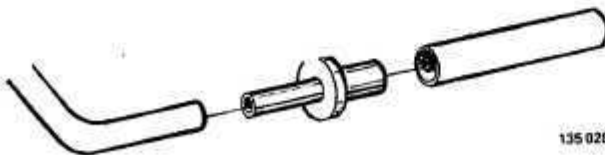
Market	Model year	Remarks
USA Federal	1977	Without pump
USA California	1977	



135 030

1. Solenoid valve. California only
2. Delay valve
3. Thermostat valve
4. EGR valve

5. Charcoal filter and vacuum valve
6. Pump
7. Vacuum amplifier
8. Air inlet, air filter

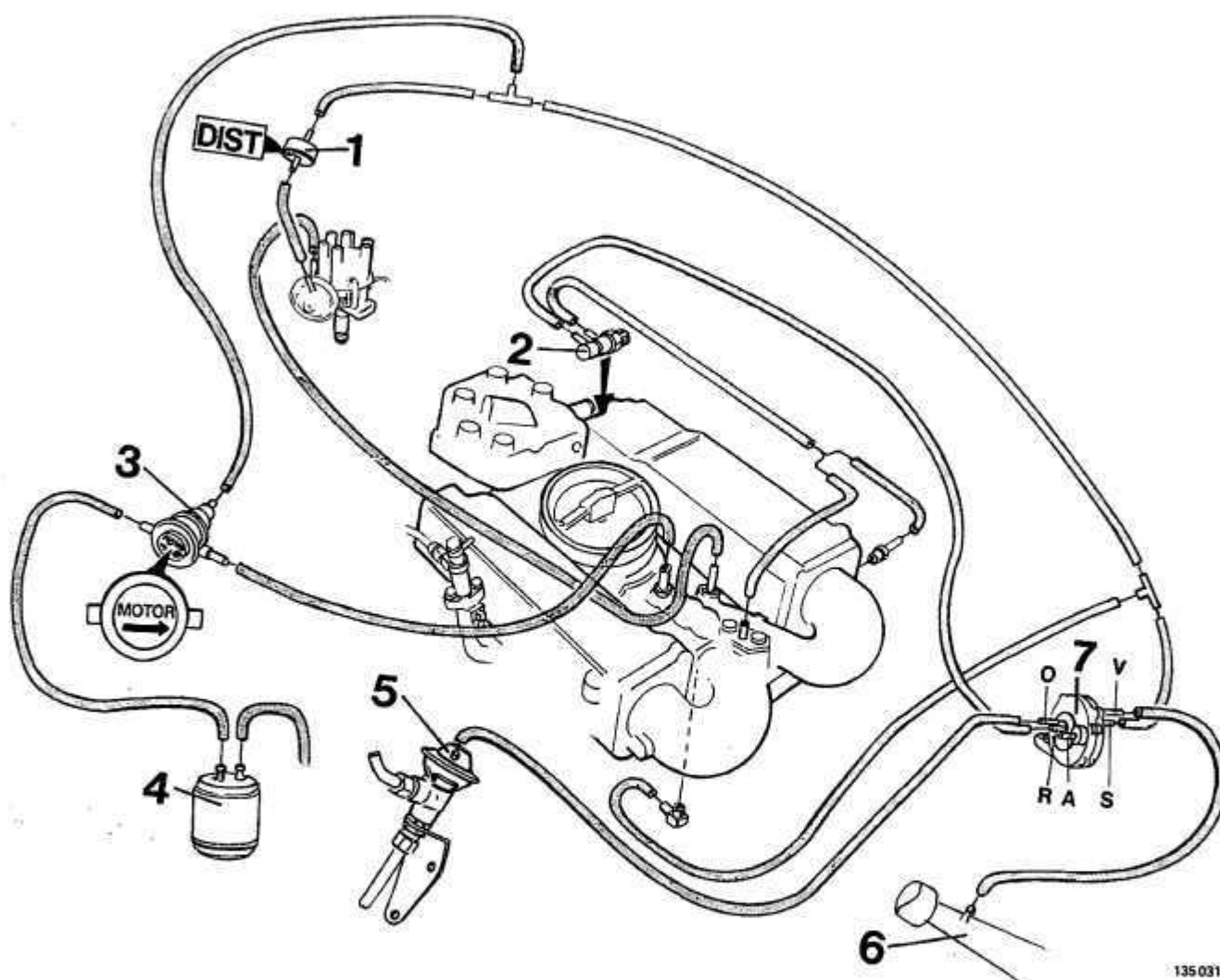


135 028

Some of the hoses are connected via an adapter and a short hose to the respective component.

B 27 F 1978

Market	Model year	Remarks
USA Federal	1978	
USA California	1978	Without EGR
Canada	1978	
Japan	1978	Without EGR



1. Delay valve
2. Thermostat valve
3. Vacuum valve
4. Charcoal filter
5. EGR valve
6. Air inlet, air filter
7. Vacuum amplifier

Note! If, as a service fix, the vehicle has been equipped with an impulse relay for the cold start injector, then there should be a delay valve (yellow) fitted on the hose between the vacuum valve and distributor.

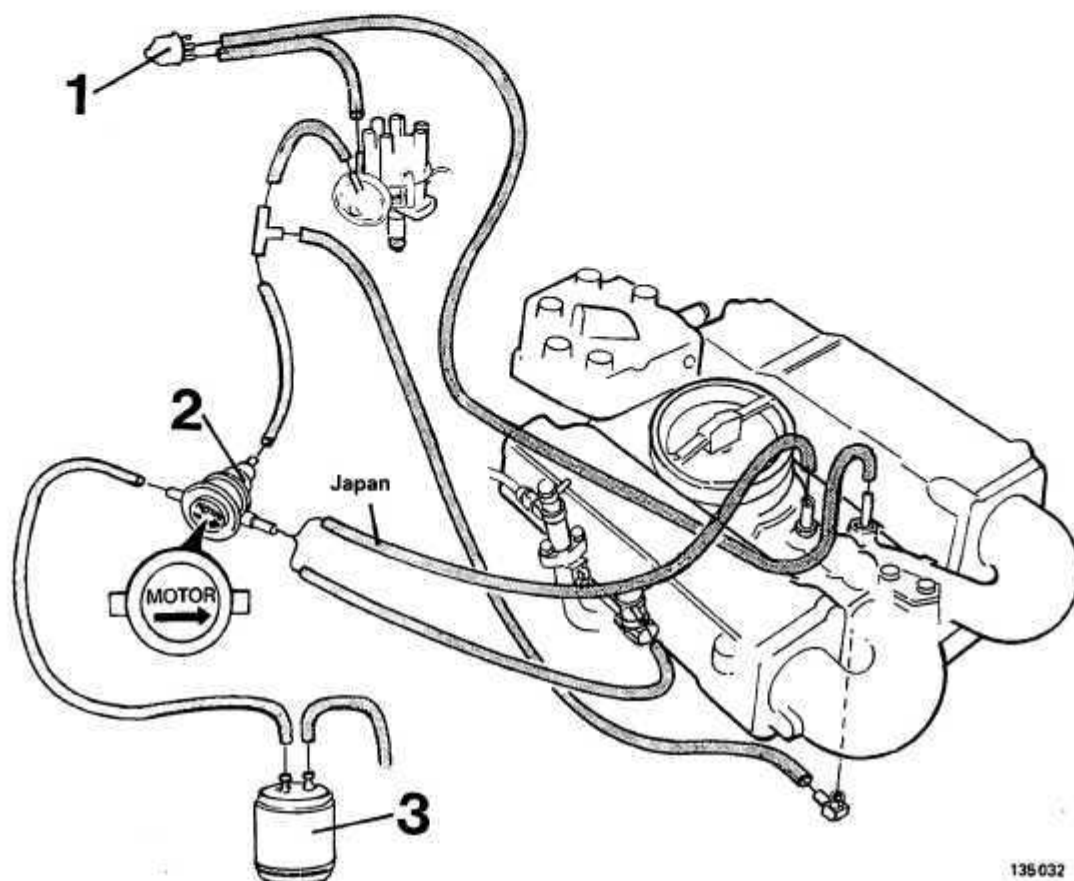
See page 23.



Some of the hoses are connected via an adapter and a short hose to the respective component.

B 27 F 1979

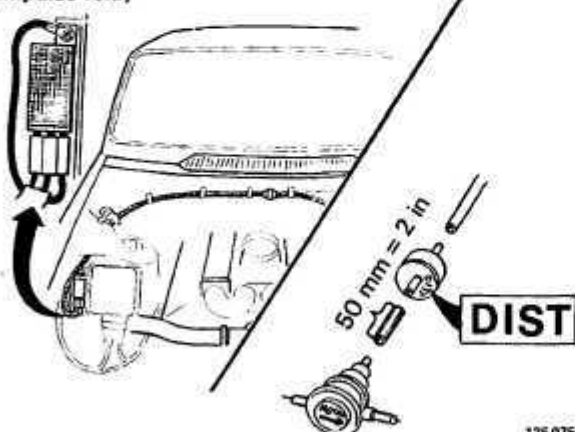
All markets



135 032

- 1. Solenoid valve
- 2. Vacuum valve
- 3. Charcoal filter

Impulse relay

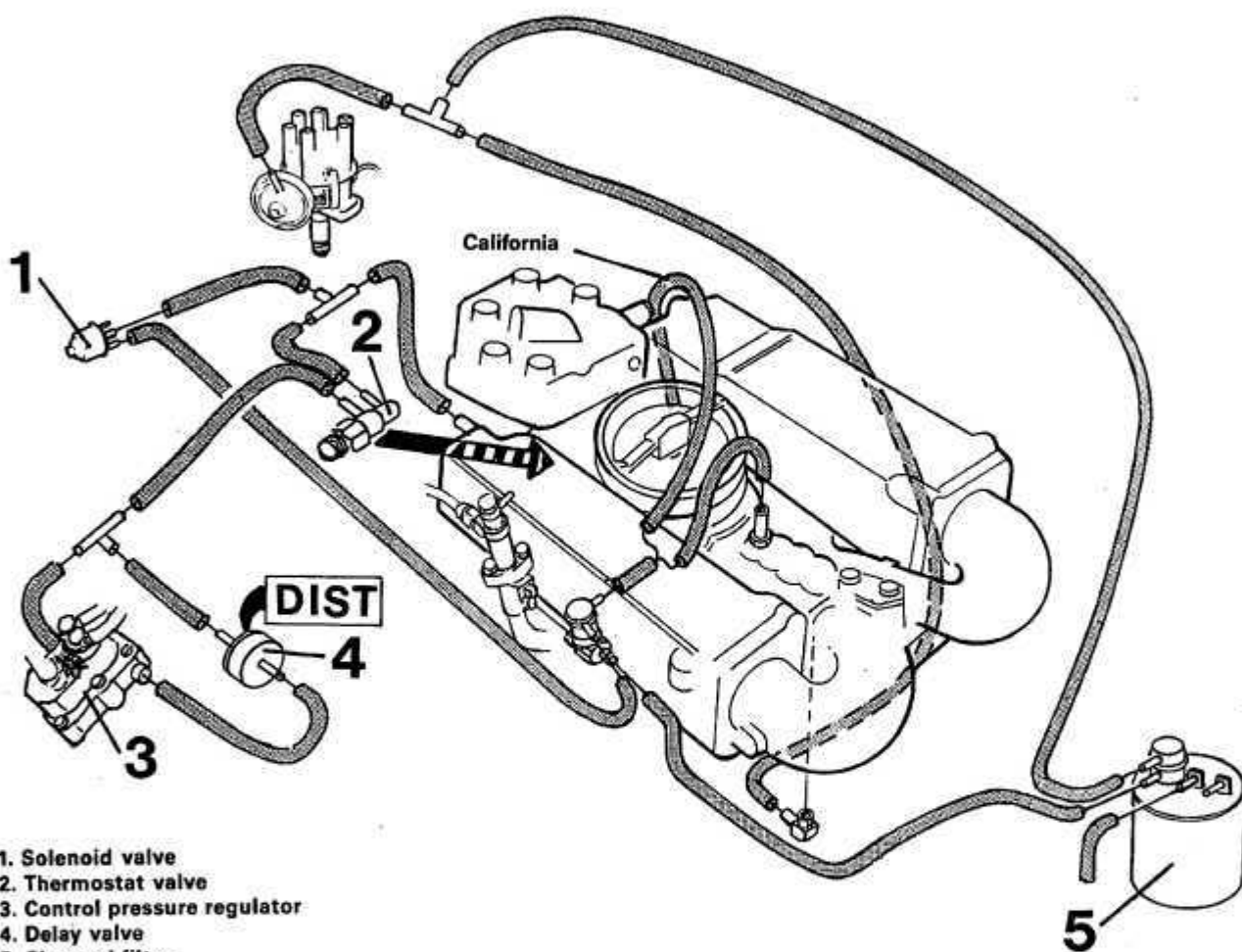


Note! If, as a service fix, the vehicle has been equipped with an impulse relay for the cold start injector, then there should be a delay valve (yellow) fitted on the hose between the vacuum valve and distributor.

135 075

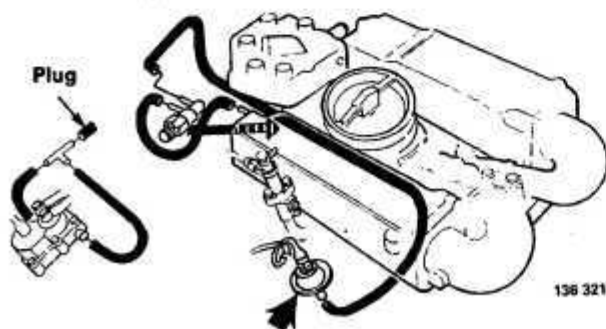
B 28 F 1980–1981

Market	Model year
All markets	1980
USA Federal	1981
Canada	1981



1. Solenoid valve
2. Thermostat valve
3. Control pressure regulator
4. Delay valve
5. Charcoal filter

135 033

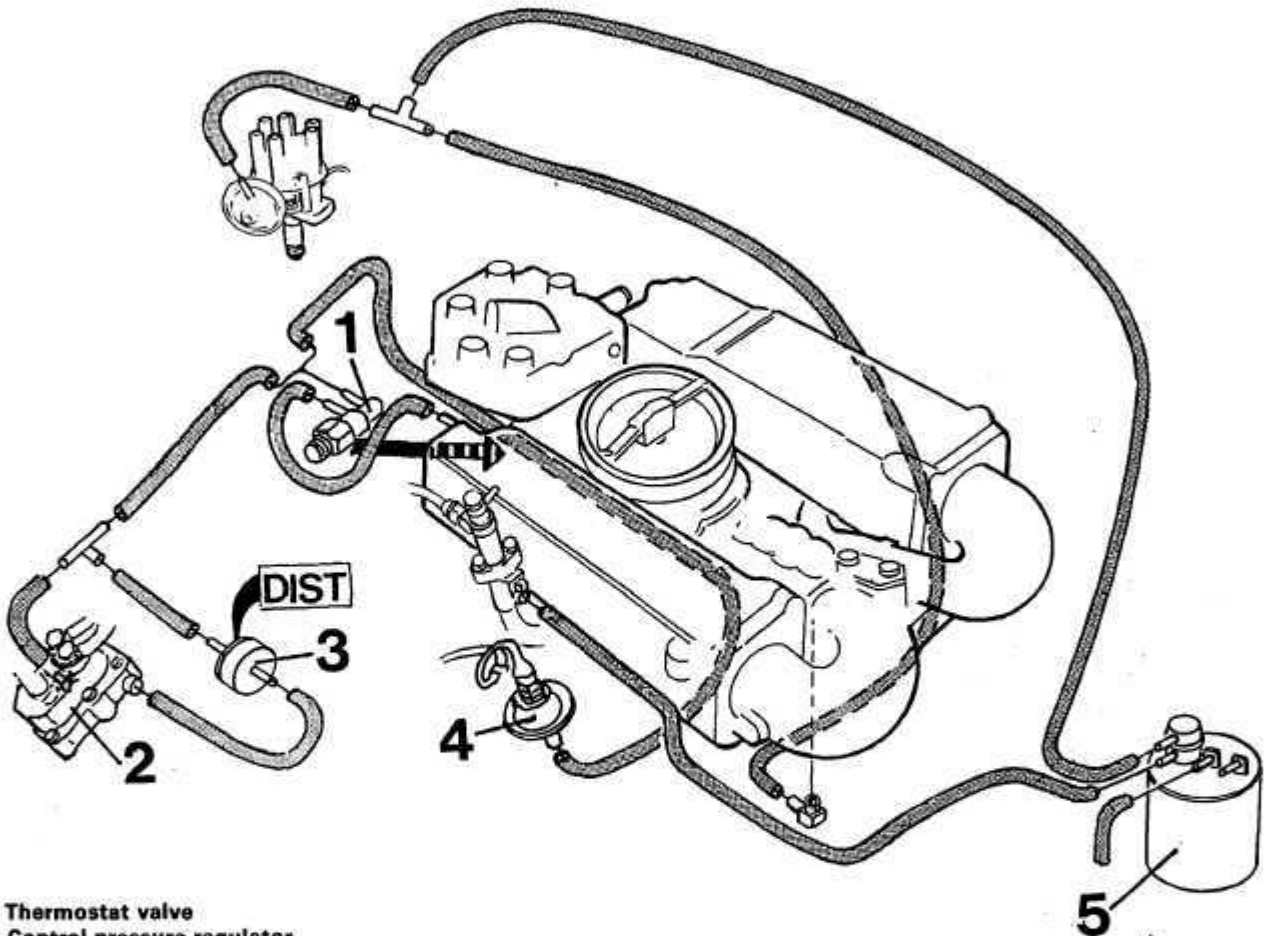


Note B 28 F USA and Canada 1980–1981

Some vehicles may be equipped with a pressure differential switch. See also page 136.

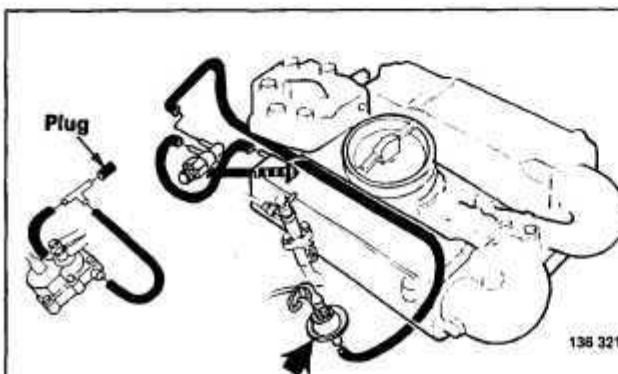
B 28 F 1981-1982

Market	Model year
USA California	1981
Japan	1981
All markets	1982



1. Thermostat valve
2. Control pressure regulator
3. Delay valve
4. Vacuum valve. Only USA and Canada 1982
5. Charcoal filter

135 084



136 321

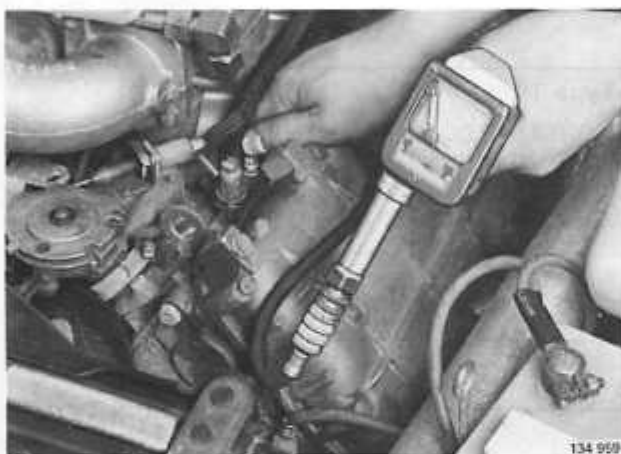
Note: B 28 F USA and Canada 1980-1981

Some vehicles may be equipped with a pressure differential switch. See also page 136.

Group 21 Engine assembly

Repairwork on installed engine	Operation	Page
Compression test	A1-2	27
Valve adjustment	B1-13	28
Cylinder head, removing	C1-25	32
reconditioning	C26-52	40
installing	C53-91	46
Timing gear chains, wear check	D1	55
replacement	D2-48	56
Camshaft/rocker arms, replacement	E1-5	66
Pilot bearing, replacement (gearbox removed)	F1-5	68
Ring gear, replacement (flywheel removed)	G1-5	69
Crankshaft seal, replacement, front	H1-18	70
rear (gearbox removed)	H19-25	73
Timing scale, checking/adjustment of position, or replacement	J1-9	75
Engine mountings	K1-2	77
 Replacement of engine		
Removing and installing engine	L1-4	78
Removing parts from engine	L14-17	80
Installing parts on engine	L18-24	83

A. Compression test



A1

Safety precaution

Disconnect the cable from terminal 15 on the ignition coil.

A2

Measure compression at full throttle (warm engine)

Compression = **0.8–1.1 MPa** (114–156 psi)

Note! Applies to warm engine, fully opened throttle and starter motor turning speed of 4.2–5.0 r/s (250–300 r/min.)

Tightening torque for spark plugs:
12 ± 2 Nm (9 ± 1.5 ft. lbs.)

B. Valve adjustment

Valve clearances (varies with engine type)

Valve clearance mm (in)	Type 1	Type 2
Intake valves, cold engine	0.10–0.15 (0.004–0.006)	0.20–0.25 (0.008–0.010)
warm engine	0.15–0.20 (0.006–0.008)	0.25–0.30 (0.010–0.012)
Exhaust valves, cold engine	0.25–0.30 (0.010–0.012)	0.30–0.35 (0.012–0.014)
warm engine	0.30–0.35 (0.012–0.014)	0.35–0.40 (0.014–0.016)
Engine type – model year		
B27A 1976–1979	X	
B28A 1980		X
1981–1982	X	
B27E 1975–1978	X	
1979–1980 Sweden + Australia	X	
1979–1980 Other markets		X
B28E 1981–1983	X	
B27F 1976–1979	X	
B28F 1980		X
1981–1982	X	

B1

Disconnect one of battery cables



Cars with AC

B2

Detach and move compressor to one side

Secure compressor to right bonnet/hood hinge.

Note! Do not disconnect the refrigerant hoses otherwise it will be necessary to drain and then evacuate the complete system before adding new refrigerant.

Remove compressor rear mounting bracket

Located on right hand valve cover.

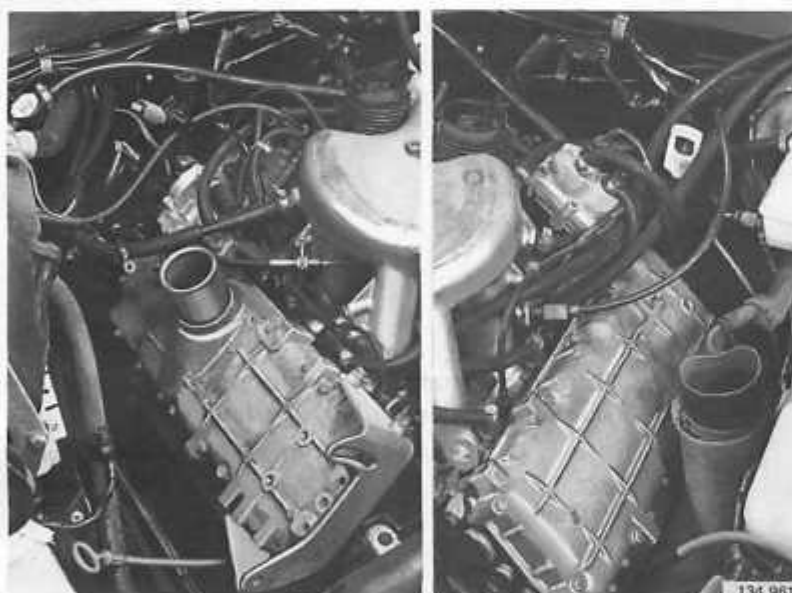


B 27/28A

B3

Obtain access to valve covers

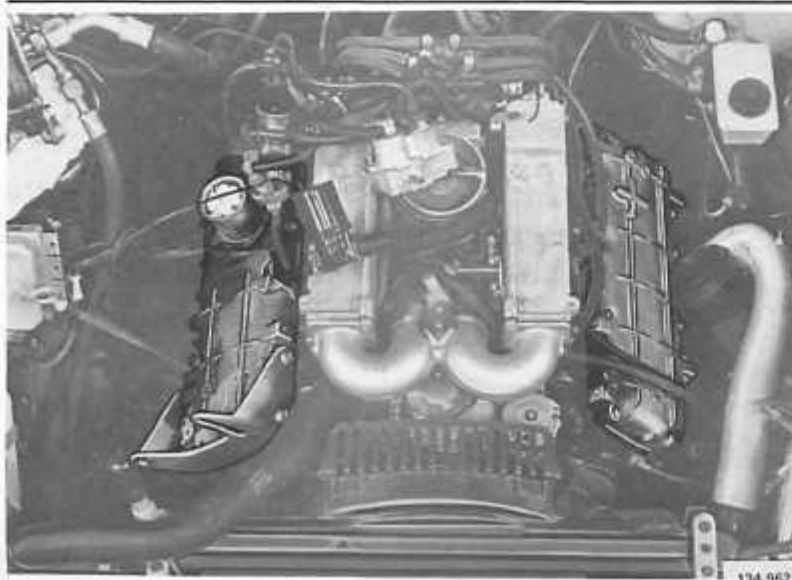
Detach carburettor and baseplate, and air filter. Place assembly on intake manifold. Cover hole in intake manifold.



B 27E 1975-1978

B4

Obtain access to valve covers



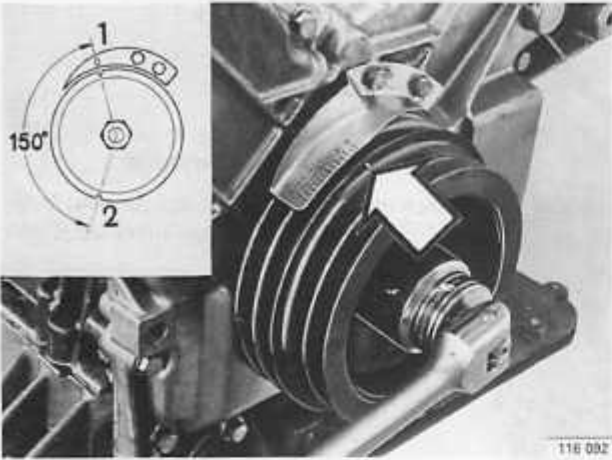
B 27E 1979-1980, B 28E, B 27F, B 28F

B5

Obtain access to valve covers

Remove vacuum pump and air pump where necessary.

B28F 1981 model



Remove valve covers

B6

Turn crankshaft to firing position for No. 1 cylinder
36 mm socket.

B7

The pulley mark "1" should align with the 0-mark on the timing scale.
Both the rocker arms for No. 1 cylinder must have clearance.

Note! There are two marks on the pulley:

- 1 = TDC cylinder 1
- 2 = TDC cylinder 6

B8

Check/adjust valve clearance

Check the following valves in the set position.

- Intake:** cylinders 1, 2 and 4
- Exhaust:** cylinders 1, 3 and 6

B9

Turn crankshaft one turn in normal direction to overlap position for No. 1 cylinder

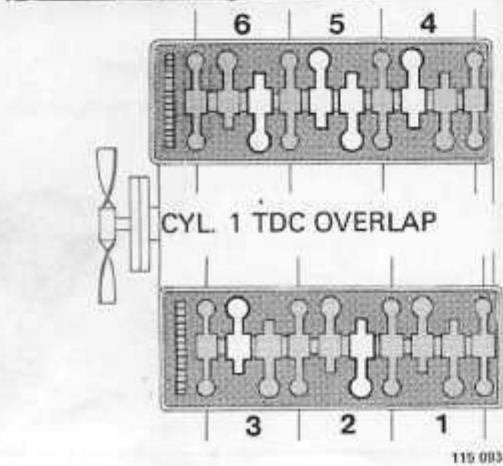
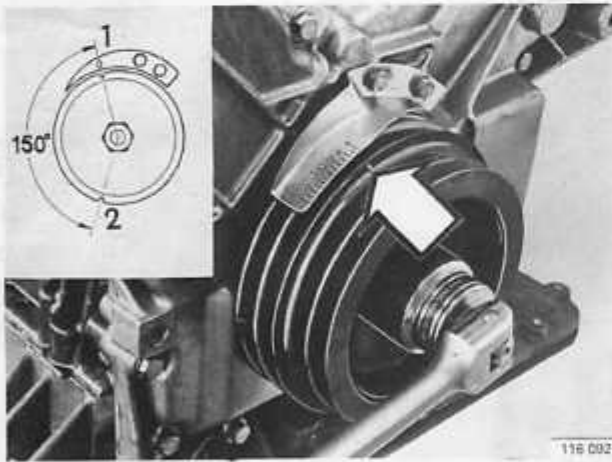
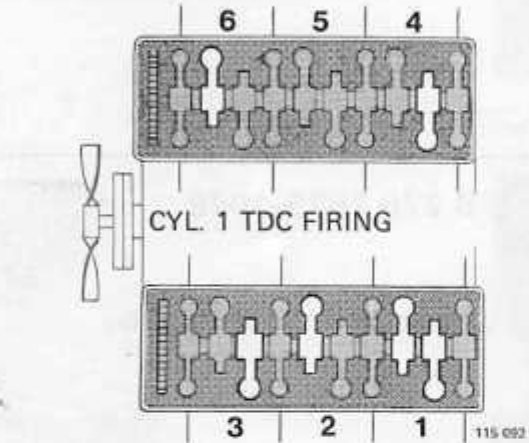
The mark "1" should align with the 0-mark on the timing scale. The rocker arms for No. 1 cylinder should not have clearance.

B10

Check/adjust clearance

Check the following valves in the set position:

- Intake:** cylinders 3, 5 and 6
- Exhaust:** cylinders 2, 4 and 5



B11

Clean gasket mating surfaces on valve covers and cylinder heads

B12

Install gaskets and valve covers

Use new gaskets. Secure gaskets with sealer (P/N 116 1026-8).

Torque to **10-15 Nm (7-11 ft. lbs.)**

To ensure that the junction between the valve cover, cylinder block and timing gear case is fully leak-proof, a thin coat of silicone (P/N 116 1048-2) can be applied to the joint.
Caution! Do not use too much silicone otherwise it may enter in to the lubrication system and block the oil channels.



135 034

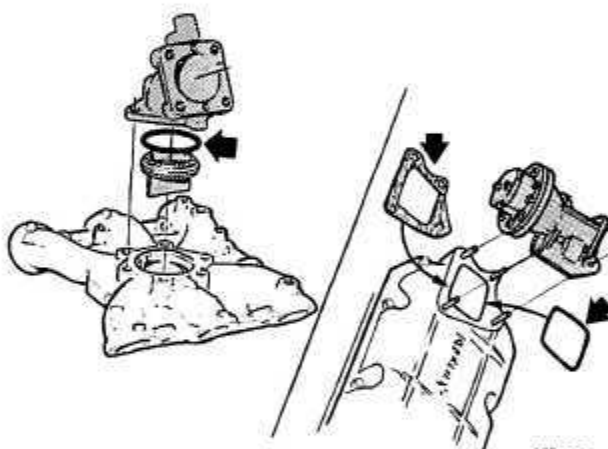
B13

Install parts

B 27/28A: use a new O-ring for the carburettor base-plate. Tightening torque 10-15 Nm (7-11 ft. lbs)

B 27/28E, F: use a new O-ring (gasket) for the vacuum pump. Make sure that the pump shaft meshes on the top of the camshaft.

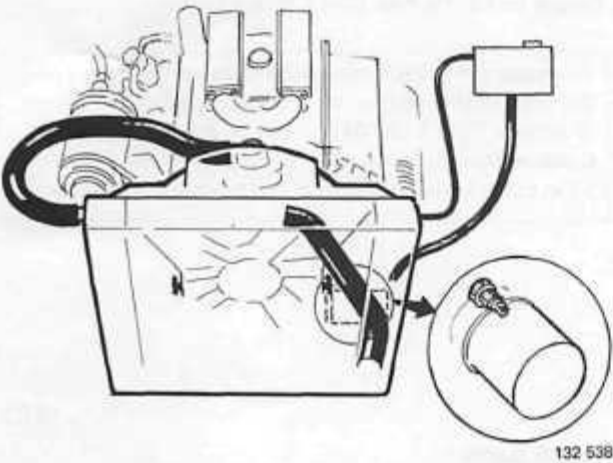
For connection of vacuum hoses, see Group 20 page 14.



135 035

C. Cylinder head, removing

Special tools: 5093, 5105, 5213



Disconnect one of battery cables

C1

Drain coolant

Open the drain taps on each side of the cylinder block. Hoses can be connected to the taps to assist collecting the coolant.

C2

Disconnect upper radiator hose

C3

Cars with AC
Operations C4-5

Detach and move compressor to one side
Secure it to the right bonnet hinge.

C4

Note! Do not disconnect the refrigerant hoses otherwise it will be necessary to drain and then evacuate the complete system before adding new refrigerant.

Remove compressor rear mounting bracket and lift off drive belt

C5

Remove intake manifold

C6

B 27/28 A —————> C7

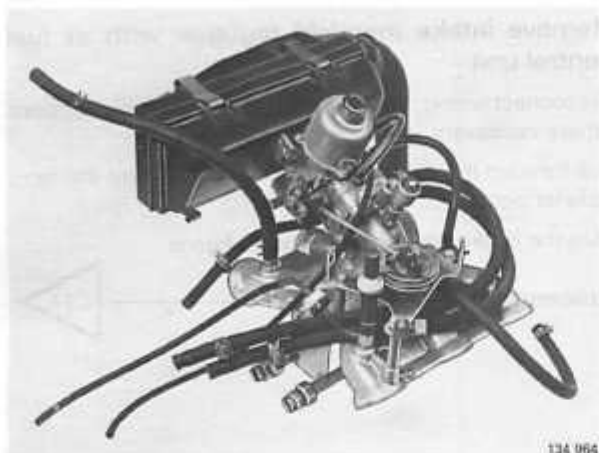
B 27E 1975-1978 —————> C8

B 27E 1979-1980, B 28E,
B 27F,
B 28F —————> C9



B 27/28 A

C7



134 964

Remove intake manifold including carburettor and air filter

Disconnect first the hot spot pipe.

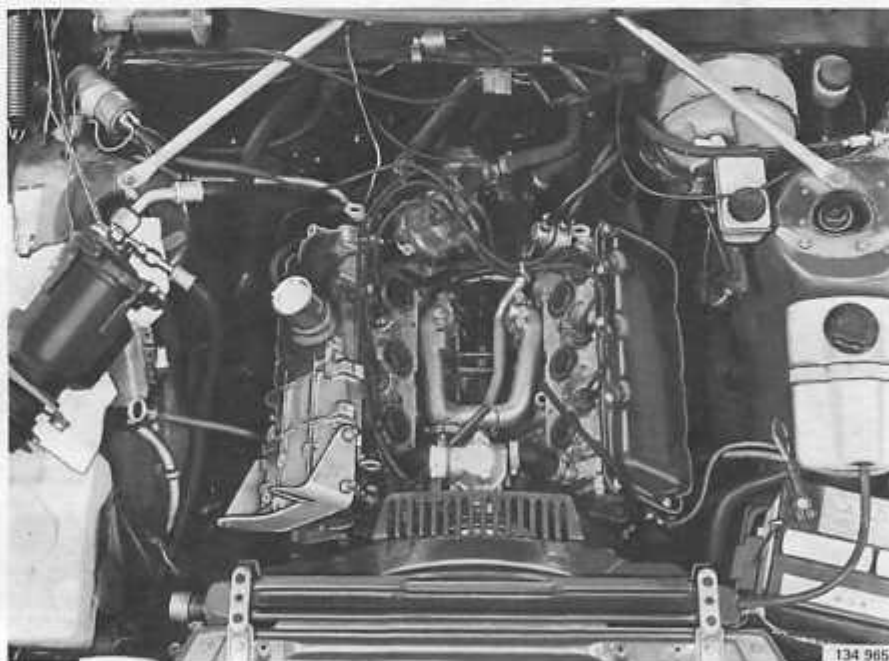
Disconnect wiring, hoses and cables. Identify connections where necessary.

Place the cable harness between the cylinder heads.

Plug the intake ports in the cylinder heads.

Proceed to

C11



134 965

B 27 E 1975–1978

C8



Remove intake manifold together with air-fuel control unit

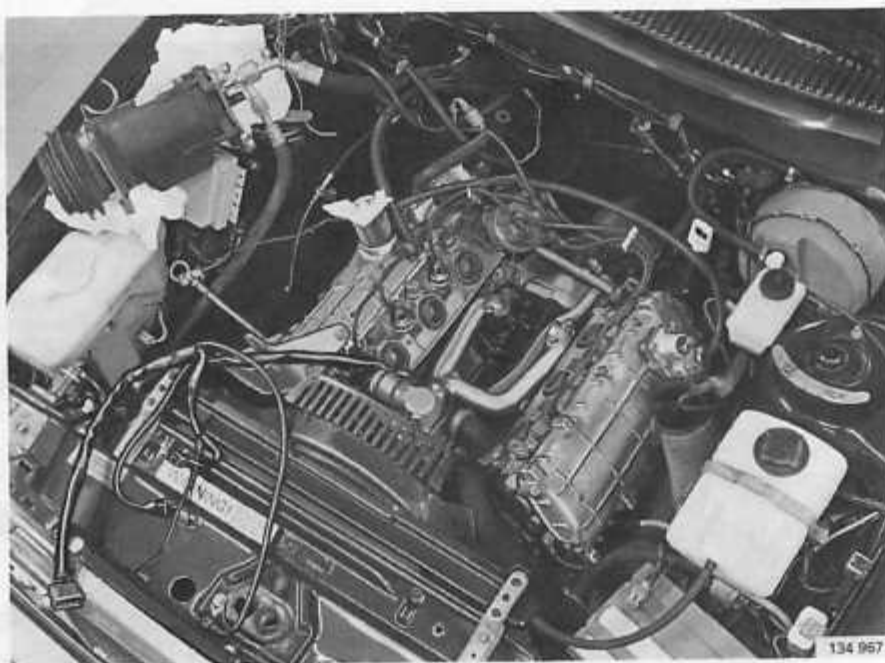
Disconnect wiring, hoses and cables. Identify connections where necessary.

Pull forward the cable harness and hang it over the front radiator panel.

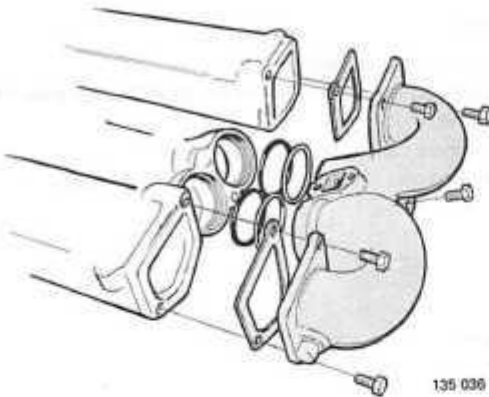
Plug the intake ports in the cylinder heads.

Proceed to

C11

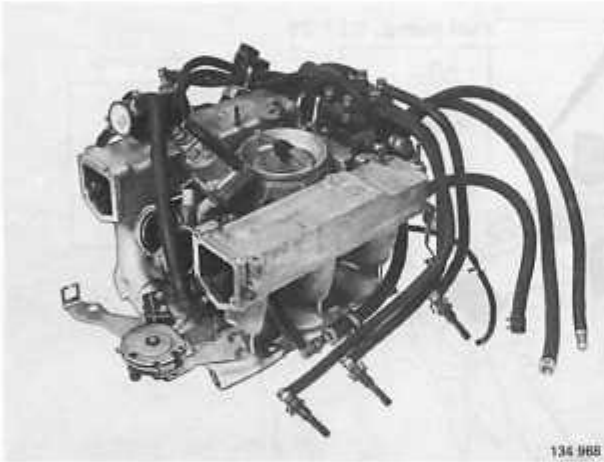


**B 27 E 1979–1980, B 28 E
B 27 F, B 28 F**



C9

Remove front section of intake manifold



C10

Remove intake manifold along with air-fuel control unit

Detach hoses and cables where necessary.

Disconnect wiring. Pull forward the cable harness and hang it over the front radiator panel.

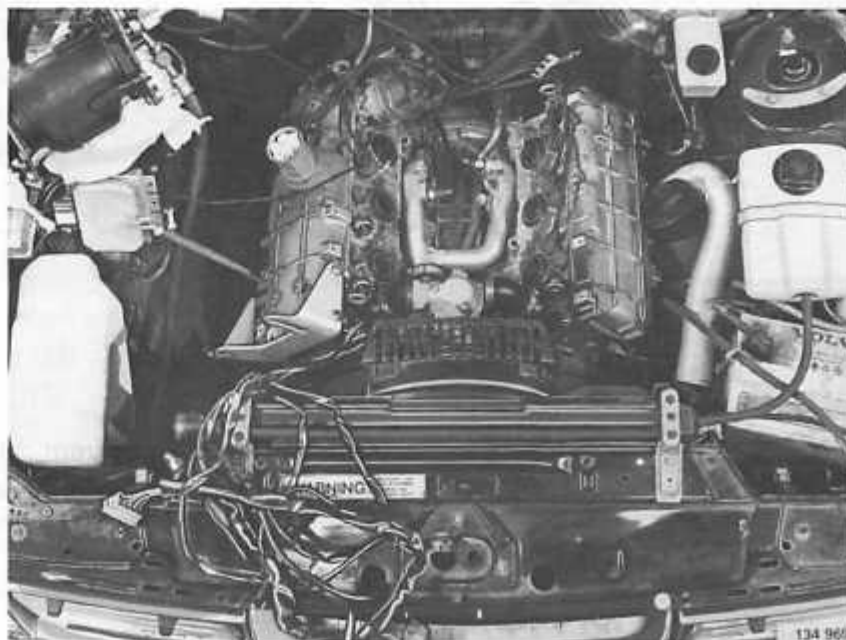
Unclip the distributor cap and disconnect the HT-leads.

Remove the intake manifold and air-fuel control unit.

Plug the intake ports in the cylinder heads.

Proceed to

C11



B 28 F 1981

Remove parts which restrict access to the cylinder heads.

Right cylinder head

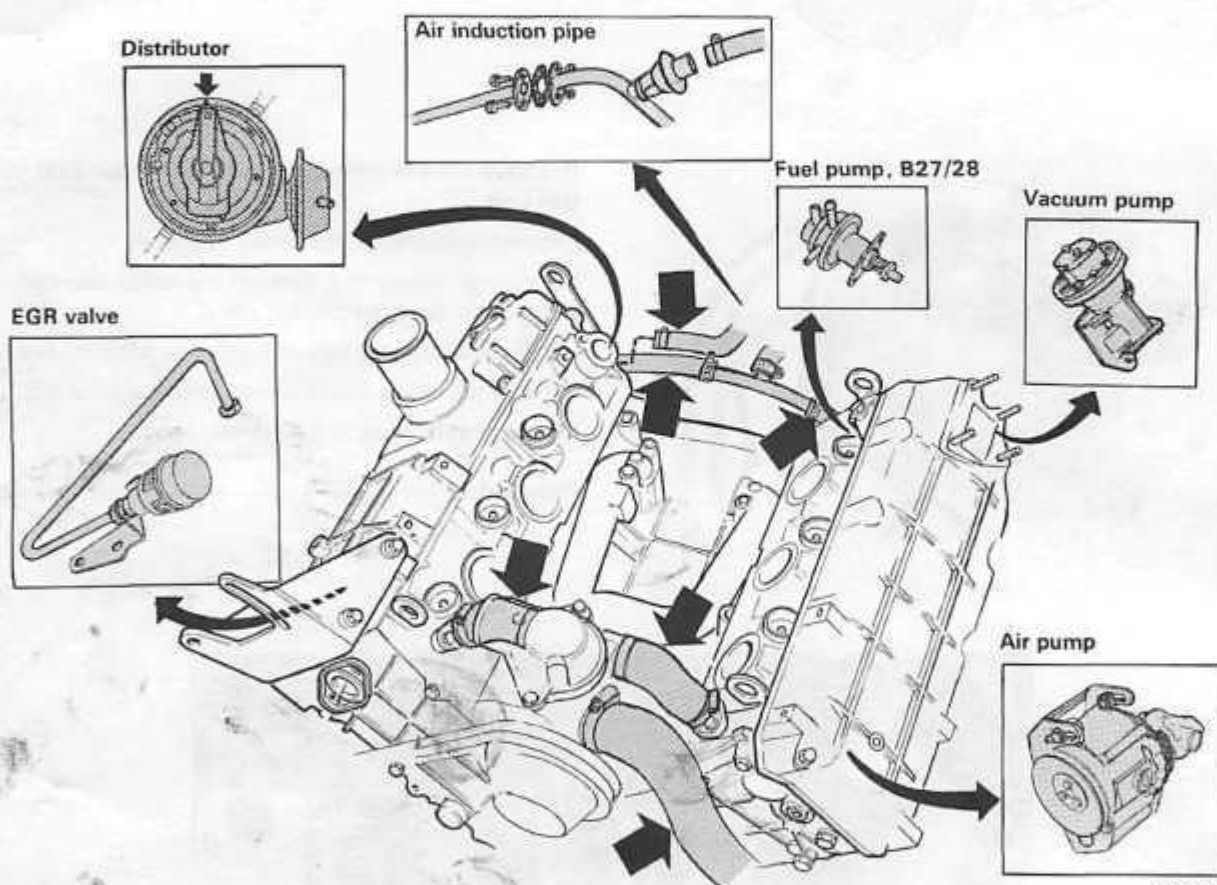
Remove:

- distributor cap and HT-leads
- distributor. First turn crankshaft to firing position for No. 1 cylinder, rotor arm points towards mark in distributor body
- (only vehicles with air pump): separate air blower pipe at rear of engine
- water hoses
- EGR valve, where fitted.

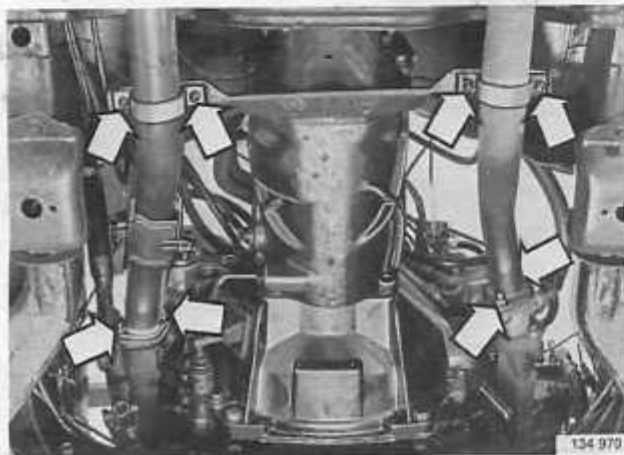
Left cylinder head

Remove:

- vacuum pump, where fitted
- air pump, where fitted. Separate air induction pipe at rear of engine
- (A-engines only): fuel pump
- water hoses.



135 037



134 970

Detach exhaust pipes from cylinder heads

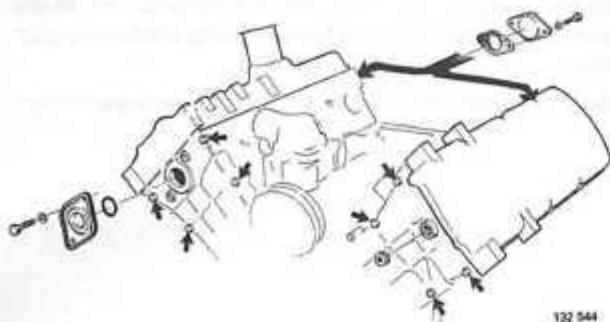
Push the exhaust system rearwards. It may be necessary to unhook the rubber support rings next to the centre silencer.

Remove the cylinder heads one at a time i.e. perform operations C13–23 separately for each cylinder head.

C13

Remove:

- valve cover
- cover plate at rear of cylinder head
- plug in timing gear case, use 8 mm Allen key (right side = cover plate)
- four upper bolts for timing gear case.

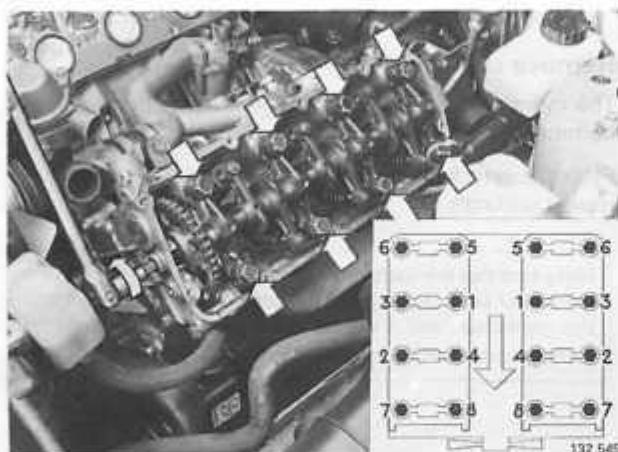


132 544

C14

Slacken camshaft centre bolt

A few turns only. 10 mm Allen key.



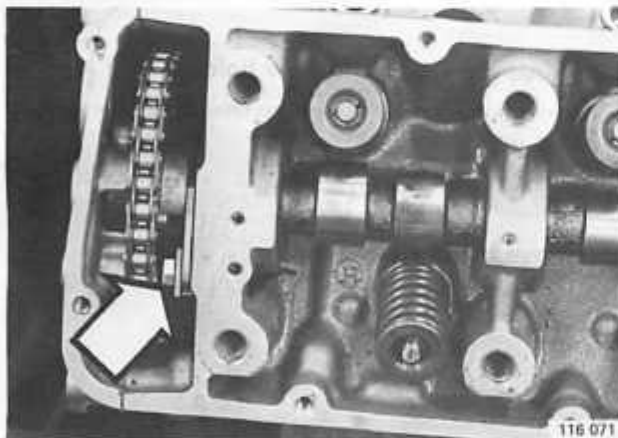
132 545

C15

Remove rocker arm and shaft assembly

Remove bolts in same order as for tightening.

Note! If both cylinder heads are to be removed, identify to avoid interchanging.



116 071

C16

Detach camshaft lock fork

Slacken bolt and push fork to one side.

C17

Secure timing gear chain

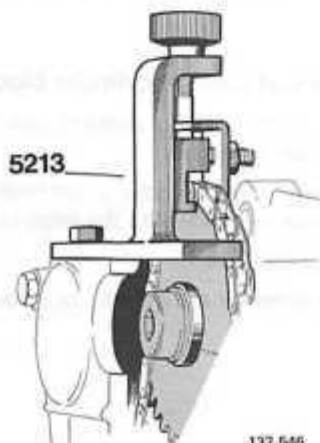
Use retainer 5213.

Hook the retainer under the chain. Tighten the nut by hand.

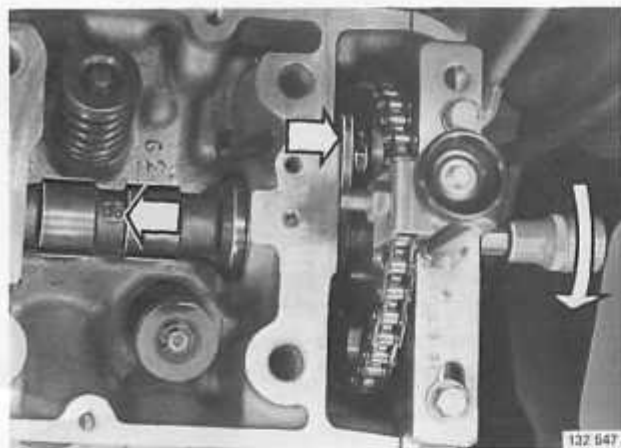
Secure the retainer to the timing gear case.

Turn the knob to keep the camshaft chain taut and the camshaft sprocket in position.

5213 keeps the timing gear chain taut when the camshaft is removed. If the tool is not used the slack in the chain will be taken up by the chain tensioner and this will make it impossible to lift the camshaft into the correct position when installing it. To put this right the timing gear case would have to be removed.



132 546

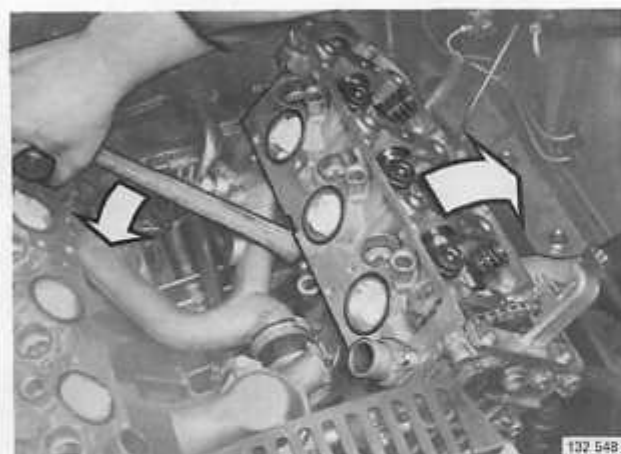


C18

Detach camshaft from sprocket

Unscrew the camshaft centre bolt, Allen key 10 mm. The left hand bolt can be unscrewed but not removed. **Make sure that the bolt does not fall down into the timing gear case.**

Move the camshaft backwards to free it from the sprocket.



C19

Remove cylinder head

The cylinder head **must not** be lifted directly up. Use a hammer shaft to lever it off.

Place the cylinder head on blocks to prevent damage to the gasket surfaces.

Make sure that the liners do not separate from their seals in the lower liner seat. If this happens, coolant can flow down into the crankcase, and it will be necessary to remove, disassemble and clean the engine thoroughly.



C20

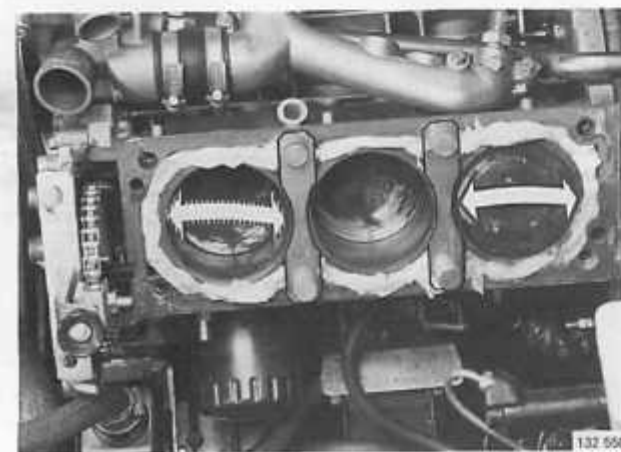
Remove gasket and fit liner holders 5093

The liner holders must always be used when the cylinder head is removed.

C21

Remove guide sleeves

Use a pair of pliers.



C22

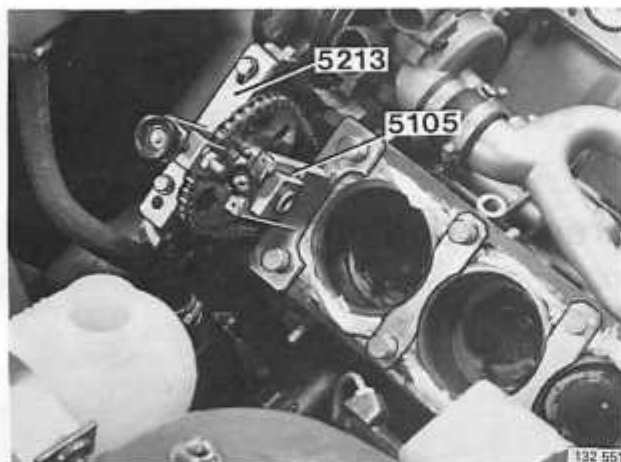
Clean gasket surfaces on cylinder block

Place paper under the cylinder liners to prevent dirt from entering the water passages.

None of the liners should be loose when cleaning the cylinder block. Move the holders to the edge one at a time.

Use a plastic scraper.

Blow-clean the holes for the cylinder head bolts.



If it is necessary to turn the crankshaft when the cylinder head is removed, or even if the other cylinder head has to be removed:

Operation C23

C23

Fit support bracket 5105

Remove retainer 5213.

Note! The timing gear chains must be kept taut.

C24

If necessary remove other cylinder head

Follow the instructions C13-23.

Gasket replacement only

Operation C25

C25

Clean gasket surfaces and check for warp

Clean the valve cover as well.

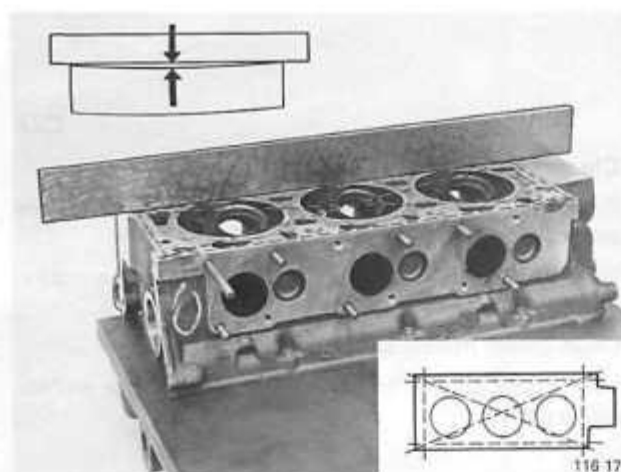
Use a plastic scraper and if necessary a fine grade wet abrasive paper.

Use a straight edge and feeler gauge to check for unevenness.

Warp max. **0.05 mm (0.002 in)** over 100 mm (3.94 in).

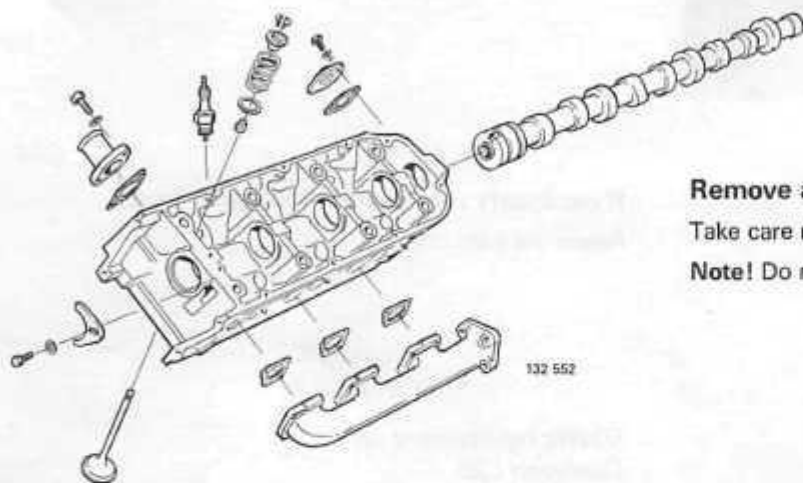
The cylinder head must not be machined but instead replaced if the warp is too great.

For fitting the cylinder head, see page 46.



C. Cylinder head, reconditioning

Special tools: 5108, 5109, 5029, 5165, 5218, 5220



C26

Remove all parts from cylinder head

Take care not to score/damage the mating surfaces.

Note! Do not interchange valve parts.

C27

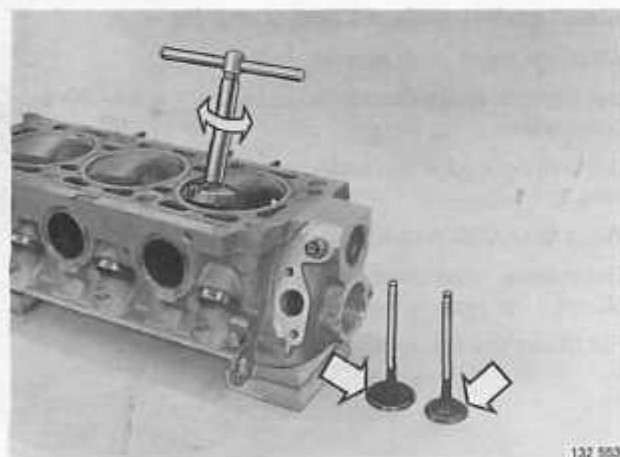
Clean cylinder head and parts

Remove carbon deposits from the combustion chambers and valves.

Clean valve seats with a grinder (to be able to see cracks, damage, etc.).

Clean gasket mating surfaces.

Use a plastic scraper and if necessary a fine grade wet abrasive paper.



C28

Check all parts

Visible damage, wear, etc.

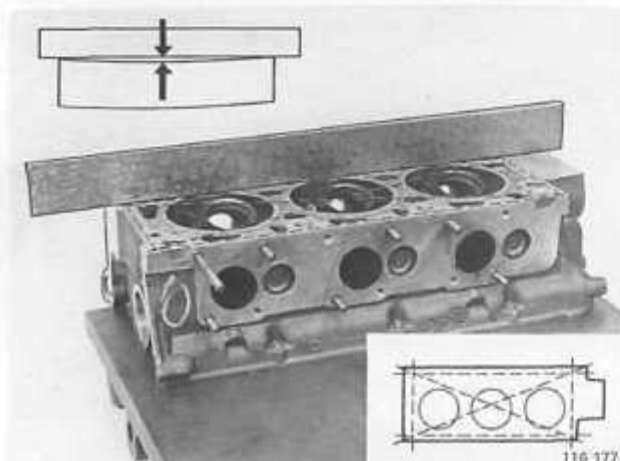
C29

Check cylinder head for warp

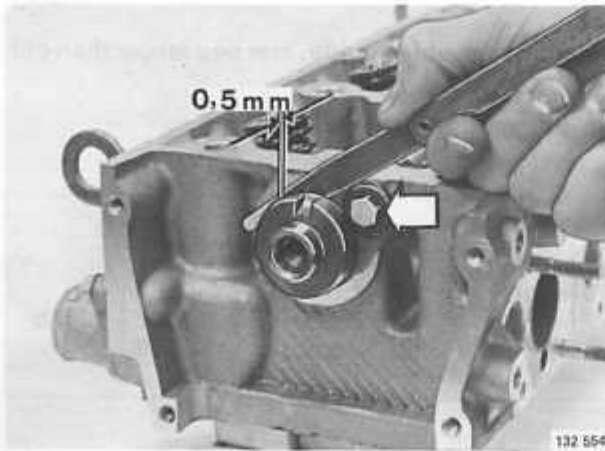
Use a straight edge and feeler gauge.

Warp = max. 0.05 mm (0.002 in) per 100 mm (3.94 in).

The cylinder head must not be machined but instead replaced if the warp is too great.



C30

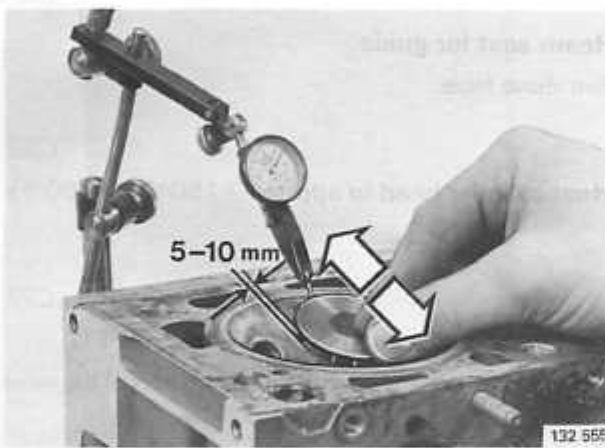


Check camshaft end float

Position the camshaft and make sure that it turns easily. Fit the locking fork. Measure the end float with a feeler gauge. The clearance must not exceed max. 0.5 mm (0.020 in). Replace the locking fork if the end float is too large.

Remove the locking fork and camshaft.

C31



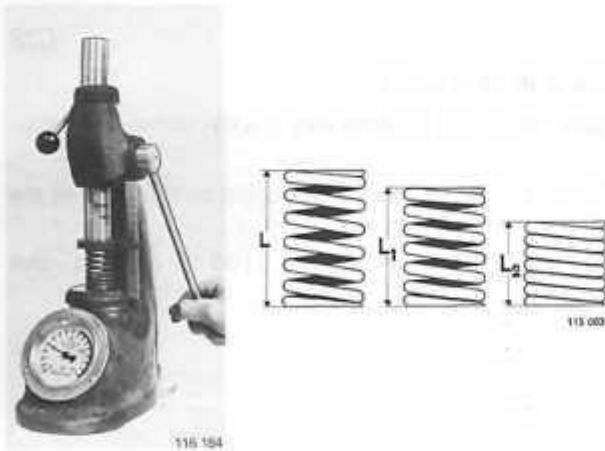
Check valve guide – valve clearances

Use a dial indicator.

Use new valves and press up 5–10 mm (0.2–0.4 in) with finger when measuring.

The clearance must not exceed max. 0.15 mm (0.0059 in).

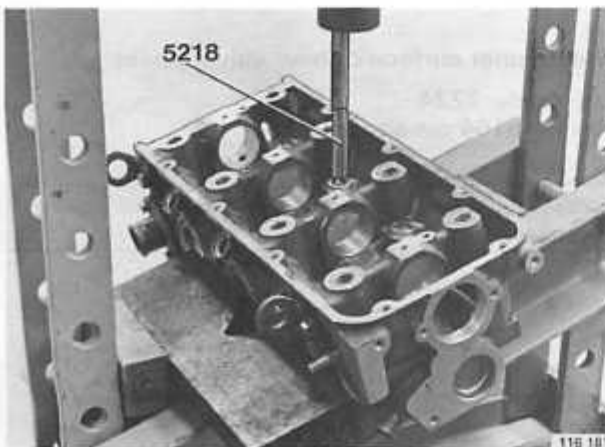
C32



Check valve springs

The springs are colour coded, and two different types are used depending on engine type.

Colour code	Length, mm (in)	Load N (lbs.)
GREY	47.2 (1.86)	0 0
	40.0 (1.57)	233–268 (52–60)
	32.2 (1.27)	521–585 (116–131)
GREEN	47.1 (1.85)	0 0)
	40.0 (1.57)	230–266 (51–59)
	30.0 (1.18)	613–689 (137–154)



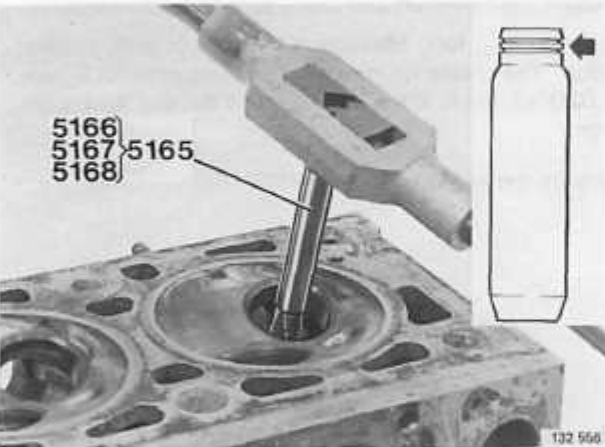
Valve guide replacement Operation C33–39

C33

Press out valve guides

Use drift 5218.

Place the cylinder head on a sloping surface so that the valve guides are vertical.



C34

Select a new valve guide, one size larger than old one

The valve guides are marked with grooves.

Valve guide	Mark	Reamer	
Standard +	no groove	-	
Oversize 1	1 groove	5166	5165
2	2 grooves	5167	
3	3 grooves	5168	

C35

Ream seat for guide

See above table.

C36

Heat cylinder head to approx. +150°C. (+300°F)

C37

Cool valve guide to approx. -70°C (-95°F)

Use liquid carbon dioxide or equivalent to cool the valve guides.

Wear protective gloves.

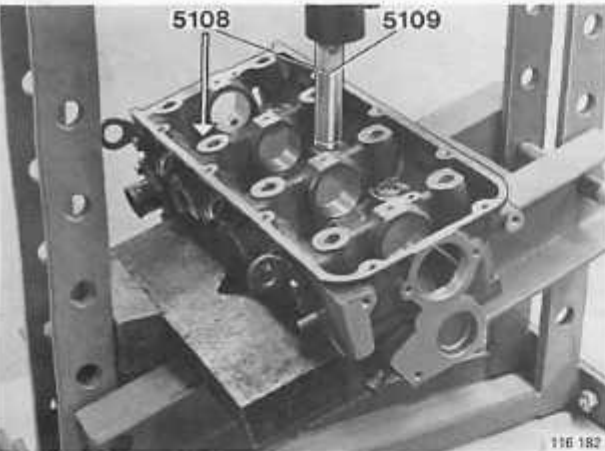
C38

Press in new guide

Note! This must be done very quickly, within 3-4 secs.

Place the cylinder head on a sloping surface so that the valve guides are vertical.

Use drift 5108 for intake and 5109 for exhaust valve guides.

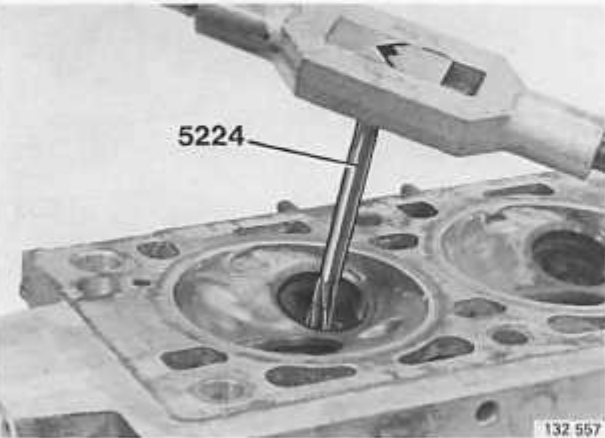


C39

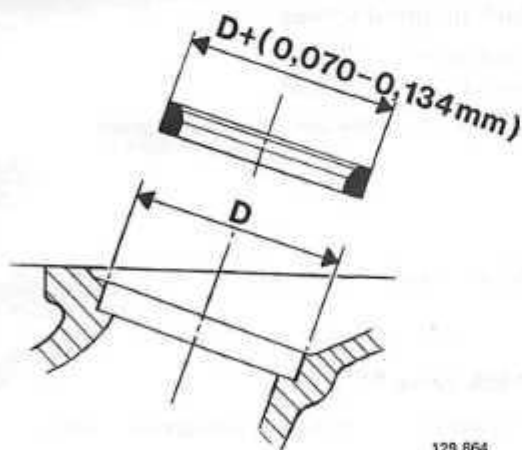
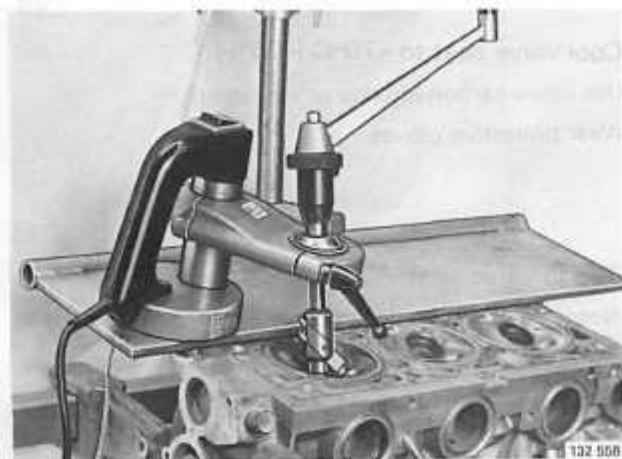
Clean inner surface of new valve guides

Use reamer 5224.

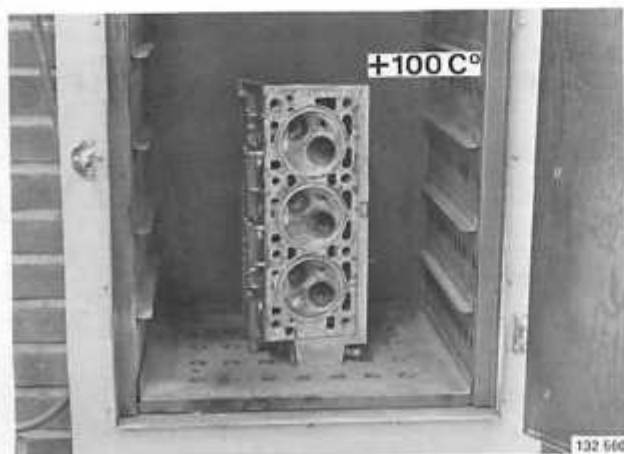
Reamer 5164 can also be used.



Valves and valve seats must be ground-in if guide has been replaced.



129 864



132 560

Valve seat replacement Operations C40–C47

Note! Valve guides must always be renewed before replacing seats, see C33–39.

C40

Clean combustion chambers

Clean the surfaces until the edge of the inserted seat is clearly visible.

C41

Remove valve seat

Machine the valve seat. Use Mira valve cutter P/N 998 6045-5. Follow the manufacturer's instructions.

Make sure that the cylinder head is not damaged. Clean carefully.

C42

Measure valve seat diameter in cylinder head and select a new seat of correct size

Use an internal micrometer.

Valve seats are available in three oversizes.

The interference between the valve seat and recess in the cylinder head must be **0.070–0.134 mm** (0.0027–0.0052 in). I. e. the valve seat must be 0.070–0.134 mm larger than the recess in the cylinder head.

If too small, fit a new cylinder head. If too large, mill the valve seat to correct size. Use a valve cutter.

C43

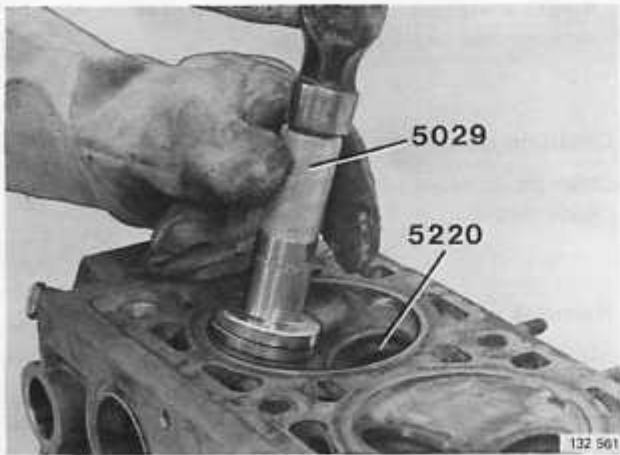
Heat up cylinder head.

Approx. +100°C. (212°F).

C44

Place new valve seat in correct assembly tool

Use 5029 for intake seats and 5220 for exhaust seats.



C45

Cool valve seat to -70°C (-95°F)
Use liquid carbon dioxide or equivalent.
Wear protective gloves

C46

Tap in valve seat
Note! This must be done quickly, within **3–4 seconds** to avoid temperature loss.

C47

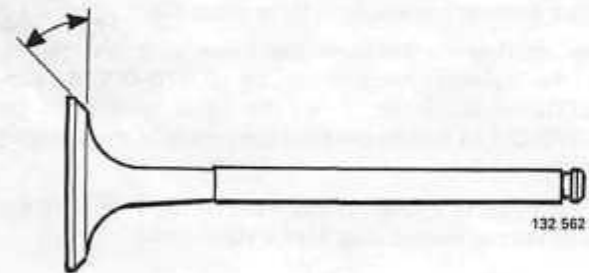
Check fit of valve seat
Make sure that the seat has bottomed correctly and is secure. If not, fit a larger size.

After valve seat replacement, valve seats must be milled and valves ground.

*Grinding of valves and valve seats
Operations C48–50*

C48

Machine grind valves
Intake valves . . . 29.5°
Exhaust valves . . . 44.5°
Also grind flush the end of the valve stem.

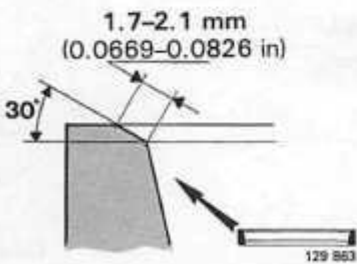


C49

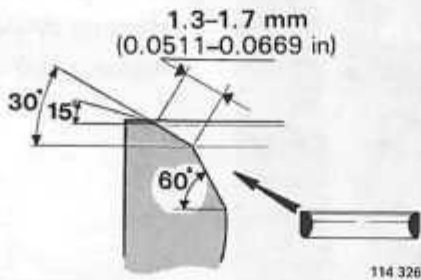
Mill or grind valve seats

C50

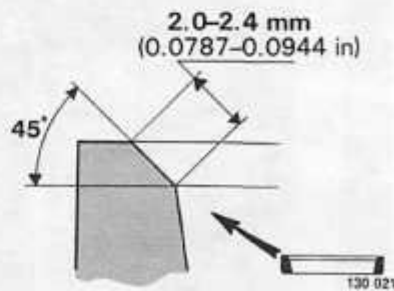
Check valve fit
If necessary grind-in valves with grinding paste.



Intake valve seat
Early types



Intake valve seat
Late types (venturi seat):
 15° and 60° are correct angles
to reduce seat width.



Exhaust valve seat

C51

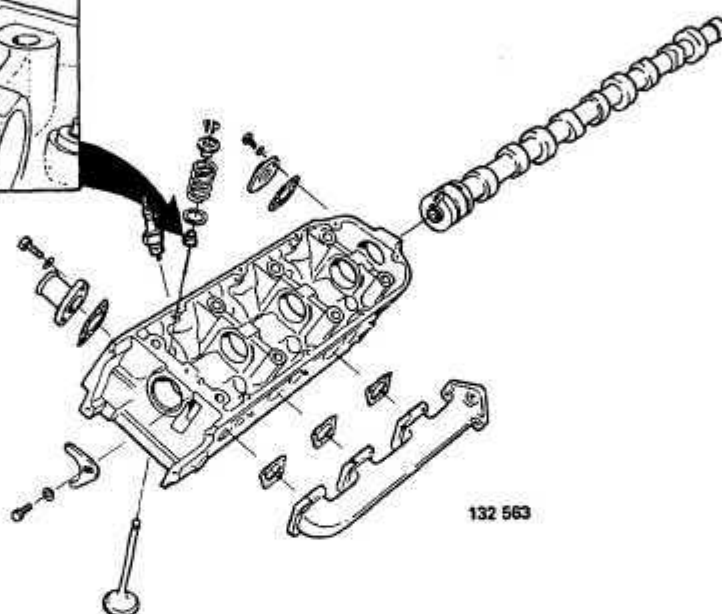
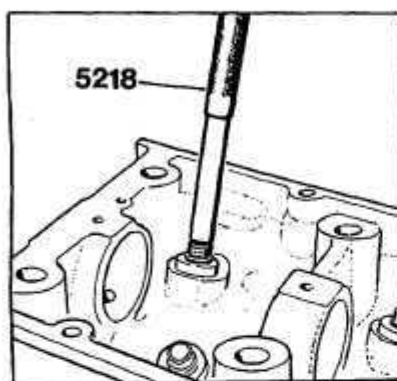
Assemble cylinder head

Use drift 5218 for valve guide seals.

Use new gaskets.

The locking fork should be loosely fitted and not touching the camshaft.

Before fitting, check that the spark plugs are clean, replace if necessary. Electrode gap = 0.6 mm (0.024 in). Tightening torque 12 ± 2 Nm (9 ± 1.5 ft. lbs.)



C52

Clean and check rocker arm shaft

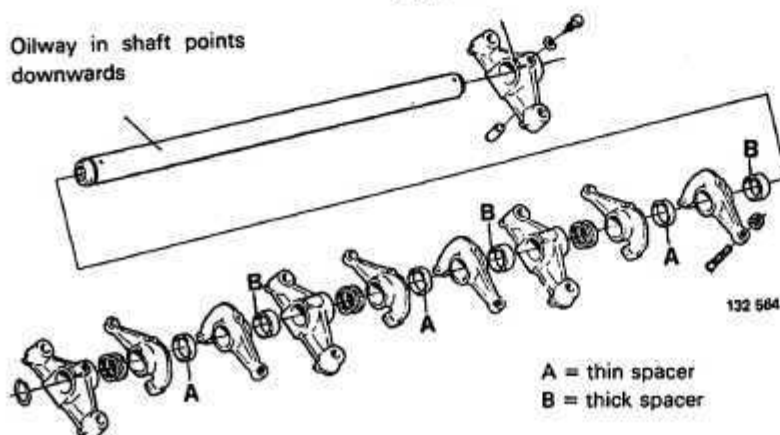
Disassemble only if necessary. (Place parts in order, so that they can be re-assembled in the same position.)

The clearance between the rocker arm and shaft is for new parts 0.012–0.054 mm. (0.0005–0.0021 in).

Note! The rocker arm contact surface on the camshaft is face-hardened and must not be ground.

The flat face must be turned towards the circlip snap-ring groove. Applies to all four rocker shaft supports

Oilway in shaft points downwards



C. Cylinder head, installing

Special tools: 5098, 5213

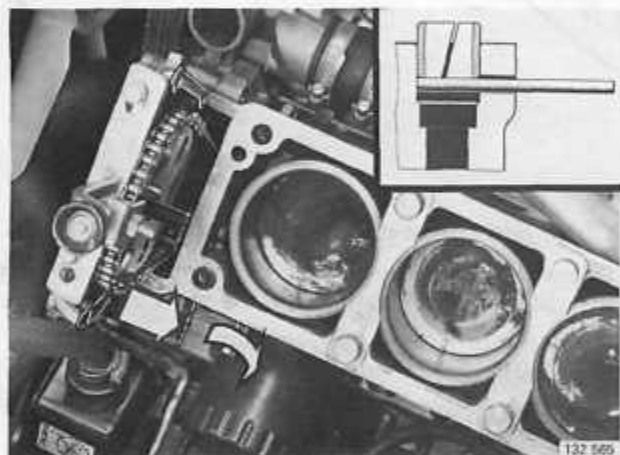


Install the cylinder heads one at a time i.e. perform operations C53–65 separately for each cylinder head.

C 53

Install retainer 5213 and remove support bracket 5105

Note! The timing gear chains must be kept taut.



C54

Close drain taps on both sides of cylinder block

C 55

Install guide sleeves

Secure the sleeves with e.g. 3 mm (0.125 in) drill. This prevents the sleeves from being forced down when the cylinder head is fitted.

C 56

Check timing gear case gasket

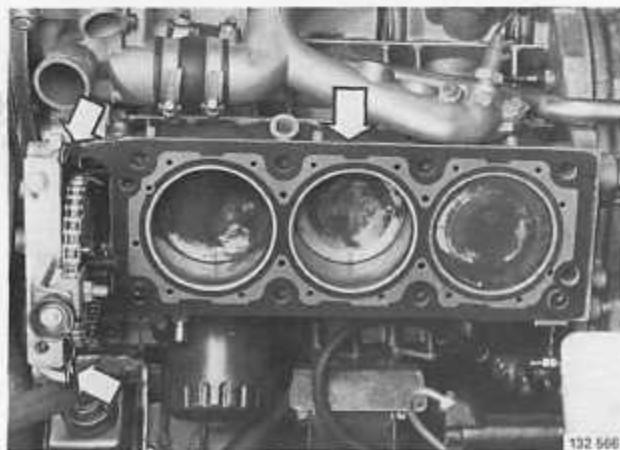
Smear with gasket paste P/N 116 1099-5. If the gasket is damaged, cut out a new piece and repair it.

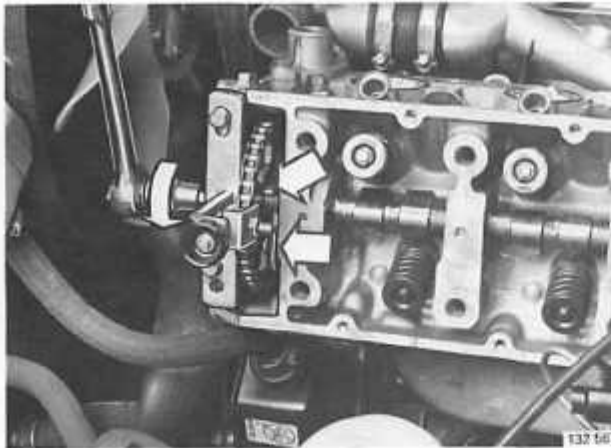
C57

Install cylinder head gasket

First remove the liner holder 5093 and then the protective paper in the water passages.

The gaskets for the left and right sides are different.





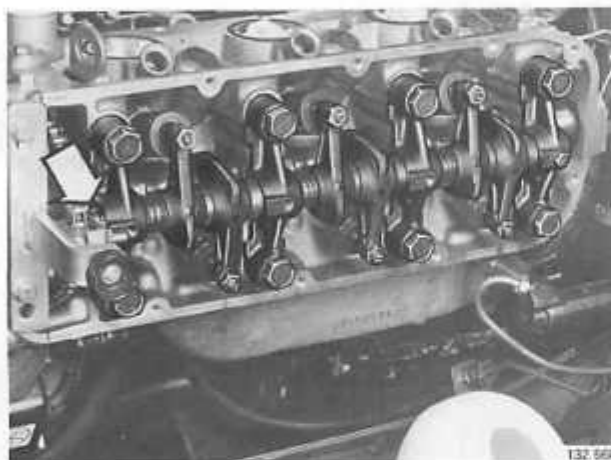
Position cylinder head

C58

C 59

Install camshaft centre bolt

Note! Make sure that the cylinder head does not move. Tighten the bolt by hand (Allen key 10 mm). Check to see that the camshaft does not catch in the locking fork, and that the stud on the sprocket fits correctly in the camshaft groove.



C60

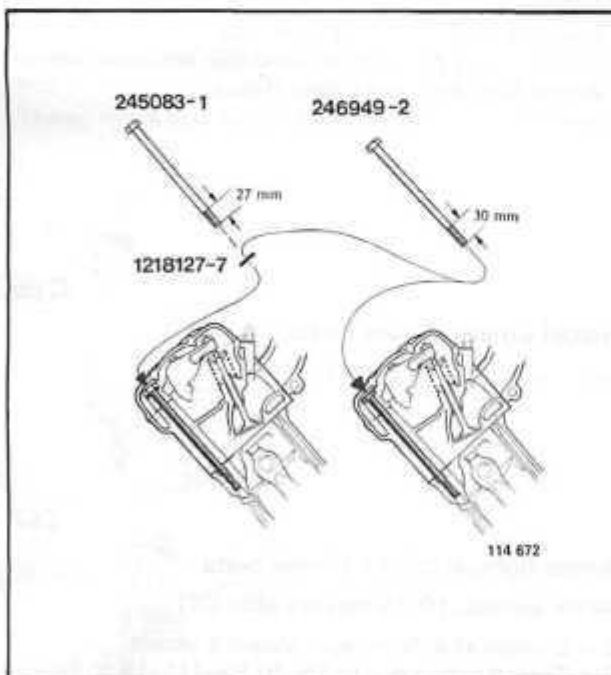
Install rocker arm assembly and bolts

Note! There are two types of bolts, see below.

First remove the 3 mm (0.125 in) drill beneath the guide sleeves (C 55).

Use the correct bridge on the left and right-hand sides. On assembly the circlips snap-rings on the rocker arm should face forwards on lefthand side and rearwards on right-hand side.

Install the bolts fingertight. **Note!** The bolts must be clean and oiled.



Two different types of cylinder head bolts are in use, depending on the thread length in the cylinder block.

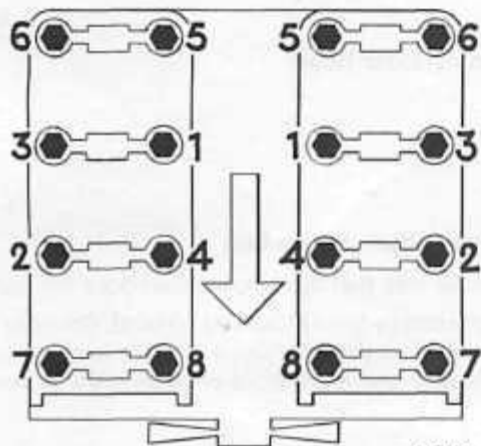
Late type = bolt thread length 27 mm (1.063 in) with washer

Early type = bolt thread length 30 mm (1.181 in) without washer

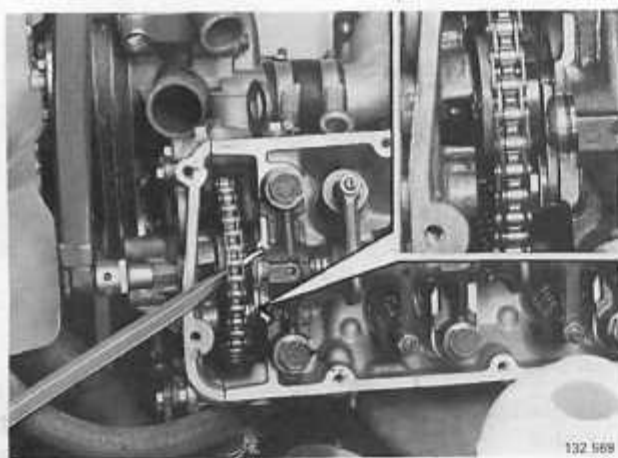
Only late type bolts are stocked.

If late type bolts are used on early type cylinder heads, washers must be used (the same washers as used for late type bolts).

	Early type Engine number	Late type Engine number
B 27A	11374	11375
B 27E/F	57276	57277
B 28A, E, F	-	A11



115 096



132 569

Tighten cylinder bolts

Tighten to the correct torque in three stages.

- 1 = 10 Nm (7 ft. lbs.)
- 2 = 30 Nm (22 ft. lbs.)
- 3 = 60 Nm (44 ft. lbs.)

C61

Remove retainer 5213

C62

Position camshaft locking fork and tighten bolt

C63

Tighten camshaft centre bolt

Allen key 10 mm.

Tighten to a torque of 70–90 Nm (52–66 ft. lbs.). Counterhold with a screwdriver.

C64

Install:

- four upper bolts in timing gear case
- plug (Allen key 8 mm) in left-hand side, and cover washer in right-hand side, use a new O-ring.
- cover washer at rear of cylinder head. Use a new gasket.

C65

Install other cylinder head

Install according to C53–65.

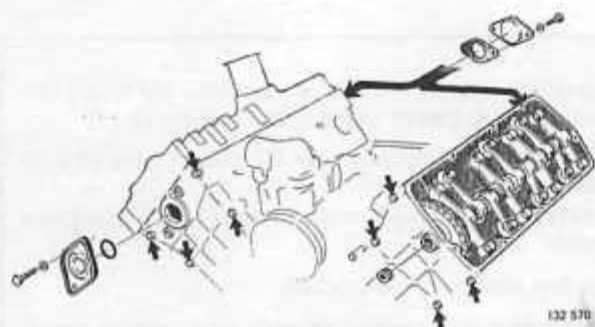
C 66

Angle-tighten cylinder head bolts

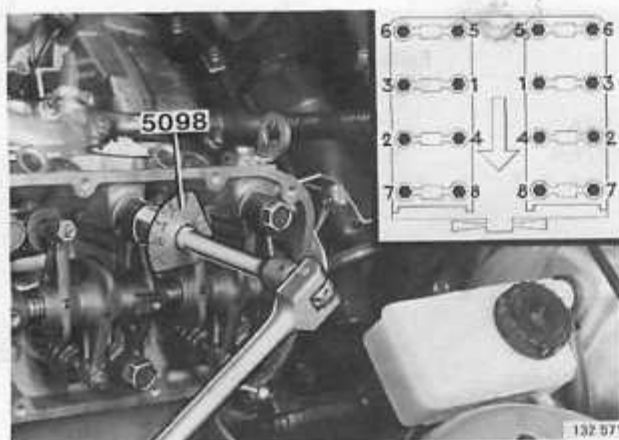
At the earliest, 10–15 minutes after C61.

- 1 = Slacken all bolts in order shown adjacent
- 2 = Tighten to a torque of 15–20 Nm (11–15 ft. lbs.) in order shown
- 3 = Angle-tighten 113–117° in order shown adjacent. Use protractor 5098. The rocker arm bridge can be used as a line of sight.

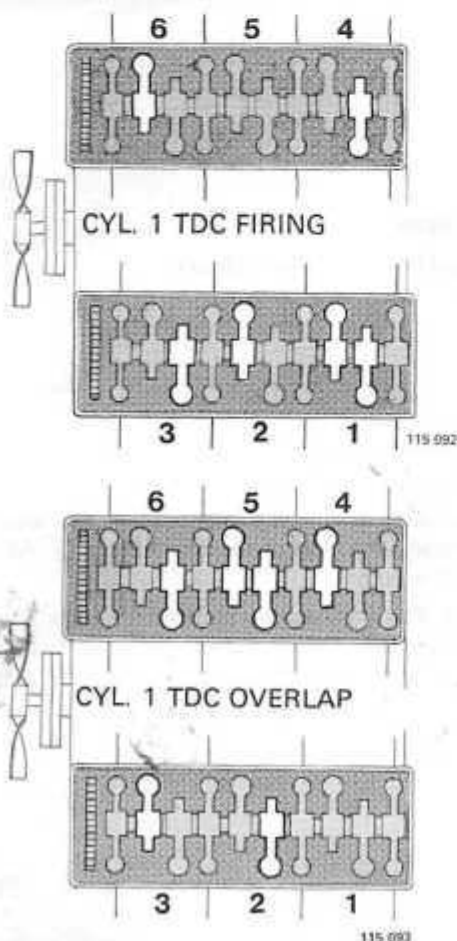
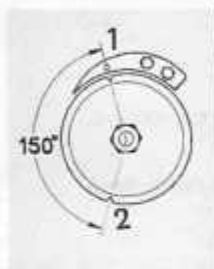
C67



132 570



132 571



Valve adjustment Operations: C68-71

Different clearances for different engine types

Valve clearance mm (in), cold engine	Type 1	Type 2
intake	0.10-0.15 (0.004-0.006 in)	0.20-0.25 (0.008-0.010 in)
exhaust	0.25-0.30 (0.010-0.012 in)	0.30-0.35 (0.012-0.014 in)
B 27 1976-1979	X	
B 28A 1980		X
1981-1982	X	
B 27E 1975-1978	X	
1979-1980		
Sweden and Aus- tralia	X	
1979-1980 Other markets	X	X
B 28E 1981-1983	X	
B 27F 1976-1979		X
B 28F 1980	X	
B 28F 1981-1982		

C68

Turn crankshaft to firing position for No. 1 cylinder

The mark "1" on the pulley should align with the zero-mark on the timing scale. Both rocker arms for No. 1 cylinder should have clearance.

C69

Check/adjust valve clearances

Check the following valves in the set position

Intake: cylinders 1, 2 and 4

Exhaust: cylinders 1, 3 and 6

C70

Turn crankshaft one turn in normal direction to overlap position for No. 1 cylinder

The mark "1" on the pulley should align with the zero-mark on the scale. The rocker arms for No. 1 cylinder should not have clearance.

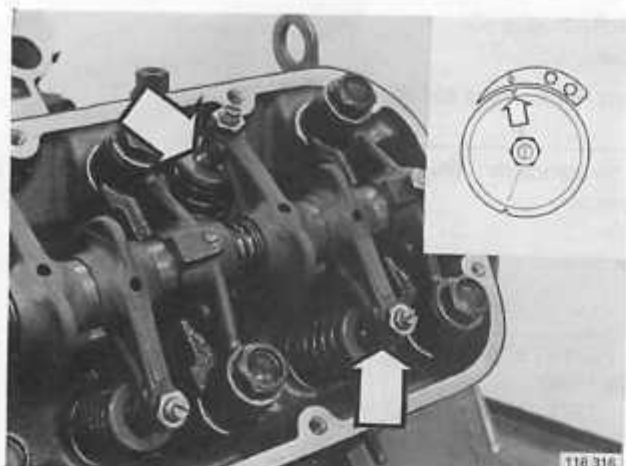
C71

Check/adjust valve clearances

Check the following valves in the set position.

Intake: cylinders 3, 5 and 6

Exhaust: cylinders 2, 4 and 5



C72

Turn crankshaft one turn to firing position for No. 1 cylinder

The mark "1" on the pulley should align with the zero-mark on the timing scale. The rocker arms for No. 1 cylinder should have clearance.

This is now the correct setting for installing the distributor.

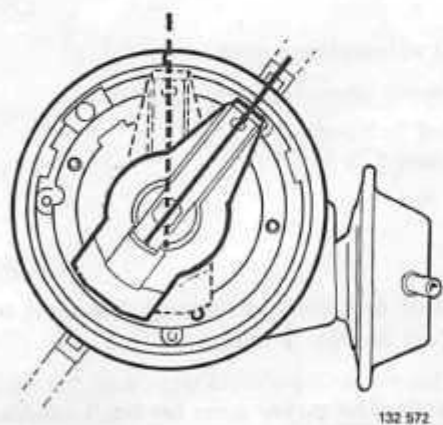
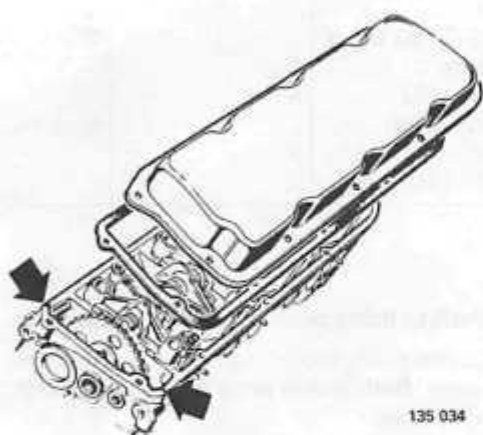
C73

Install gaskets and valve covers

Use new gaskets. Apply a few spots of sealing compound. (P/N 116 1026-8).

Place only four bolts in each valve cover. Do not tighten since the covers are to be removed later on.

To ensure that the junction between the valve cover, cylinder block and timing gear case is fully leak-proof, a thin coat of silicone (P/N 116 1048-2) can be applied to the joint. **Note!** Do not use too much silicone otherwise it may enter the lubrication system and block the oil channels.



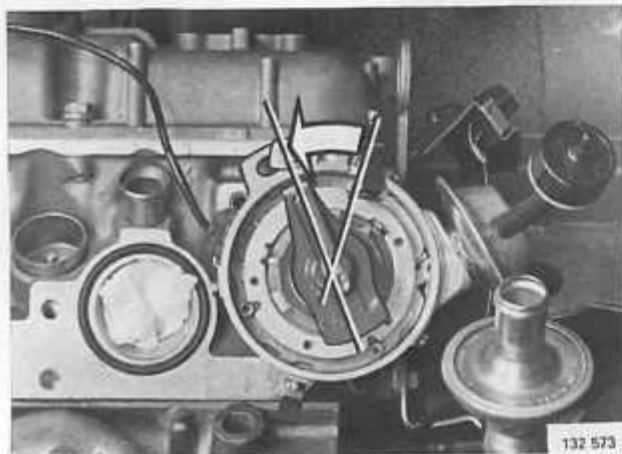
C74

Install distributor

The rotor should point as shown adjacent.

When the distributor is pressed into position the rotor should point towards the mark on the distributor body. Adjust by turning the body.

Tighten the nut. Place the washer beneath the rotor.





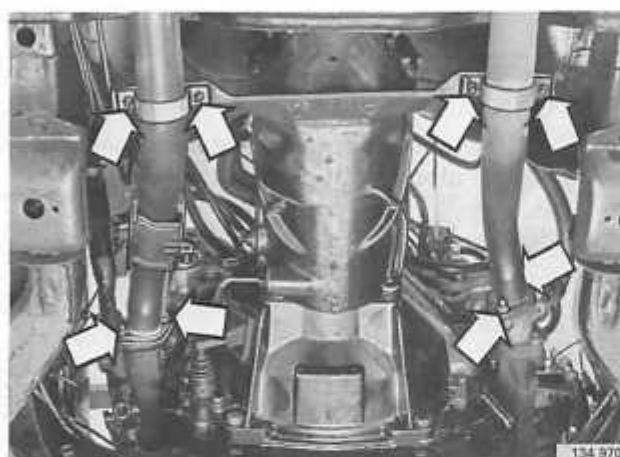
Operation C 75 does not apply to
B 27E 1975-1978

C75

Install distributor cap

A-engines: reconnect the HT-leads.

E/F-engines: **do not** connect the HT-leads. The distributor cap should be installed loosely i.e., not clamped. If the cap is clamped when the intake manifold is installed, damage may result.



Install exhaust system

Use new gaskets. The gasket tongues should face towards the branch pipe.

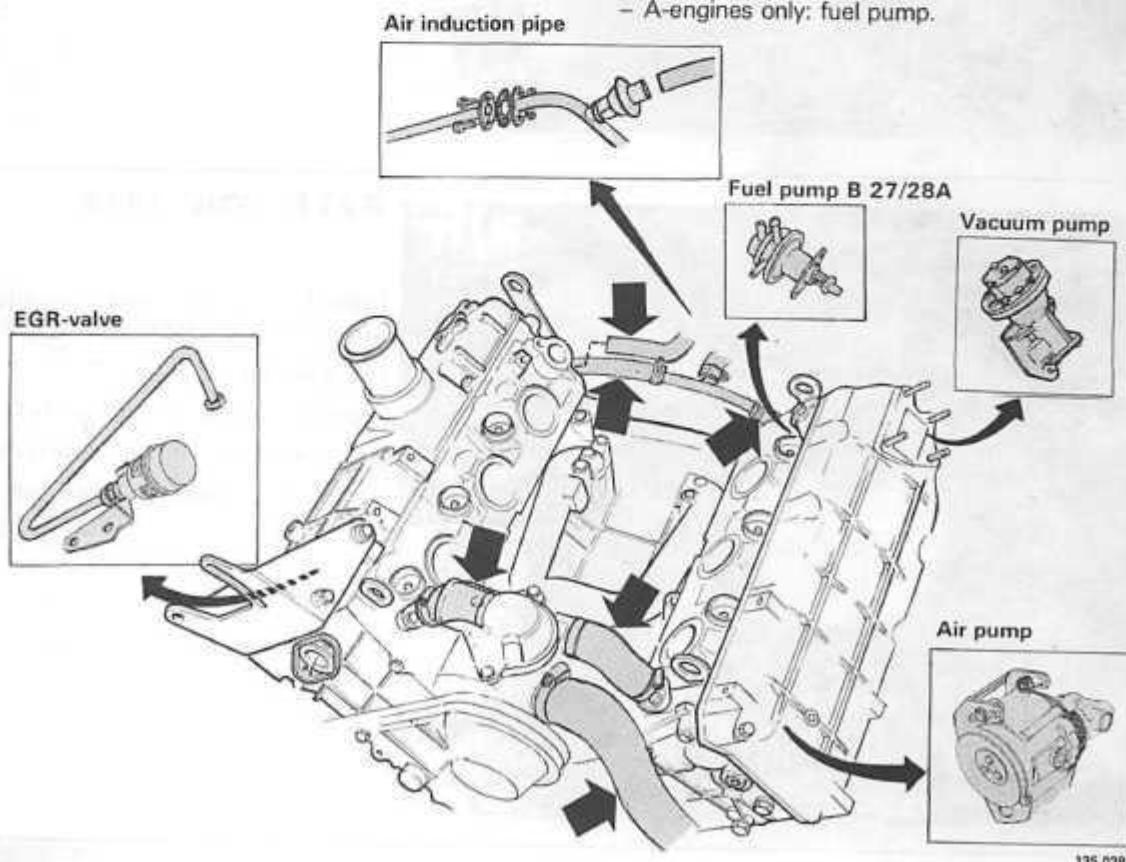
C76

Install:

Note! Use new gaskets.

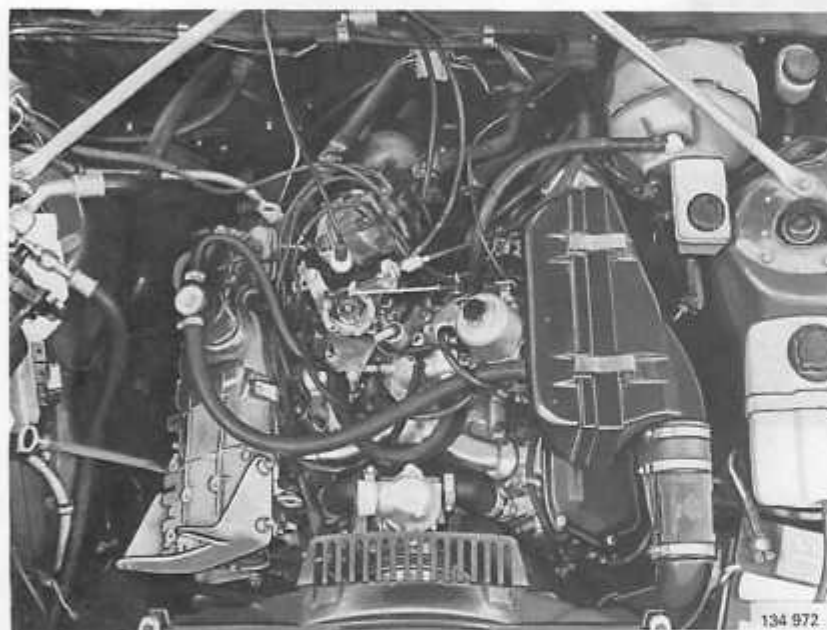
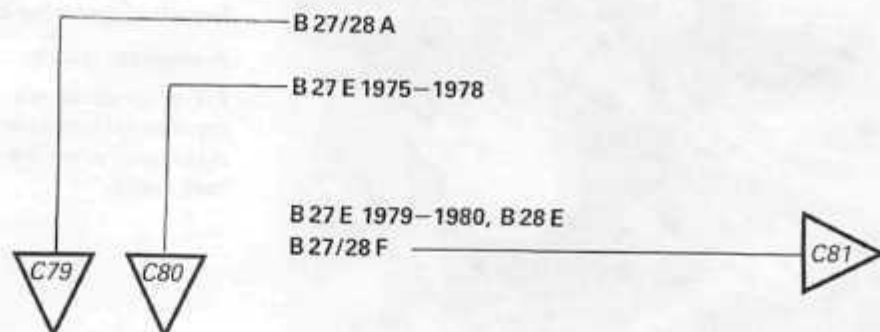
- air induction pipe at rear of engine
- water hoses
- vacuum pump (where fitted). Make sure that the pump shaft meshes with the top of the camshaft
- air pump (where fitted). Connect the hose to the non-return valve
- EGR-valve (where fitted)
- A-engines only: fuel pump.

C77



C78

Install intake manifold



B 27/28 A

C79

Install complete intake manifold along with carburettor and air filter

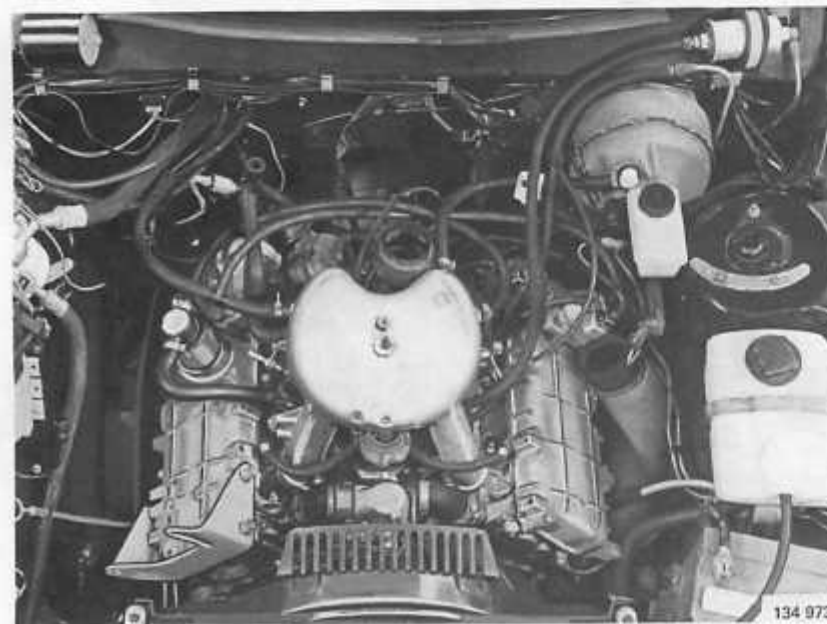
Use new O-rings.

Tightening torque 10-15 Nm (7-11 ft. lbs.)

Reconnect the hot spot tube.

Reconnect all wiring, hoses and cables.

Reconnect all vacuum hoses, see page 14.



B 27 E 1975-1978

C80

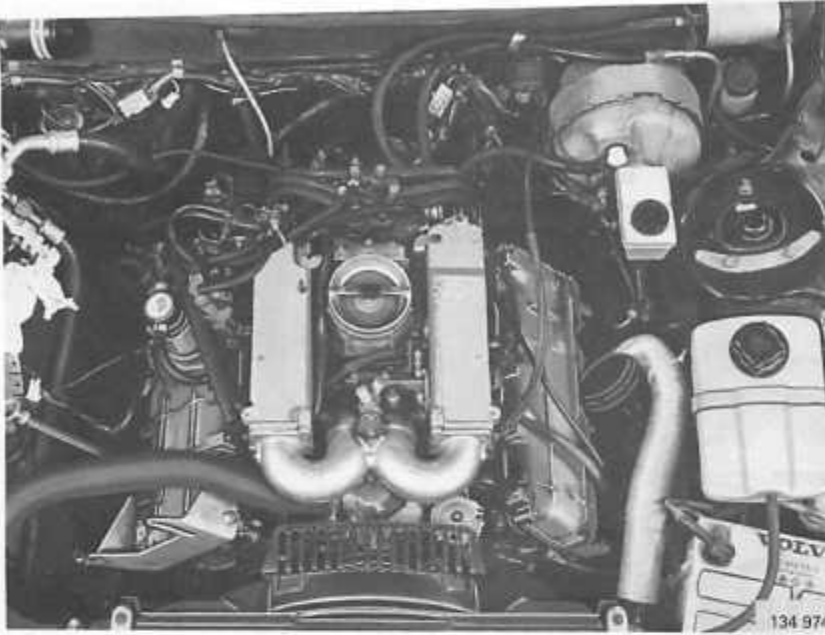
Install complete intake manifold along with air/fuel control unit

Use new O-rings.

Tightening torque 10-15 Nm (7-11 ft. lbs.)

Reconnect all wiring, hoses and cables.

Reconnect all vacuum hoses, see page 14.



**B 27 E 1979–1980
B 28 E, B 27/28 F**

C81

Install complete intake manifold along with air/fuel control unit

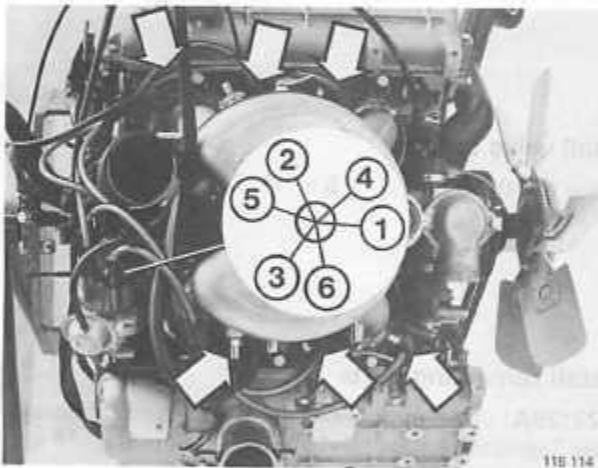
Use new O-rings.

Tightening torque 10–15 Nm (7–11 ft. lbs.).

Reconnect all wiring, hose, cables.

Reconnect all vacuum hoses, see page 14.

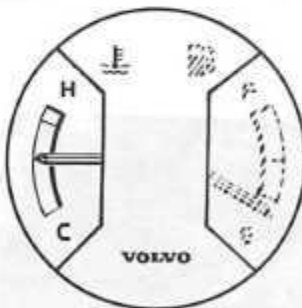
Reconnect the front section of the intake manifold.



*E/F engines
Operation C82*

C82

Clamp distributor cap. Reconnect HT-leads



Reconnect upper radiator hose

C83

Fill with coolant. Reconnect battery
Set the car heater control to max. heat.

C84

Start engine and warm-up to normal operating temperature

C85

Make sure there are no oil or coolant leakages.
Top-up if necessary.

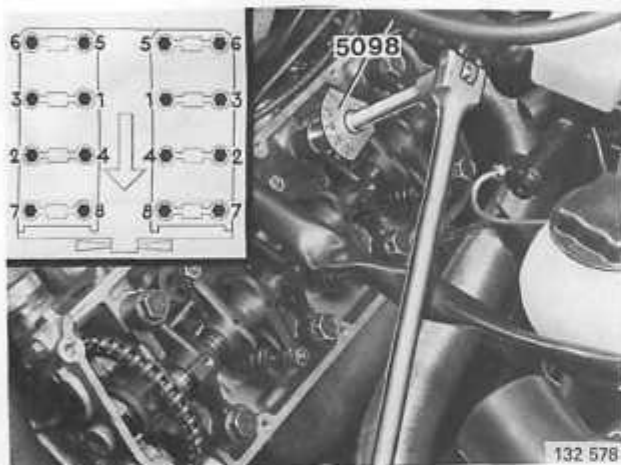
C86

Turn off engine

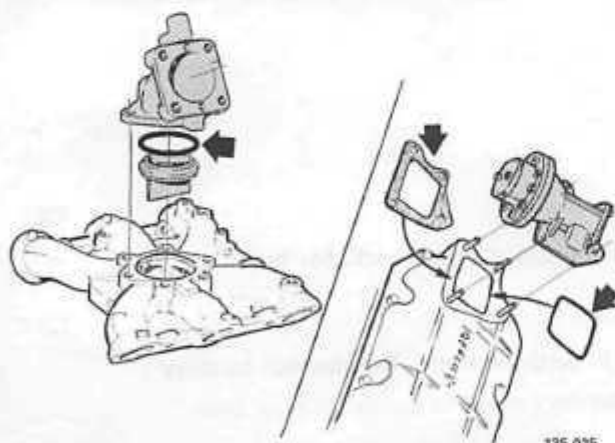
Allow 30 minutes for the engine to cool before re-tightening the cylinder head bolts.



134 980



132 578



135 035



134 975

C87

Remove valve covers

It may be necessary to remove the vacuum pump from the left-hand valve cover.

B 27/28A: remove the carburettor baseplate retaining screws from the intake manifold. Place the carburettor plus base plate and air filter on the intake manifold.

C88

Re-tighten cylinder head bolts

The cylinder head bolts must be tightened in the following order, one at a time.

- Slacken the bolt
- Tighten to a torque of 15–20 Nm (11–15 ft. lbs.)
- Angle-tighten to 113–117°. Use protractor 5098.

C89

Install valve covers

Torque to 10–15 Nm (1–1.5 kpm). 7–11 ft. lbs.

C90

Install remaining parts

B 27/28A: use a new O-ring for the carburettor baseplate. Tightening torque 10–15 Nm (1–1.5 kpm). 7–11 ft. lbs.

B 27/28E, F: use a new O-ring (gasket) for the vacuum pump (if removed). Make sure that the pump shaft meshes on top of the camshaft.



134 976



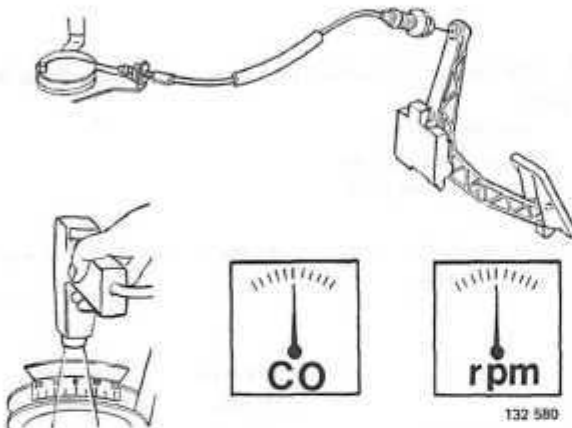
Cars with air conditioning
Operation C91

C91

Install

- rear compressor bracket
- compressor
- drive belts.

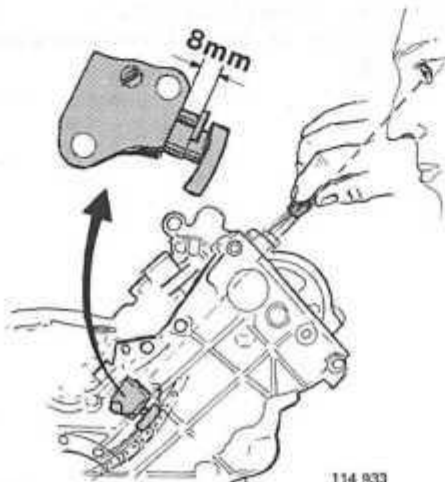
C92



Check/adjust:

- throttle control
- ignition timing
- idle speed + CO-content.

D. Timing gear chains, checking for wear



D1

A quick method of checking the timing gear chains is to remove the left-hand valve cover and check the position of the chain tensioner. If in any doubt whatsoever, remove the timing gear case and inspect carefully.

If the tensioner pin protrudes by 4 or more notches (8 mm) (0.315 in) the chains should be renewed.

Note! Excessively worn chains can cause low oil pressures, and engine damage may result.

D. Timing gear chains, replacement

Special tools: 5103, 5112

D2

The sprockets and also the strainers behind the belt tensioners must be replaced if the chains are renewed.

The following parts should be changed from early to late types:

- chain tensioners
- straight chain dampers
- bent chain dampers

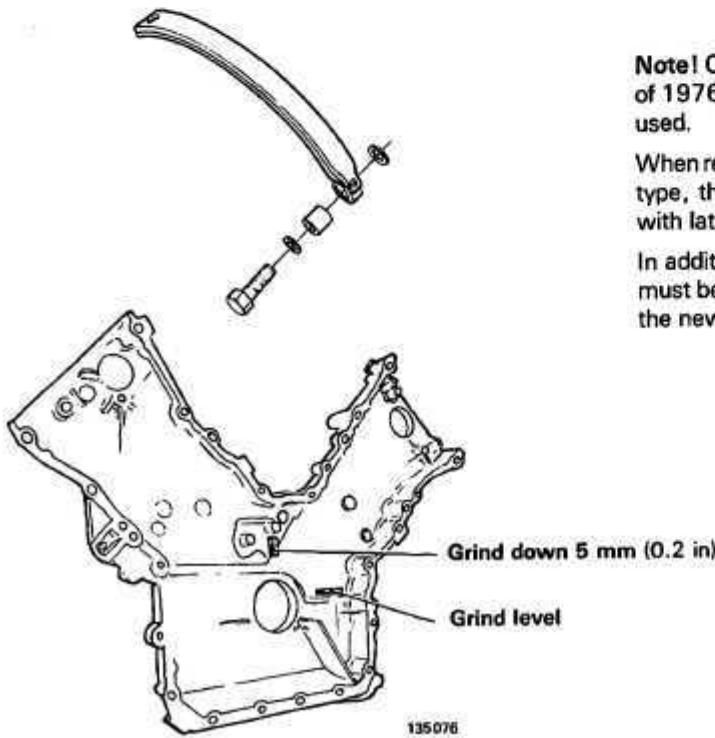
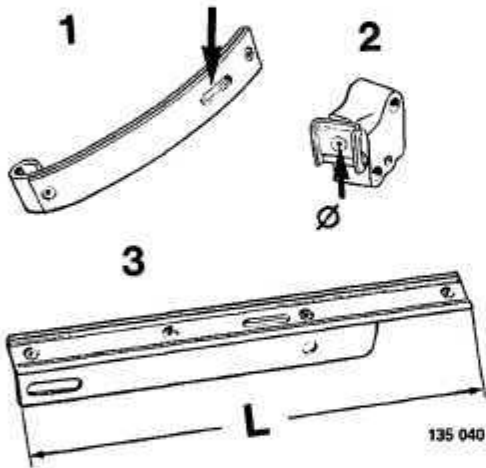
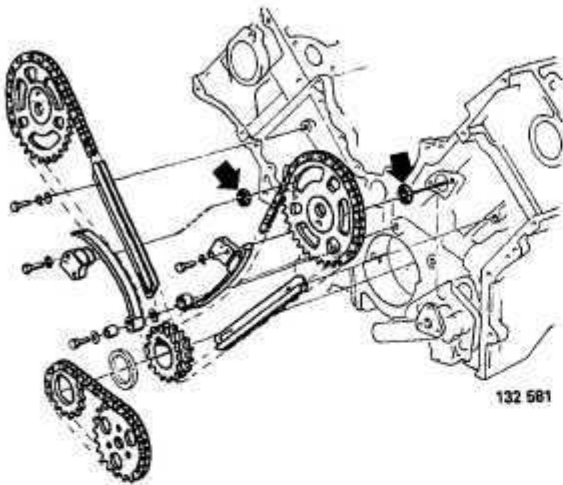
Late type chain tensioners may only be used with late type chain dampers.

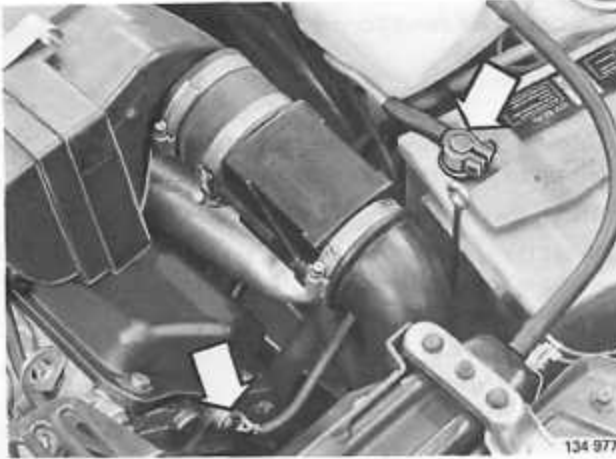
	Early type mm (in)	Late type mm (in)
1 Bent chain damper	without oilway	with oilway
2 Chain tensioner	$\varnothing = 0.4$ 0.016	$\varnothing = 1.2$ 0.0472
3 Straight chain damper ..	$L = 174$ 6.85	$L = 220$ 8.66

Note! On early manufactured B27 engines (up to middle of 1976) a bent chain damper with a small mounting was used.

When replacing an early type bent chain damper with a late type, the bolts, washers and spacers must be replaced with late types as well.

In addition the two support faces in the timing gear case must be ground down, see fig. This is to provide room for the new wider dampers.





Disconnect battery earth lead
Both at the battery and the timing gear case.

D3



B 27/28A

Remove carburettor baseplate retaining screws from intake manifold

Place the carburettor plus baseplate and the air filter on the intake manifold.
Plug the hole in the intake manifold.-

D4

B 27/28E, F

Remove air filter and preheating hose (where fitted)

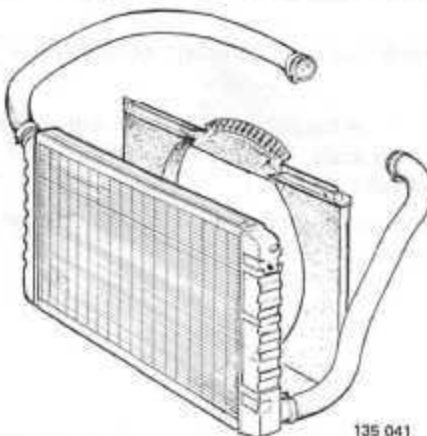
D5



Drain coolant

Open the drain tap on the left-hand side of the cylinder block. A hose can be connected to the drain tap to assist collecting the coolant.

D6



Remove:

- radiator and hoses
- fan shroud.

Cars with automatic transmission: counterhold the nipples on the oil cooler to prevent damage.

D7



*Cars with air conditioning
Operation D8*

D8

**Detach and move aside compressor.
Remove rear compressor mounting bracket.**

Attach the compressor to the right bonnet/hood hinge.

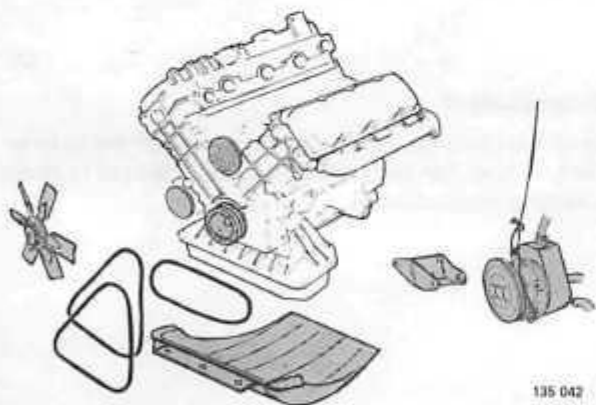
Note! Do not slacken any of the refrigerant hoses otherwise the complete system will have to be evacuated and filled with new refrigerant.



D9

Remove valve covers

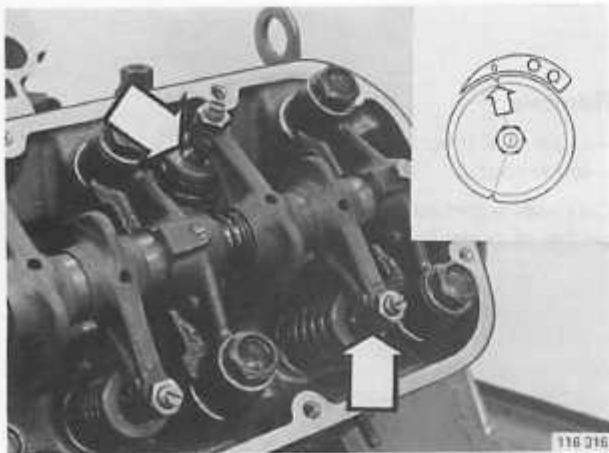
It may be necessary to remove the air and vacuum pumps from the left-hand valve cover.



D10

Remove:

- cooling fan
- splash guard
- drive belt for power pump and alternator
- power pump and mounting bracket. Hang up pump with a wire so that it is not in the way.



D11

Turn crankshaft to overlap position for No. 1 cylinder

The mark "1" on the pulley should align with the zero-mark on the timing scale. The rocker arms for No. 1 cylinder should not have clearance.

Note! There are two notches, 1 = TDC cylinder 1 and 2 = TDC cylinder 6.

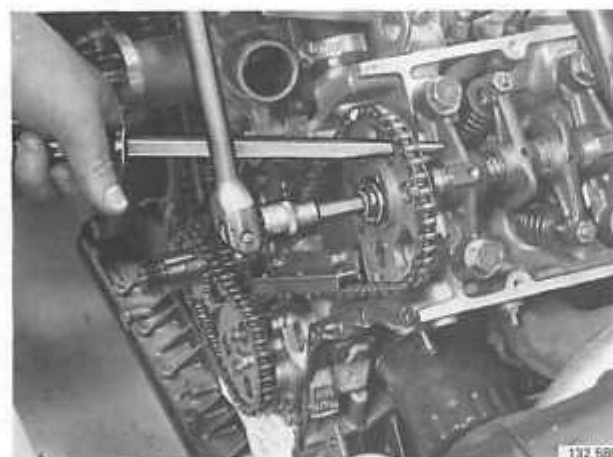


Lock flywheel

Remove the cover plate on the left-hand side of the flywheel casing (RHD vehicles = right side).

Fit locking sector 5112 to the upper bolt (RHD vehicles = lower bolt).

D12

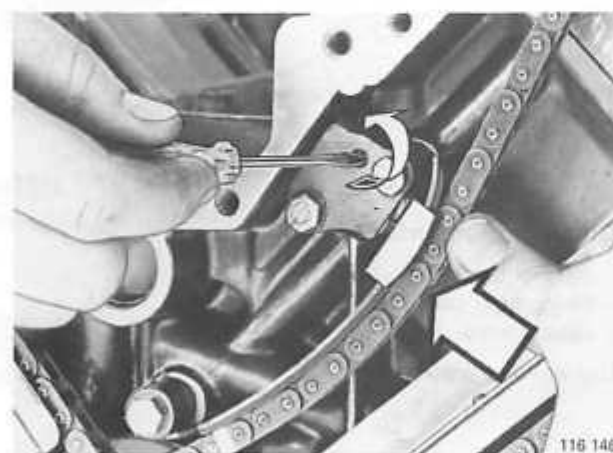


Remove crankshaft pulley

36 mm socket

Take care that the key on the crankshaft does not fall out. Remove locking sector 5112.

D13



Remove timing gear case

Plug the hole in the oil sump with paper.

D14

Slacken camshaft centre bolts

Allen key 10 mm.

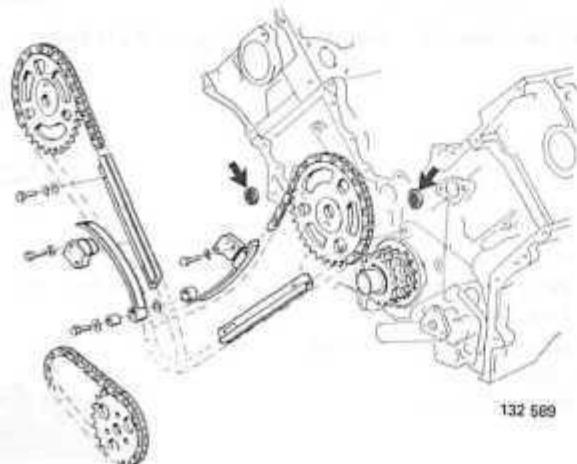
If necessary use a screwdriver as a counterhold.

D15

Slacken timing gear chains

Turn each lock 1/4 turn anticlockwise and push in the piston.

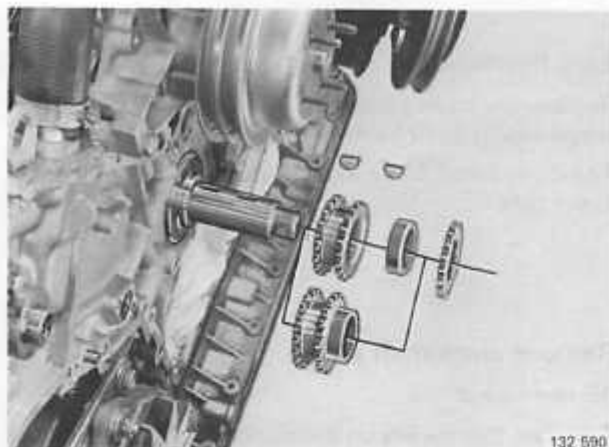
D16



Remove:

- oil pump sprocket and chain
- chain tensioners and oil strainers
- bent and straight chain dampers.
- camshaft sprockets and chains.

D17



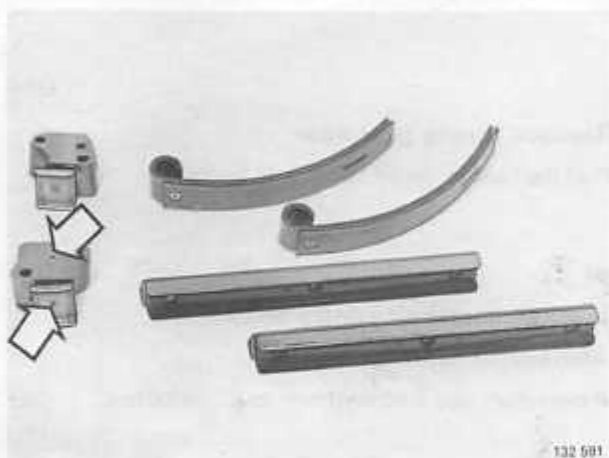
132 590

Remove from crankshaft:

- outer sprocket
- spacer sleeve (early type) and key
- inner sprocket and key.

If necessary use a puller to remove the sprocket.

D18



132 591

D19

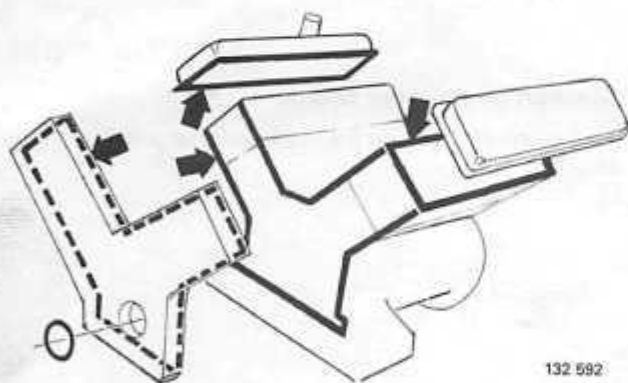
Clean and check condition of chain tensioners and dampers

Note! Do not disassemble the tensioners. If the lock falls out it will be necessary to renew the tensioner.

Make sure that the oil passages in the tensioners are not blocked, and that the dampers are not worn or damaged.

If necessary install new parts.

Note! Chain tensioners and dampers should be changed to later types, see page 56.



132 592

D20

Tap out timing gear case seal

D21

Clean gasket surfaces on:

- cylinder block
- timing gear case
- valve covers.

Use a wooden scraper.

D22

Oil crankshaft, sprockets and spacer sleeve

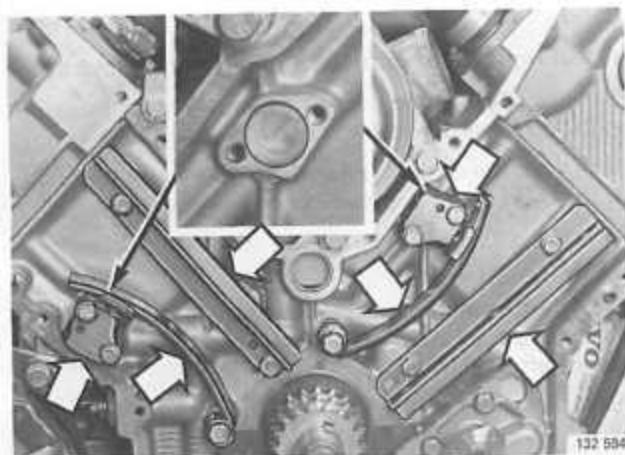
D23

Install:

- inner key
- inner sprocket. **Note!** The line on the sprocket should face outwards
- spacer sleeve (early type)
- outer key
- outer sprocket.

132 593

D24

**Install:**

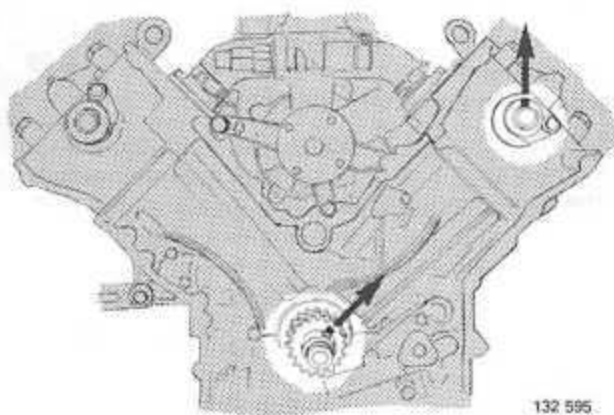
- new strainers in cylinder block
- chain tensioners
- straight chain dampers
- bent chain dampers. Apply locking fluid (P/N 116 1053-2) to bolts.

D25

Set crankshaft and left-hand camshaft

The key in the crankshaft should point towards the left-hand camshaft.

The groove in the camshaft should point upwards and the rocker arms for No. 1 cylinder should not have clearance.



D26

Install left-hand camshaft chain and sprocket

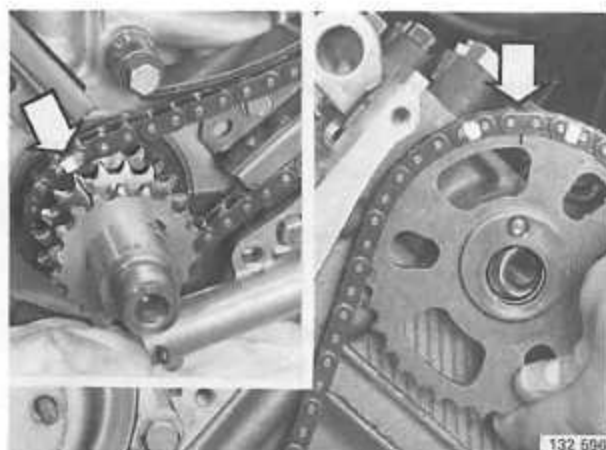
Place the chain on the camshaft sprocket, with the mark on the sprocket between the two marks on the chain.

Place the chain on the inner crankshaft sprocket, with the mark on the chain opposite the mark on the sprocket.

Stretch the chain on the pulling side (the side against the straight chain damper).

Position the camshaft sprocket. Make sure that the sprocket fits in the groove in the camshaft.

Install the centre bolt.

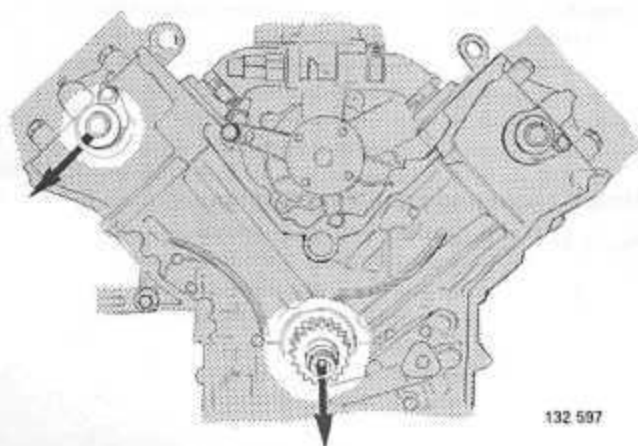


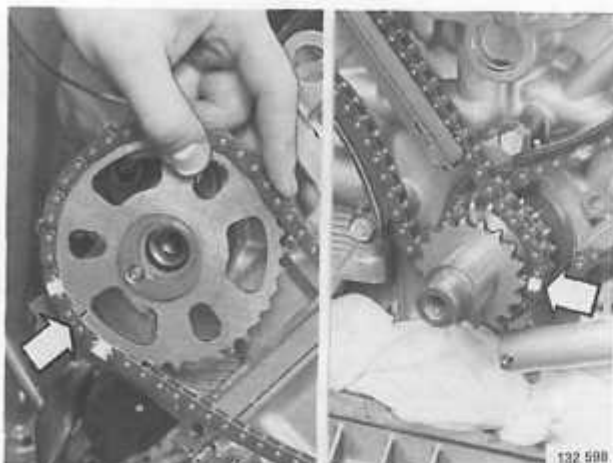
D27

Set crankshaft and right-hand camshaft

Install the crankshaft nut. Turn the crankshaft clockwise so that the key points directly downwards.

The groove in the camshaft should point outwards, see fig., and the rocker arms for No. 6 cylinder should not have clearance.





D28 Install right-hand camshaft chain and sprocket

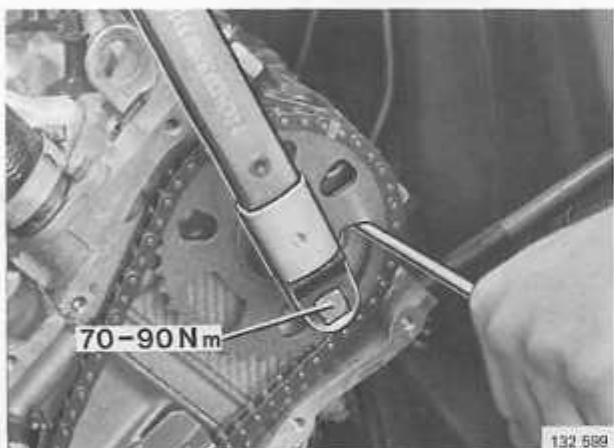
Place the chain on the camshaft sprocket, with the mark on the sprocket between the two marks on the chain.

Place the chain on the crankshaft sprocket, with the mark on the chain opposite the mark on the sprocket.

Stretch the chain on the pulling (the side against the straight chain damper.)

Install the camshaft sprocket. Make sure that the sprocket fits in the groove in the camshaft. If necessary rotate the **crankshaft** slightly.

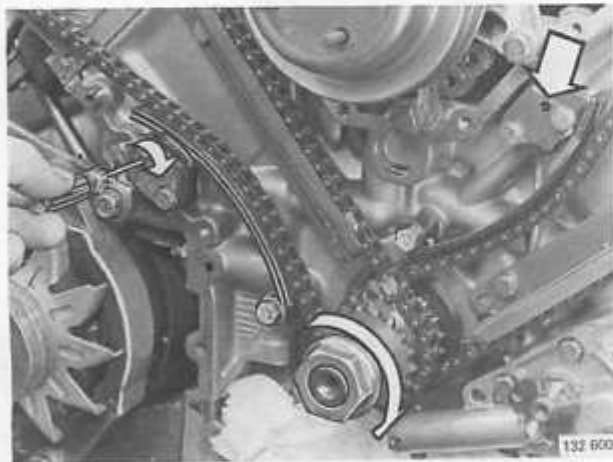
Install the centre bolt.



D29

Tighten both camshaft centre bolts

Tighten to a torque of **70-90 Nm** (52-66 ft. lbs.). Use a screwdriver as a counterhold, placing it between two cogs on the sprocket without holes.



D30

Turn locks 1/4 turn clockwise

D31

Set chain tension

Turn the crankshaft round twice.

Remove the crankshaft nut.

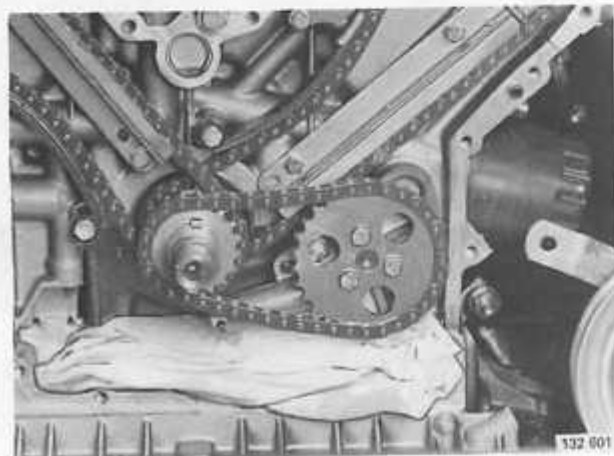
Note! The key in the crankshaft should point upwards to prevent it from falling out of its groove.

When the crankshaft has been rotated the marks for the chains and sprockets do not coincide. It is necessary to rotate the crankshaft a large number of turns to obtain the correct position.

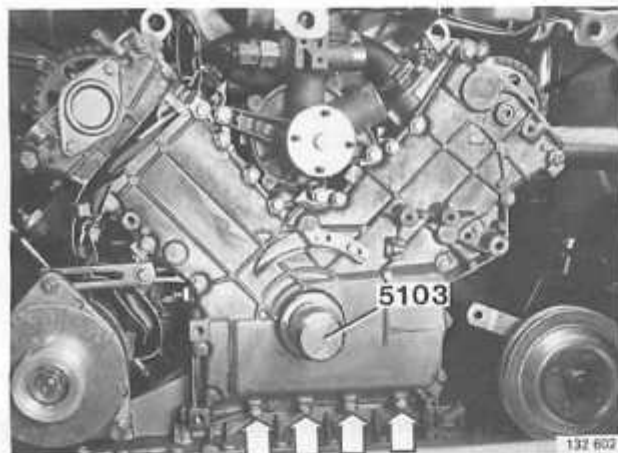
D32

Install chain and sprocket for oil pump

Apply locking fluid (P/N 116 1053-2) to the bolts.



D33



Remove protective paper. Install timing gear case

Use new gaskets.

Smear the four lower bolts with locking fluid P/N 116 1056-5.

Tightening torque 10–15 Nm (7–11 ft. lbs.).

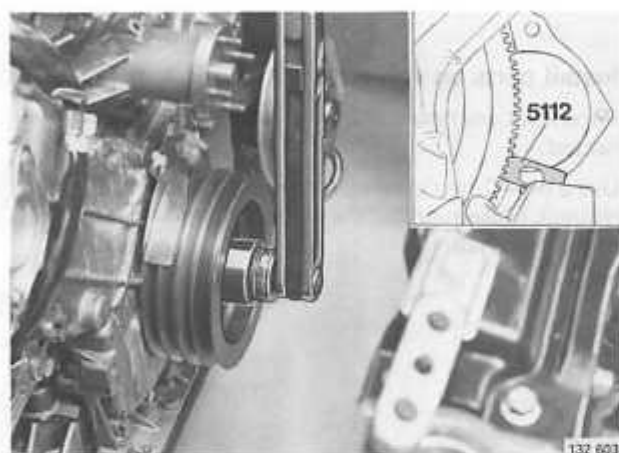
Clamp the wiring harness to the side of the timing gear case.

D 34

Install new seal in timing gear case

Grease the seal. Use drift 5103.

D 35



Install crankshaft pulley

Fit locking sector 5112 to the flywheel casing at the lower bolt (RHD-vehicles = upper bolt.)

Make sure that the key does not fall out.

36 mm socket.

Tighten the nut to the correct torque, see left.

Note! There are two different types of nuts.

D36

Install cover plate on flywheel casing

Remove locking sector 5112.

If necessary adjust valve clearance, see B7–10, page 30.

D37

Cut gasket for timing gear case

Cut flush to the cylinder block.

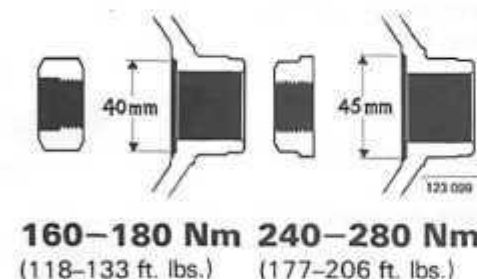
D 38

Install valve covers

Use new gaskets. Apply sealing agent (P/N 116 1026-8) to a few places to secure the gaskets.

Tighten to a torque of 10–15 Nm (7–11 ft. lbs.)

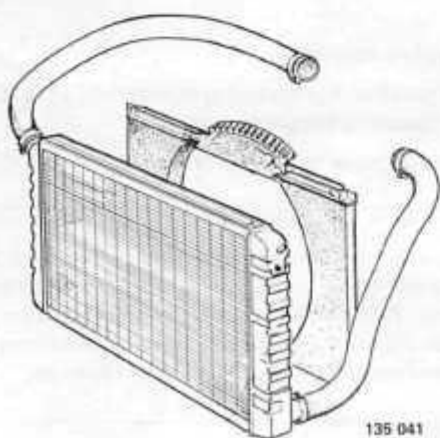
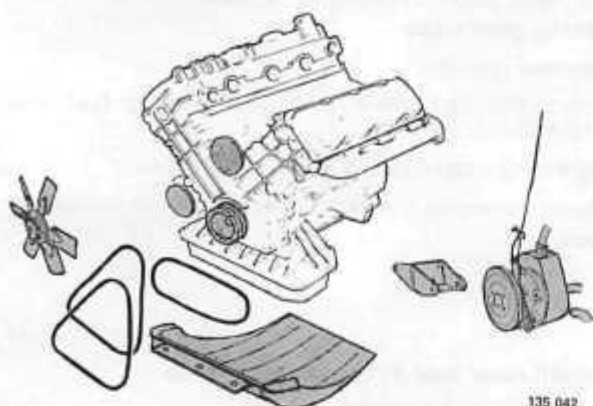
To ensure that the junction between the valve cover, cylinder block and timing gear case is fully leak-proof, a thin coat of silicone (P/N 116 1048-2) can be applied to the joint.
Note! Do not use too much silicone otherwise it may enter the lubrication system and block the oil channels.



160–180 Nm 240–280 Nm
(118–133 ft. lbs.) (177–206 ft. lbs.)



135 034



D39

Close drain tap in left-hand side of cylinder block

D40

Install:

- power pump bracket
- power pump
- cooling fan
- drive belts for alternator and power pump
- splash guard.

D41

Install parts on valve covers

Reconnect any hoses and wires which have been disconnected.

Use a new O-ring (gasket) for the vacuum pump (if removed). Make sure that the pump shaft meshes on top of the camshaft.

*Cars with air conditioning
Operation D42*

D42

Install:

- compressor rear bracket
- compressor
- drive belt, to correct torque

D 43

Install fan shroud and radiator

Reconnect all hoses and wiring.

Cars with auto-gearbox: connect oil tubes to oil cooler. Counterhold the nipples on the cooler to prevent damage.



B 27/28A

D44

Install carburettor + baseplate, and air filter

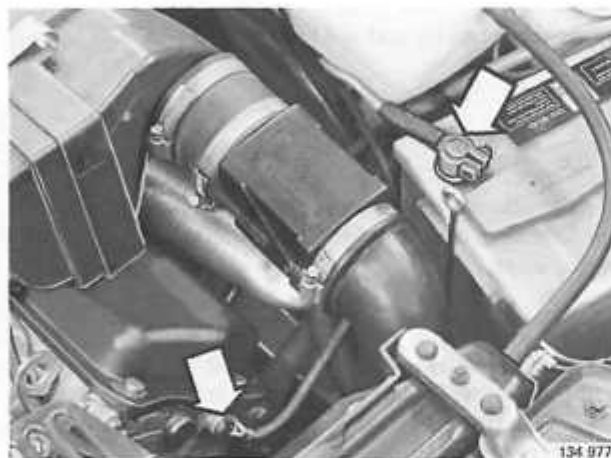
Use a new O-ring. Tightening torque 10–15 Nm (7–11 ft. lbs.).

Reconnect hoses, linkages and wiring.

B27/28E, F

D45

Install air filter and pre-heating hose (if equipped).



D 46

Reconnect battery

Reconnect earth lead to timing gear case as well.

D 47

Fill with coolant. Warm-up engine and check

Top-up if necessary.

D 48



132 607

D48

Check/adjust:

- ignition timing
- idle speed and CO-content.

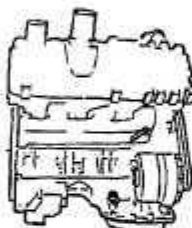
E. Camshaft/rocker arms, replacement

Damaged (worn) rocker arms and/or camshafts may be due to one or more of the following causes:

- **Incorrect oil quality or viscosity.** It is important that the correct oil is used and that it is changed sufficiently often with regard to driving conditions.
- **Contaminated oil.** May be caused by camshaft grindings, coolant or petrol/gasoline, etc.
- **Insufficient oil supply to the rocker arms.**

It is absolutely essential that the engine is cleaned thoroughly before replacing damaged or worn camshafts/rocker arms.
If this is not done the new parts will in all probability wear out quickly and will have to be replaced once again.

E1



114 922

Before replacing rocker arms and/or camshafts, perform the following checks to establish the cause of the damage/wear:

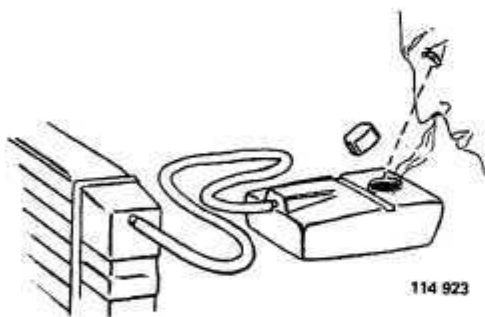
● **Check oil level and condition of oil**

If the oil level is too high, the oil is too thin or smells of petrol/gasoline, it is possible that the oil has been diluted with petrol/gasoline.

● **Check for coolant leakage**

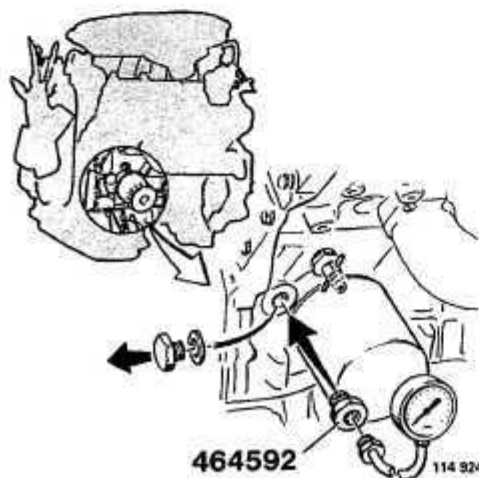
Camshaft/rocker arm wear may be caused by coolant leakage via the cylinder head gaskets. The coolant reduces the ability of the oil to lubricate.

Coolant leakage can usually be detected by oil in the coolant. Look at and smell the coolant in the expansion tank.



114 923

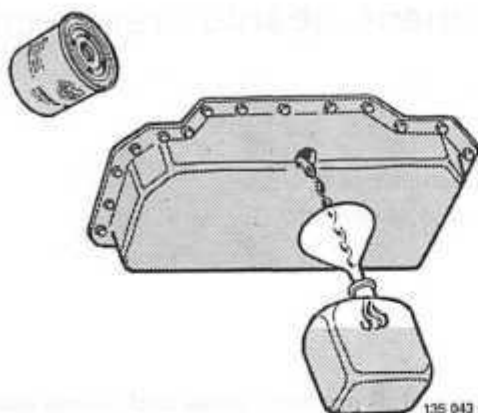
- **Check oil pressure** (if camshaft/rocker arms have been replaced before). See N1, page 87.



464592

114 924

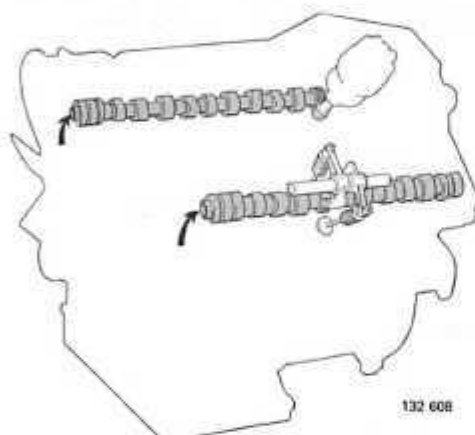
Working procedure



E2

Flush engine clean

Change the engine oil and filter.
Warm-up the engine approx. 10 minutes.
Drain the oil and remove the filter.



E3

Replace camshafts/rocker arms

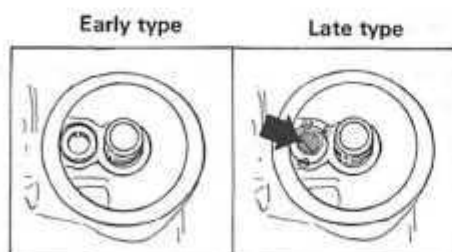
Remove the cylinder heads, see C1-25, page 32.

Replace necessary parts. Lubricate the parts well before installation.

Install the cylinder heads, see C53-92, page 46.

Note! If there is a coating of carbon waste deposits on the valve casing or timing gear case, or if it is a repeat replacement, the valve casing, timing gear case, oil sump/pan and oil strainer must be removed and thoroughly cleaned.

Different types of camshafts. Part number stamped on end.



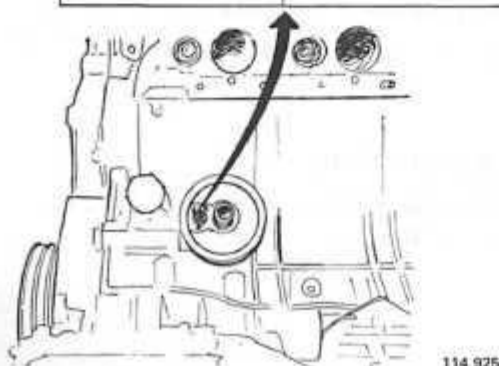
E4

Check overflow/relief valve

If an early type valve (without filter) is fitted, replace it with a new type, (with filter). See 01-5, page 90.

Late type valves introduced on:

Engine type	Engine number
B27A	None
B28A	1143 →
B27E	76992 →
B28E	All
B27F	None
B28F	11169 →



E5

Install NEW oil filter and fill with NEW engine oil

F. Crankshaft pilot bearing, replacement (gearbox removed)

Pilot bearings are fitted only on vehicles with manual gearboxes

Special tools: 4090

1426 or 1801 + 5101 (depending on diameter of bearing)

5113 or 2484 or 5111 (depending on type of gearbox)

F1

Remove clutch pressure plate and driven plate

Inhex 6 mm.

Slacken the pressure plate retaining bolts crosswise, a few turns at a time, to avoid distorting the plate.

F2

Remove bearing

Use extractor 4090. Clean the bearing seat.

F3

Install bearing

Tap in the bearing until it abuts the crankshaft.

There are two types of bearings:

Early type = inner diameter 17 mm (0.669 in). Use standard handle **1801** and drift **5101**.

Late type = inner diameter 15 mm (0.590 in). Use drift **1426**.

F4

Install driven plate

Turn the plate so that the hub faces outwards, away from the flywheel.

There are different centering drifts for the different types of gearboxes:

M 50/51 = drift **5113**

M 45/46 early type = drift **2484**

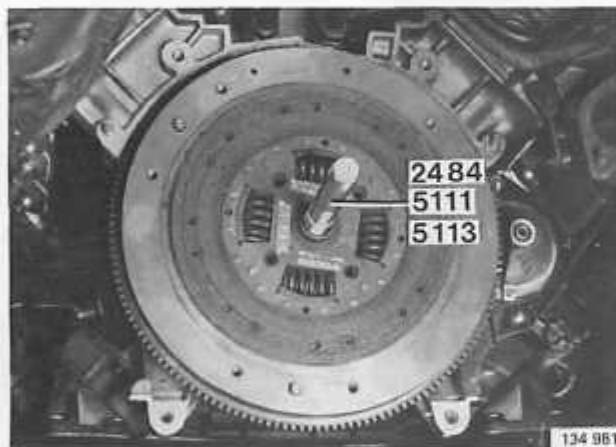
M 45/46 late type = drift **5111**

F5

Install pressure plate

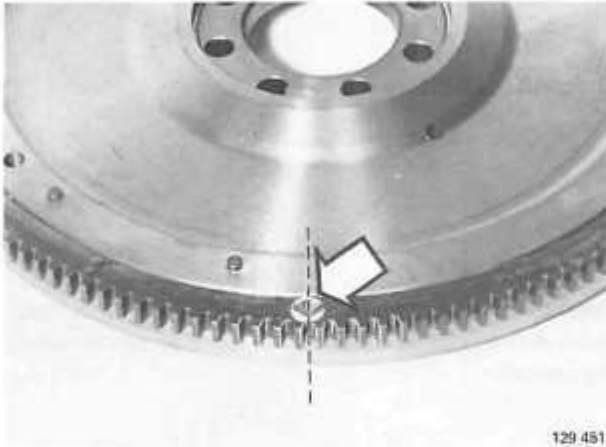
Tighten the retaining screws crosswise, a few turns at a time, to avoid straining the plate.

Inhex 6 mm.



G. Ring gear, replacement (flywheel removed)

Applies to vehicles with manual gearboxes only. On automatic drive vehicles the carrier plate is replaced along with the ring gear.



G1 Heat new ring gear to approx. 230°C (450°F)

Use an oven or an oxy-acetylene flame.

If you intend to use an oven begin heating the new ring gear now. If you are going to use oxy-acetylene the ring gear should be heated just before it is fitted.

G2

Drill a hole between two cogs

Use a 10 mm (0.394 in) drill.

The hole should be approx. 9 mm (0.394 in) deep.

Caution! Do not drill into the flywheel (causes imbalance).



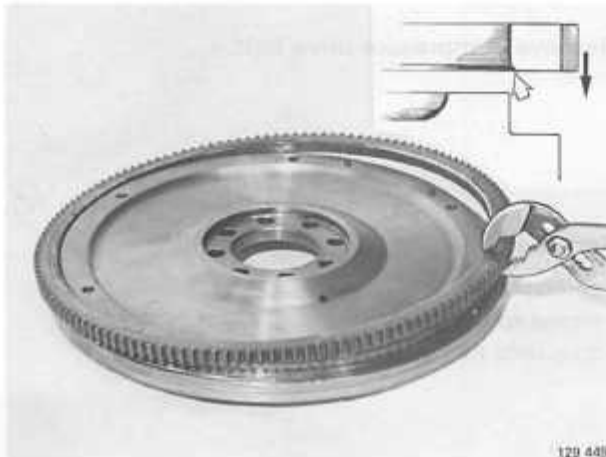
G3

Remove old ring gear

Set up the flywheel in a vice, use soft jaws to prevent damage.

If necessary crack the ring gear with a chisel above the drilled hole.

Clean the contact surfaces on the flywheel.



G4

Heat up new ring gear to approx. 230°C (450°F)

Check the temperature with solder (40% tin, 60% lead). Solder melts at 220–230°C. (430–450°F).

G5

Install new ring gear

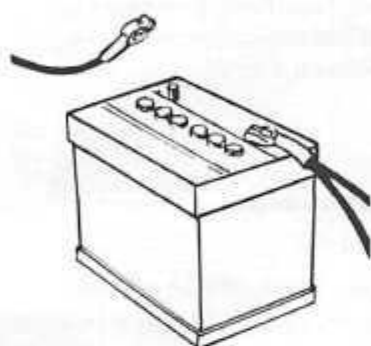
Position the ring gear. **Note!** The bevelled side must face the flywheel.

If necessary use a brass drift to tap down the ring gear until it bottoms.

Leave to cool.

H. Crankshaft front seal, replacement

Special tools: 5103, 5112



Disconnect battery

H1

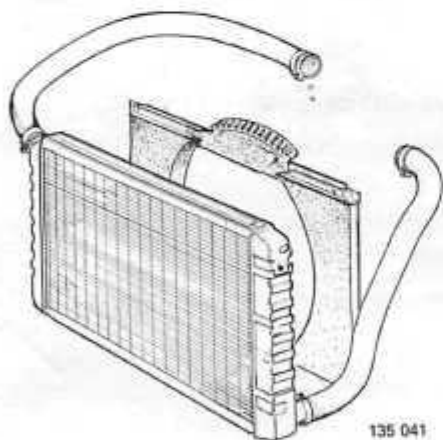


132 611

Drain coolant

H2

Open the drain tap on the left-hand side of the cylinder block. A hose can be connected to the drain tap to collect the coolant.



135 041

Remove:

- radiator and hoses
- fan shroud

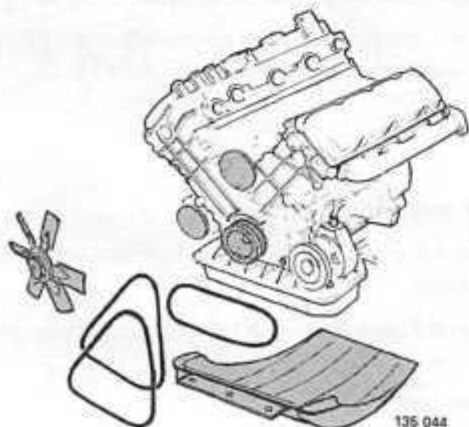
H3

Cars with auto-gearboxes: counterhold the nipples on the oil cooler to prevent damage to the pipes.

Cars with air-conditioning
Operation H4

H4

Remove compressor drive belt

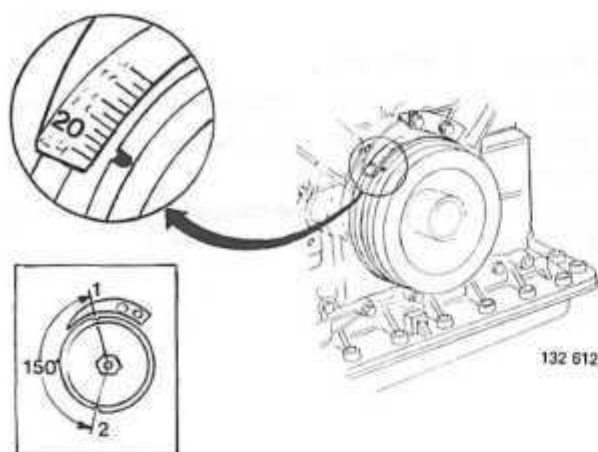


135 044

Remove:

- cooling fan
- engine splash guard
- drive belts for power pump and alternator.

H5



H6

Rotate crankshaft until engine is approx. 20° B.T.D.C., cylinder 1

36 mm socket.

This is done to prevent the key on the crankshaft falling down into the sump.

Note! There are two timing marks on the pulley, 1 = T.D.C. cylinder 1 and 2 = T.D.C. cylinder 6.

H7

Lock flywheel

Remove the cover plate on the left-hand side of the fly-wheel cover (RHD-vehicles = right-hand side).

Lock the flywheel with locking sector 5112 at the upper bolt (RHD-vehicles = lower bolt).

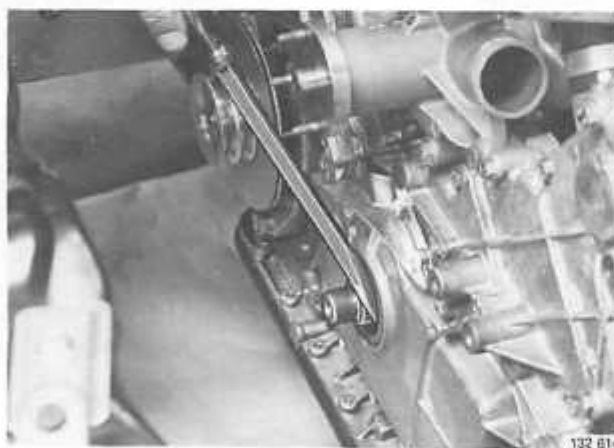


H8

Remove crankshaft pulley

36 mm socket.

Take care that the key on the crankshaft does not fall out.

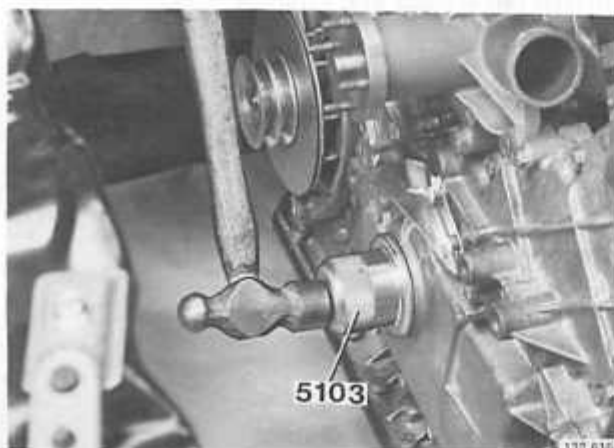


H9

Remove seal

Carefully lever out the seal with a screwdriver.

The mating surface of the timing gear case must not be damaged.



H10

Clean and check mating surfaces

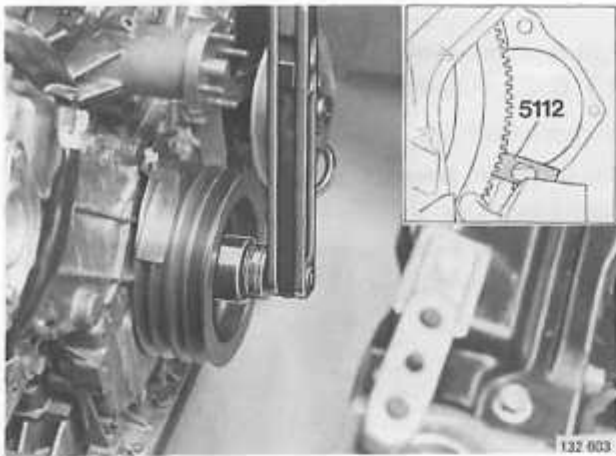
Both the pulley and casing

H11

Install new seal

Pack grease between the lips of the seal.

Use drift 5103.



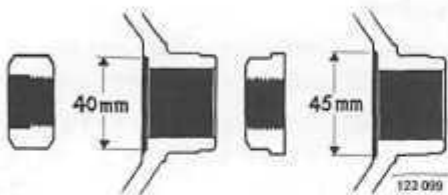
H12

Install crankshaft pulley

Take care that the key on the crankshaft does not fall out. Transfer locking sector **5112** to the lower hole (RHD-vehicles = upper hole).

Install the nut and tighten to the specified torque. See left. **Note!** There are two different types of nuts.

36 mm socket.



H13

Install cover plate on flywheel casing

Remove locking sector **5112**.

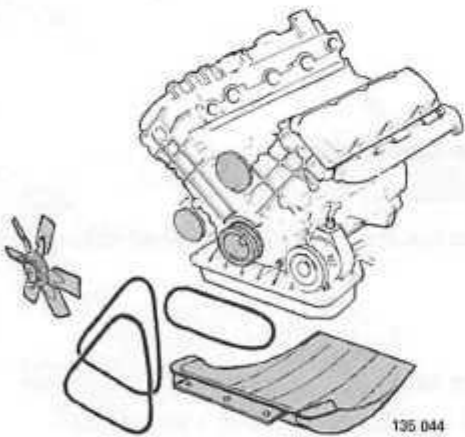
H14

Close drain tap in left-hand side of cylinder block

H15

Install:

- cooling fan
- drive belts for the power pump and alternator. Set to the correct tension.
- cars with AC: compressor drive belt to correct tension
- engine splash guard.



H16

Install fan shroud and radiator

Reconnect hoses and wiring for electric cooling fan (where fitted).

Cars with auto-gearbox: reconnect all tubes to the oil cooler. Counterhold the nipples to prevent damage.

H17

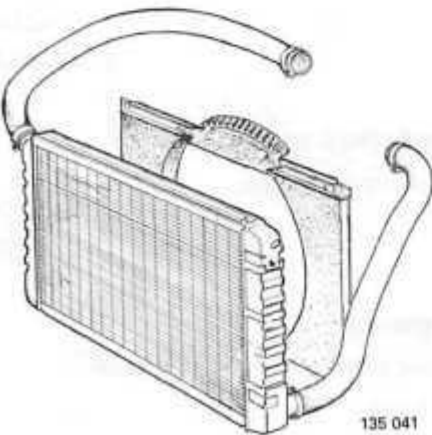
Reconnect battery.

Fill with coolant

H18

Warm-up engine and check

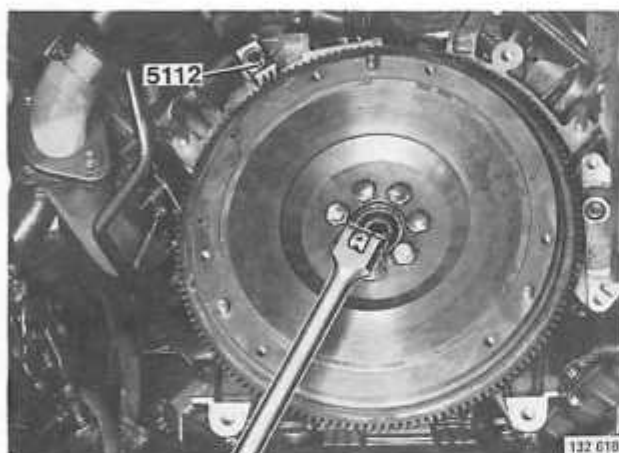
Top-up with coolant if necessary.



H. Crankshaft rear seal, replacement (gearbox removed)

Special tools: 1801, 5112, 5953

5113 or 2484 or 5111 (depending on type of gearbox)



*Manual gearboxes
Operation H19*

H19

Remove pressure plate and driven plate

Inhex 6 mm.

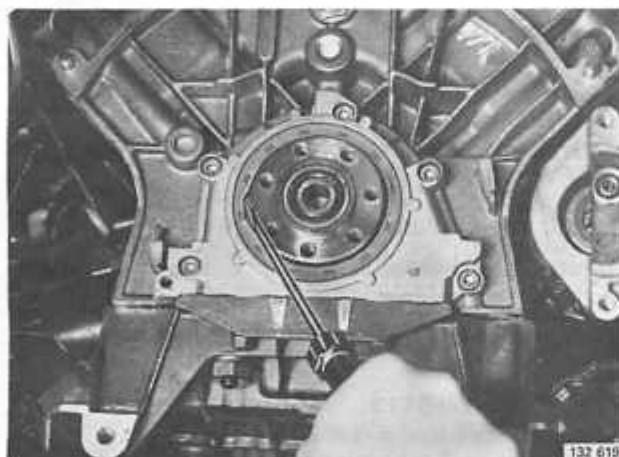
Slacken the pressure plate retaining bolts crosswise to avoid distorting the plate.

H20

Remove flywheel and carrier plate

Lock the flywheel with locking sector 5112.

H21



Remove crankshaft rear seal

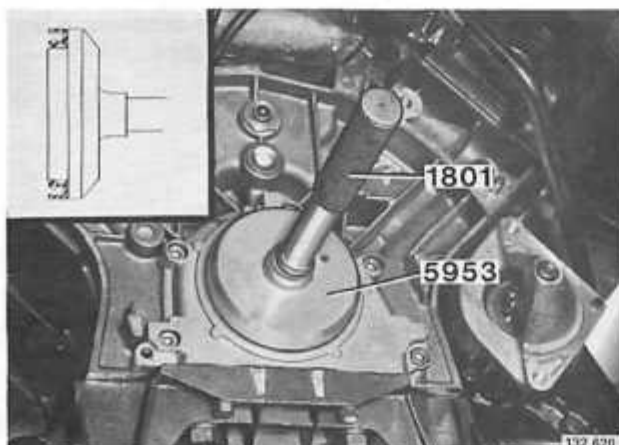
Lever out the seal with a screwdriver. Take care not to damage the sealing surfaces in the holder and crankshaft.

H22

Clean and check sealing surfaces

Both in the holder and crankshaft.

H23



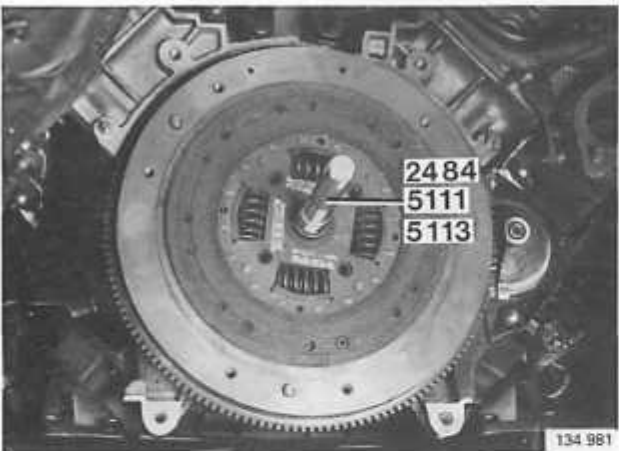
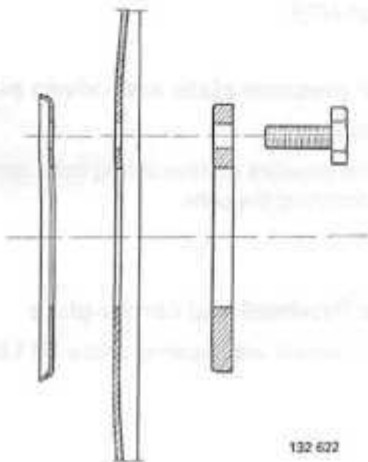
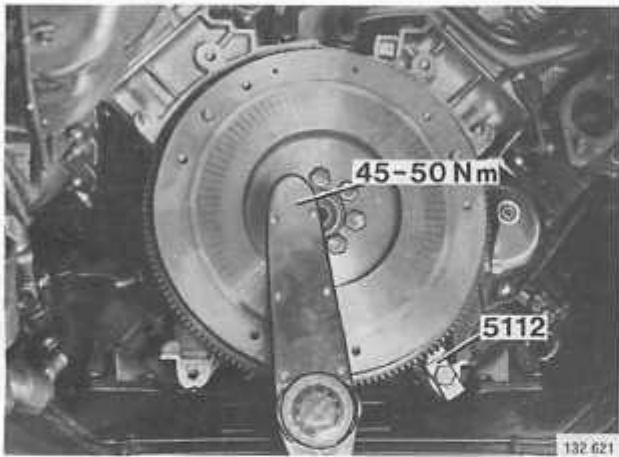
Install new seal

Assemble standard handle 1801 and drift 5953.

Lubricate the seal and groove. Pack grease between the sealing lips.

Place the seal on the drift, see fig.

Tap in the seal until the drift abuts the crankshaft.



H24

Install flywheel and carrier plate

The flywheel can only be fitted in one position. The screw holes are assymetrically located.

Use new bolts.

Tighten to a torque of **45-50 Nm** (33-37 ft. lbs.). Use locking sector **5112** to lock the flywheel.

Automatic gearboxes

Note the position of the support plates. The inner plate must be turned so that the bevel edge faces forwards.

*Manual gearboxes
Operation H25*

H25

Install driven plate and pressure plate

Turn the driven plate so that the hub faces outwards, away from the flywheel.

There are different centering drifts for the different types of gearboxes:

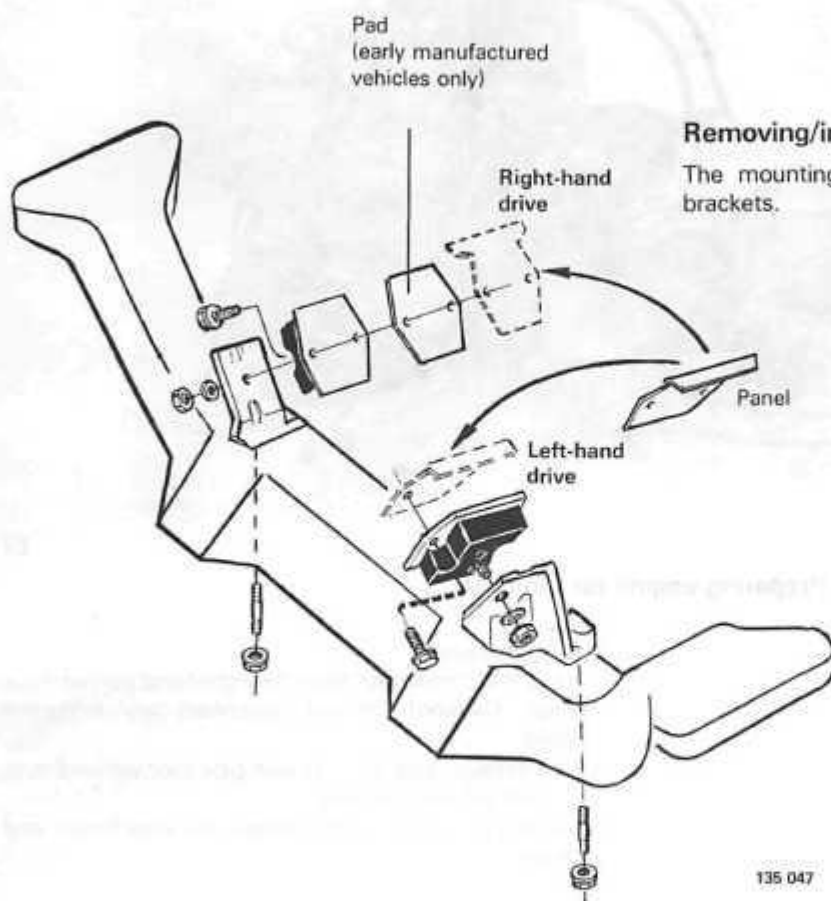
- M 50/51 = drift **5113**
- M 45/46 early type = drift **2484**
- M 45/46 late type = drift **5111**

Tighten the pressure plate retaining bolts crosswise, a few turns at a time, to avoid distorting the plate.

Inhex 6 mm.

K. Engine mountings

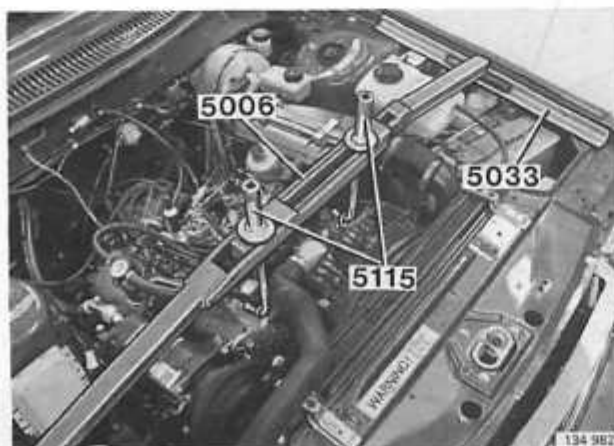
Special tools: 5006, 2×5033, 2×5115



K1

Removing/installing

The mountings are removed/installed along with the brackets.



K2

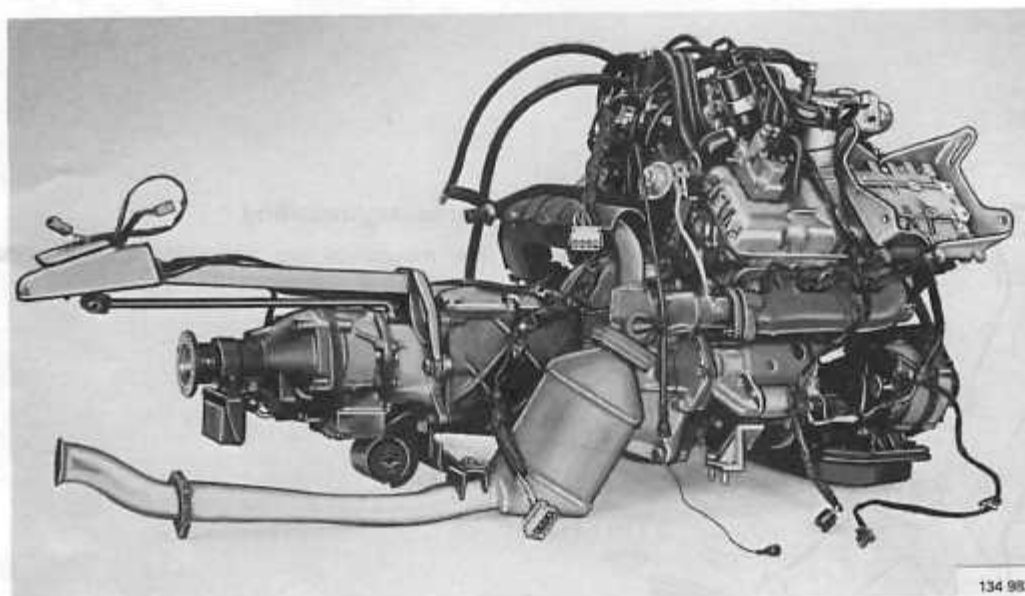
Lifting tool

Use beam 5006, two support rails 5033 and two lifting hooks 5115 to off-load the engine mountings.

L. Replacement of engine

Operations L1-4
Special tools: 2810, 2x5100

The engine is removed and installed with the gearbox attached.



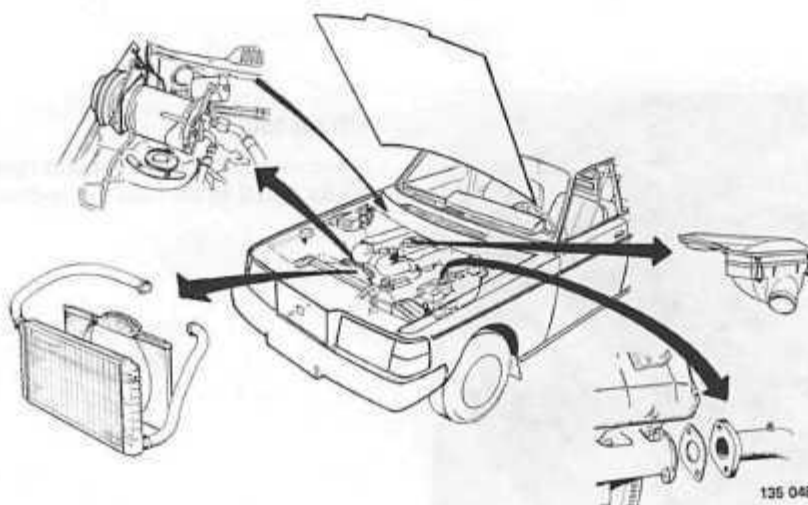
L1

Preparing engine for removal

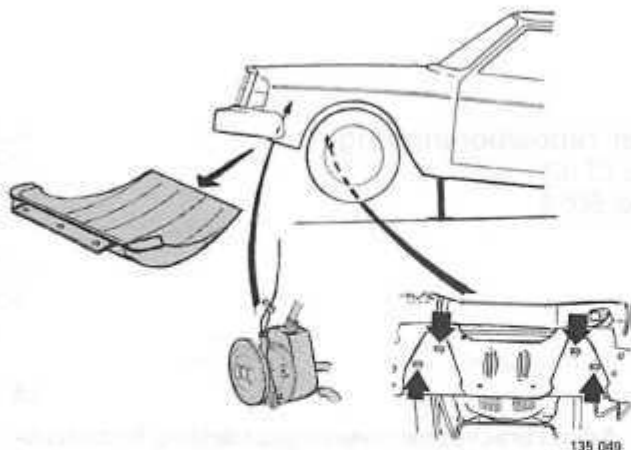
Remove:

- bonnet/hood
- lead from battery
- air filter + preheating hose
- radiator and fan shroud

- AC compressor.
Hang the compressor from the right-hand bonnet/hood hinge. **Caution!** Do not disconnect any refrigerant hoses.
- front exhaust pipe from branch pipe (not vehicles with coupled exhaust system)
- disconnect wiring, water hoses, vacuum hoses and cables.



L2



From beneath engine

Remove:

- splash guard
- power steering pump. **Note!** Do not disconnect any of the hoses. Hang the pump from the body with a wire
- engine mounting retaining bolts in the front crossmember.

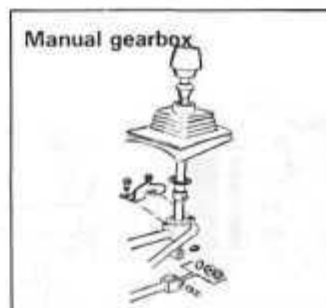
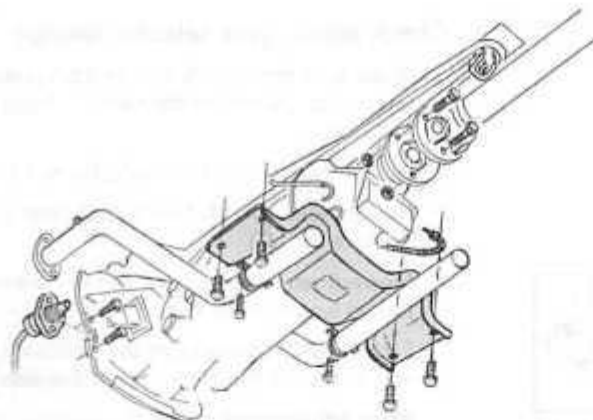
L3

Remove parts from gearbox

Remove:

- mounting clamps for the front exhaust pipe
- (cars with coupled exhaust system): uncouple
- (manual gearboxes): clutch master cylinder and gear lever
- (auto gearboxes): selector control linkage from gearbox

- speedometer drive cable
- propeller shaft
- gearbox crossmember. Off-load the gearbox with a garage jack
- disconnect wiring.



135 050

L4



Lift out engine

Use lifting cradle (2×5100 and 1×2810).

Working procedures after repositioning the engine, see L5-13, page 80.

Working procedures after repositioning engine

Operations L5–L3

Special tool: 5098



Manual gearboxes

L5

Adjust bracket for reverse gear detent. Install rubber gaiter/bellows.

Engage 1st gear.

Adjust the clearance between the bracket and gear lever.
Correct clearance = 0.5–1.5 mm. (0.02–0.06 in)

Use a feeler gauge.

Re-tighten the retaining screws.

Engage 2nd gear and re-check the clearance.

Install the rubber gaiter/bellows.

Automatic gearboxes

L6

Check/adjust gear selector linkage

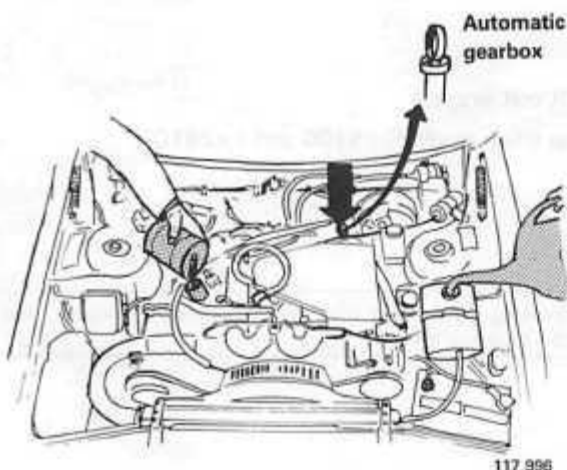
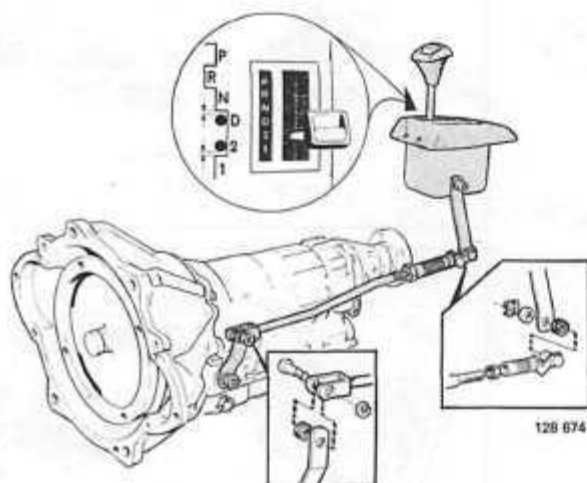
1. Make sure that the clearance from position "D" to the stop is approximately the same as from position "2" to the stop.
2. Adjust the length of the selector rod if necessary.

Rough adjustment: turn the adjuster at the rear of the selector rod.

Fine adjustment: turn the serrated sleeve (max. visible thread length = 35 mm = 1.377 in)

Extending the rod reduces the clearance in position "D" and increases the clearance in position "2".

After adjustment: move the selector lever to position "1" and then back to "P". Re-check according to item 1.



Fill engine oil and coolant

Engine oil capacity 6.5 litres (6.9 US qts) (including oil filter). Add an additional 0.5 litre (0.5 US qts) if the engine has been disassembled and the crankcase is completely dry.

Cooling system capacity 10.9 litres (11.5 US qts). Set the dashboard heater control to max. heat.

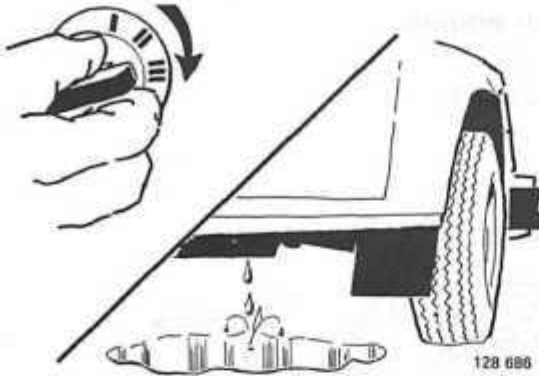
Automatic gearboxes

L8

Check oil level, top-up if necessary

The engine must be running. Engage either "N" or "P".

L9

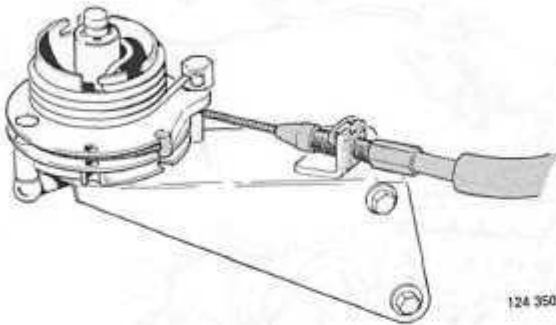


128 686

Check engine

Start the engine and warm-up.
Check for oil and coolant leakages.
Top-up if necessary.

L10



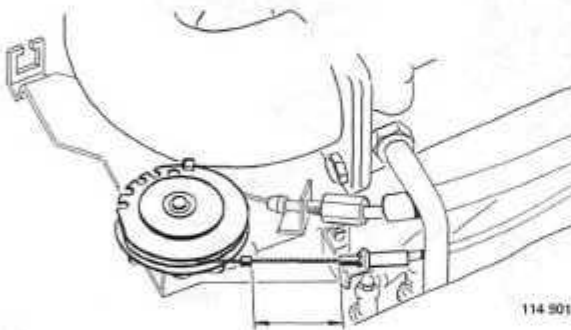
124 350

Adjust throttle cable

The drum must strike the stop on return. The cable must be taut but must not affect the position of the drum.
At full throttle the drum must strike the other stop.

Automatic gearboxes

L11



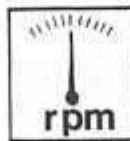
114 901

Adjust throttle cable

Press the accelerator pedal to the floor. **Note!** Do not adjust the linkage by hand otherwise the setting will be incorrect.

At full throttle the distance from the cable sleeve to the clip must be 50.4–52.6 mm (1.98–2.07 in)

L12



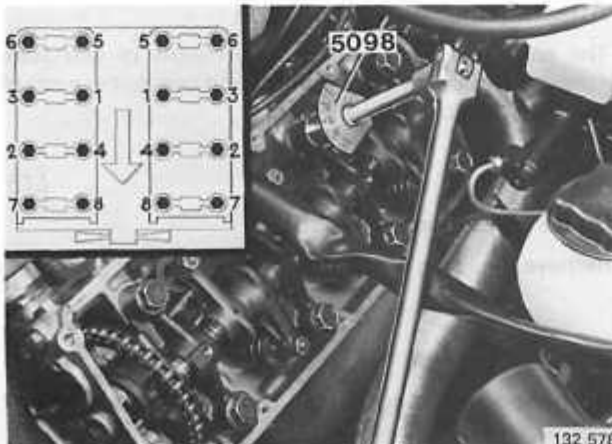
132 607

Check/adjust:

- ignition setting
- idle speed and CO-content

If engine has been disassembled

L13



132 578

Re-tighten cylinder head bolts

Note! The engine must have been warmed-up and allowed to cool for 30 minutes before re-tightening the bolts.

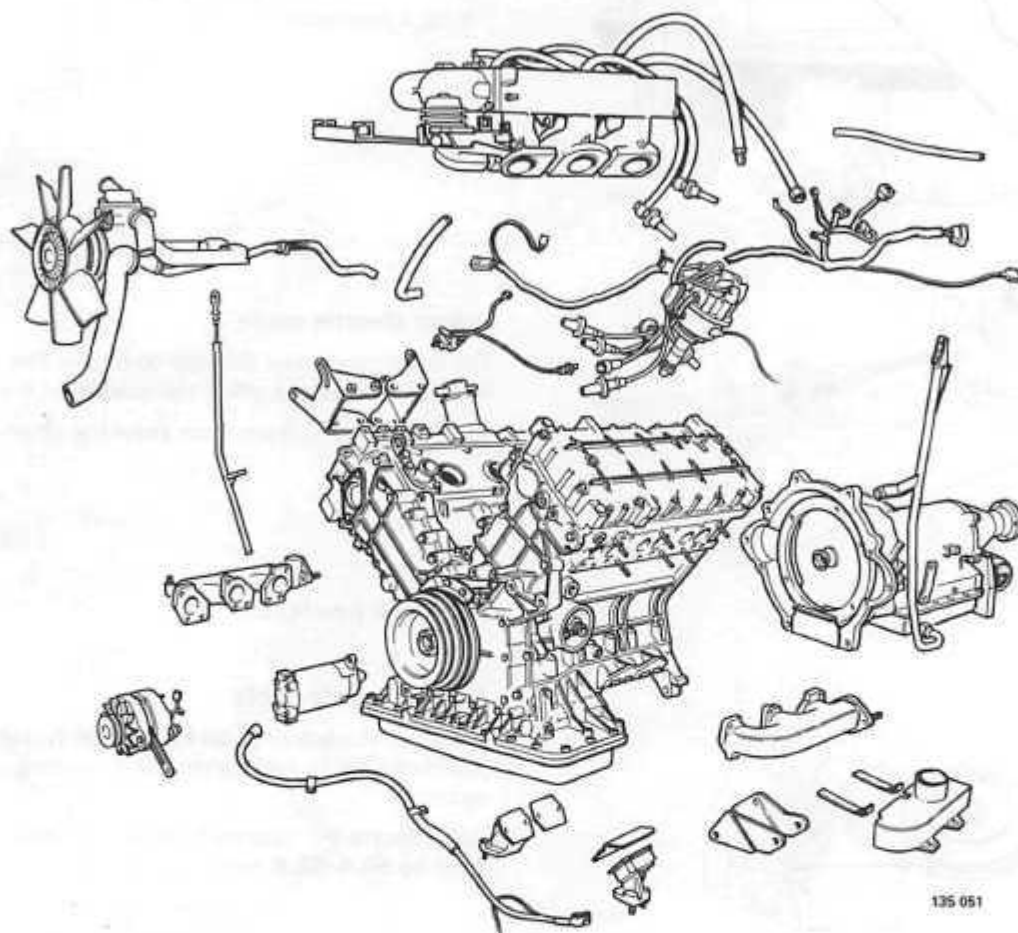
Follow the procedure below, one bolt at a time.

- Slacken the bolt
- Tighten to a torque of 15–20 Nm (11–15 ft. lbs.).
- Angle-tighten to 113–117°. Use protractor 5098.

Removing parts from engine

Operations L14-17

Special tools: 2520, 2903, 5099



L14

Remove:

- starter motor
- gearbox. **Note!** Auto: do not forget the torque converter bolts
- oil filter. Use wrench **2903**
- drain taps for coolant.

L15

Attach fixture 5099 to engine

The engine is held in position by means of two bolts screwed into the flywheel casing, and one bolt in each of the drain tap screw holes.

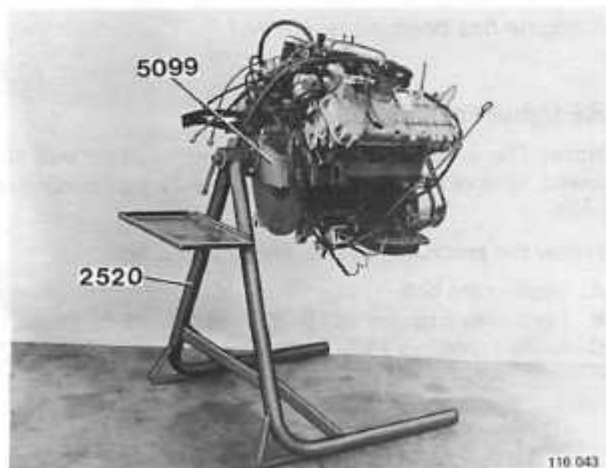
L16

Place engine on stand 2520

Remove the lifting cradle.

L17

Remove remaining parts



110 043

Installing parts on engine

Operations L18-24

Special tools: 1426 or 1801 + 5101 (depending on diameter of pilot bearing)
5113 or 2484 or 5111 (depending on type of gearbox)
5112

Only operations where special care must be exercised are dealt with in this section.

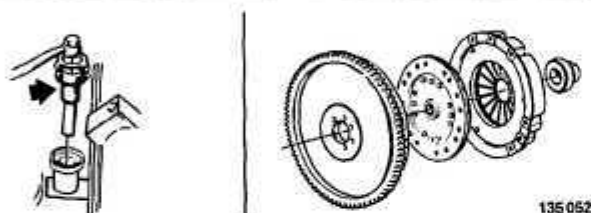
L18



Always use:

- new gaskets and seals
- new bolts for flywheel/carrier plate
- new crankshaft pilot bearing (manual gearboxes).

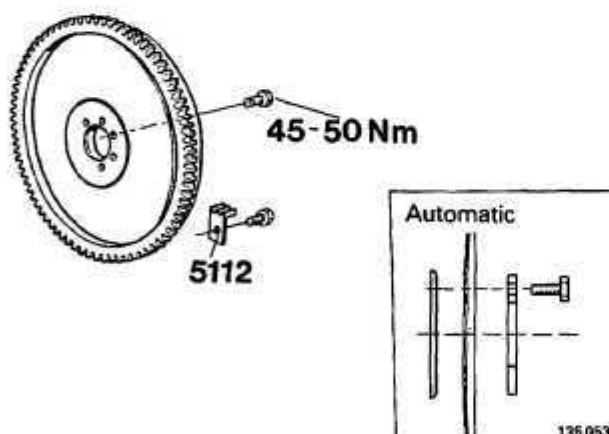
L19



Check, replace if necessary:

- (E/F-engines) rubber seals at the injectors. The seals may have become oval and cause: air leakage, erratic idling, etc.
- water and vacuum hoses
- clutch + release bearing

L20



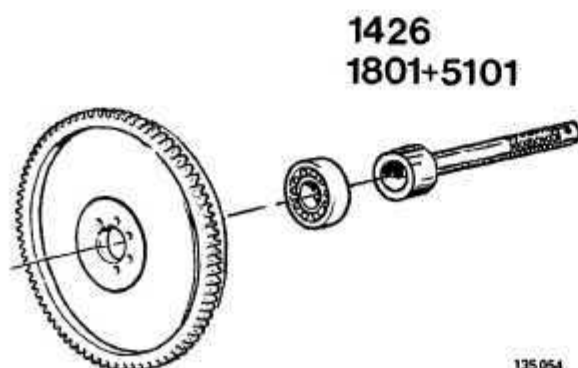
Flywheel (manual), carrier plate (auto)

New bolts. Tighten to a torque of 45-50 Nm (33-37).

Use locking sector 5112 to secure flywheel.

Automatic: Note position of support plates. The inner plate must be turned, bevel side forwards.

L21



Crankshaft pilot bearing

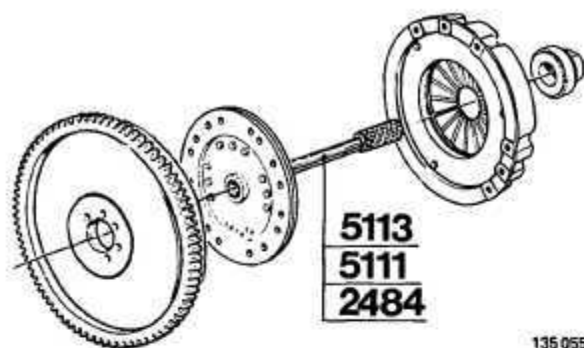
Tap in the bearing until it abuts the crankshaft.

There are two types of bearings:

Early type = inner diameter 17 mm (0.669 in) Use standard handle 1801 and drift 5101.

Late type = inner diameter 15 mm (0.590 in). Use drift 1426.

L22



135 055

Driven plate, pressure plate

Turn driven plate so that the hub faces outwards, away from the flywheel.

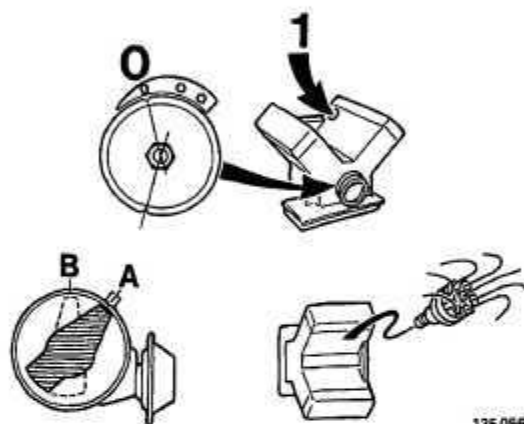
There are different centering drifts for the different gearbox types:

M50/51 = drift 5113

M45/46 early type = drift 2484

M45/46 late type = drift 5111

Tighten the pressure plate retaining screws crosswise, a few turns at a time, to avoid distorting the plate.



135 056

A Before installation
B After installation

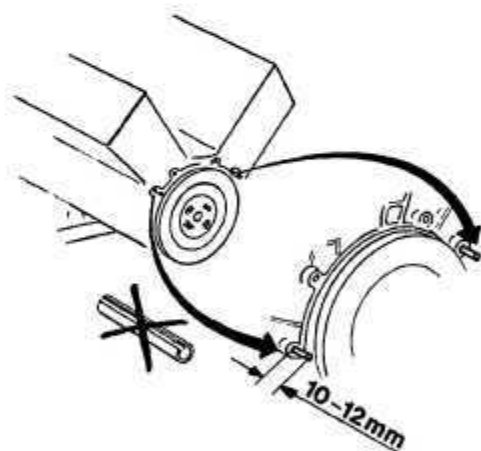
Distributor

Set engine to T.D.C. cylinder 1 firing position. Make sure that cylinder 1 intake valves are at the firing position and not the overlap position.

Turn the rotor so that it points towards the clip for the distributor cap.

Install the distributor. When installed, the rotor should point towards the mark on the distributor body.

L23



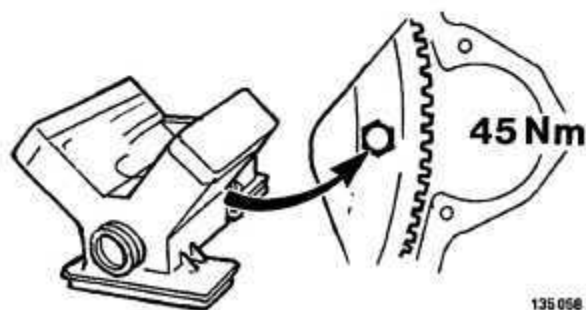
135 057

Gearbox

Check that the guide pins in the cylinder block protrude by 10-12 mm. (0.4-0.47 in)

If tubular pins are installed replace with solid ones (P/N 1232544-5). Apply locking fluid.

L24



135 058

Automatic gearboxes

Lightly grease the torque converter guide and the equivalent hole in the crankshaft.

Tighten the torque converter retaining bolts to 45 Nm (4 bolts) = 35 ft. lbs.

Group 22 Lubricating system

	Operation	Page
Engine oil, oil filter	M1-2	86
Oil pressure, check	N1	87
check/remedial action for low pressures	N2-8	87
Overflow valve (at oil filter), replacement to late type	O1-5	90
Oil pump, removal/installation	P1	92
cleaning/inspection	P2	92

M. Engine oil, oil filter
Special tool: 2903



M1

Engine oil

The engine should be hot when changing the oil. Replace the drain plug washer.

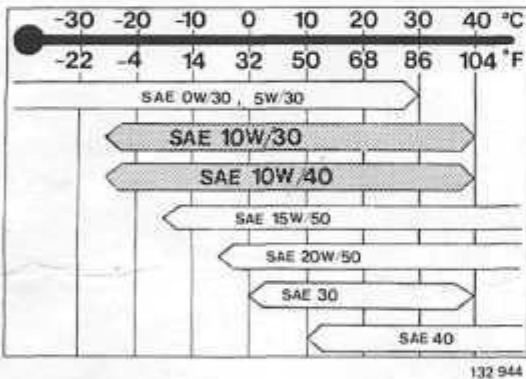
Oil capacity, excl oil filter	6.0 litres (6.3 US qts)
incl oil filter	6.5 litres (6.9 US qts)
Difference, max.-min.	1.0 litres (1.0 US qts)

If the engine has been disassembled and the crankcase is completely dry add an additional 0.5 litre of oil.

USA and Canada

Type and grade according to API Service-SF/CC
Note! SE/CD-oils must not be used.

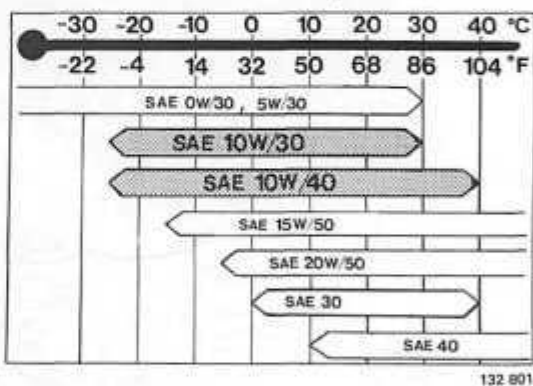
Viscosity: Temperature range
(stable ambient temperatures)



Other markets

Type and grade ... according to API Service-SE/CC or SF/CC

Viscosity: Temperature range
(stable ambient temperatures)



SAE 15W/50 or SAE 20E/50 oils are recommended for use in extreme driving conditions which involve high oil consumption and high oil temperatures, e.g. mountain driving with frequent decelerations or fast motorway driving. (Note however the lower temperature limits.)



M2

Oil filter

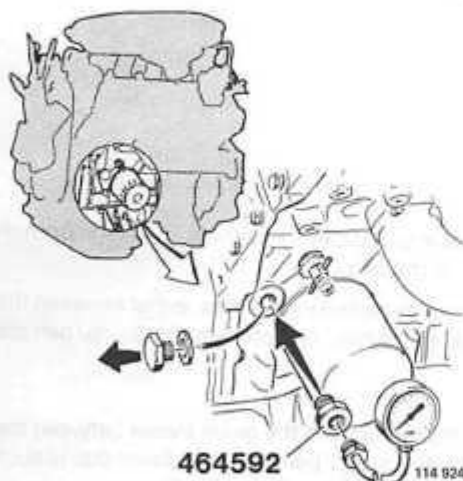
Use strap wrench 2903 to remove the filter.

See the installation instructions on the cartridge.

For replacement of filter only, add 0.5 litre (0.5 US qt) of engine oil.

N. Oil pressure, check

N1



Use the output on the left-hand side of the engine, in front of the oil filter, to measure the oil pressure. If the pressure is measured anywhere else, the results will be invalid.

The adapter (P/N 464592-5) can be used for B20 and B17-B23 engines.

With a hot engine and new oil filter, the oil pressure should be:

15 r/s (900 r/min)	min	0.1 MPa (14.2 psi)
50 r/s (3 000 r/min)		0.4 MPa (57 psi)

* Correct type, grade and viscosity

Low oil pressures

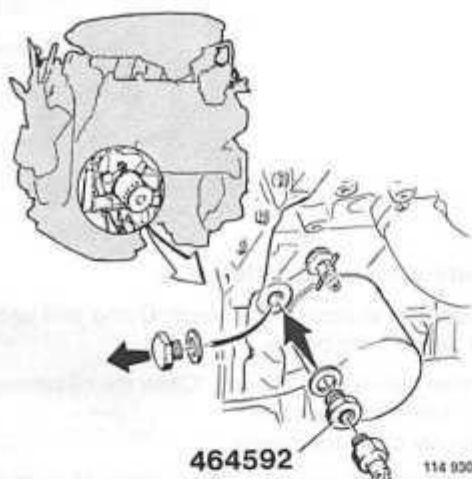
Carry out the following checks/remedies

N2

Check oil level

*Cars with GT-instruments
Operation N3*

N3



Check that oil pressure sender is correctly installed

The oil pressure sender for GT-instruments should be located on the port on the left-hand side of the engine (in front of the oil filter).

The adapter (P/N 464592-5) must be used if a correct fit is to be obtained.

Note! The standard oil pressure sender must be left installed. If this sender is replaced (by an incorrect one or a plug) one of the oilways in the cylinder block is exposed and the oil pressure will be too low.

N4

Check oil flow to all rocker arms

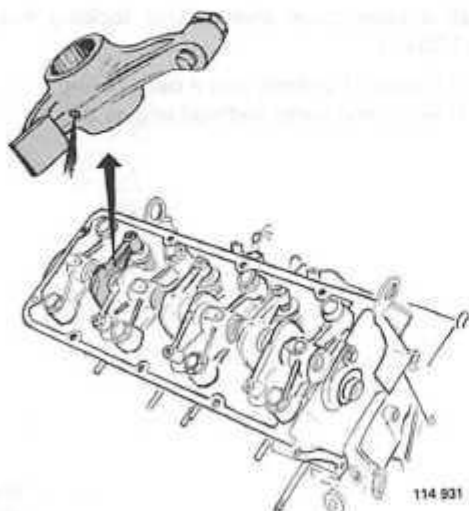
Disconnect the lead from terminal 15 on the ignition coil (safety precaution).

Crank the engine and check the flow of oil from the rocker arm jets. Ample oil should flow and no air bubbles should be present.

Different fault symptoms:

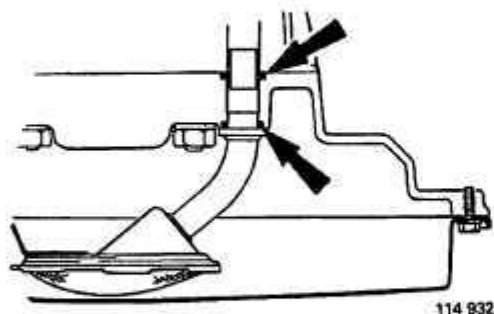
Air bubbles, see N5-6.

Poor oil flow from all rocker arms, see N7-8.

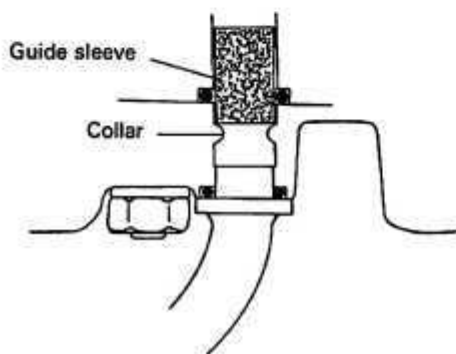


AIR BUBBLES IN OIL

Operations N5-6.



114 932



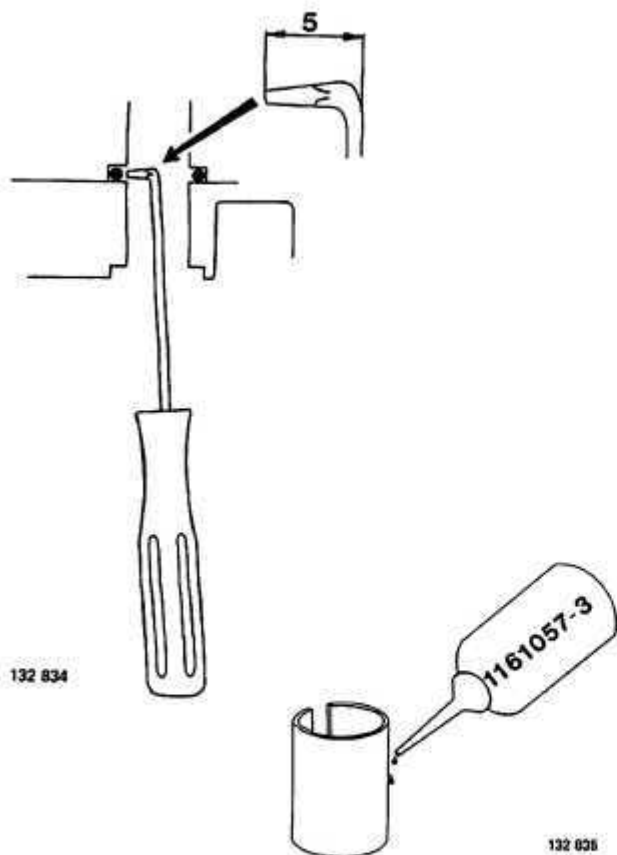
N5

Air bubbles in oil indicates that there is leakage from the intake side of the oil pump.

The reason may be leaking O-rings, either between the engine block and sump, or between the sump/pan and oil strainer.

On early engine versions the guide sleeve between the cylinder block and sump/pan may have fallen out. In such cases the oil will leak from the upper O-ring.

New cars are fitted with a collar in the sump/pan which prevents the sleeve from falling out.



132 834

132 036

N6

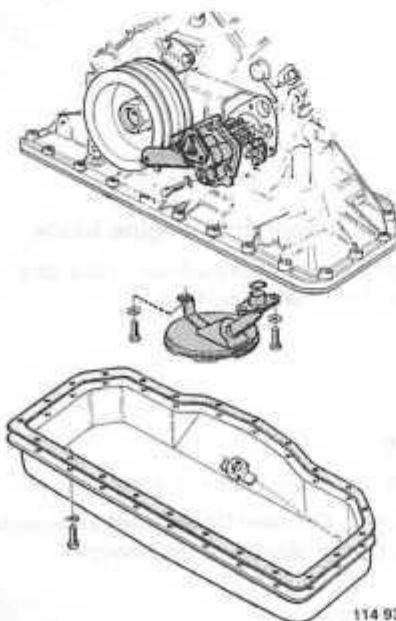
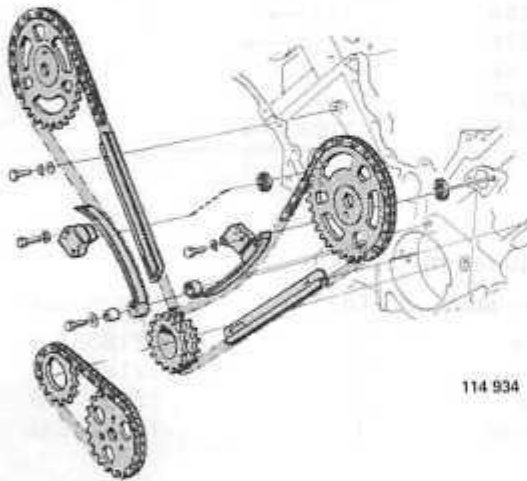
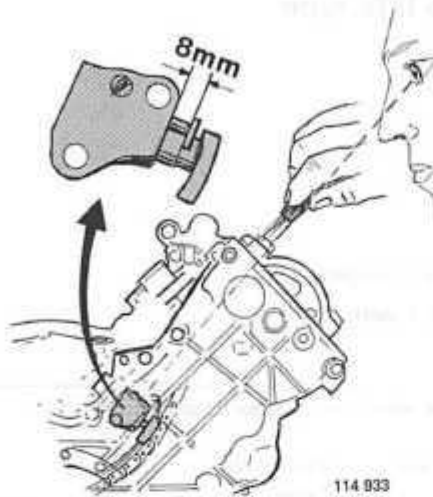
If guide sleeve has fallen out:

It is possible to replace the upper O-ring and secure the guide sleeve from below.

- remove pieces of old O-ring. Clean the oil strainer, both internally and externally
- Carefully clean the oilway
- Install a new O-ring. Use a bent screwdriver to position the O-ring.
- Install a new guide sleeve. Use locking fluid P/N 1161057-3
- install a new oil strainer and a new O-ring
- install remaining parts and add engine oil.

POOR OIL FLOW AT ALL ROCKER ARMS*Operations N7-8*

Indicates internal leakage or poor pump capacity

**N7****Check timing gear chains for wear**

If the chains are worn the chain tensioners will have reached their outmost position. Oil will leak past the pistons in the chain tensioners and the oil pressure will be too low.

Use a torch and assess the condition of the chain tensioners.

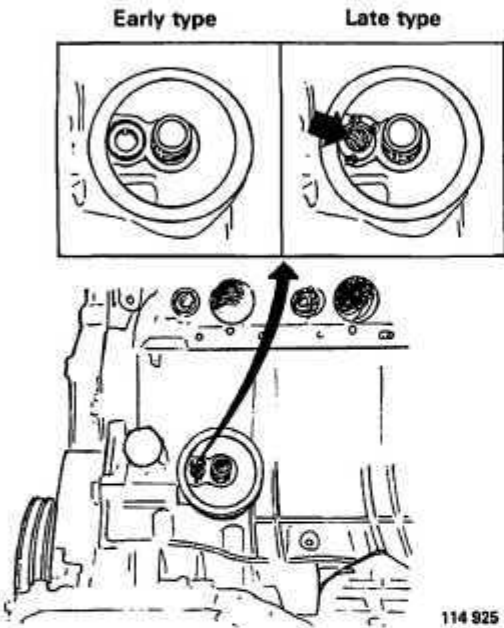
Replace the chains if the pin in the tensioner protrudes by more than 4 teeth (8 mm = 0.315 in). See D2-48, page 56.

N8**Check:**

- that oil strainer is not blocked
- oil pump and relief valve
- that oil pump shaft is firmly secured to cylinder block.

O. Relief valve

Replacement from early to late type (oil filter removed)



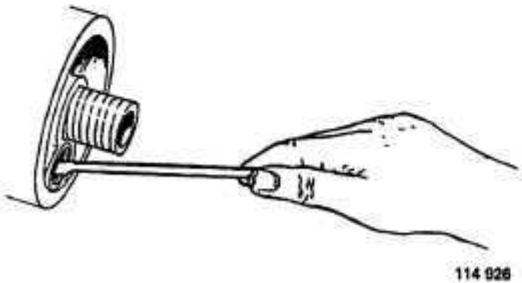
Early type = without filter
Late type = with filter

Late type valves are introduced on:

Engine type	Engine No.
B 27A	None
B 28A	1143 →
B 27E	76992 →
B 28E	All
B 27F	None
B 28F	11169 →

Required materials:

Description	Qty	Part number
Valve	1	1218056-8
Seal	1	1218054-3
Filter	1	1218175-6
Washer	1	1218055-0



01

Withdraw old valve from engine block

Use a pair of pliers or a screwdriver. Take care not to damage the oil filter mating surface.

02

Clean hole

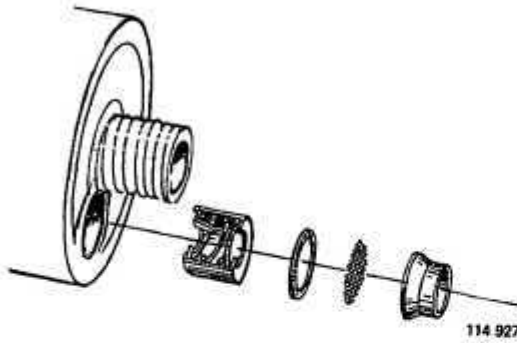
Remove dirt, etc. Use a knife or scraper.

Clean thoroughly. **Caution!** Do not use compressed air. Dirt, oil deposits, can be blown into the oilways.

03

Install new parts

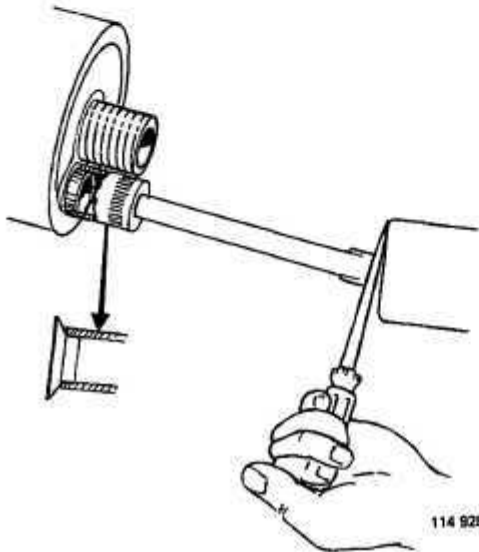
Install the valve, with the spring facing inwards.



04

Press on washer

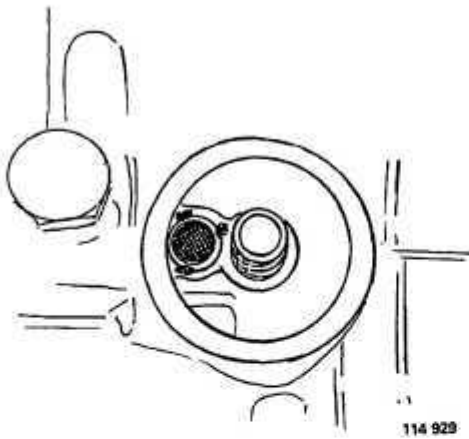
Use a 11 mm (inner dia) socket.



05

Secure washer

Use a drift to make three small notches around the washer.



P. Oil pump

P1

Removing/installing

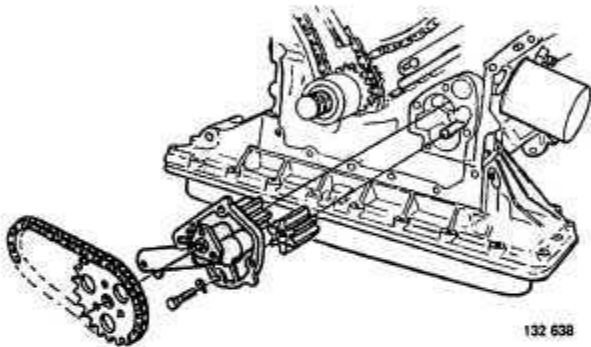
Timing gear case,
removing, see D3-14, page 57.
installation, see D20-21, 33-47, pages 60 and 62.

Clean all parts before installation. Also clean the housing in the cylinder block.

Oil the housing, cogs and shafts.

Tightening torque retaining bolts, oil pump/cylinder block = 10-15 Nm (7-11 ft. lbs.)

Smear locking fluid (P/N 1161053-2) on the bolts for the oil pump sprocket.



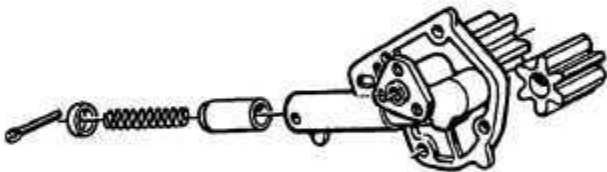
132 638

P2

Cleaning/inspection

The oil pump is supplied as a complete unit (i.e. cover, cogs and relief valve). Spare parts are however available for the relief valve.

Clean and inspect all parts. If in doubt, check tolerances, see below.



132 639

Specifications mm (in)

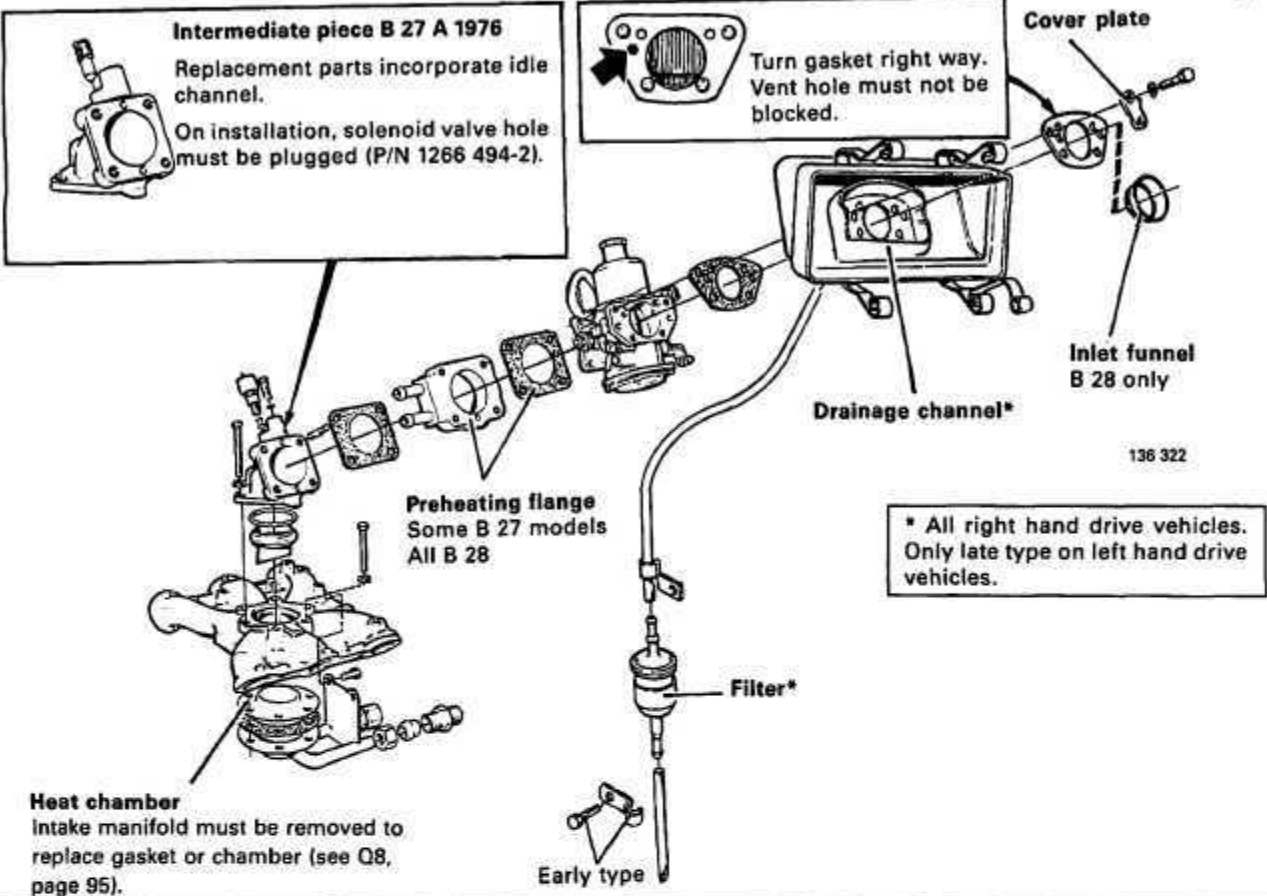
Axial clearance	0.025-0.084	0.0009-0.0033
Radial clearance between tooth top and pump housing (excluding bearing clearance)	0.110-0.185	0.0043-0.0072
Backlash (excluding bearing clearance)	0.17-0.27	0.0066-0.0106
Bearing clearance, drive shaft	0.015-0.053	0.0006-0.0021
idler shaft	0.015-0.051	0.0006-0.0020
Relief valve spring length		
unloaded	89.5	3.52
under load of 88.3 N (20 lbs.)	56.5-60.5	2.22-2.38

Group 25 Intake and exhaust systems

Intake manifold	Operation	Page
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Lambda-sond system		
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Installing pressure differential switch (B28F USA+Canada 1980-1981)	AG 1-10	136
Replacement of Lambda-sond	AH 1-2	139
Altitude adjustment (USA only)	AJ 1-4	140

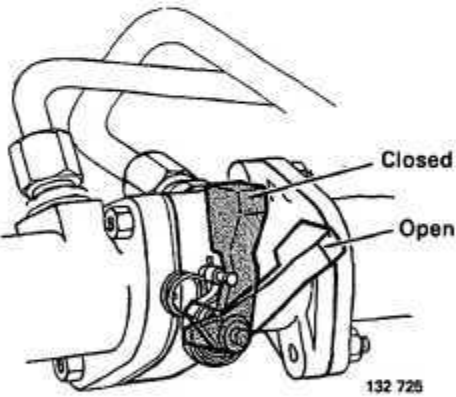
Q. Intake manifold B 27/28 A

Q1



Throttle housing

Q2



Checking

Ensure smooth operation of throttle and position of lever at different engine temperatures and speeds.

Closed = cold engine and at idle.

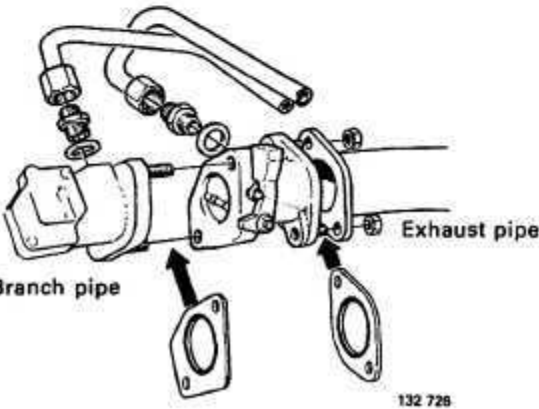
Open = warm engine at speeds above idle. Throttle opening depends on power output.

Q3

Replacement

The exhaust pipe must be disconnected from branch pipe to obtain access to throttle housing. Also necessary to unscrew mounting bracket near gearbox so that exhaust pipe can be guided to rear.

Use new gaskets when installing throttle housing. Install gasket with reinforced metal edge facing branch pipe and throttle housing respectively.



Q4

Removing intake manifold

Three working procedures for removing intake manifold are described below. Choose method which suits purpose of repair.

As a safety precaution, always disconnect battery before starting repair.

Q5

Installing intake manifold

Use new O-rings and gaskets. Tightening torque 10–15 Nm (7–11 ft.lbs.).

For connection of vacuum hoses see page 14.

After installation check/adjust:

- throttle controls
- idle speed and CO content.

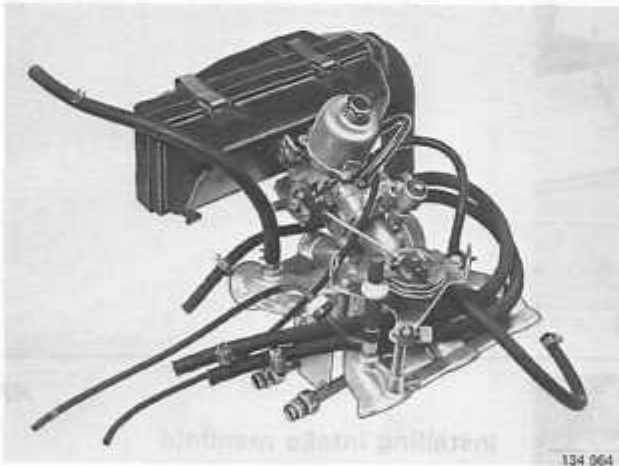


Q6

Method 1 Replacing O-rings

Disconnect intake manifold and lift it up slightly to obtain access to the O-rings.

Note! Tubes to Hot-spot must be disconnected from rear edge of intake manifold.



Q7

Method 2 In connection with removing cylinder heads

Intake manifold must be removed complete with carburettor.

It will be necessary to drain the coolant.



Q8

Method 3 Removing intake manifold e.g. when fitting a new Hot-spot gasket

Intake manifold can be removed without carburettor and intermediate section.

It is not necessary to drain the coolant.

R. Intake manifold B 27 E 1975–1978



R1

Removing intake manifold

Intake manifold must be removed with air-fuel control unit.

Disconnect battery prior to removal of manifold.

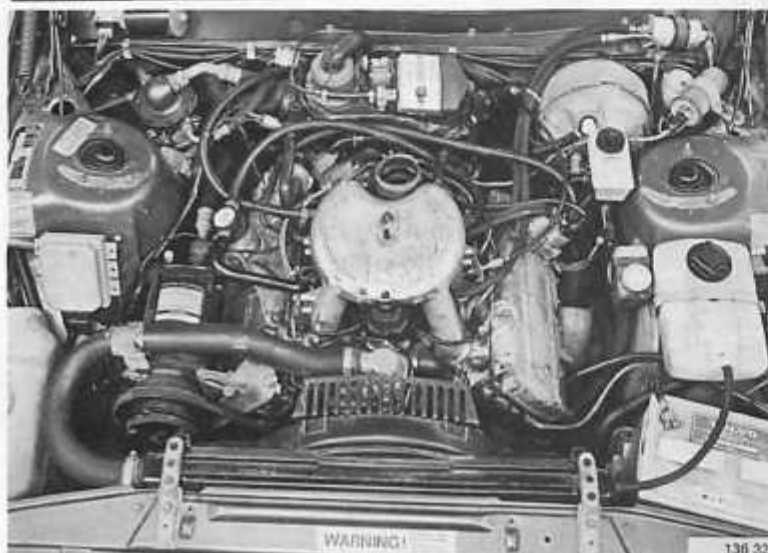
Clean all fuel line connections before disconnecting pipes.

Disconnect (move to one side) wires, hoses and cables, identify if and as necessary.

Place wiring harness on panel above radiator.

Detach clips retaining distributor cap.

Remove intake manifold.



R2

Installing intake manifold

Install new O-rings.

Tightening torque 10–15 Nm (7–11 ft.lbs.).

Re-connect wires, hoses and cables.

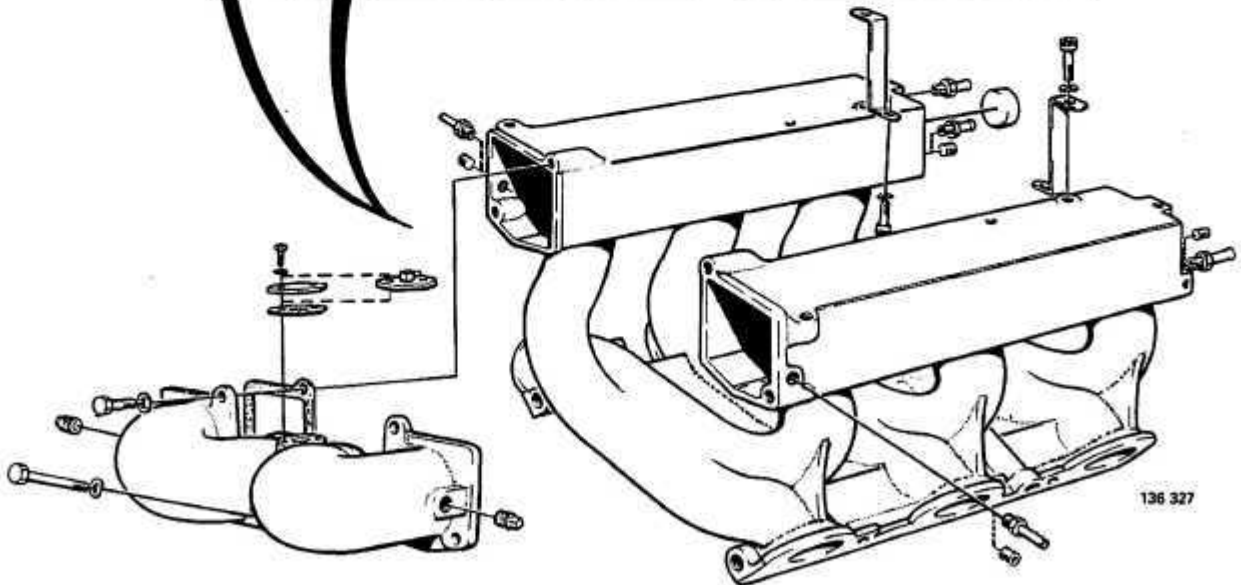
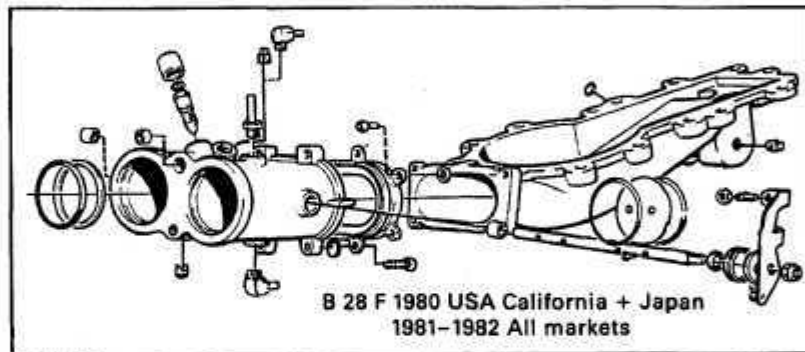
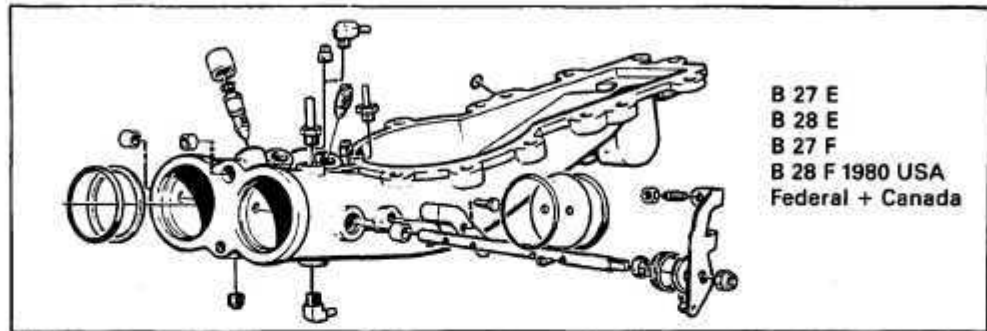
For connection of vacuum hoses, see page 14.

After installation, check/adjust:

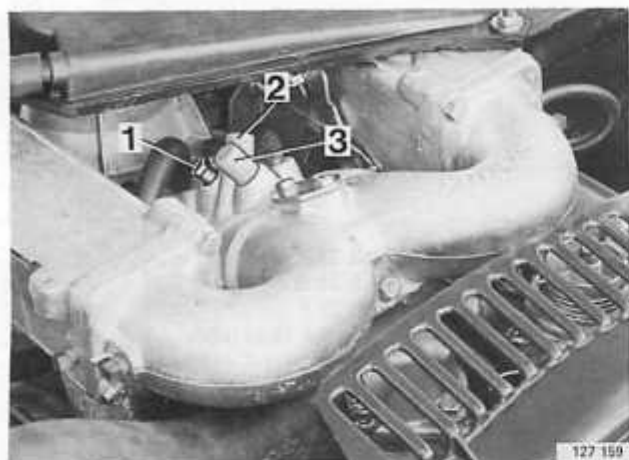
- throttle controls
- idle speed and CO content.

S. Intake manifold B 27 E 1979–1980, B 28 E, B 27/28 F

S1



Basic setting of balance screws



S2

Screws 2 and 3 are set at the factory and should not normally need to be adjusted.

They should however be adjusted if lower part of air flow sensor is replaced or if engine running is poor.

To adjust:

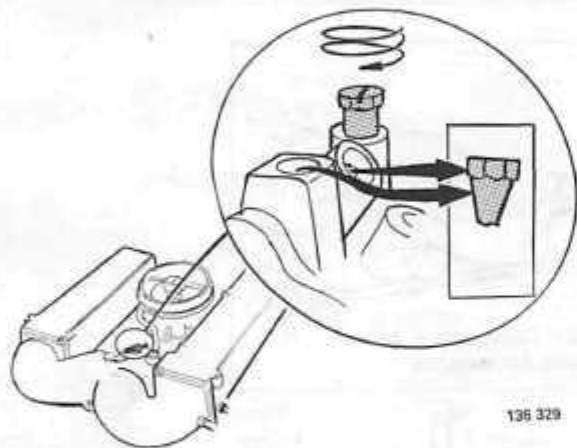
- screw in screws 2 and 3 fully.
- unscrew no. 2 for left bank (cylinders 1, 2, 3) 1 1/2 turns
- unscrew no. 3 for right bank (cylinders 4, 5, 6) 5.0 turns.

Note! B 28 F with constant idle speed system

Idle adjustment screw (1) must be screwed in fully.

Screws (2 and 3) must be tightened until the heads shear.

Failure to shear adjustment screw heads may contravene USA Federal laws.



Removing intake manifold



S3

Disconnect battery

S4

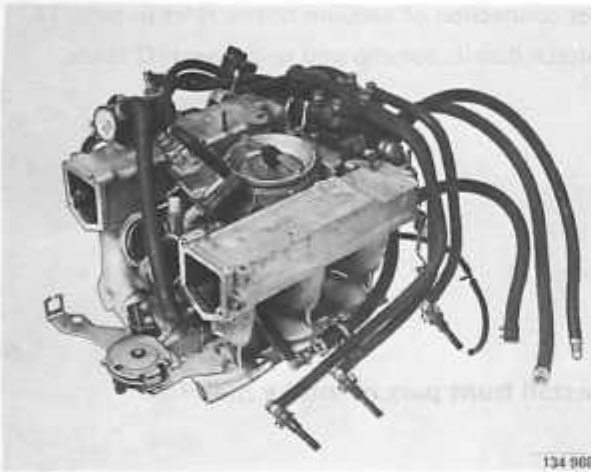
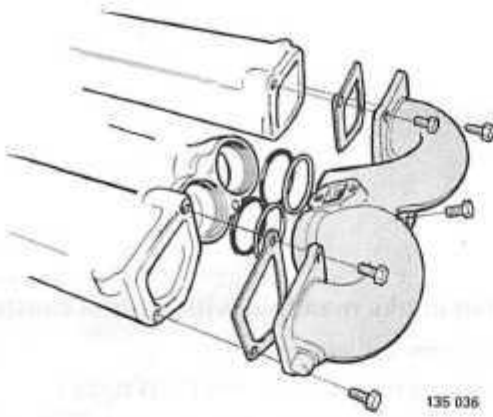
Detach distributor cap and disconnect HT leads

Detach both clips (arrowed).

If cap is not removed it may be damaged when intake manifold is removed/installed.

S5

Disconnect front part of intake manifold



S6

Detach intake manifold with air-fuel control unit

Move hoses and cables to one side, disconnect as necessary. Clean fuel line connections thoroughly before disconnecting pipes.

Detach wiring and place harness on top of radiator panel.

Remove intake manifold with air-fuel control unit.



B 28 F 1981

Installing intake manifold



S7

Install intake manifold with air-fuel control unit

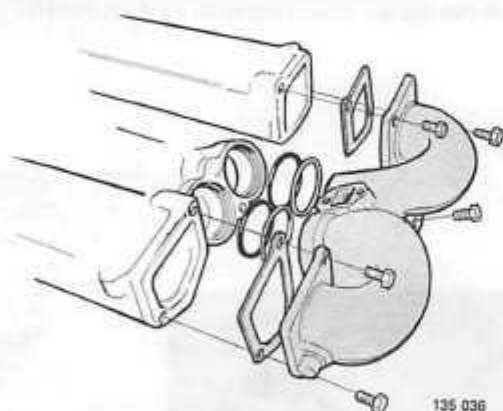
Install new O-rings.

Tightening torque 10–15 Nm (7–11 ft.lbs.).

Connect wires, hoses and cables.

For connection of vacuum hoses, refer to page 14.

Attach distributor cap and re-connect HT leads.



S8

Install front part of intake manifold

S9

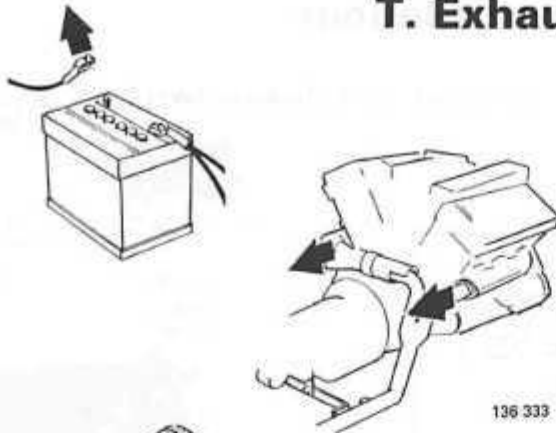
Check/adjust:

- throttle controls
- idle speed and CO content.

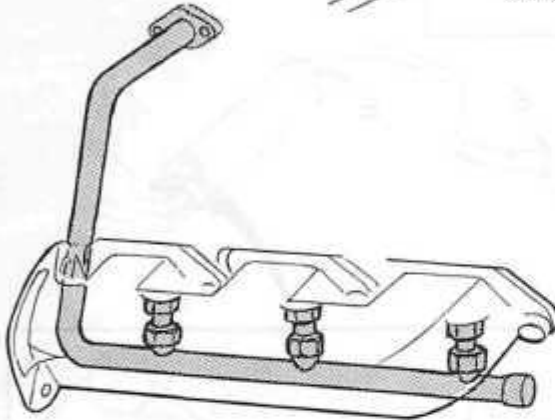


B 28 F 1981

T. Exhaust manifold



136 333



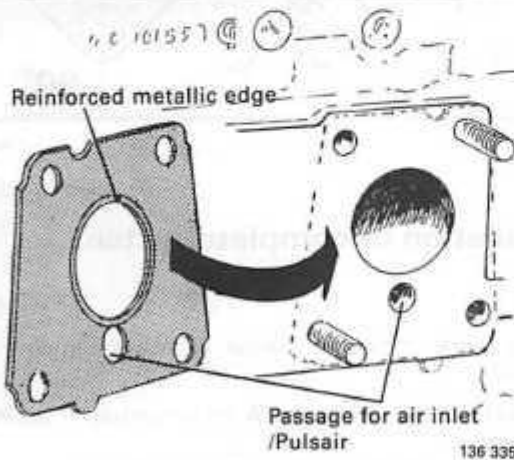
136 334

Removing/installing

T1

As a safety precaution disconnect one of battery leads. Exhaust system must be disconnected from **both** branch pipes before exhaust manifold can be removed. Also exhaust mounting near gearbox must be removed so that the exhaust pipe can be moved to rear to obtain access to branch pipes.

Branch pipe should be removed/installed with air inlet pipes or Pulsair system pipes in position (as applicable).



136 335

Gaskets

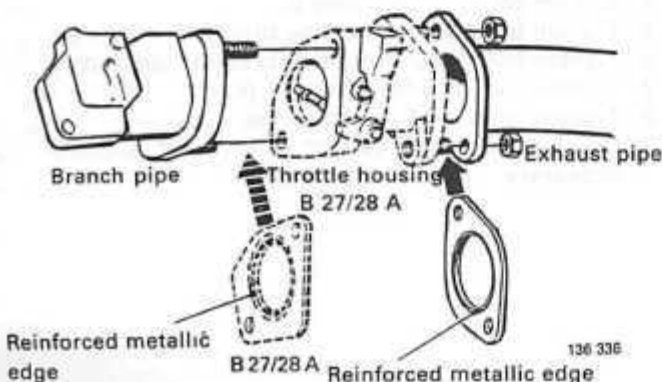
T2

Several different types of branch pipe gaskets are in use. Only late type, shown adjacent, is stocked by Parts Dept.

Gaskets are supplied in packs of three, and must be **separated by cutting** and not by folding, or damage may result.

Gaskets must be installed with reinforced metallic edge facing cylinder head.

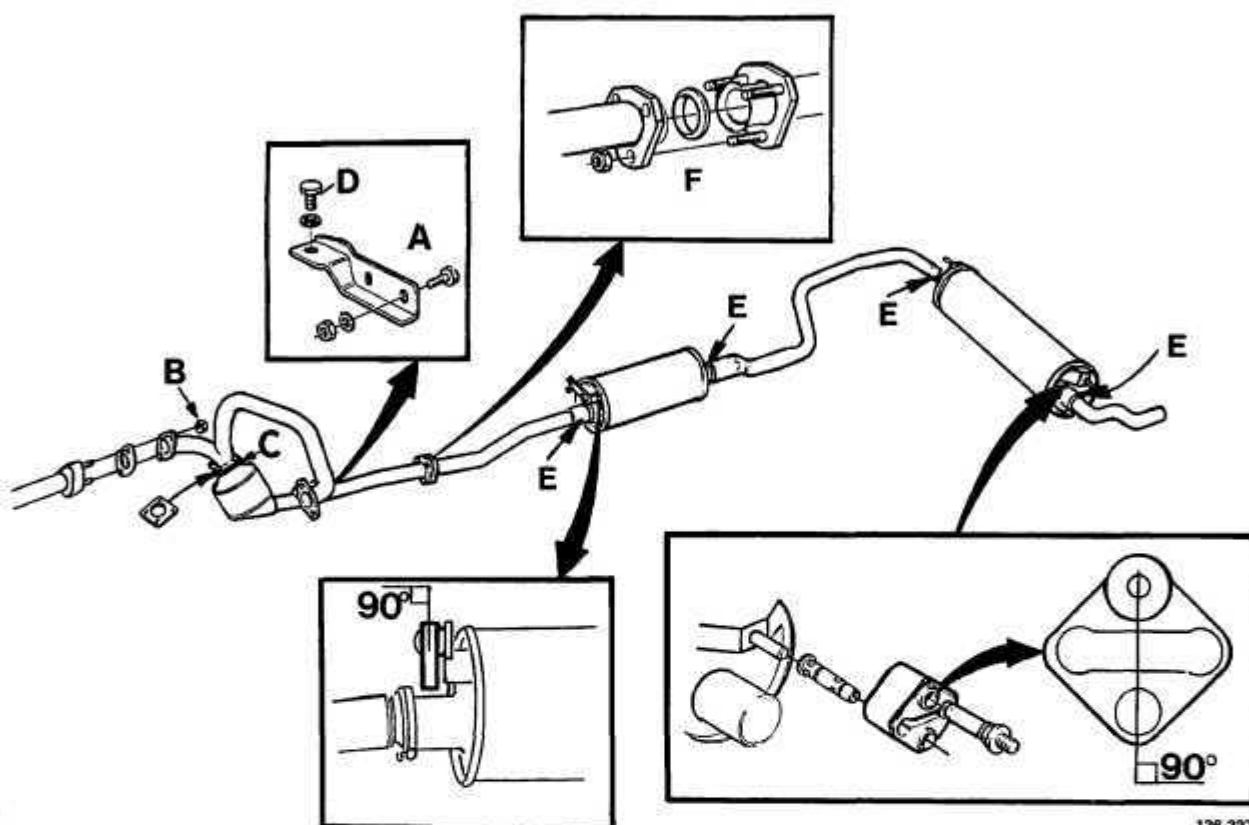
Gaskets between exhaust pipe and branch pipe must be installed with reinforced metallic edge facing branch pipe.



136 336

U. Exhaust pipe and silencer

Type of exhaust system installed depends on market and model year. Shown below is the exhaust system on B 28 F USA 1980.



General

U1

- Use new gaskets. Turn gasket metallic face against manifolds. Steel face with raised edge should be replaced only if damaged.
- Exhaust pipe should be inserted approx. 40 mm (1.6 in.) into silencer.
- Clearance between exhaust system and body should not be less than 20 mm (0.8 in.).

Installation of complete system

U2

Follow work sequence below to avoid tension in system.

1. Unscrew retaining bolts A on mounting bracket - gearbox.
2. Hang up and align complete exhaust system.
3. Tighten nuts B at front pipe - manifold.
4. Tighten catalytic converter C.
5. Tighten bolts D for mounting bracket - front pipe.
6. Tighten bolts A for mounting bracket - gearbox.
7. Tighten clamps E for silencer - pipe.
8. Tighten coupling F as applicable.
9. Check that system cannot strike body, adjust if necessary.

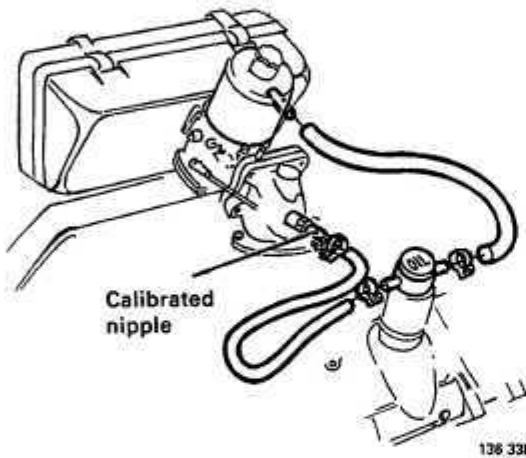
ERIG'S AUTO PARTS LTD.
1502 W. 2nd AVENUE
VANCOUVER, B.C. V6J 2G3
TELEPHONE 731-0111

V. Crankcase ventilation

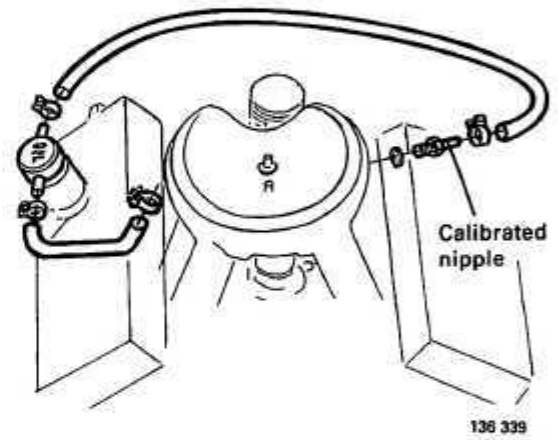
Cleaning/checking

V1

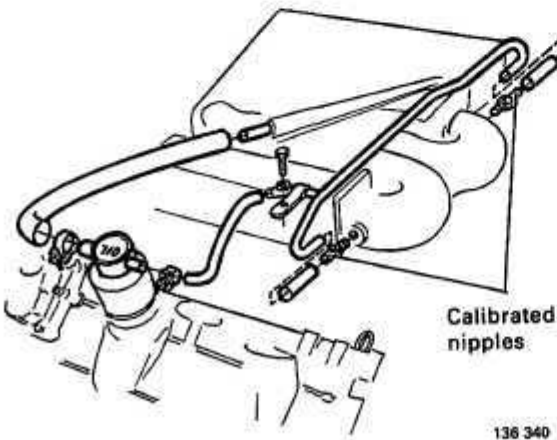
- clean/check all hoses
- clean calibrated nipple
- clean oil filler cap and clean/replace strainer as necessary.



B 27/28 A

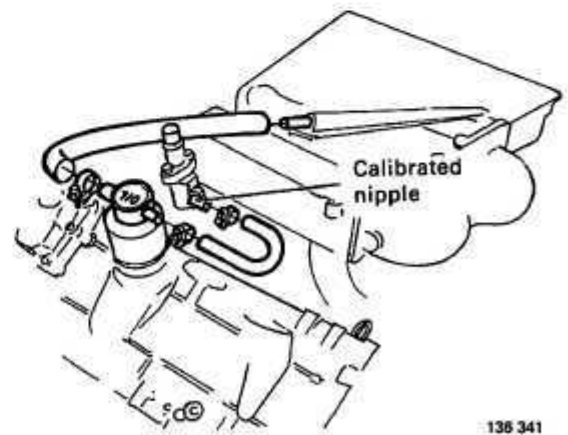


B 27 E 1975-1978



B 27 F 1976-1978

Note! Modified crankcase ventilation system may be fitted on some models, see B27F 1979.

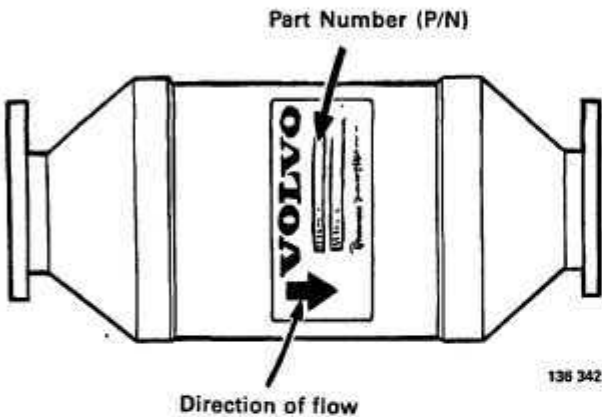


B 27 E 1979-1980

B 27 F 1979

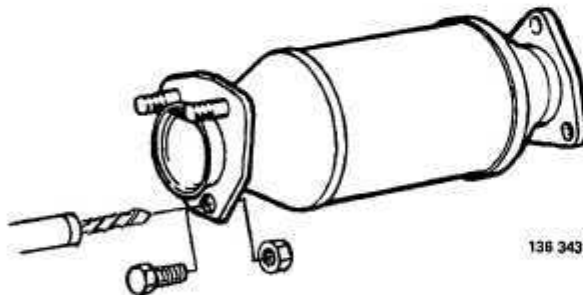
B 28 E/F

X. Catalytic converter



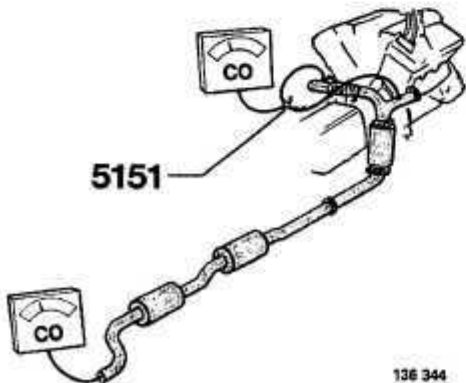
X1

Type of catalytic converter fitted to vehicle depends on engine type, year model and market. Direction of flow and part number are indicated on converter.



X2

Some converters are attached to exhaust system by pin studs and it is not necessary to replace converter if one of studs is damaged. In such cases drill out damaged stud and install nut and bolt.

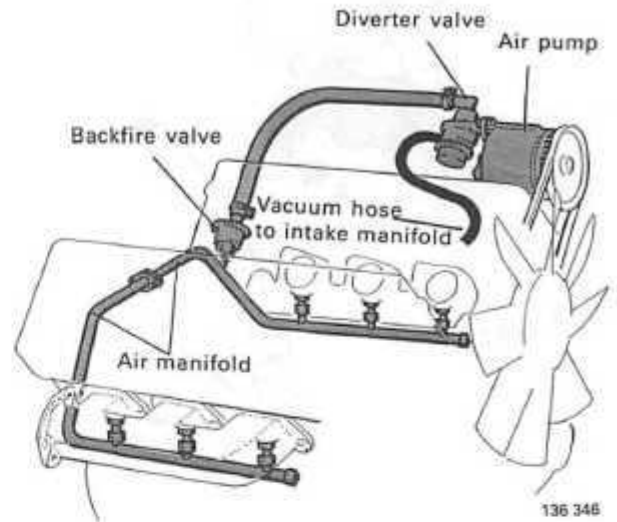
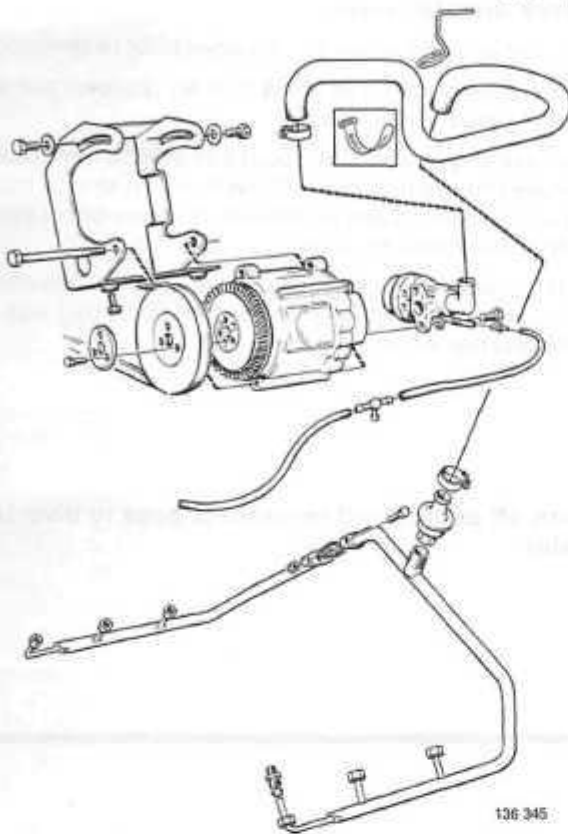


X3

Efficiency of catalytic converter can be checked by recording and comparing CO level before and after converter.

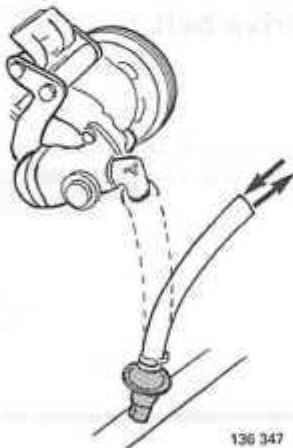
Y. Air pump

Y1



IMPORTANT

- Air pump must not be lubricated or dismantled but instead replaced if defective.
- Never plug or obstruct the diverter valve outlet since this can cause severe damage to air pump.



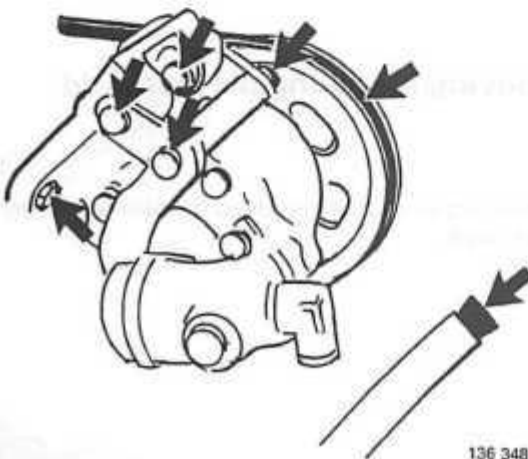
Checking air injection system

Operations Y2-5

Y2

Check backfire valve

Disconnect hose from diverter valve and check function of backfire valve by alternately blowing and sucking on hose.



Y3

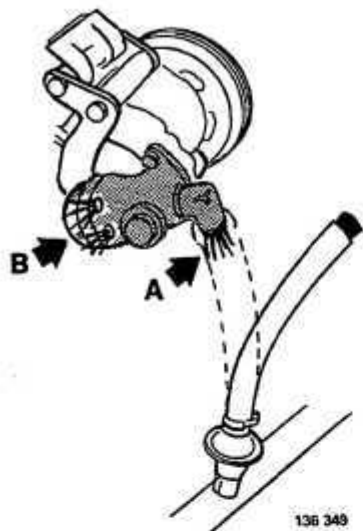
Check air pump attachment and drive belt

Check drive belt for cracks, wear, etc.

Check security of air pump.

Plug end of diverter valve hose (safety precaution) and start engine. Pump operates noisily especially when cold.

Y4



Check diverter valve

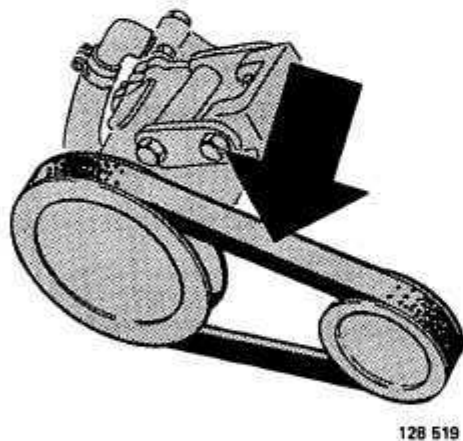
Diverter valve hose must be plugged prior to checking. Run engine at idle and check that air is blown out of port (A) on diverter valve.

Increase engine speed to about 50 r/s (3500 r/min) and release throttle quickly. Air flow from (A) should stop for a few seconds and air should be blown out of vent holes (B) on side of valve.

If incorrect, check vacuum hose between diverter valve and engine intake manifold before testing with a new diverter valve.

Y5

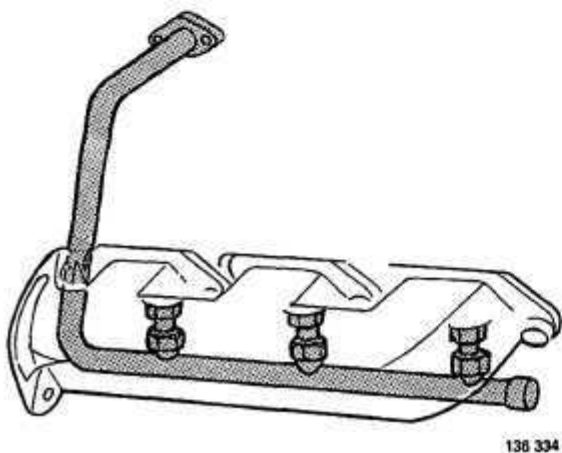
Turn off engine and re-connect hose to diverter valve



Replacing drive belt

Y6

If drive belt has snapped check function of backfire valve. (A defective valve can cause belt to break off.)



Removing/installing air manifold

Y7

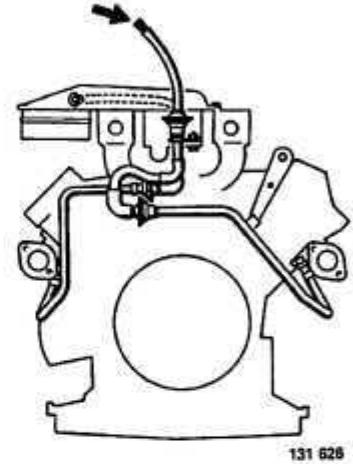
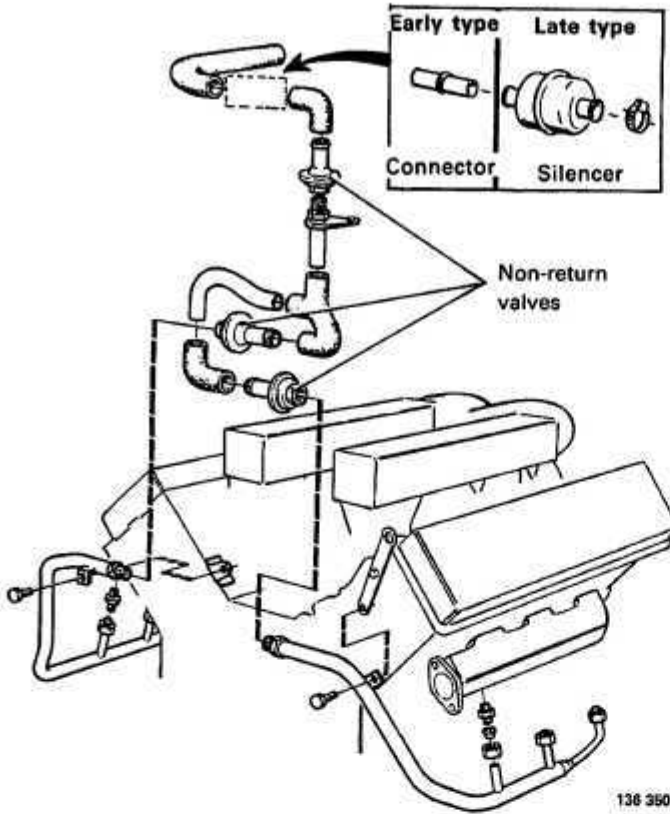
Air manifold should be removed/installed attached to branch pipe.

Z. Pulsair system

General

Z1

Disconnect and plug connections of Pulsair system before checking/adjusting CO content otherwise results will be false.



Checking Pulsair system

Z2

Check:

- security of all connections
- hoses for leaks.

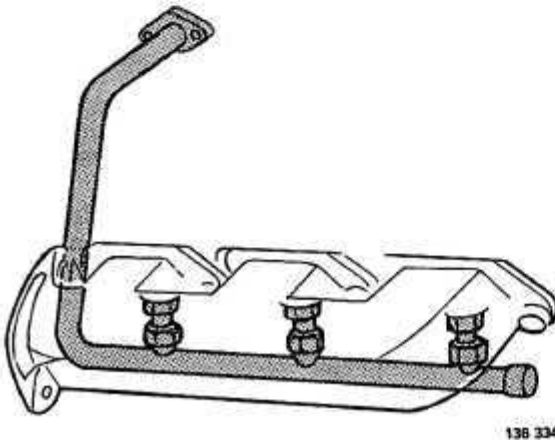
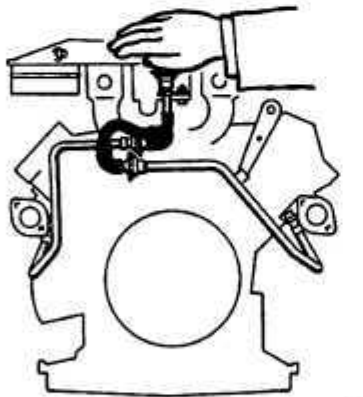
Z3

Check non-return valves

Disconnect hoses from upper non-return valve.

Start engine and hold hand above valve. It should be possible to feel air being drawn into system and that no exhaust gases are leaking.

Next check remaining two valves in same way.



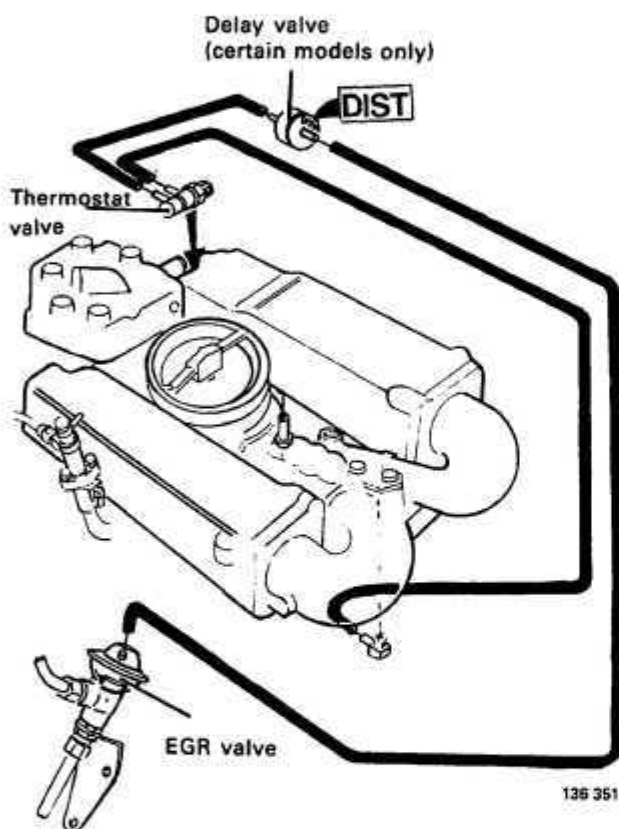
Removing/installing air manifold

Z4

Air manifold should be removed/installed attached to branch pipe.

AA. Exhaust gas recirculation (EGR)

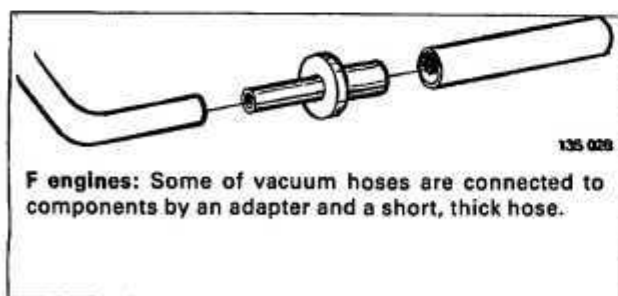
ON/OFF system



AA1

EGR system is fitted on following engines:

- B 27 F 1976 automatic Canada and USA Federal
1977 automatic Canada
- B 27 E 1980 Sweden and Australia
- B 28 E 1981-1982 Sweden and Australia



Cleaning EGR system

AA2

See instructions on page 117.

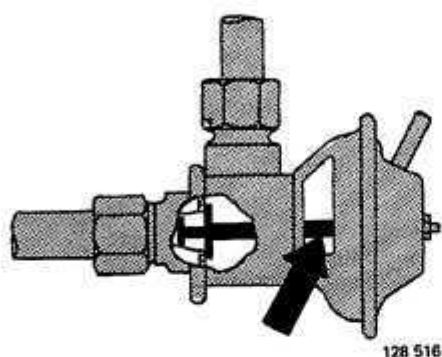
Adjusting dashboard indicator lamp

AA3

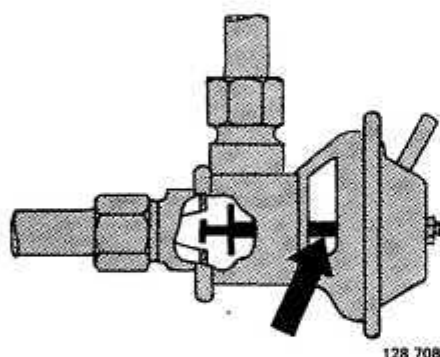
F engines only

See instructions on page 117.

Function check



Closed



Open

AA4

EGR valve should only open at part throttle with warm engine. To check function of valve, observe movement of link rod at different engine rpm and temperatures. An open valve will cause erratic idling and possibly stall the engine.

AA5

Check that EGR valve:

- is closed at all engine rpm with cold engine, i.e., coolant temperature **below 55°C (130°F)**
- opens at part throttle with warm engine, i.e., coolant temperature **above 60°C (140°F)**.
Vehicles with delay valve: EGR valve opens approx. 2 seconds after engine is accelerated.
- closes when engine speed drops to idle.

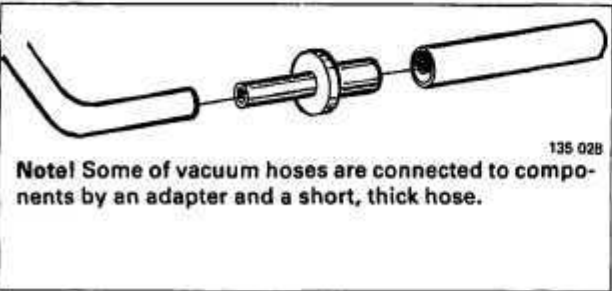
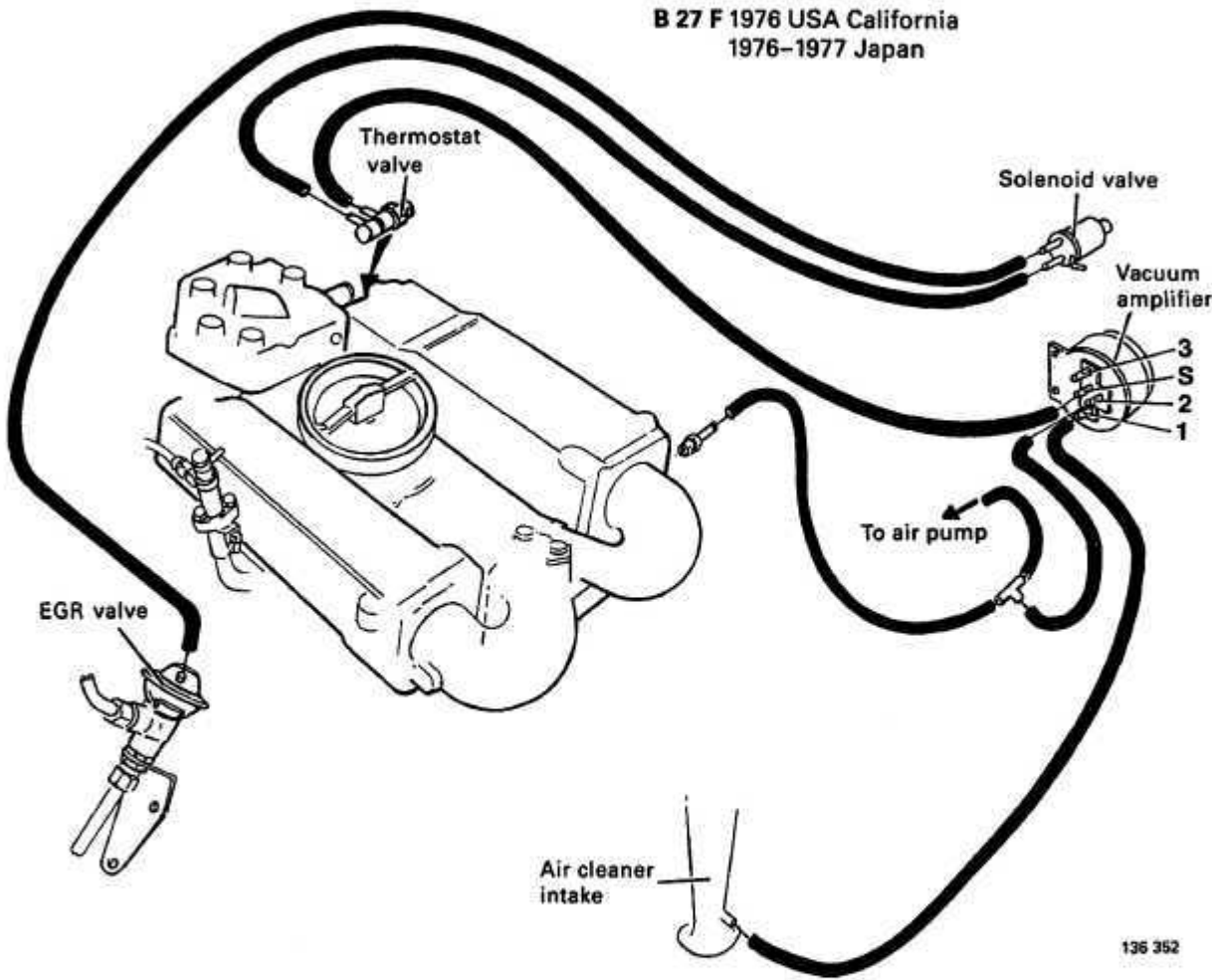
AA6

FAULT SYMPTOM	PROBABLE CAUSE/REMEDY
EGR valve opens when engine cold (coolant below 55°C = 130°F)	Defective thermostat valve. Replace. Thermostat valve must open at 55–60°C (130–140°F)
EGR valve does not open at part throttle with warm engine (coolant temperature above 60°C = 140°F)	Vacuum hoses defective, kinked or incorrectly connected. Thermostat valve does not open. Test by removing vacuum hose from EGR valve and blowing through hose into valve. Note! On vehicles with delay valve, disconnect hose after valve and check as above. EGR valve seized. Clean/replace valve.
EGR valve does not close when engine rpm drops to idle	EGR valve seized. Clean/replace valve.

AB. Exhaust gas recirculation (EGR)
STEPLESS system, type 1

AB1

This system is fitted to following engines:
B 27 F 1976 USA California
1976-1977 Japan



Cleaning EGR system

AB2

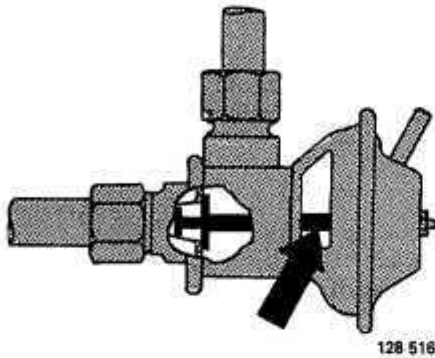
See instructions on page 117.

Adjusting dashboard indicator lamp

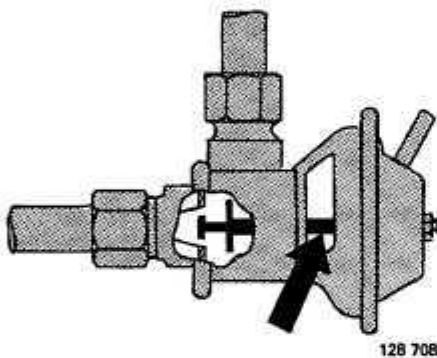
AB3

See instructions on page 117.

Function check



Closed



Open

AB4

EGR valve should only open at part throttle with warm engine. To check function of valve, observe movement of link rod at different engine rpm and temperatures.

An open valve will cause erratic idling and possibly stall the engine.

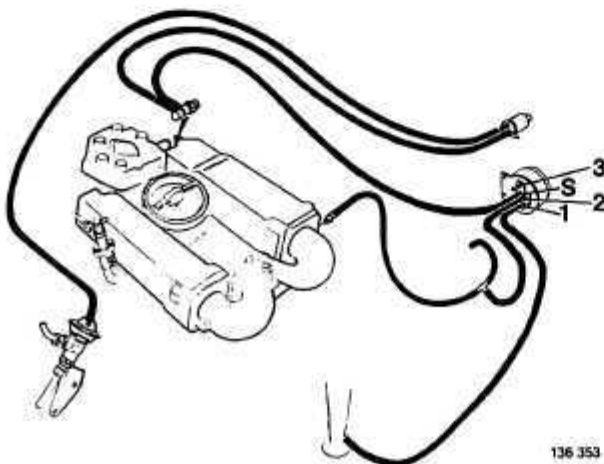
AB5

Check that EGR valve:

- is closed at all engine rpm with cold engine, coolant temperature **below 55°C (130°F)**.
If valve opens, thermostat is defective. Thermostat valve should open at 55–60°C (130–140°F).
- is closed at idle with warm engine and opens at part throttle with warm engine coolant temperature **above 60°C (140°F)**.
If defective, see fault tracing, AB6–12.
- closes quickly when engine rpm drops to idle. If valve does not close or closes slowly, solenoid valve is blocked or EGR valve has seized.

Fault tracing Defective EGR system with warm engine

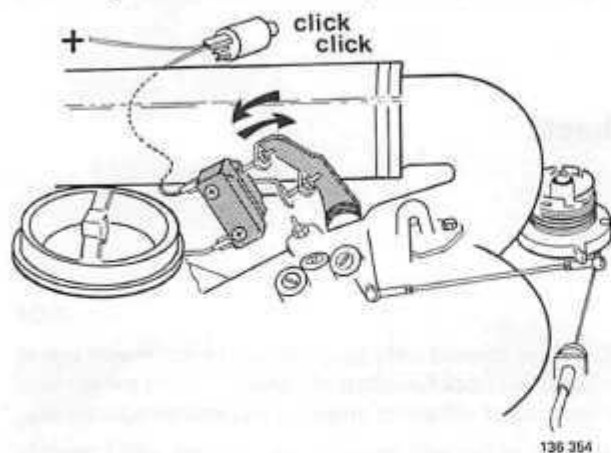
Operations AB6–12



AB6

Check all hoses and connections

Make sure that vacuum hoses are correctly connected and not kinked, damaged, etc.



AB7

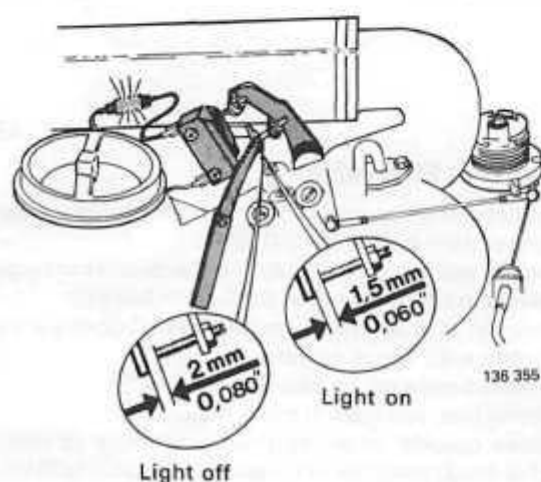
Check microswitch and solenoid valve

Turn on ignition.

Press microswitch to make/break circuit to solenoid. A click should sound from solenoid.

If incorrect, check:

- microswitch ground
- current supply to solenoid
- wire between microswitch and solenoid.



AB8

Check microswitch adjustment

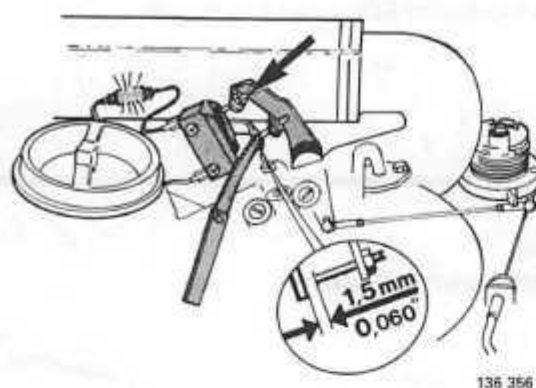
Connect a test lamp between microswitch and wire to solenoid.

Ignition should be on.

Place a 1.5 mm (0.06 in) feeler gauge between stop screw and boss. Test lamp should **light up**.

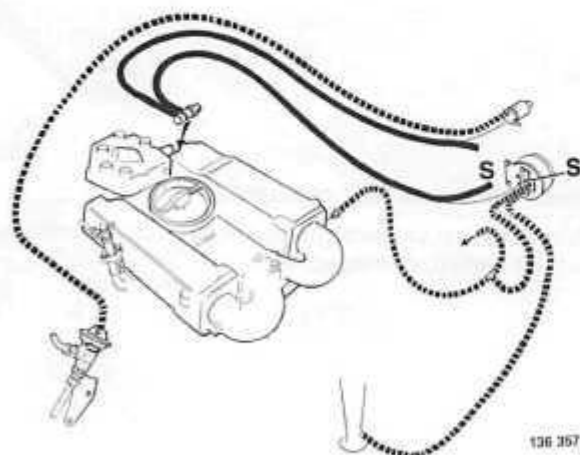
Change to a 2 mm (0.08 in) feeler gauge and check that test lamp is **off**.

Switch off the ignition.



Adjusting microswitch:

- place a 1.5 mm feeler gauge between stop screw and boss.
- slacken lock nut and unscrew **upper** stop screw until test lamp goes out
- screw in stop screw until lamp just lights. Tighten lock nut
- check adjustment according to AB8.



AB9

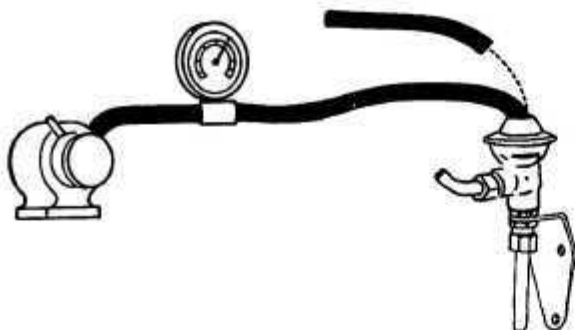
Check thermostat valve

Disconnect thermostat valve hoses from 'S' on vacuum amplifier and from solenoid valve.

Blow through valve to check that it is open. **Note!** Engine must be warm, i.e., above 60°C (140°F).

Re-connect hose to solenoid valve.

AB10



136 358

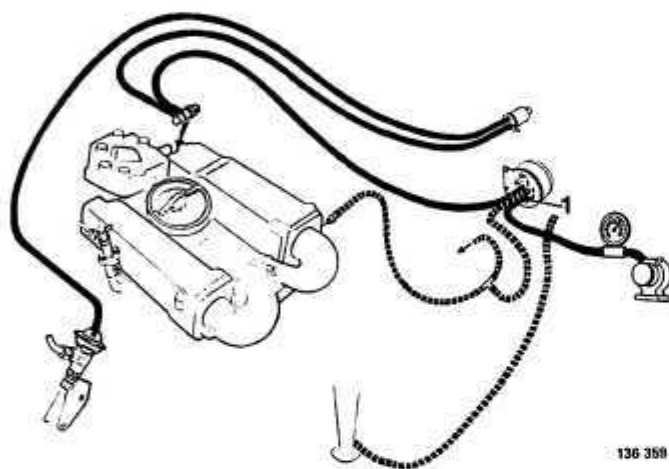
Check EGR valve

Disconnect vacuum hose from valve.

Connect hose to a vacuum pump and switch pump on. Valve should open.

Re-connect hose.

AB11



136 359

Check vacuum amplifier and solenoid valve

Start engine and run at idle.

Disconnect hose from connection 1 on vacuum amplifier.

Connect a vacuum pump to connection 1.

Switch on pump and check function of EGR valve.

Valve should be closed when engine idles. If valve opens solenoid valve is defective.

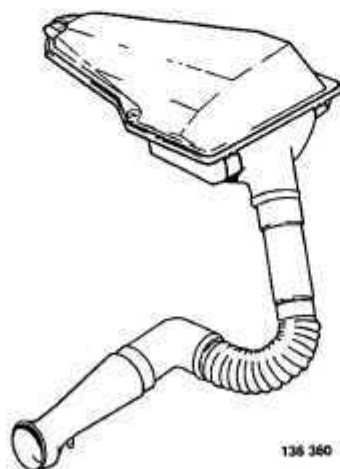
Check for leaks in vacuum amplifier and hoses by checking that pump gauge reading remains stable for at least 10 seconds.

Increase engine rpm and check that valve opens. If not, solenoid valve or vacuum amplifier is defective.

Turn off engine.

Disconnect vacuum pump and re-connect hose to vacuum amplifier.

AB12



136 360

Check air filter inlet

Check that air inlet is leakproof. Leaks would cause too low a depression at venturi end of inlet.

Check air filter, inlet hose and filter cartridge.

AC. Exhaust gas recirculation (EGR)

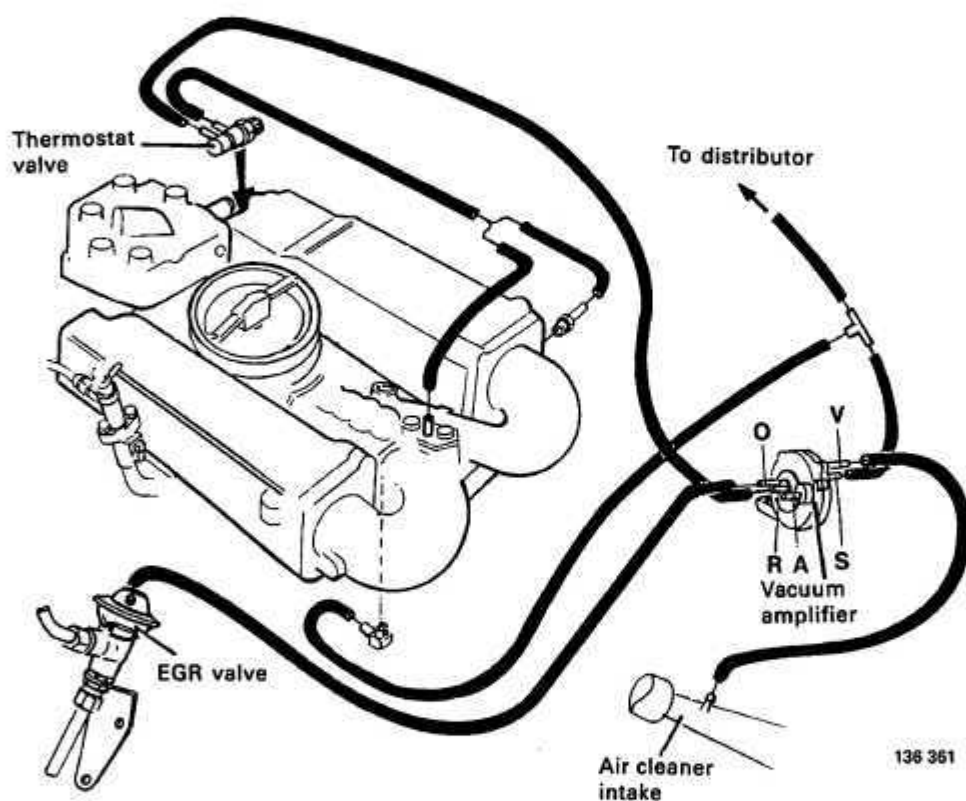
STEPLESS system, type 2

AC1

This system is fitted to following engines:

B 27 F 1977 USA Federal and California

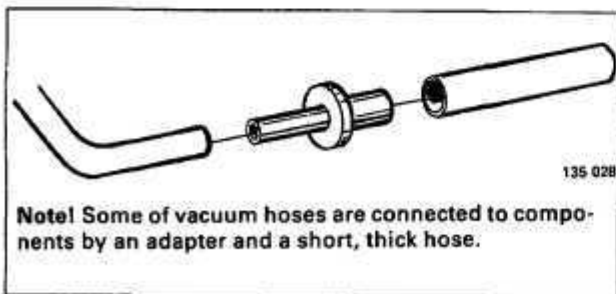
B 27 E 1979 Sweden and Australia



Cleaning EGR system

AC2

See instructions on page 117.



Note! Some of vacuum hoses are connected to components by an adapter and a short, thick hose.

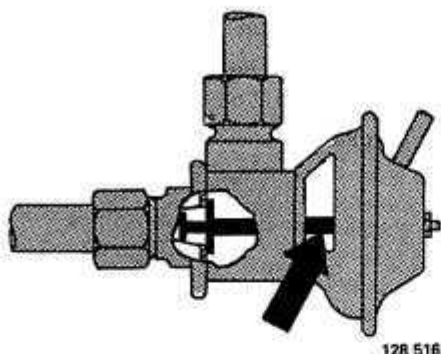
Adjusting dashboard indicator lamp

AC3

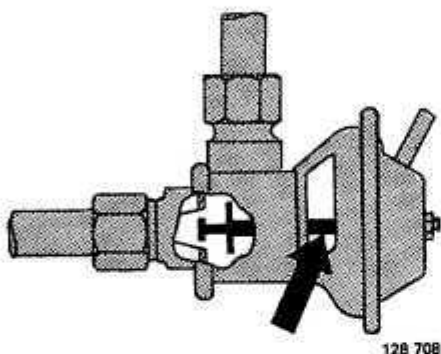
F-engines only

See instructions on page 117.

Function check



Closed



Open

AC4

EGR valve should only open at part throttle with warm engine. To check function of valve, observe movement of link rod at different engine rpm and temperatures.

An open valve will cause erratic idling and possibly stall the engine.

AC5

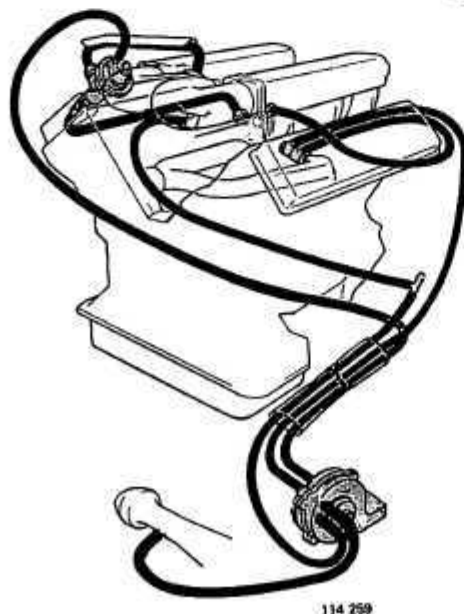
Check that EGR valve:

- is closed at all engine rpm with cold engine, coolant temperature **below 55°C (130°F)**.
If valve opens, thermostat is defective. Thermostat valve should open at 55–60°C (130–140°F)
- is closed at idle with warm engine and opens at part throttle with warm engine
coolant temperature **above 60°C (140°F)**.
If defective, see fault tracing, AC6–10.
- closes quickly when engine rpm drops to idle. If EGR valve does not close disconnect hose from valve and re-check. If valve still does not close vacuum amplifier is probably defective. Re-test with a new vacuum amplifier. If valve still does not close it has probably seized and should be cleaned/replaced as necessary.

Fault tracing

Defective EGR system with warm engine

Operations AC6–10



AC6

Check all hoses and connections

Make sure that vacuum hoses are correctly connected and not kinked, damaged, etc.

Also check vacuum hoses which are indirectly connected to system, e.g. to distributor.



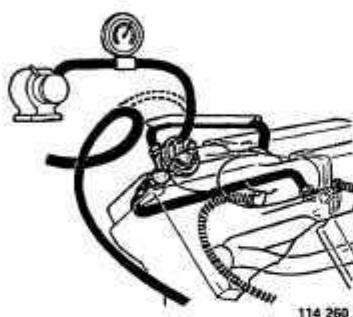
AC7

Check thermostat valve

Disconnect thermostat valve hoses from intake manifold and connection 'R' on vacuum amplifier.

Blow through valve to check that it is open. **Note!** Engine must be warm, i.e., above 60°C (140°F).

Re-connect hoses.



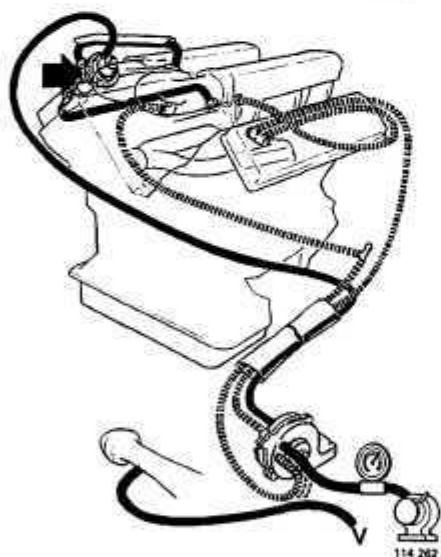
AC8

Check EGR valve

Disconnect vacuum hose from valve.

Connect hose to a vacuum pump and switch pump on. Valve should open.

Re-connect hose.



AC9

Check vacuum amplifier

Disconnect vacuum hose marked "V" from vacuum amplifier.

Start engine and run at idle.

Connect a vacuum pump to vacuum amplifier connection 'V' and start pump. EGR valve should open if vacuum amplifier is functioning correctly.

Turn off engine and re-connect hose 'V'.



AC10

Check air filter inlet

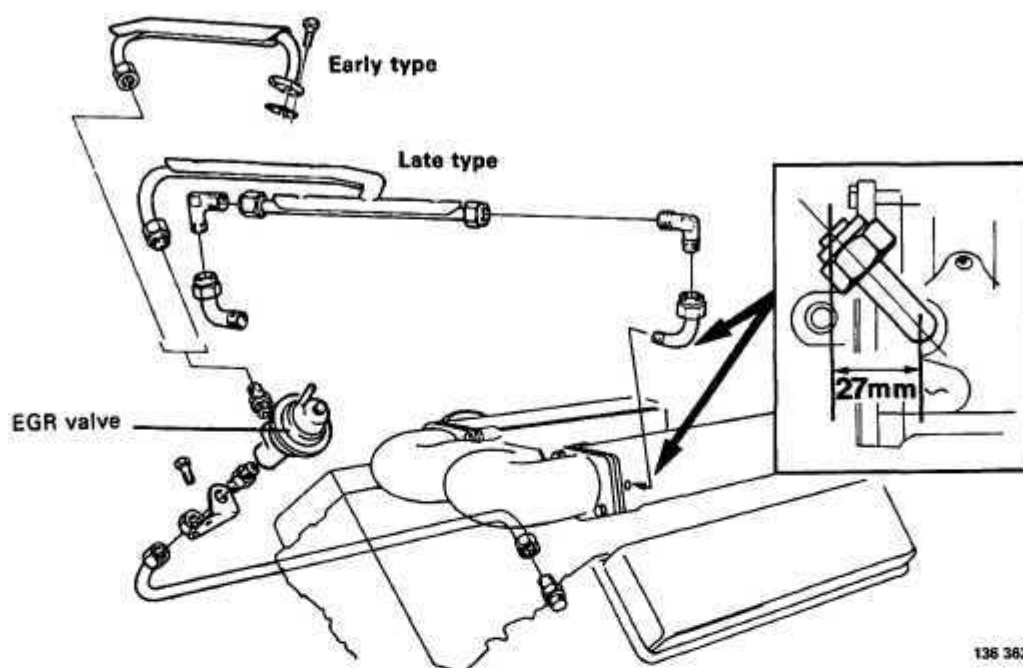
Check that air inlet is leakproof. Leaks would cause too low a depression at venturi end of inlet.

Check air filter, inlet hose and filter cartridge.

AD. Cleaning of exhaust gas recirculation system

(Applies to all EGR systems)

AD1



136 362

To clean EGR system, tap all parts lightly with a soft mallet to remove carbon deposits.

Remove dirt from channels and nipples with a screwdriver and blow parts clean with compressed air.

Special care should be taken to ensure that valve seat in EGR valve is free from carbon.

F engines: dashboard indicator lamp should be adjusted after cleaning system.

B 27 F 1976 USA California and 1976-1977 Japan: microswitch must be adjusted when system is cleaned, see page 112 operation AB8.

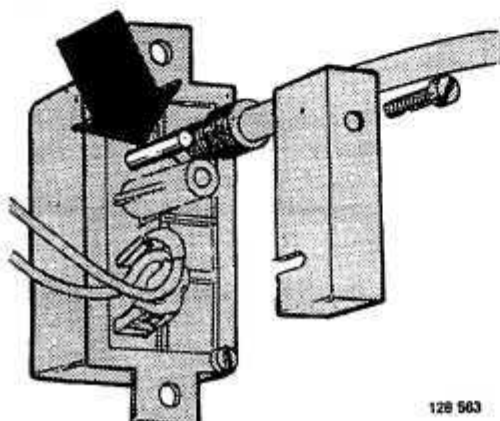
IMPORTANT

- Do not clean EGR valve in detergent since diaphragm is easily damaged.
- Hold EGR valve in hand when cleaning and not in a vice.

AD. Adjusting dashboard indicator lamp

F engines only

AD2



128 563

Indicator lamp will light each time the exhaust gas recirculation system is due for service.

Lamp is actuated by a switch connected to car odometer and mounted on back of speedometer.

To zero switch, remove cover (shown adjacent) and depress white push button (arrowed).

Re-fit cover after adjustment.

AE. Installing new type pipes on exhaust gas recirculation system

B 27 E 1979–1980 and B 28 F 1976–1978

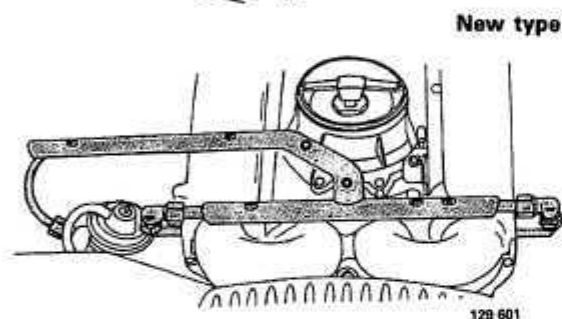
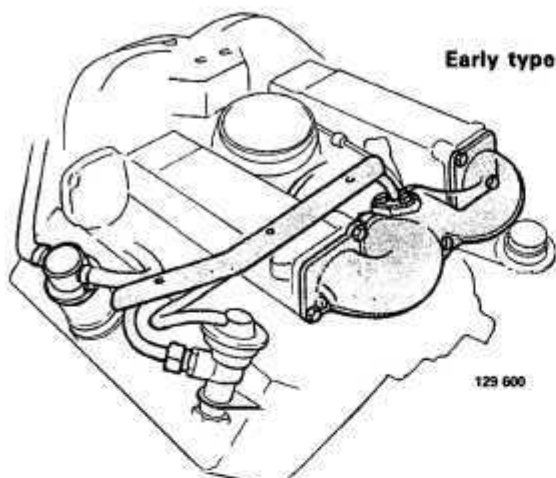
General

AE1

A new type of EGR pipe was introduced into production for 1980 models. It can also be fitted as a replacement part to vehicles built before 1980.

Improved distribution of recirculated exhaust gases between cylinders is obtained with new type pipe. This improves running at extremely low temperatures ($-30^{\circ}\text{C} = -22^{\circ}\text{F}$).

If engine runs poorly at $-30^{\circ}\text{C} (-22^{\circ}\text{F})$, radiator blinds should be fitted. If this does not help, replace EGR pipe with new type. Note! Crankcase ventilation system must be modified slightly on B 27 F models when installing new type pipe.

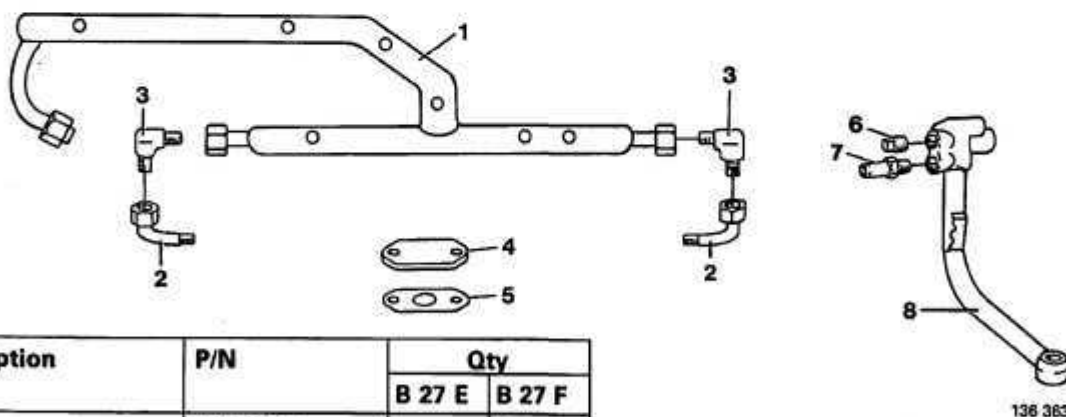


Replacing EGR pipes:

B 27 E 1979–1980 page 119
B 27 F 1976–1978 page 121

Parts required to install new type EGR pipe

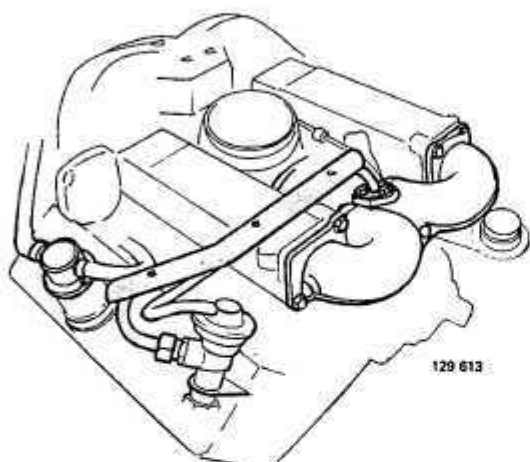
AE2



No.	Description	P/N	Qty	
			B 27 E	B 27 F
1	Pipe	1274332-4	1	1
2	Nipple	1274334-0	2	2
3	Elbow nipple	1274504-8	2	2
4	Cover plate	269377-8	1*	1
5	Seal	464517-2	1	1
6	Plug	952069-3	—	1
7	Nipple	1269487-9	—	1
8	Start injector pipe	1269485-3	—	1

* Only B 27 E 1980 without AC. For other models use cover plate 1306596-6 + nipple 947559-1.

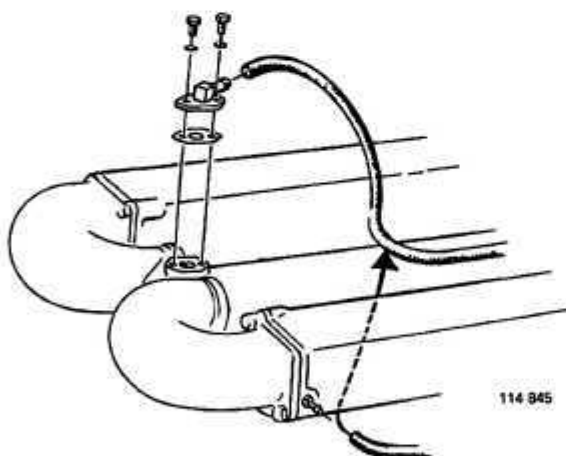
Installing new type pipes on exhaust gas recirculation system B 27 E 1979-1980



AE3

Remove:

- air filter
- pipe between EGR valve and intake manifold.



AE4

B 27 E 1980 without AC

Install gasket and cover plate on intake manifold

Install cover plate without nipple.

B 27 E 1980 with AC and 1979

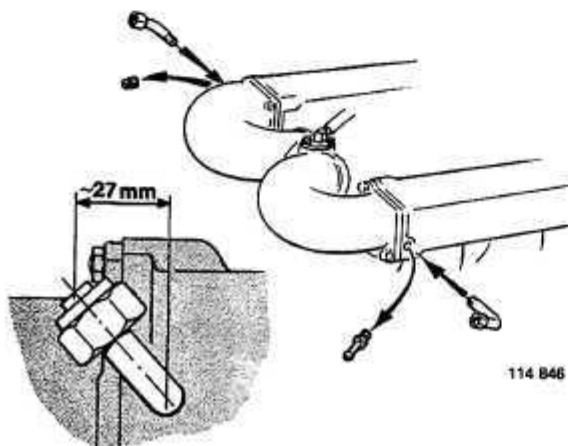
AE5

Install gasket and cover plate on intake manifold

Install cover plate with nipple pointing to rear.

Connect vacuum hose to new nipple.

Note! Route hose along inside of intake manifold right bank.

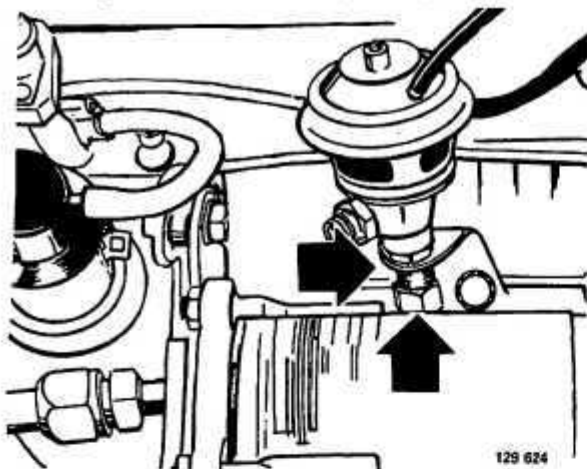


AE6

Install elbow nipples in intake manifold

Remove nipple and plug from intake manifold.

Screw in elbow nipples approx. 6 turns until position shown adjacent is obtained (finer adjustments will be made later when EGR pipe is attached).



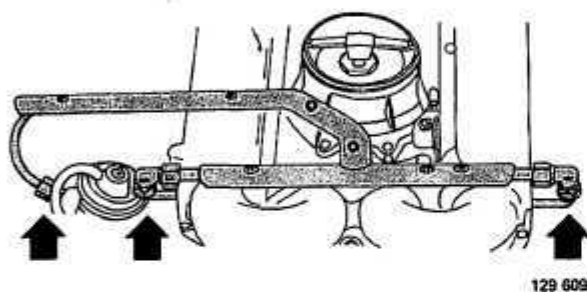
AE7

Unscrew EGR valve

EGR valve must be unscrewed slightly before pipe can be attached.

Slacken nut on pipe from exhaust manifold.

Secure hose with clips.



AE8

Assemble new pipe and elbow nipples

Tighten unions by hand.

AE9

Install pipe

Tighten unions by hand.

Check that pipe does not contact intake manifold, adjust if necessary.

Tighten all unions; EGR valve retaining nuts last.

AE10

Check that hoses do not contact pipe

Clamp hoses where necessary.

AE11

Install air filter

AE12

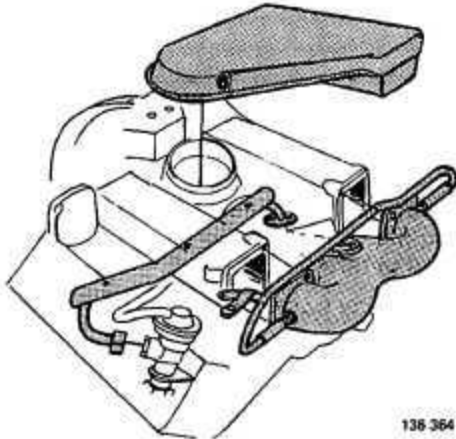
Check operation

Start engine and run to normal operating temperature. Check for leakage.

Installing new type pipes on exhaust gas recirculation system

(Includes modification of crankcase ventilation system)

B 27 F 1976-1978

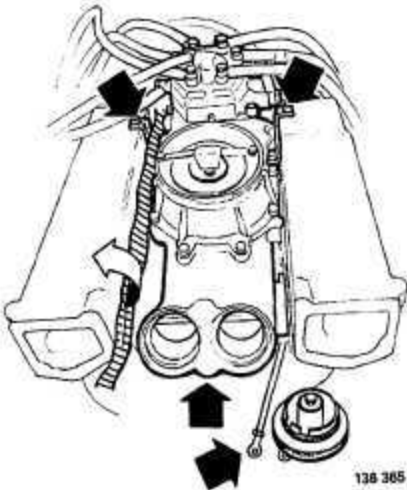


138 364

Remove:

- air filter
- pipe between EGR valve and intake manifold
- crankcase breather pipe
- front part of intake manifold.

AE13



138 365

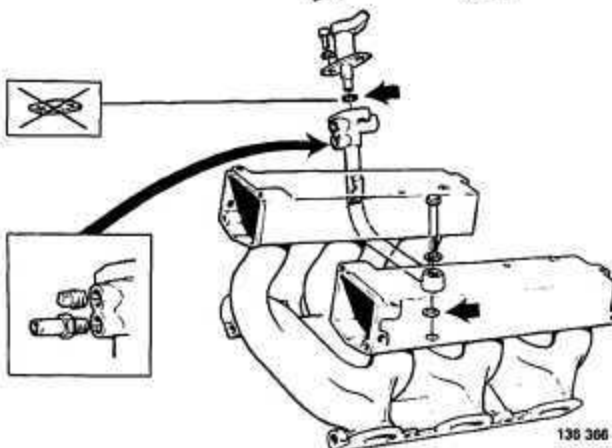
Clear parts, wires, etc. from air-fuel control unit to obtain access to start injector pipe

Remove retaining screws, arrowed (2x) and link rod from throttle pulley.

Unclamp wiring harness and place it to right of intake manifold.

Lift up front section of air-fuel control unit slightly, making sure that pipe from auxiliary air valve does not detach from air-fuel control unit.

AE14



138 366

Replace pipe for start injector

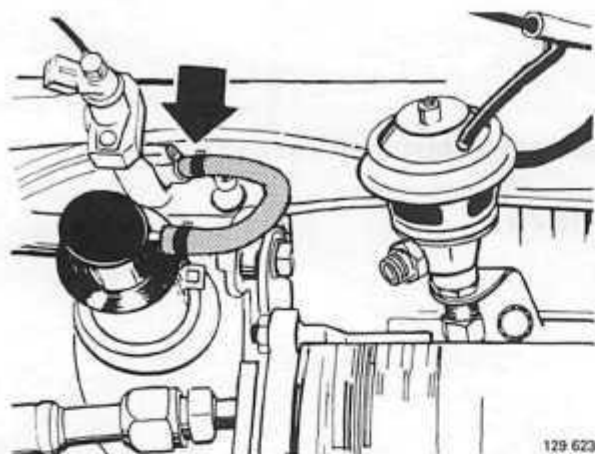
Transfer parts to new pipe.

Place plug in upper hole in pipe.

Check/replace O-rings.

Note! On some vehicles a gasket has been fitted between start injector and pipe. This gasket should be replaced with an O-ring.

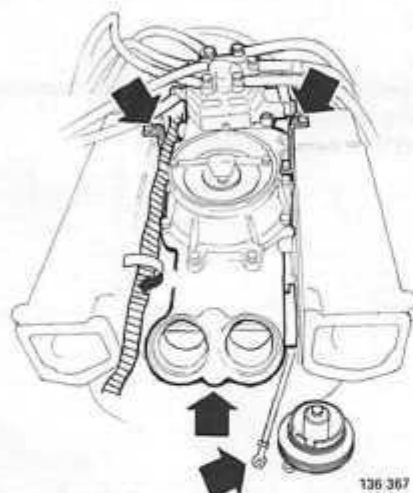
AE15



AE16

Connect hose for crankcase ventilation

Connect hose to nipple on pipe for start injector.
Secure hose with clips.

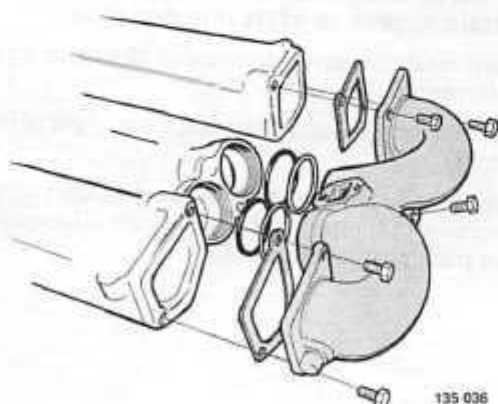


AE17

Install:

- retaining screws for air-fuel control unit
- wiring harness, re-clamp
- link rod to throttle pulley.

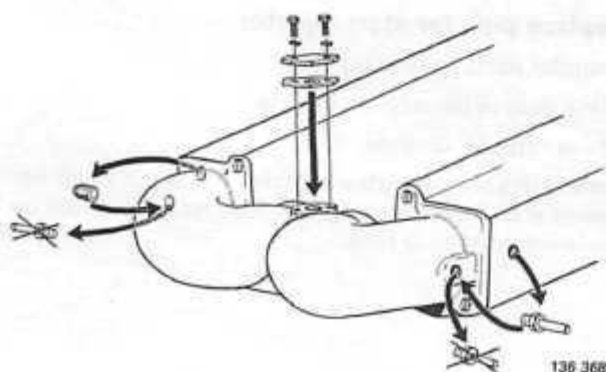
Check that pipe from auxiliary air valve is still in position.



AE18

Install front part of intake manifold

Install new O-rings and gaskets.



AE19

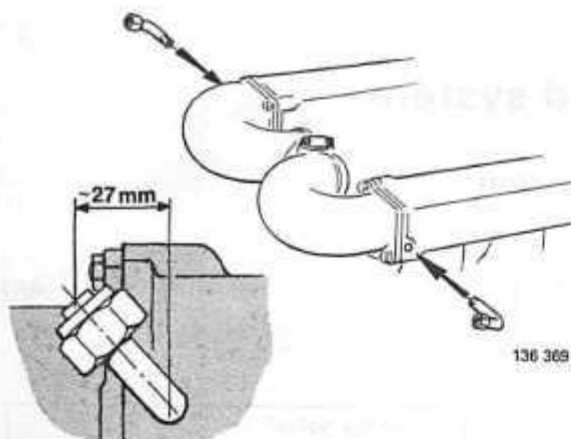
Install cover plate with gasket and replace nipples/plugs

Withdraw nipples from front holes in intake manifold.
Transfer plug on right side and nipple on left side from rear to front hole.

AE20

Install elbow nipples in intake manifold

Screw in elbow nipples approx. 6 turns. Check security and position of nipples. (fine-adjust after installing new pipe).



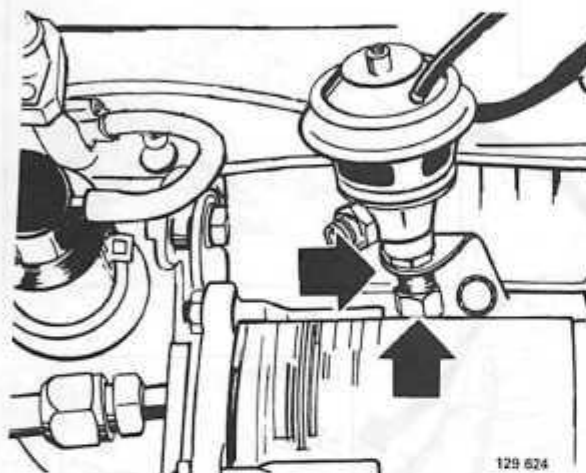
AE21

Unscrew EGR valve

EGR valve must be slackened slightly before pipe can be attached.

Slacken nut on pipe from exhaust manifold.

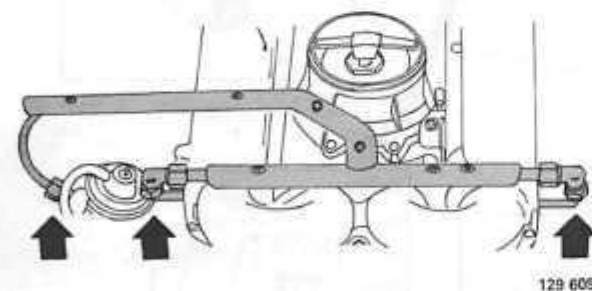
Slacken nut securing valve to mounting bracket.



AE22

Assemble new pipe and elbow nipples

Tighten unions by hand.

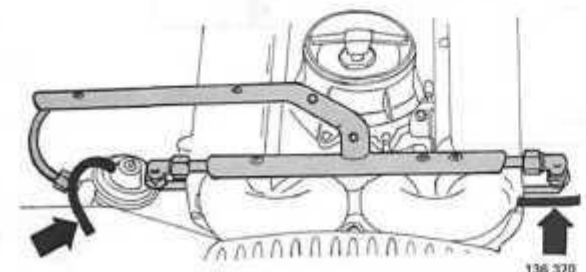


AE23

Install new pipe

Tighten unions by hand.

Check that pipe does not contact intake manifold, adjust if necessary. Tighten all unions, EGR valve retaining nuts last.



AE24

Check that hoses do not contact pipe

Clamp hoses where necessary.

AE25

Install air filter

AE26

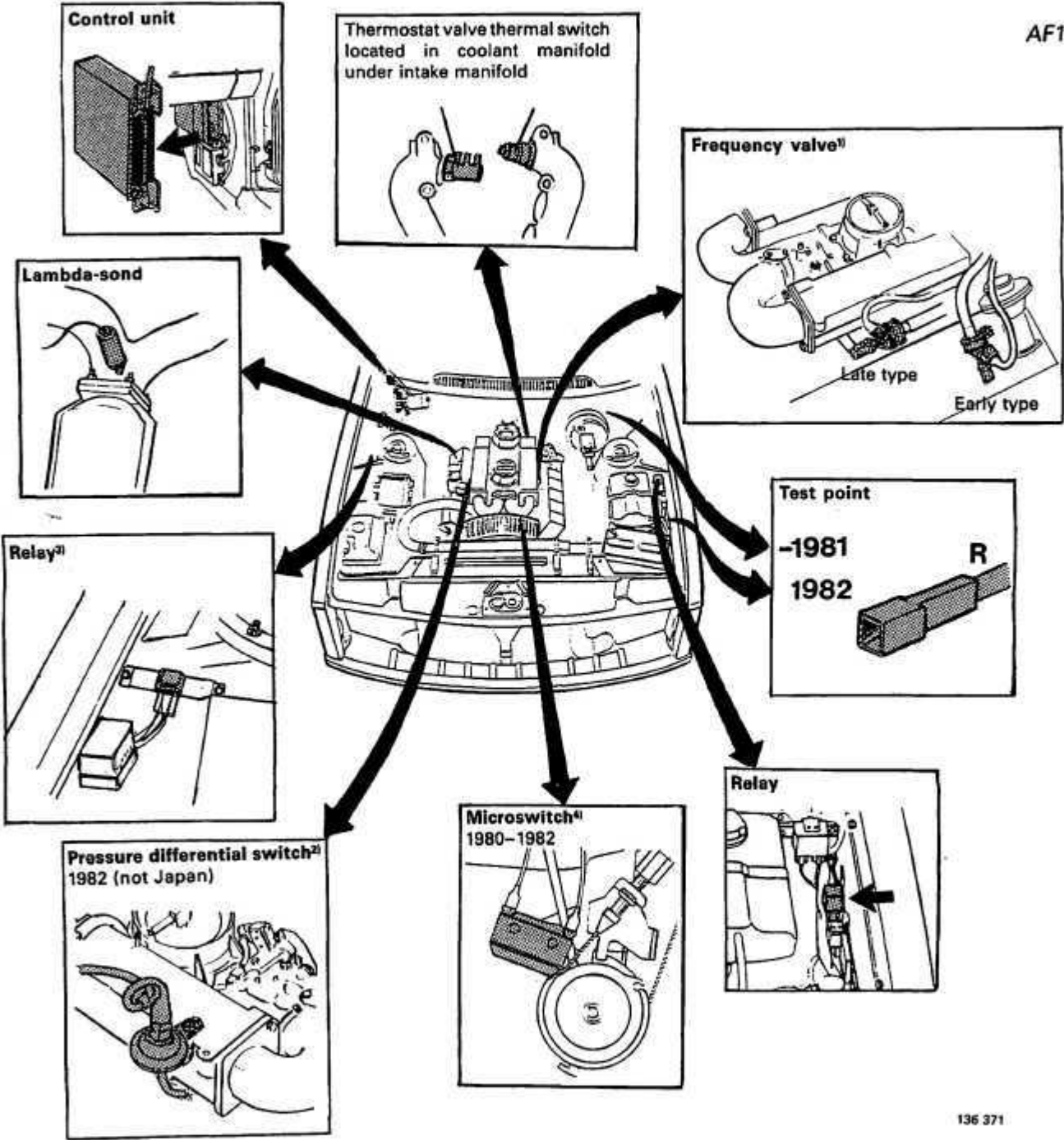
Check operation

Start engine and run to normal operating temperature. Check for leakage.

AF. Lambda-sond system

Component location

AF1



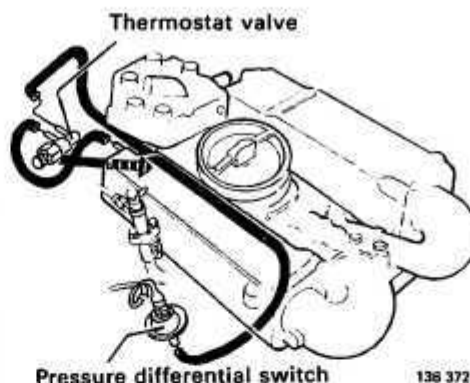
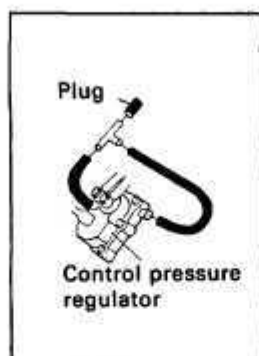
Footnotes

- ¹⁾ Location changed during 1980.
- ²⁾ B 28 F USA + Canada 1980-1981 models may have been equipped with switch, see page 136.
- ³⁾ Only fitted to B 28 F USA + Canada 1980-1981 with pressure differential switch.
- ⁴⁾ On B 28 F USA 1980-1982 models designed for use at high altitudes, microswitch should be disconnected, see page 140.

Connection of vacuum hoses

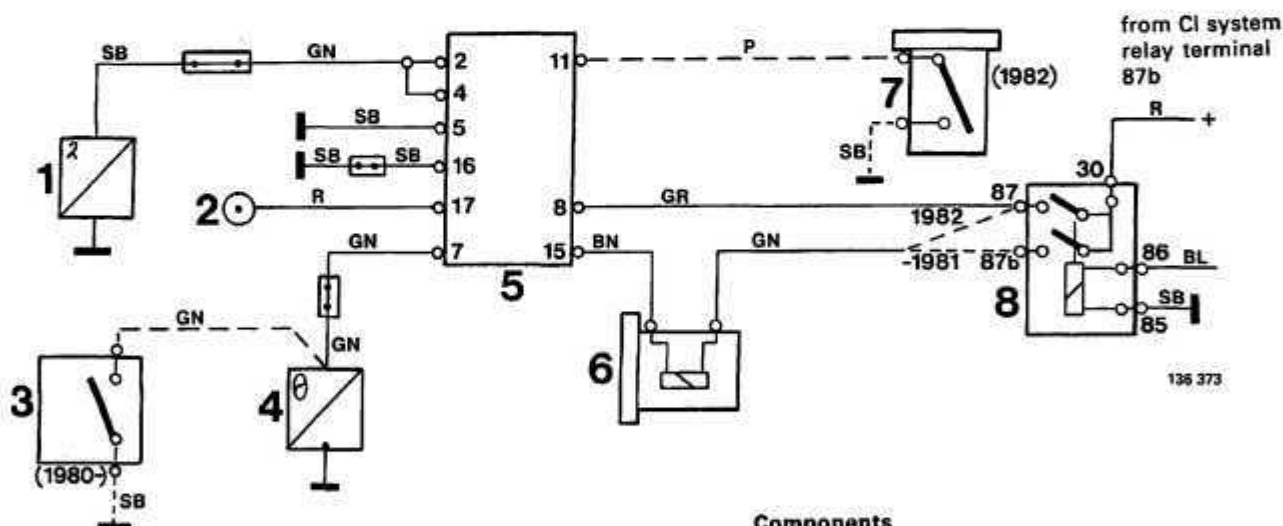
for pressure differential switch

AF2



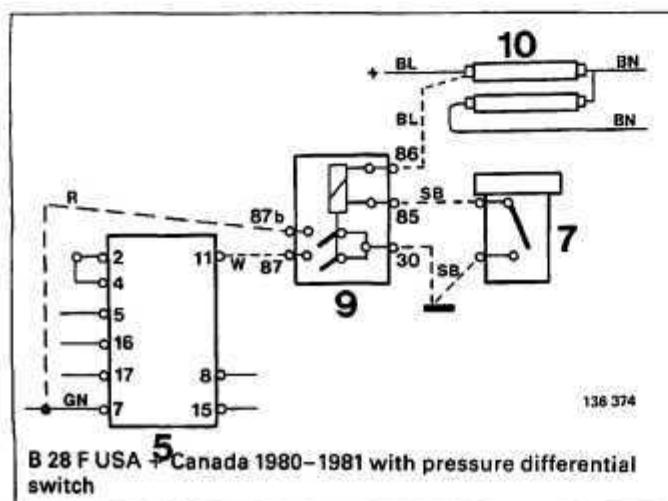
Wiring diagram

AF3



Components

- 1 Lambda-sond
- 2 Test point
- 3 Microswitch 1980-1982
- 4 Thermal switch
- 5 Control unit
- 6 Frequency valve
- 7 Pressure differential switch 1982 USA + Canada (some B 28 F USA + Canada 1980-1981)
- 8 Relay
- 9 Relay
- 10 Ballast resistor, ignition coil



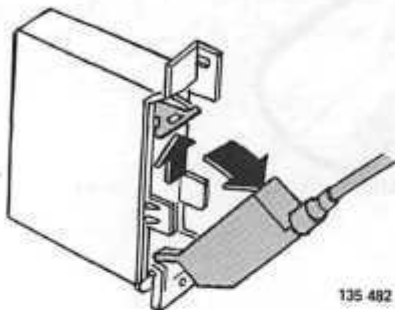
Colour codes

SB = black
GR = grey
W = white

R = red
NB = brown
BL = blue

GN = green
P = pink

General instructions



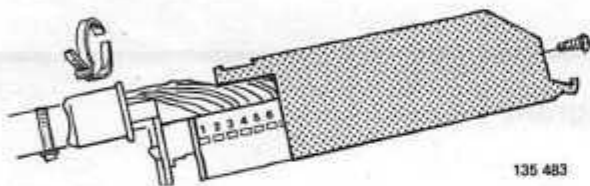
AF4

Removing connector from control unit

Ignition should be turned off when removing/installing connector.

Push lock spring up and fold out connector.

Do **not** pull connector straight out.



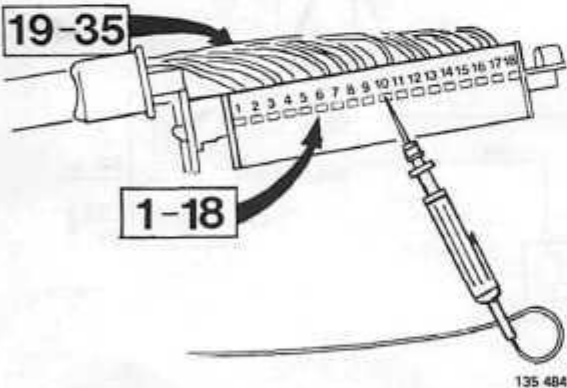
AF5

Checking terminals

CAUTION

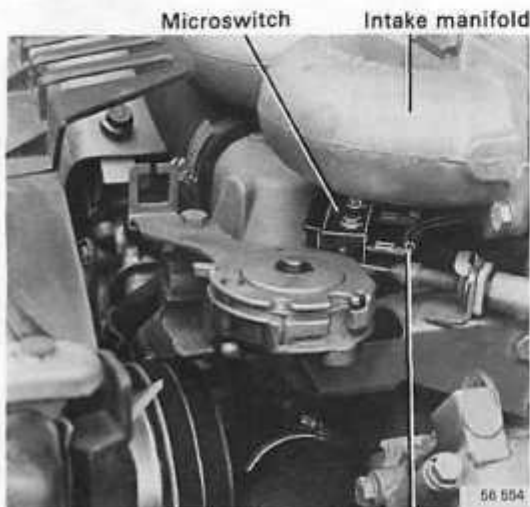
Never check terminals from front of connector.
Experience has shown that terminals and circuit can be damaged when tested from front.

Remove cover from connector.



Check terminals through holes in side of connector.
Do not use excessive force.

Terminal numbers are stamped in side of connector.



AF6

Microswitch

B 28 F USA 1980–1982 models designed for use at high altitudes, microswitch should be disconnected, see page 140.

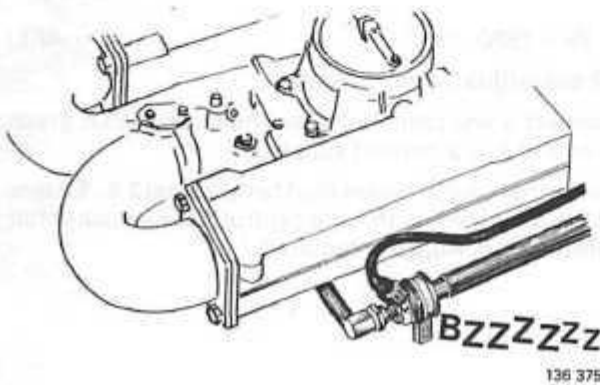
Connector

Fault symptoms

AF7

System faults can be:

- starting difficulties, especially with hot engine
- rough running
- rough idle with cold engine, below 15°C (60°F). This can result from a defective thermal switch
- high fuel consumption
- B 28 F 1982 USA + Canada (some B 28 F USA + Canada 1980–1981 models): poor acceleration with cold engine, below 55°C (130°F). Can result from defective pressure differential switch
- B 28 F 1980–1982: low top speed/poor performance. Can result from defective microswitch.



The symptoms above can of course result from other engine faults.

A rough check of the system can be performed by starting engine and listening to (feeling) the frequency valve. If the valve "buzzes" the Lambda-sond system is probably OK.

Fault tracing (check) of Lambda-sond system

If possible, engine temperature should be below 15°C (50°F) when checking Lambda-sond system because it is necessary to check thermal switch when installed on vehicle.

Also, temperature must be below 50°C (120°F) when checking thermostat valve on vehicles equipped with pressure differential switch.

*B 28 F 1982 USA + Canada
some 1980–1981 models*

AF8

Check vacuum hoses

Check that hoses are correctly connected and not kinked or defective.

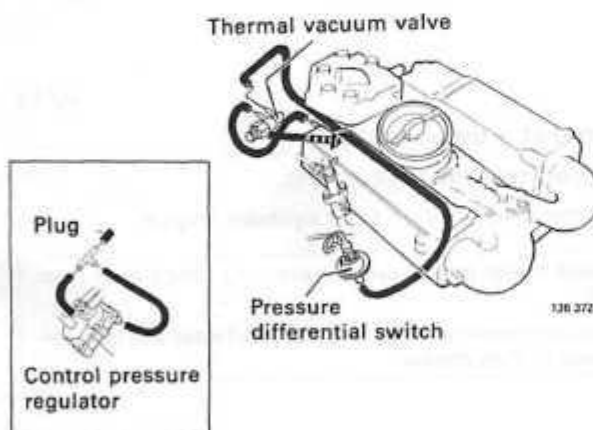
AF9

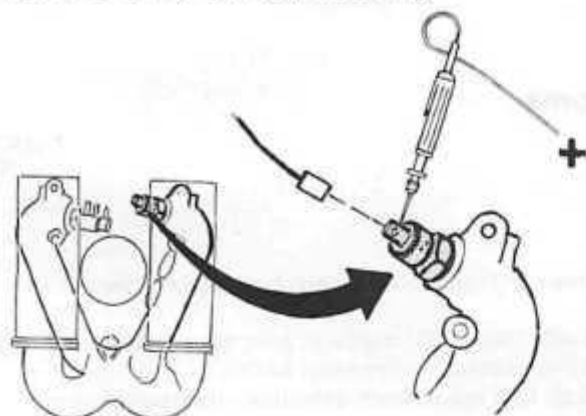
Check thermal vacuum valve (cold engine)

Coolant temperature below 50°C (120°F).

Disconnect hose from pressure differential switch and blow in hose.

Valve should be open at temperatures below 55°C (130°F).





136 376

AF10

Check thermal switch

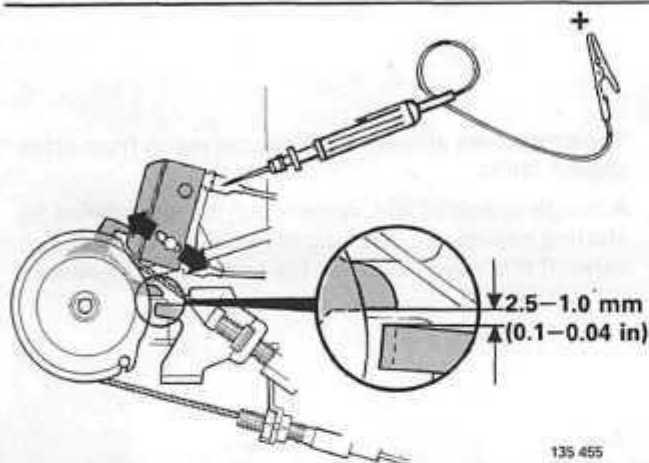
Disconnect yellow wire from microswitch.

Connect a test lamp between wire and a 12 V current supply.

Test lamp should **light** (switch closed) at temperatures **below 15°C (60°F)** and be **off** at temperatures **above 15°C (60°F)**.

Reconnect wire.

In cases where valve function is suspect, remove valve and check separately.



135 455

B 28 F 1980-1982

AF11

Check/adjust microswitch

Connect a test lamp between the microswitch green wire and a 12 V current supply.

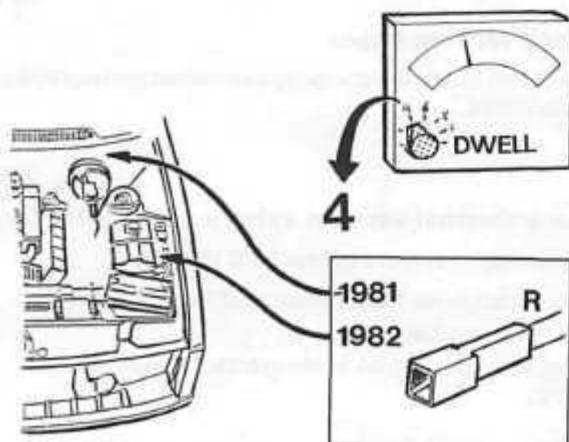
Check that switch closes (test lamp lights) **2.5-1.0 mm (0.1-0.04 in)** before throttle control pulley touches full throttle stop. Adjust if required.



135 417

AF12

Disconnect Lambda-sond



136 377

AF13

Connect a dwell meter

Connect red wire to test point.

Set meter to position for **4 cylinder** engine.

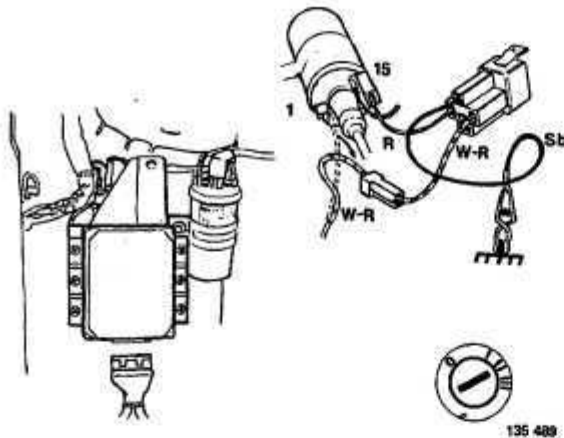
Dwell meter must have a measuring range of at least 70°.

Recommended meters: Volvo Mono-Tester and later versions of SUN meters.

AF14

As a safety precaution remove connector from ignition control unit

It is also necessary to remove the connector to activate the system when test relay 5170 is connected.



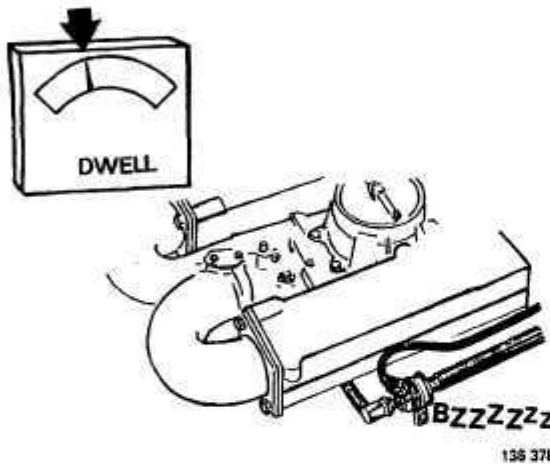
AF15

Connect test relay 5170. Turn on ignition

AF16

Check meter reading and listen to frequency valve

A buzzing sound should be heard from valve and meter should show 42–48°.



Valve does not buzz and meter shows 0



Valve does not buzz but meter deflects



Valve buzzes but meter shows 0 → Probably broken wire to test point

Valve buzzes but meter reading too high



AF17

Check full throttle enrichment (cold engine)

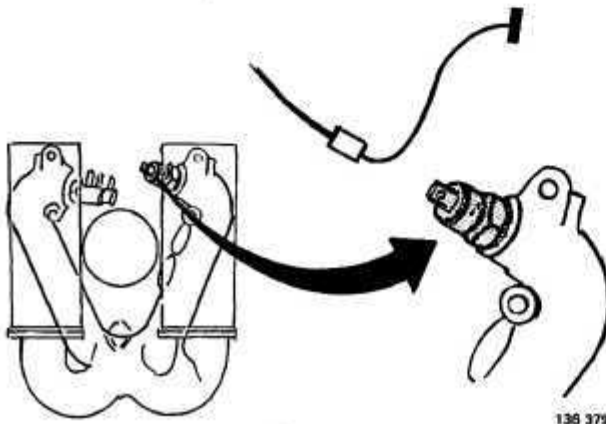
Disconnect and earth wire from thermal switch.

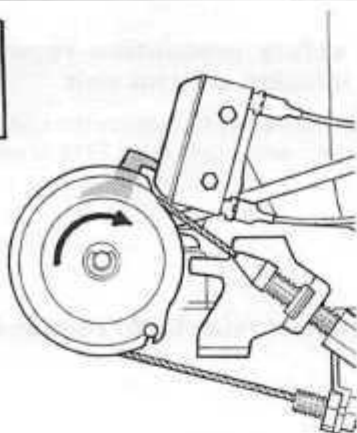
Dwell meter reading should change to:

B 27 F 1978–1979	73–80°
B 28 F 1980–1982	51–57°

Re-connect wire.

If readings are not according to above, check wiring before testing with a new control unit.





135 491

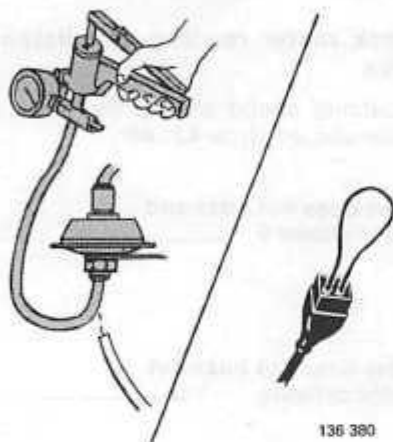
B 28 F 1980–1982

AF18

Check full throttle enrichment

Rotate throttle control pulley to full throttle position so microswitch closes. Dwell meter reading should change to **51–57°**.

If not, check wiring and microswitch.



136 390

B 28 F 1982 USA + Canada
Some 1980–1981 models

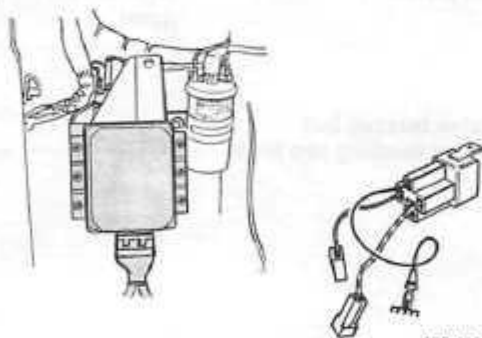
AF19

Check acceleration enrichment

Connect a vacuum pump to pressure differential switch and start pump.

Disconnect pump. When pump is disconnected, switch closes and dwell meter reading should change to **82° or above** for a short period, and then decrease.

If incorrect, connect a bridge wire across terminals of connector. If meter reading now changes to **82° or above**, the wiring and control unit are OK, and switch should be replaced.



135 493

AF20

Turn off ignition. Remove test relay 5170

Connect wiring.

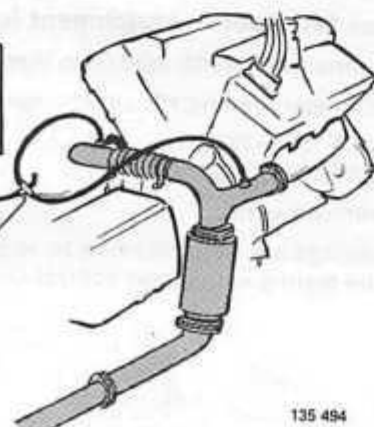
AF21

Connect ignition control unit connector

Check that rubber seal is in place. Without the seal, water can leak in and cause oxidation etc.



5151



135 494

AF22

Connect CO meter. Start engine

Connect meter with adaptor 5151, lever should be in mid-position.



136 381

B 28 F 1982 USA + Canada
Some 1980–1981 models

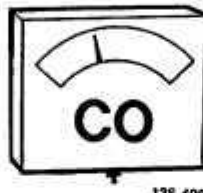
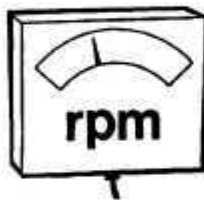
AF23

Check thermal vacuum valve

Warm-up engine and disconnect hose from pressure differential switch. Place finger over end of hose.

Thermal vacuum switch should close (i.e. no suction) at approx. 55°C (130°F).

AF24



136 496

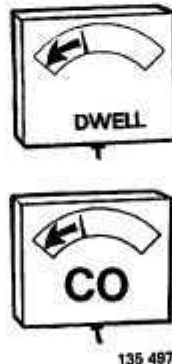
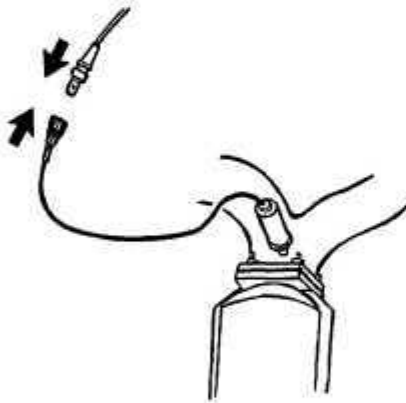
Warm-up engine

Wait at least 5 min after coolant thermostat has opened before carrying out next step.

AF25

Check idle speed and CO content

Adjust if and as necessary.



135 497

AF26

Check Lambda-sond function

Connect Lambda-sond to dwell meter and CO meter. Check reading.

Dwell meter reading should change slightly, usually drop when sond is connected. CO level should drop to less than 1.0%.

If neither CO content nor dwell meter reading changes:

Disconnect Lambda-sond and ground the wire. CO content and dwell angle should increase.

Wiring and control unit are OK if meter reading increases.

Re-test with a new Lambda-sond.

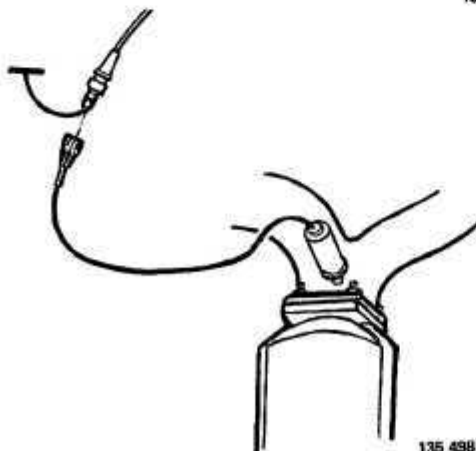
If meter reading does not change, either control unit or wiring to control unit is defective.

CO content does not change, dwell meter reading drops significantly:

This indicates a defective frequency valve. Re-test with a new valve.

CO content and dwell meter reading increase:

This indicates a defective Lambda-sond (internal short-circuit). Re-test with a new Lambda-sond.

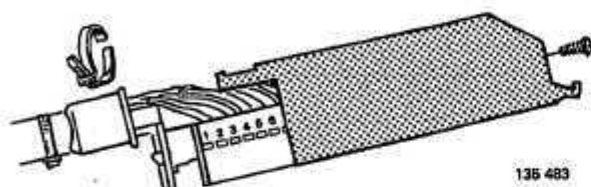


135 498

End of test

From AF16: Frequency valve does not buzz and meter shows 0

On completion of repair proceed with operation AF17 on page 129.



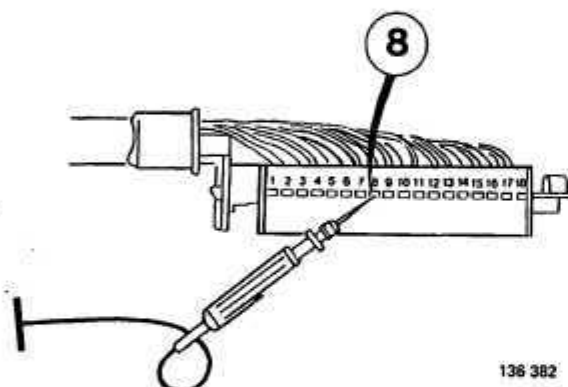
136 483

Switch off ignition

AF27

**Remove connector from control unit
Remove cover**

AF28



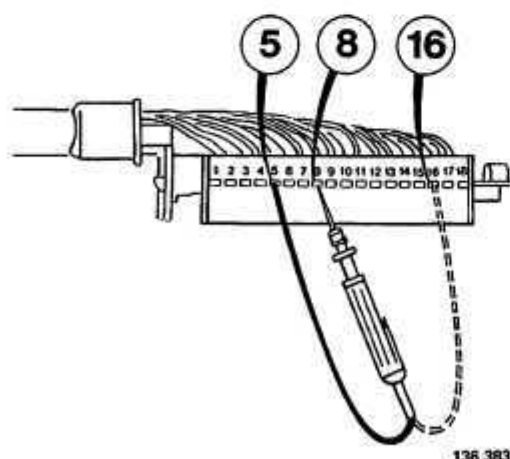
136 382

Switch on ignition. Check current supply

AF29

Connect a test lamp between terminal 8 and ground.
Lamp should light.

If not, check wiring and system relay, see wiring diagram on page 125.



136 383

Check ground connections

AF30

Connect a test lamp between terminals 8 and 5, and 8 and 16 respectively. Lamp should light in both cases.

If lamp does not light, check ground connections at intake manifold.

Test with a new control unit

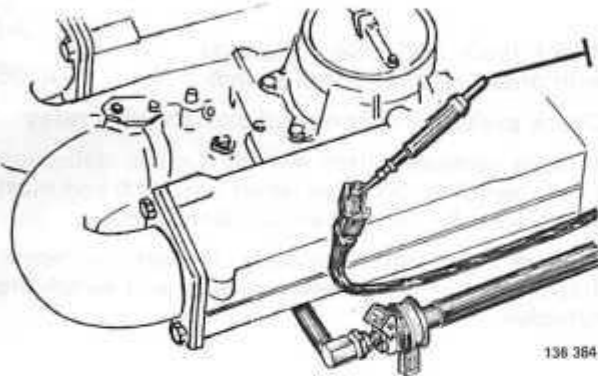
AF31

(only necessary if no faults are detected when performing above checks)

End

From AF16: Valve does not buzz but meter deflects

On completion of repair continue with operation AF17 on page 129.

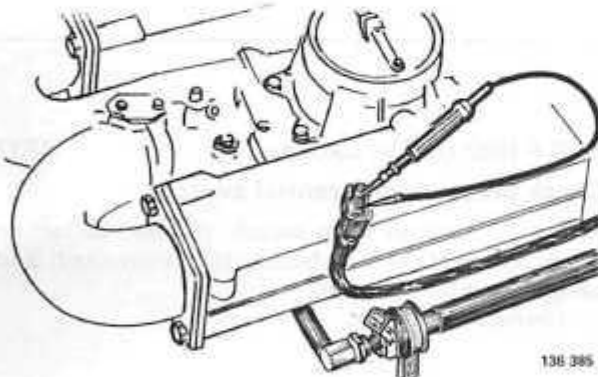


AF32

Check current supply to frequency valve

Connect a test lamp between the connector pin (green wire) and earth. Lamp should light.

If lamp does not light, check function of system relay and wiring.

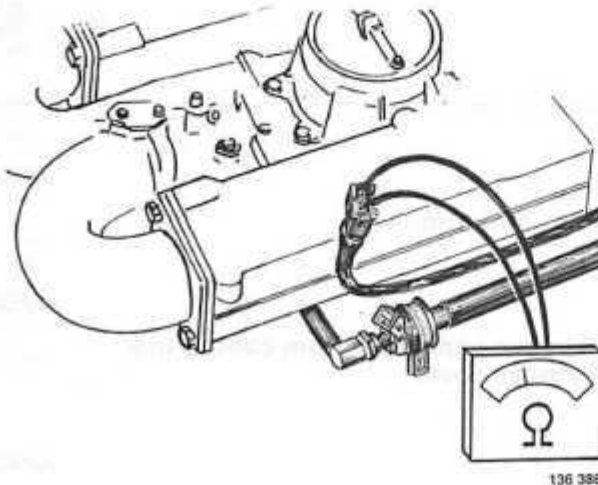


AF33

Check wire from frequency valve to control unit

Connect a test lamp between both connector pins. Lamp should light (dimly).

If lamp does not light, control unit or wiring to control unit is defective.



AF34

Measure frequency valve resistance

Use an ohm meter.

Resistance should be 2–3 ohms.

Replace frequency valve if incorrect.

AF35

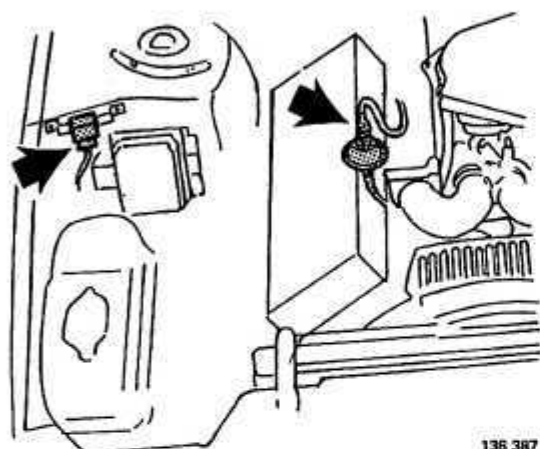
Test with a new control unit

(only necessary if no faults are detected when performing above checks)

End

From AF16: Valve buzzes but meter reading is too high

On completion of repair proceed with operation AF17 on page 129.



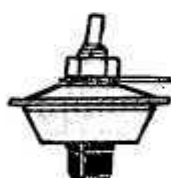
B 28 F 1980–1981 USA + Canada
with pressure differential switch

AF36

Check pressure differential switch with relay

Remove connector from switch. If meter deflection drops, switch is defective (short-circuited) and must be replaced. Re-connect switch connector.

Remove connector from relay. If meter deflection drops, relay or wires between relay and switch are defective.



B 28 F 1982 USA + Canada

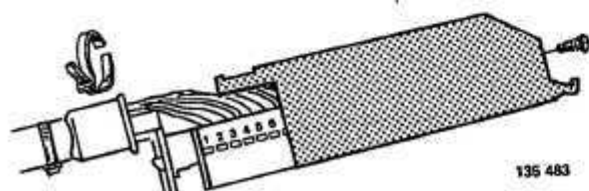
AF37

Check pressure differential switch

Remove connector from switch. If meter deflection drops, connection is defective (short-circuited) and switch must be replaced.

Re-connect connector.

136 388



Turn off ignition

AF38

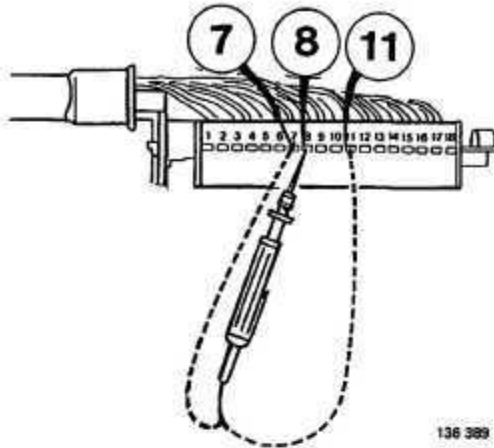
Remove connector from control unit
Remove cover

AF39

Turn on ignition

AF40

AF41



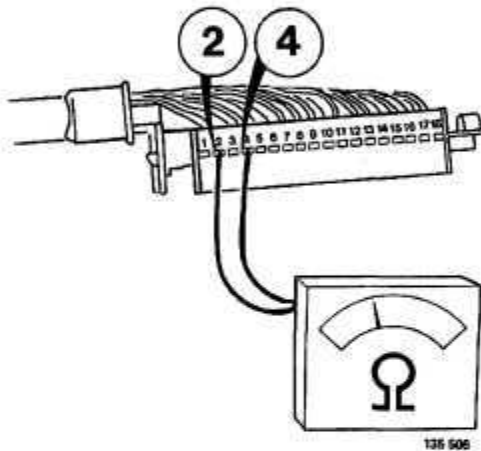
Check wiring to:

- thermal switch and microswitch, as applicable
- pressure differential switch, as applicable

Connect a test lamp between terminals 8 and 11, and between terminals 8 and 7 respectively.

Lamp should **not** light in both cases. If lamp lights, wire is short-circuited.

AF42



Check wires to Lambda-sond

Note! Lambda-sond must be disconnected.

Connect an ohm meter between terminals 2 and 4 on connector.

Resistance should be infinite. Short circuit is indicated by small reading.

AF43

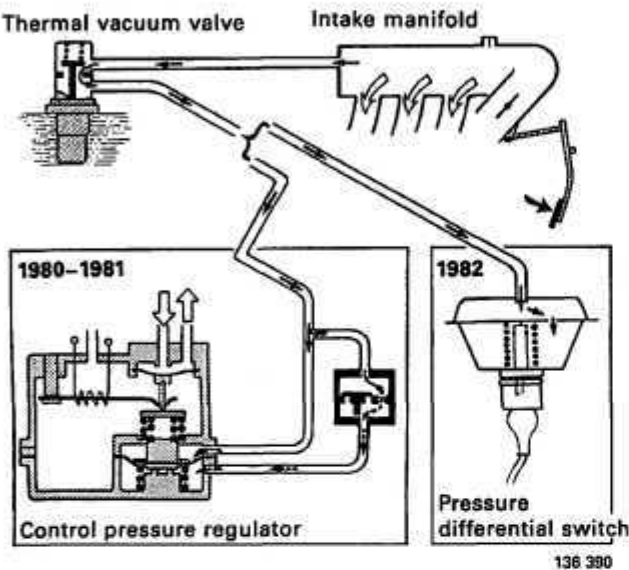
Test with a new control unit

(only necessary if no faults are detected when performing above checks)

End

AG. Installing pressure differential switch

B 28 F USA + Canada 1980-1981



General

AG1

Fuel enrichment during acceleration is obtained via the control pressure regulator on 1980-1981 models, and via a pressure differential switch on 1982 models. The pressure differential switch is connected to the Lambda-sond control unit.

The new system was introduced to improve engine response especially in cold conditions.

If necessary the pressure differential switch can be fitted to 1980-1981 models.

For installation instructions, see next page.

Parts required to install pressure differential switch

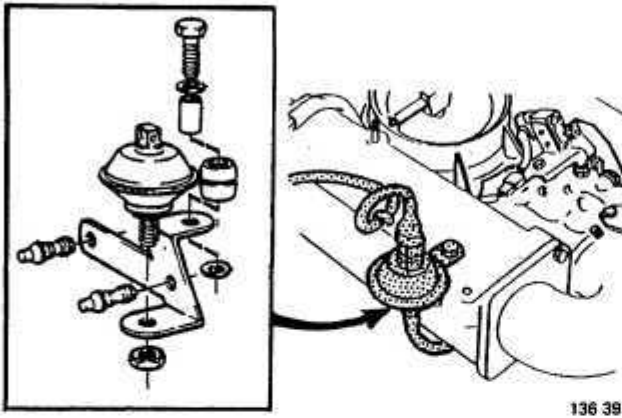
AG2

Description	P/N	Qty
Wire connector	1586597-5	1
Wiring harness	1323529-6	1
Relay	1235013-8	1
Pressure differential switch	1269669-6	1
Nut	1218179-8	1
Screw	955276-1	1
Washer	960139-4	2
Spacer	1269816-3	1
Bushing	1317011-3	1
Bracket	1269815-5	1
Bump stop	1210210-9	2
Hose (per metre)	192055-2	300 mm
Screw	955138-3	2
Washer	955946-9	2
Bracket	3711399-0	1
Connector (for vacuum hose)	1266008-0	1
Plug	418646-6	1
Hose (per metre)	948958-4	200 mm
Strip clamp	948702-6	2

Note! On USA and Canadian markets these parts are supplied in a kit P/N 75081-0.

Installing pressure differential switch

B 28 F USA + Canada 1980-1981



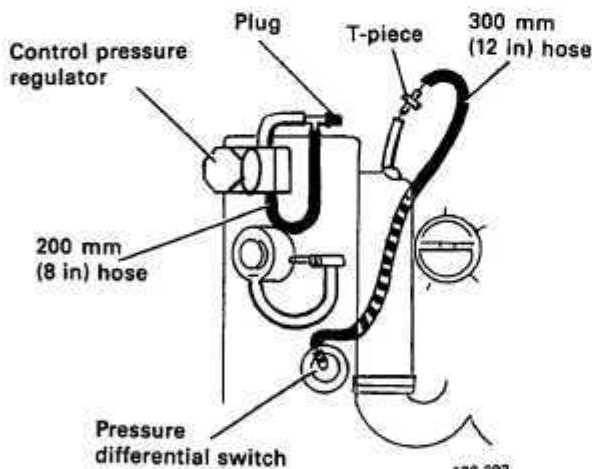
136 391

Mount switch on bracket

AG3

Install switch on intake manifold

AG4



136 392

Disconnect control pressure regulator

Disconnect vacuum hose from T-piece.
Place a rubber plug in hose connection.

Exchange hoses connected to delay valve with a new hose, 200 mm (8 in) in length.

AG5

Connect vacuum hose to pressure differential switch

Hose length = 300 mm (12 in).

Connect one end of hose to pressure differential switch and other end via a connector to manifold.

AG6

Install mounting bracket and relay

Rustproof drill holes.

Secure mounting bracket with screws and washers.

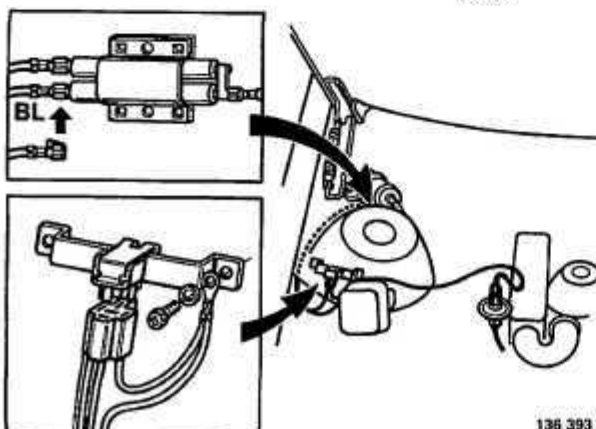
AG7

Connect wiring harness

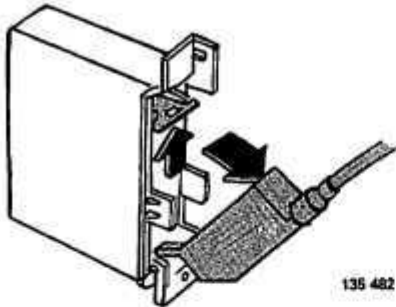
Connect harness to switch and relay. Connect ground wire to one of retaining screws on mounting bracket.

Connect blue wire to blue wire next to ignition coil ballast resistance.

AG8



136 393



AG9

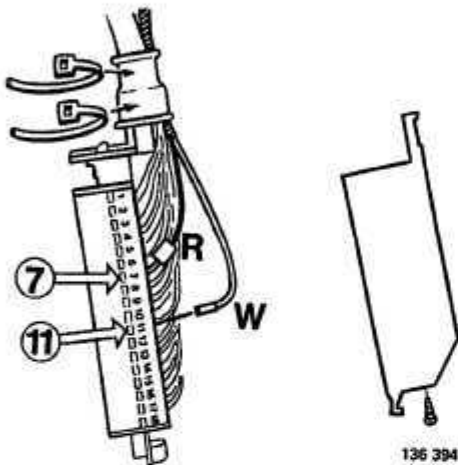
Connect wiring to Lambda-sond control unit

IMPORTANT

Ignition must be switched off when connector on control unit is removed/installed.

Route wiring harness alongside existing wires and through rubber grommet in firewall.

Withdraw connector from control unit and fold out cover.

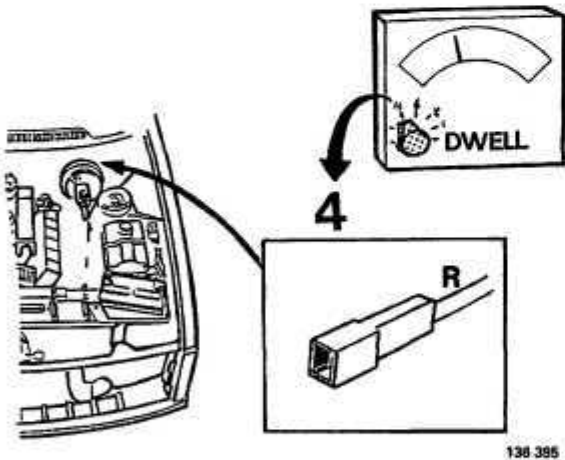


Using a connector, connect red wire to existing wire at terminal 7.

Connect white wire to terminal 11.

Re-fit cover. Secure rubber sleeve with new strip clamps.

Re-connect connector.



AG10

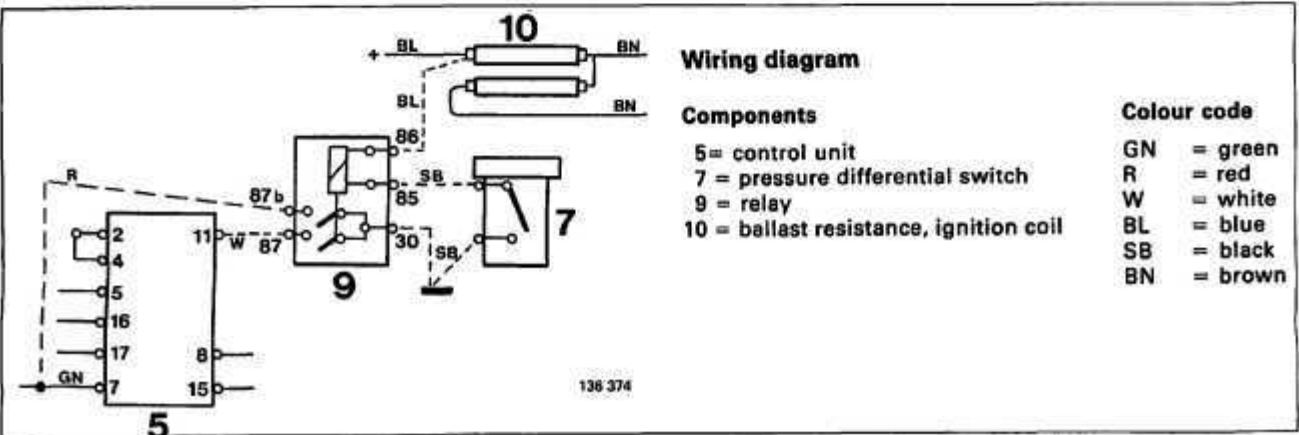
Check function

Note! Engine should be cold, i.e. coolant temp. below 50°C (120°F). If engine is hotter, thermostat valve will close and disconnect pressure differential switch.

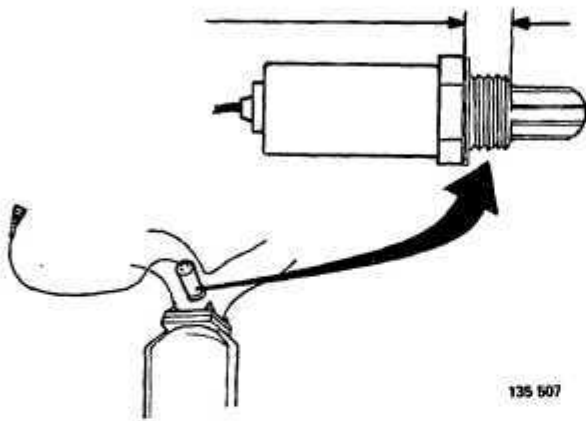
Connect a dwell meter to test point.

Set meter to position for 4 cylinder engines.

Start engine and check reading. Pointer should deflect briefly when engine is revved.



AH. Lambda-sond, replacement

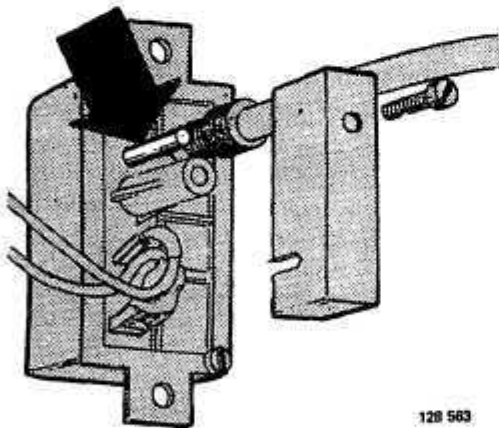


Replacing Lambda-sond

Smear bolt joint paste "Never-Seez" (P/N 1161035-9) on Lambda-sond threads. Make sure that no paste enters slot as this will inhibit function of Lambda-sond.

Torque to **55 Nm** (40 ft.lbs).

AH1



Reset warning lamp

Warning lamp is actuated by a switch mounted on rear of speedometer, and is connected to the odometer.

The lamp lights to remind owner that it is time to replace Lambda-sond.

Remove rear cover from connector and depress white push button to reset lamp.

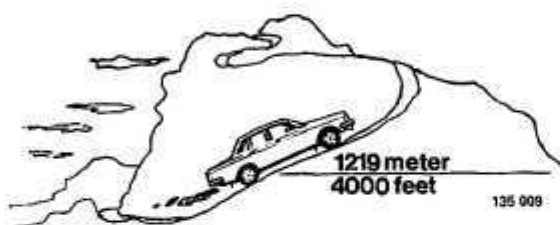
Re-fit cover.

AH2

AJ. Altitude adjustment (Legal requirement)

General

AJ1



Environmental Protection Agency defines:

- **High altitude** as altitudes **above 1219 meters (4000 feet)**
- **Low altitude** as altitudes **below or equal to 1219 meters (4000 feet)**

- All vehicles which leave the factory are adjusted for low-altitude driving.
- **New vehicles (1982–1983):** If vehicle is to be operated mainly in high altitude areas it **must be adjusted** for high altitude operation before delivery to customer. This adjustment must be carried out by dealer and considered as a normal part of Pre-delivery service.
- **Owners of vehicles manufactured before 1981** which are used predominantly in high altitude areas, **are recommended** to have vehicle adjusted for high-altitude driving.

Refer to "High Altitude adjustment manual for further information."

Note! Vehicles previously adjusted for high-altitude operation and now operating in low-altitude areas **should be re-adjusted** for low-altitude use. Also the 'High Altitude' decal must be removed.

High altitude modification

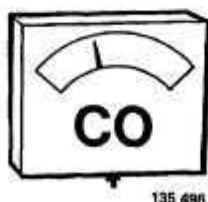
AJ2

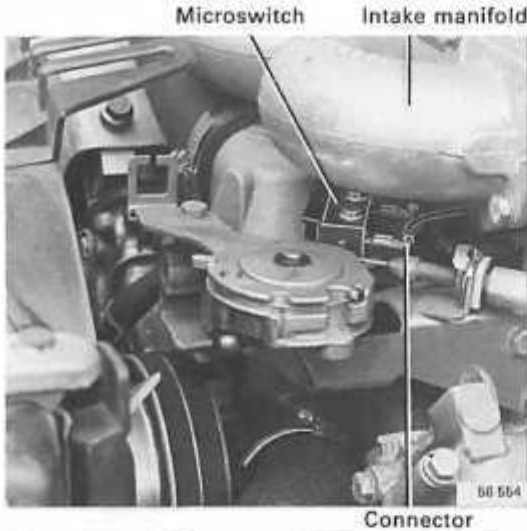
Check/adjust idle speed and CO content.

Should be checked and if necessary adjusted at the actual altitude the vehicle is to be driven at.

Engines with sealed CO adjustment must be resealed after performing the adjustment.

For further information see B27/28 CI Fuel injection, repair manual group 2 (23).





B 28 F 1980–1982

AJ3

Disconnect full throttle enrichment

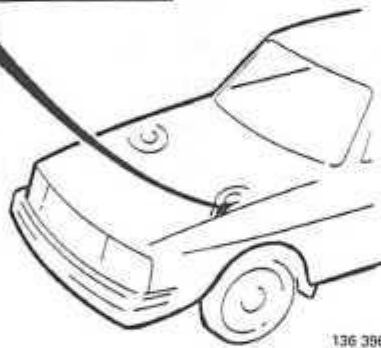
Disconnect black lead from microswitch.

Insulate connector and secure it to wiring harness. Make sure that it does not touch microswitch.

Engines with sealed CO adjustment must be resealed after performing the adjustment

For further information see B27/28 CI Fuel injection, repair manual group 2 (23).

**THIS VEHICLE IS MODIFIED
FOR HIGH ALTITUDE DRIVING**



Attach high altitude sticker

P/N 1313496-0.

Clean surface before attaching sticker.

AJ4

Group 26 Cooling system

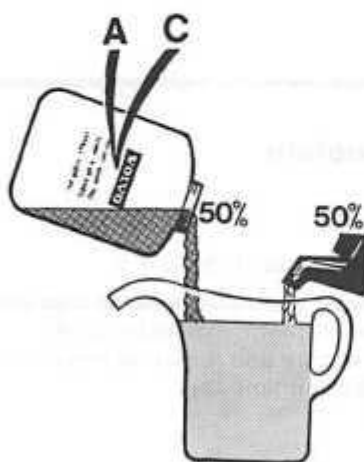
	Operation	Page
Fault symptoms – poor cooling		143
Coolant	AK 1–5	143
Testing cooling system	AL 1	145
Radiator	AM 1–3	145
Thermostat	AN 1–3	146
Temperature sensor	AQ 1	146
Coolant (water) pump, replacement	AP 1–18	147
Drive belts	AQ 1	150
Cooling fan	AR 1–3	151
Electric cooling fan	AS 1–5	152

Fault symptoms – poor cooling

Engine overheats and/or poor operation of air conditioning

POSSIBLE CAUSE	REMEDY	Operation
Coolant leakage, opening pressure of expansion tank cap too low	Pressure-test system	AL1
Radiator blocked by e.g. insects	Clean	AM1
Air bypasses radiator Air guide beneath radiator not fitted (not standard on 1975)	Check/adjust position	AM3
Ignition setting too low Retarded ignition increases engine combustion temperature	Check/adjust	–
CO content too low Poor mixture (low CO) increases engine combustion temperature	Check/adjust	–
Idle speed too low Too low an idle reduces cooling	Check/adjust	–
Radiator blocked with sludge Incorrect type of coolant or aged coolant	Check radiator Check/drain coolant	AM2 AK1–5
Incorrect type of thermostat Note engine must not be driven for long periods without thermostat	Check/replace	AN1–3
Vehicles with AC: Idle speed compensation defective	Check/adjust	–
B 27 F 1977 California: temperature steered ignition advance defective	Check/adjust	–
1979–1983: Electric cooling fan defective	Check/adjust	AS1–5

AK. Coolant



136 397

General

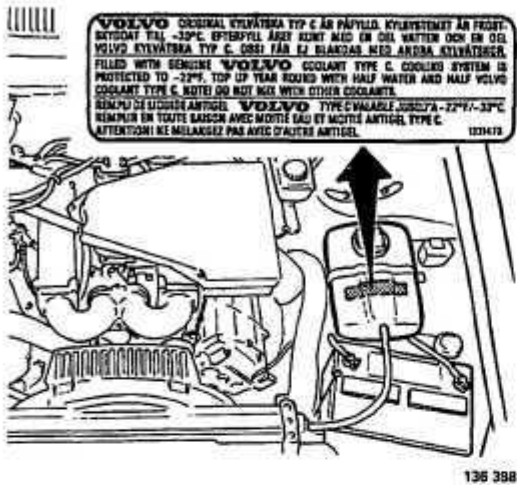
AK1

Since aluminium is used in the engines, active corrosion protection is necessary in the coolant to help prevent corrosion damage.

* Use genuine Volvo coolant diluted with **clean** water in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage.

Vehicles manufactured before 1981 were filled with **type A** (red) coolant whereas vehicles manufactured after 1981 are filled with the improved **type C** (blue-green) coolant.

* See overleaf



Topping-up cooling system

AK2

Never add only water to the cooling system. Use genuine Volvo coolant diluted 50/50 with clean water.

Two different types of coolants are in use, type A and type C. When topping up a cooling system filled with type A coolant – either use type A or add type C coolant. Note, however, that no more than 25% of the coolant can be substituted with type C coolant. If more coolant is required the cooling system must be drained and filled afresh with type C coolant.

E.g. If cooling system capacity = 9.5 litres no more than 2.4 litres of type C coolant can be used to top up system. (2.4 l refers to diluted coolant i.e. 50% water + 50% concentrated coolant).

Changing coolant

AK3

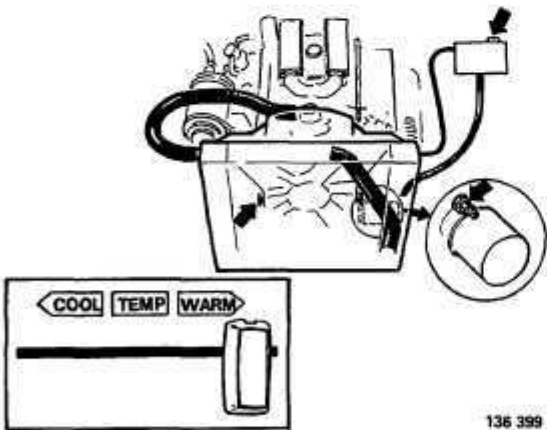
The coolant must be replaced regularly since the corrosion protection in the coolant loses effect with time.

Always fill cooling system with **type C** coolant. Remember to change the decal (P/N 1 331 473-7) on the expansion tank when changing to type C coolant.

Draining

AK4

- set dashboard heater control to max. heat
- disconnect battery
- unscrew cap from expansion tank
- open drain cocks on both sides of cylinder block. Attach hoses to cocks to prevent spillages
- disconnect lower radiator hose from radiator
- close cocks, re-connect lower radiator hose and battery.



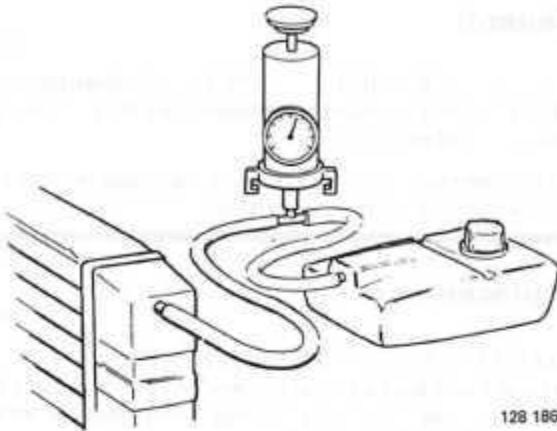
Filling coolant

AK5

Volume = 10.9 litres (11.5 US qts)

- ensure heater controls are set to max heat
- add coolant through expansion tank
- warm-up engine and top up as required
- re-fit expansion tank cap.

AL. Pressure testing cooling system



AL1

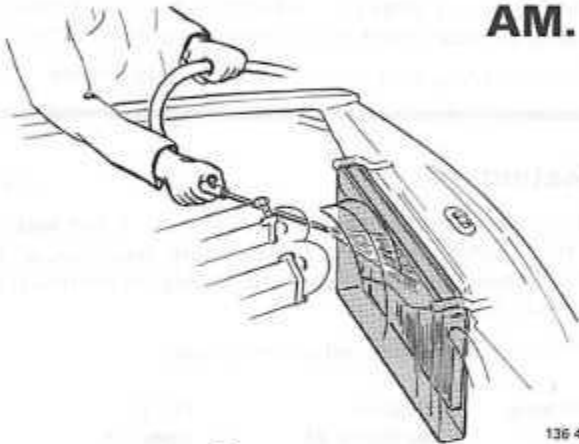
Check breather hose between radiator and expansion tank. Replace hose if worn or cracked.

Connect pressure tester between radiator and expansion tank.

Increase pressure and check opening pressure of expansion tank cap and for leaks:

- opening pressure = 65–85 kPa (9.2–12.0 psi)
- check that pressure does not drop noticeably during 30 seconds.

AM. Radiator



Cleaning radiator

AM1

Remove flies, etc. from radiator grille by hosing radiator from inside as illustrated. Blow clean with compressed air.

Note! Do not spray water or blow air at too high a pressure at radiator or damage may result.



Checking radiator

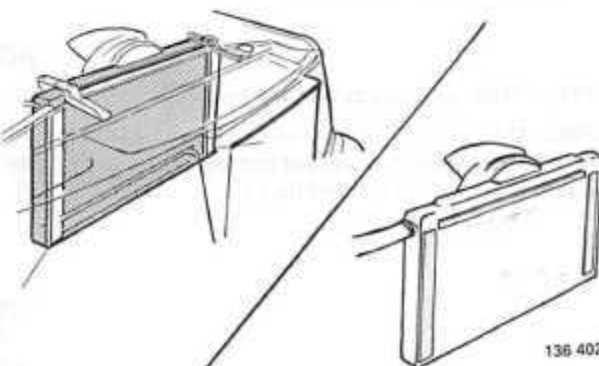
AM2

Heat up engine until thermostat opens and then for a further few minutes.

Turn off engine.

Detach fan shroud from radiator.

Check radiator with hand, warm and cold sections indicate that radiator is partly blocked.



Checking/adjusting position of radiator

AM3

Radiator must lie flush with front panel otherwise some air will bypass radiator.

Adjust position of front panel as required.

Plastic foam can also be used to seal gap between radiator and front panel.

- 2 strips 20×50×410 mm
- 1 strip 10×25×660 mm

AN. Coolant thermostat

General

AN1

It is important that the correct type of thermostat is fitted to vehicle because it determines flow of coolant through cooling system.

Do not run engine for long periods without thermostat otherwise engine may overheat.

Replacement

AN2

B 27 E 1979–1980, B 28 E and B 27/B 28 F: remove front part of intake manifold to obtain access to thermostat. Use new O-rings and gaskets when installing new thermostat.

Use gasket supplied with new thermostat.

Drain approx. 2 litres of coolant from drain cock on left side of cylinder block before replacing thermostat.

Top-up cooling system after warming-up engine.

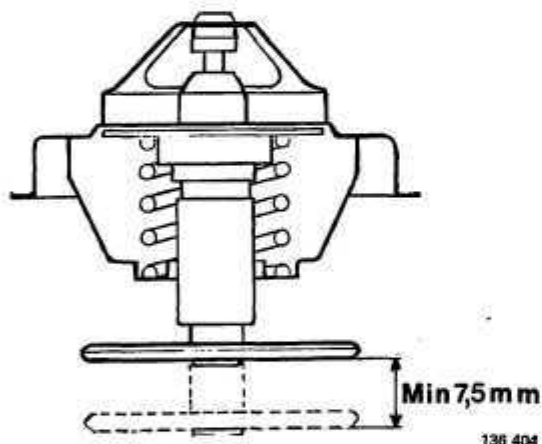
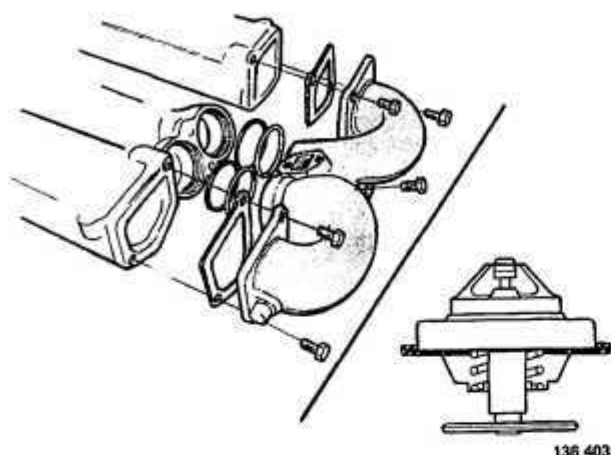
Testing

AN3

Thermostat can be tested, if required, in hot water. After reaching opening temperature (see below) it should not take longer than 2 minutes for thermostat to open fully.

Three types of thermostats are in use:

Marking	Begins opening at	Fully open at
82	81–83°C (178–181°F)	90–94°C (194–201°F)
87	86–88°C (187–190°F)	95–99°C (203–210°F)
92	91–93°C (196–199°F)	100–104°C (212–219°F)



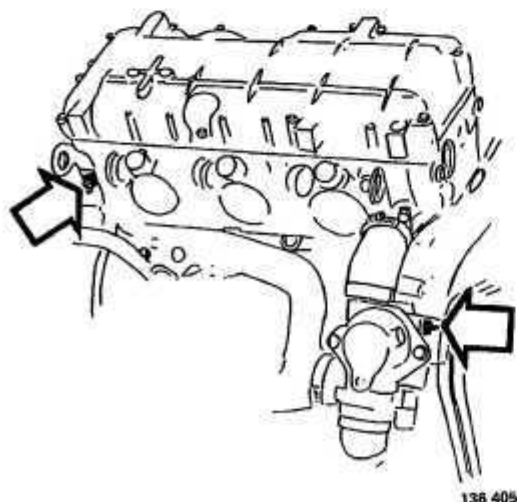
A0. Coolant temperature sensor

Location of sensor

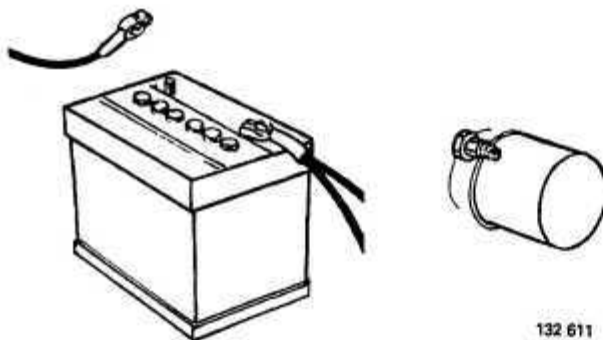
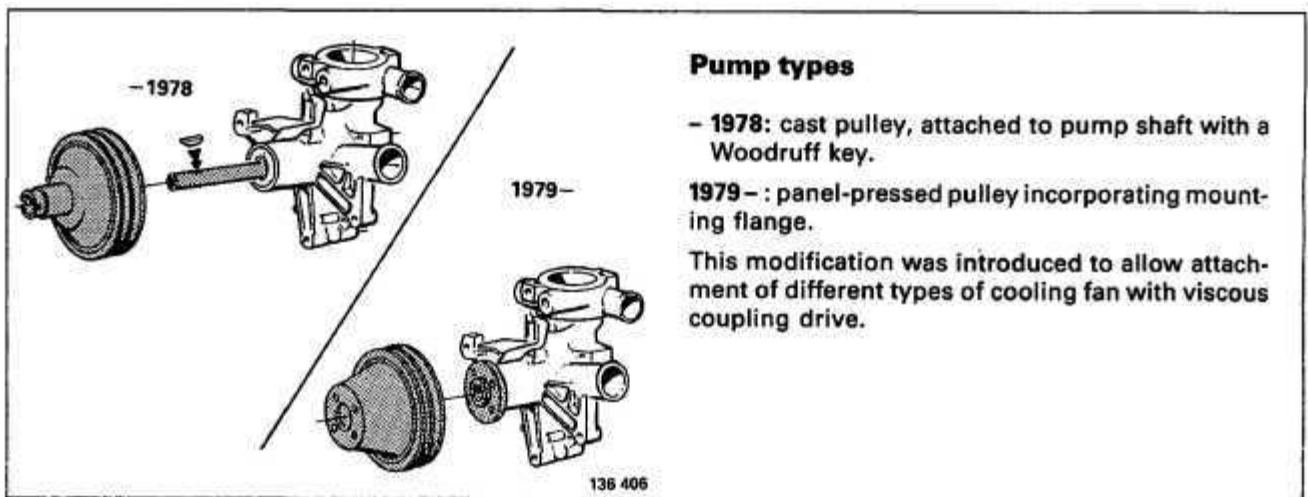
A01

1975–1979: in coolant (water) pump.

1980–1983: at rear of left cylinder head. (This location is more sensitive to coolant temperature, especially if cooling system is underfilled.)



AP. Coolant pump replacement



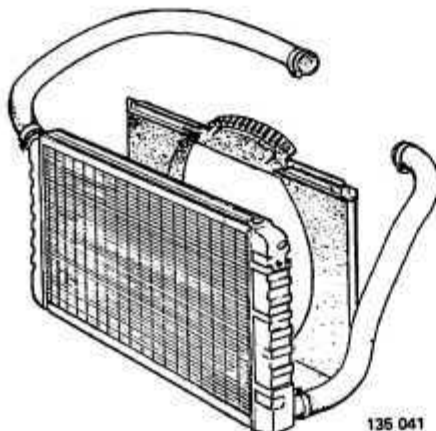
Disconnect battery

AP1

Drain coolant

AP2

Open drain cock on left side of cylinder block. Connect hose to drain cock to prevent spillages.



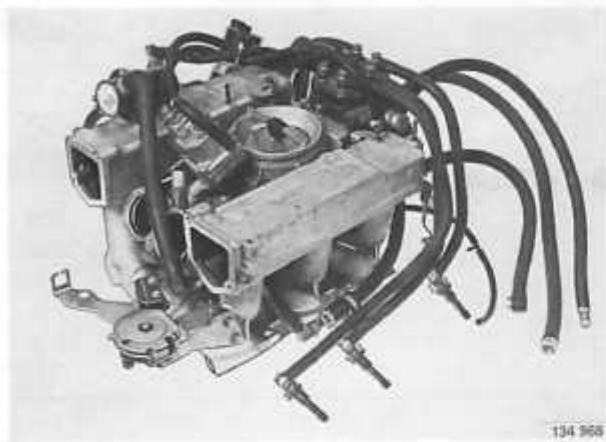
Disconnect/remove:

AP3

- radiator with hoses
- fan shroud

Disconnect wires for thermal switch (electric cooling fan) as required.

Cars with automatic transmission: counterhold nipples on oil cooler tubes so that they do not slacken.



E/F engines

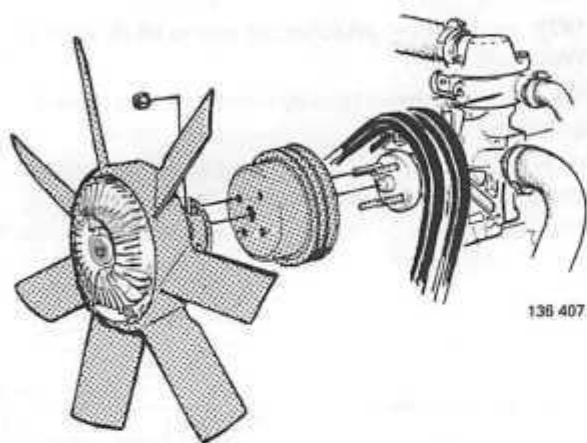
AP4

Detach intake manifold

B 27 E 1975–1978, see R1 on page 96.

Other E/F engines, see S1–6 on page 97.

Not necessary to remove intake manifold on A-engines.



AP5

Slacken alternator drive belts

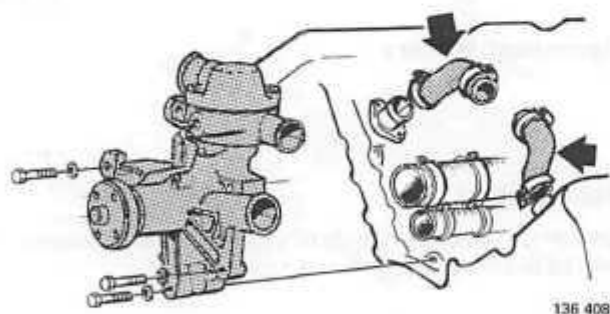
Remove splash guard beneath engine.

Slacken alternator mounting bolts and bolt in mounting arm.

AP6

Remove:

- cooling fan
- coolant pump pulley.



AP7

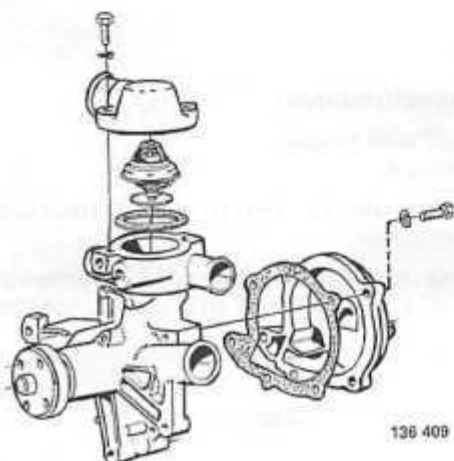
Disconnect hoses from pump

Hoses between pump and cylinder heads must be removed. Slacken the clamps before disconnecting hoses from pump.

AP8

Remove coolant pump

(Three bolts.)

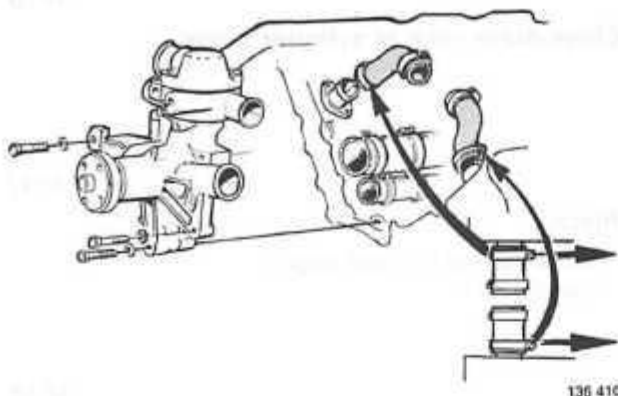


AP9

Transfer parts to new coolant pump

Clean gasket surfaces. Install new gaskets (supplied with pump).

Also transfer temperature sender, connectors and pin studs in pulley flange, if so equipped.



Check coolant hoses

Replace cracked, stiff hoses. Also check radiator hoses.

Install coolant pump and connect hoses

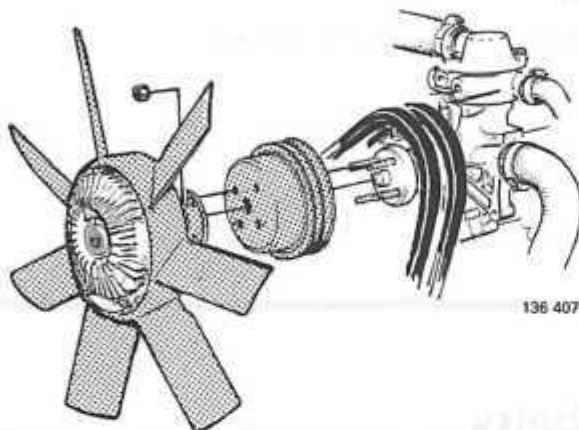
Tightening torque 15–20 Nm (11–15 ft.lbs.).

Note! Lower clamp screws on side hoses (arrowed) should face intake manifold.

Install pulley and cooling fan

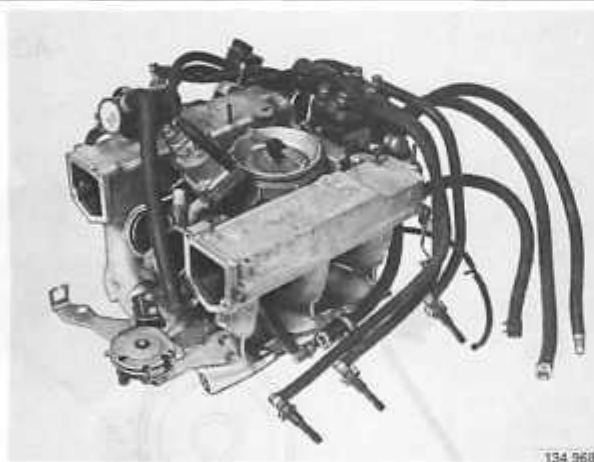
Position drive belts.

Note! 1975–1978: ensure key in pump shaft is located correctly.



Tension drive belts

It should be possible to depress belts 5–10 mm (0.2–0.4 in) midway between pulleys when correctly set.



E/F engines

Install intake manifold

B27 E 1975–1978, see R2 on page 96.

Other E/F engines, see S7–9 on page 97.

Install fan shroud and radiator

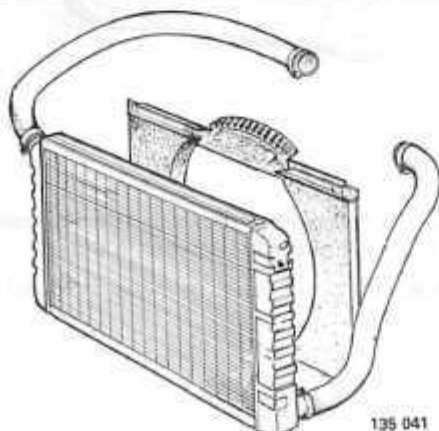
Position fan shroud over fan.

Install radiator and secure fan shroud.

Re-connect hoses.

Re-connect wires for thermal switch (electric cooling fan) as required.

Cars with automatic transmission: counterhold nipples on oil cooler tubes to prevent damage.



AP16

Close drain cock in cylinder block

AP17

Install:

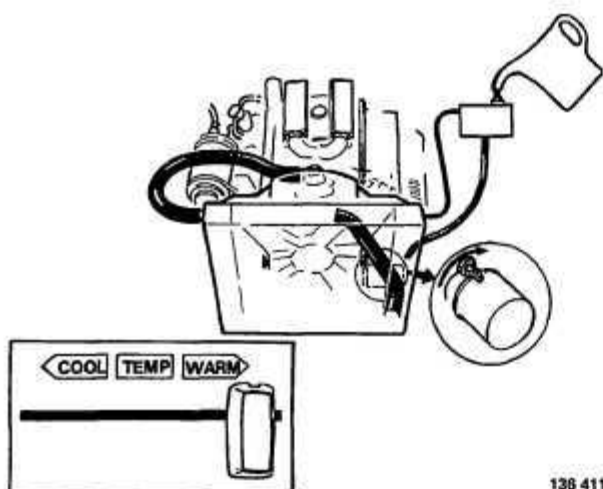
- splash guard beneath engine
- battery cable.

AP18

Fill coolant. Warm-up engine and check function

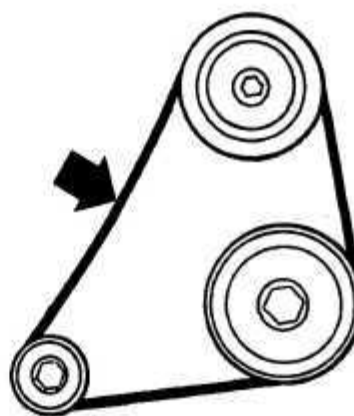
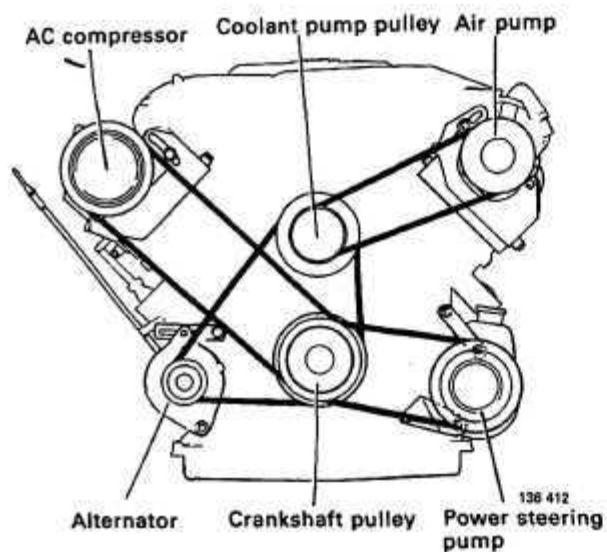
Top-up cooling system if required.

138 411



AQ. Drive belts

AQ1



138 413

When correctly tensioned belts can be depressed 5–10 mm (0.2–0.4 in) midway between pulleys.

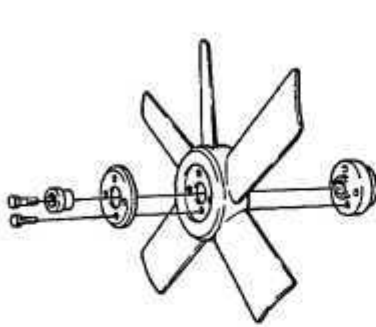
Note! Alternator drive belts must be replaced in pairs.

AR. Cooling fan

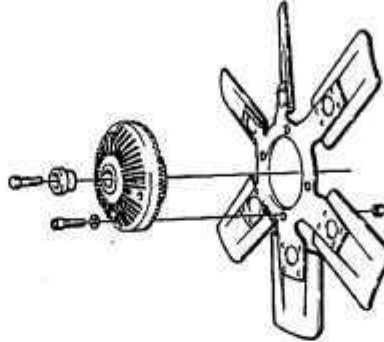
Type of cooling fan fitted to vehicle depends on model year, market and engine type.

1975–1978

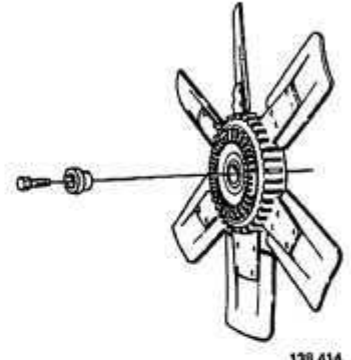
AR1



Fixed fan



Fan with type 1 viscous coupling drive

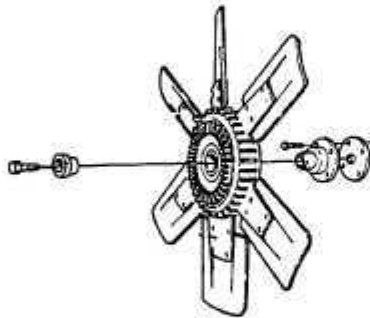


138 414

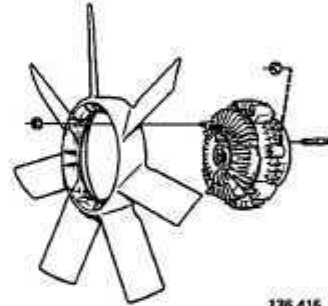
Fan with type 2 viscous coupling drive

1979–1983

AR2

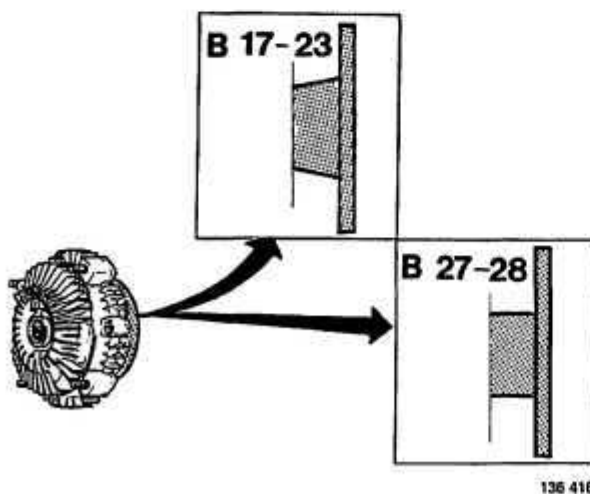


Fan with viscous coupling drive



136 415

Thermally controlled fan with viscous coupling drive



136 416

IMPORTANT

The thermally controlled viscous coupling used on B17–23 must not be fitted to B27/28 engines. The reason for this is that the coolant pump shaft, where the coupling is centered, is 3 mm (0.12 in) larger on B17–23 engines.

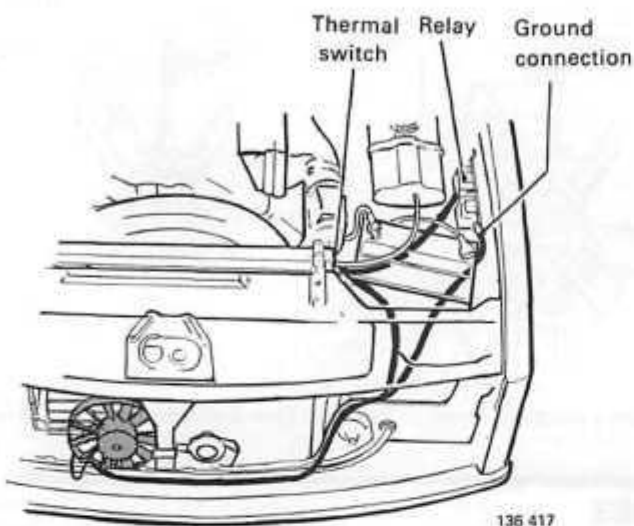
If the coupling were to be fitted, strong imbalance would occur which would result in high repair costs to, for instance, the engine block coolant pump mounting.

On fitting the coupling no radial play should be felt. The coolant pump shaft should be a push fit in the coupling.

The couplings can be identified by the flange shown adjacent: on the B17–23 it is slightly tapered whereas on the B 27/28 it is cylindrical.

AR3

AS. Electric cooling fan

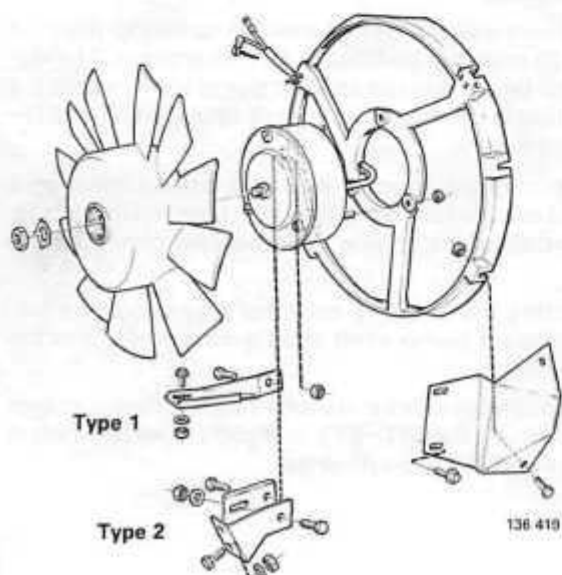
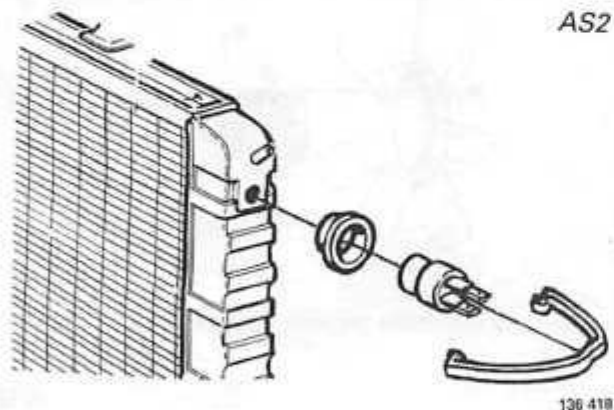


AS1

Electric cooling fans were introduced on 1979-models with air conditioning, intended for markets with hot climates.

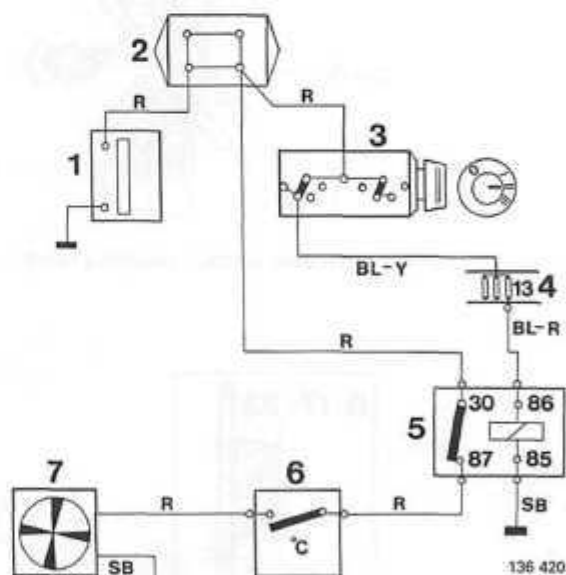
Fan is switched on/off by a thermal switch in radiator. Switches on at 100°C (212°F). Switches off when temperature drops to 95°C (203°F).

AS2



Wiring diagram

AS3



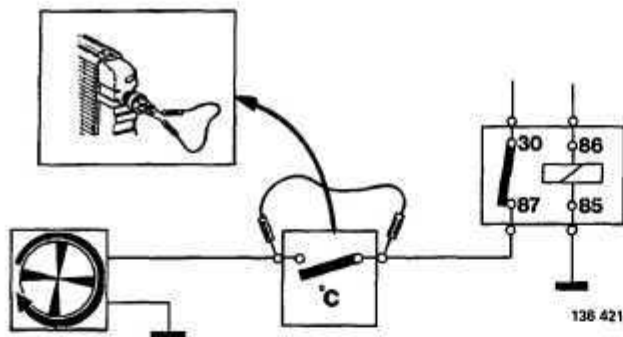
Ignition ON and coolant temperature below 100°C (212°F).

Component

- 1 Battery
- 2 Terminal box
- 3 Ignition switch
- 4 Fuse box (fuse 13)
- 5 Relay
- 6 Thermal switch
- 7 Electric cooling fan

Colour code

- R = red
- BL = blue
- Y = yellow
- SB = black



Check of electric cooling fan and relay

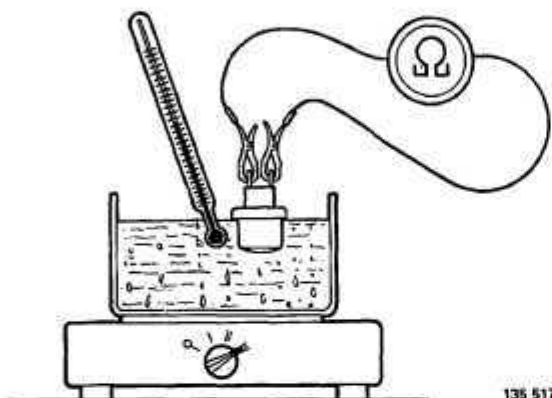
AS4

Turn on ignition.

Connect a wire between terminals on thermal switch. Fan should start. (Do not disconnect existing wires).

If not, check function of relay and wiring.

Turn off ignition.



Check of thermal switch

AS5

If required, the thermal switch can be tested by heating it in an oil bath or oven and observing the pointer of an ohm meter connected between the two terminals.

The switch should switch on at 97–102°C (207–216°F) (small deflection).

On cooling to 97–92°C (207–198°F) the switch should break the circuit (large deflection).

Note! If an oil bath is used to heat the switch care should be taken to ensure that the switch does not touch the sides or bottom of the bath. Also, the thermometer should be held near to the switch.

Group 27 Engine controls

	Operation	Page
General instructions	AT 1	154
Choke linkage B 27/28 A	AU 1-4	155
Throttle, setting		
B 27/28 A	AV 1-10	156
B 27 E 1975-1978	AX 1-8	158
1979-1980	AY 1-8	160
B 28 E 1981-1983	AY 1-8	160
B 27 F 1976-1979	AY 1-9	160
B 28 F 1980	AY 1-10	160
1981 USA Federal + Canada	AY 1-10	160
1981 USA California + Japan	AZ 1-13	163
1982	AZ 1-13	163

AT. General instructions

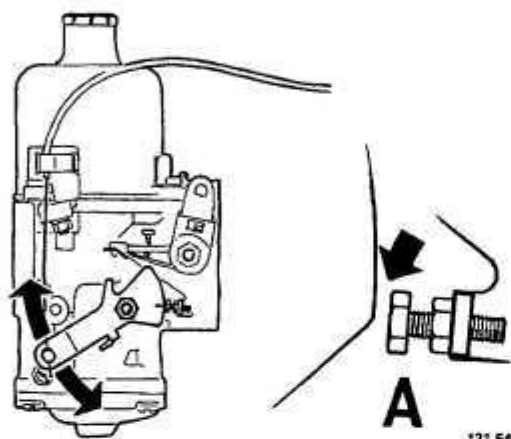
AT1

Observe the following instructions when checking/adjusting engine idle speed:

- Engine should be warmed-up from cold at 25 r/s (1500 r/min).
- Air conditioning must be switched off, as applicable.
- Ignition setting and CO content should be according to specifications.
- F engines with Lambda-sond: Lambda-sond must be connected and CO content below 1.0%.
- B 27, B 28 A (carbureted engines): check/adjust engine rpm within **8 minutes** of coolant thermostat opening.
- B 27, B 28 E/F (injection engines): wait at last **5 minutes** after coolant thermostat has opened before checking/adjusting engine rpm.

15.7 VLS 304 AVTUNE
VANCOUVER, B.C. V6J 3G3
TELEPHONE 731-8171

AU. Choke, adjusting B 27/28 A



AU1

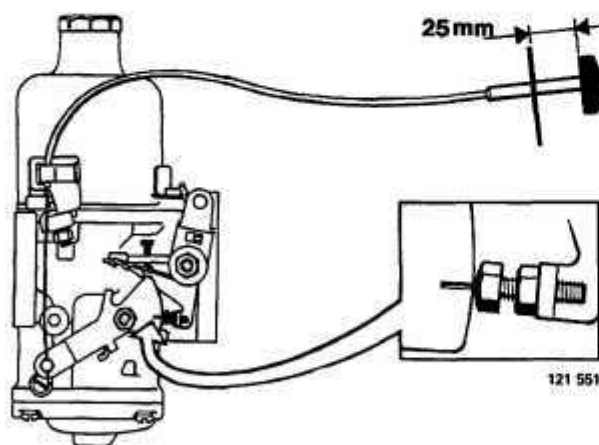
Check choke control

Ensure lever makes full sweep when choke is pulled out.

Push choke in and check that lever is in lower stop position and fast idle adjustment screw A does not contact lever. Adjust if necessary.

AU2

Connect tachometer – warm-up engine



AU3

Adjust fast idle

Pull out choke (approx. 25 mm = 1.0 in) until mark (arrowed) on lever is opposite fast idle screw.

Adjust engine rpm with screw to:

B 27 1976–1977 **20.0–26.7 r/s** (1200–1600 r/min)

1978–1979 **23.3–26.7 r/s** (1400–1600 r/min)

B 28 1980–1983 **20.8–22.5 r/s** (1250–1350 r/min)

Push choke in again.

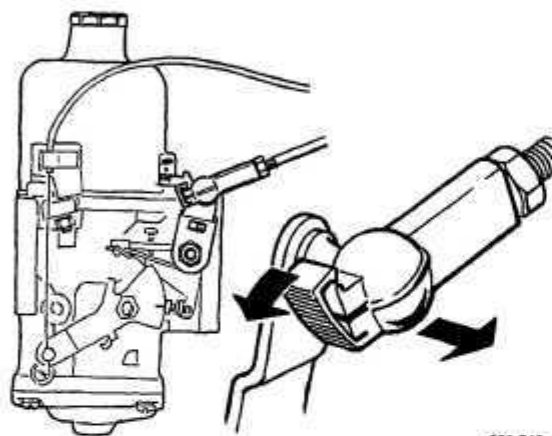
AU4

Switch off engine. Disconnect tachometer

AV. Throttle control, adjusting

Includes: basic setting of throttle valve.
See also general instructions on page 154.

B 27/28 A

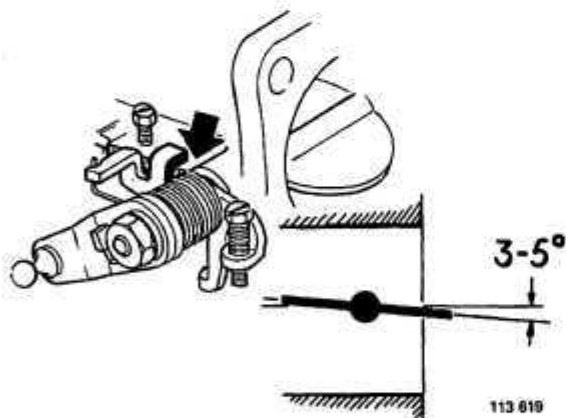


121 548

AV1

Disconnect link rod from carburettor Check throttle valve and pulley

Detach clamp from swivel end and disconnect link rod.
Check that throttle valve and pulley move smoothly.



113 619

AV2

Check opening angle of throttle valve

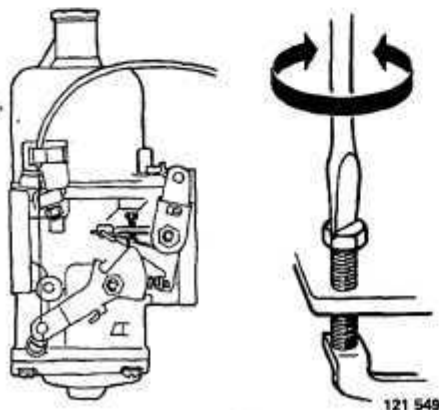
Opening angle at full throttle = $85-87^\circ$, that is $3-5^\circ$ from horizontal. Deviation is small but easily seen.

Adjust angle by tapping end (arrowed) on lever.

AV3

Connect tachometer – warm-up engine

Warm-up engine at 25 r/s (1500 r/min).



121 549

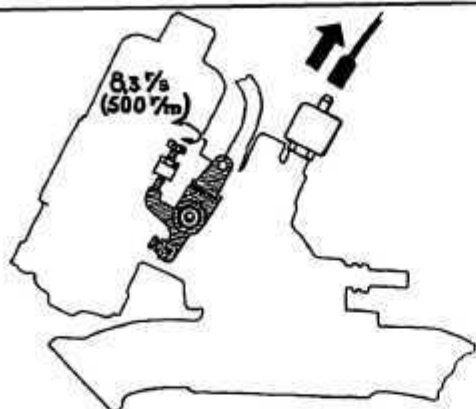
B 27 A 1976

Adjust idle

(= basic setting of throttle)

Adjust to 14.2 r/s (850 r/min).

AV4



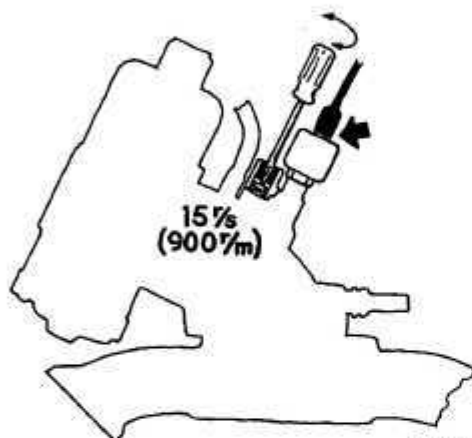
B 27 A 1977–1979; B 28 A 1980–1982

AV5

Basic-set throttle

Disconnect wire from solenoid valve.

Adjust idle to 8.3 r/s (500 r/min) with throttle screw, see fig. Lock screw with lock nut and seal with paint.



113 463

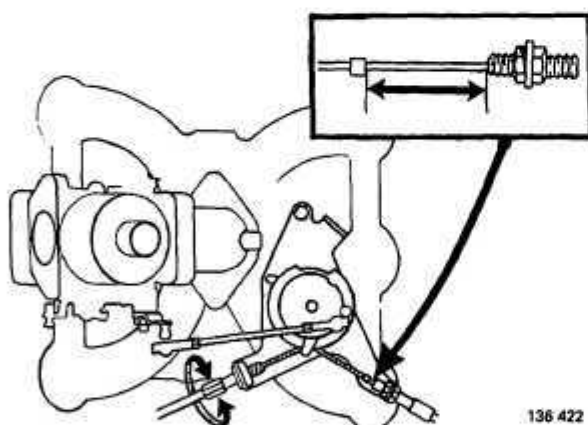
AV6

Adjust idle

Re-connect wire to solenoid valve.

Turn off engine. Re-start engine in order to open solenoid valve.

Adjust idle speed to 15 r/s (900 r/min) using mixture adjusting screw.



136 422

AV7

Turn off engine. Disconnect tachometer

AV8

Adjust throttle cable

Pulley should contact end stop in idle position. Cable must be taut.

At full throttle, pulley should contact full throttle stop.

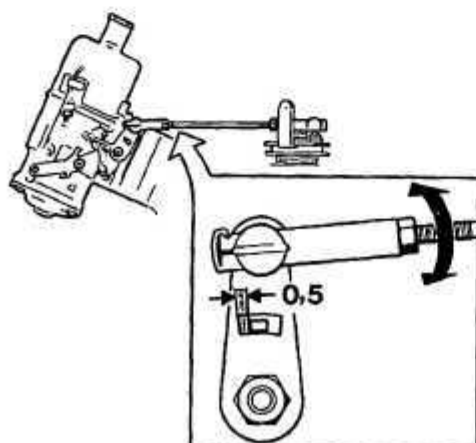
AV9

Adjust kick-down cable (automatic)

Depress accelerator to floor.

Note! Do not operate control by hand otherwise setting will be incorrect.

At full throttle, distance between clip on cable and cable sleeve = 50.4–52.6 mm (1.98–2.07 in).



132 646

AV10

Attach/adjust link rod

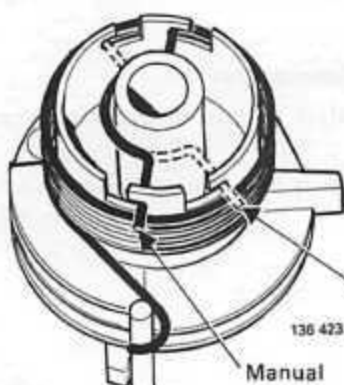
Connect link rod and attach clamp.

Adjust link rod to obtain a 0.5 mm (0.02 in) clearance between lever and throttle spindle flange.

AX. Throttle control, adjusting

Includes: basic setting of throttle valve.
See also general instructions on page 154.

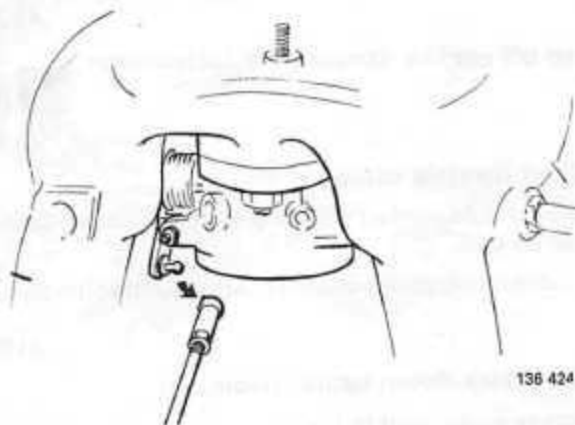
B 27 E 1975-1978



Throttle pulley spring

Note: two different positions for spring:

- one for vehicles with automatic transmission
- one for vehicles with manual transmission



Connect tachometer. Warm-up engine

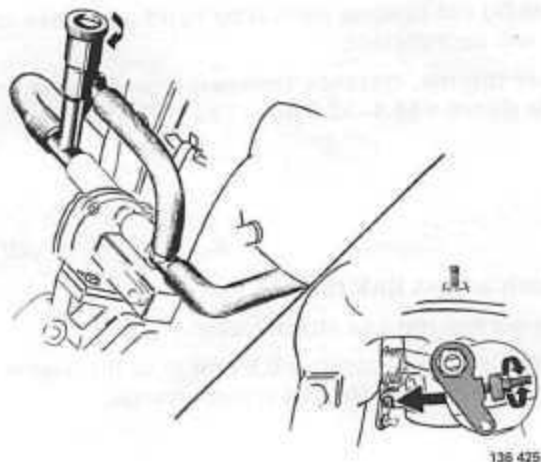
Warm-up engine at 25 r/s (1500 r/min).

AX1

Detach link rod from throttle pulley

Check that throttle pulley moves freely.

AX2



Basic-set throttle

Check that throttle valve operates smoothly.

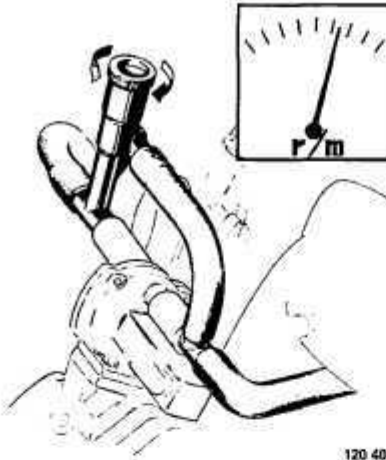
Screw in idle adjustment screw to bottom.

Adjust engine rpm with screw on throttle lever to 11.7 r/s (700 r/min).

AX3

Throttle

AX4



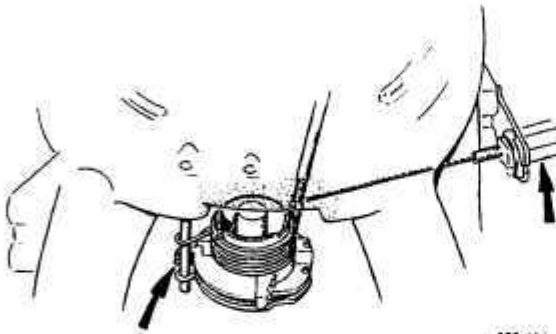
120 407

Adjust idle speed

15.0 r/s (900 r/min).

AX5

Turn off engine. Disconnect tachometer



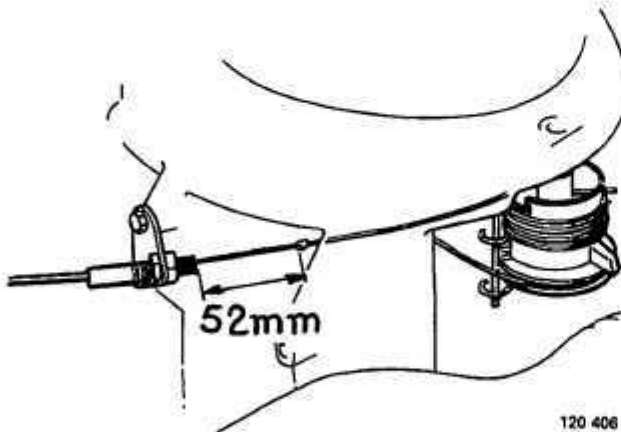
120 404

AX6

Adjust throttle cable

Pulley should contact end stop in idle position. Cable must be taut.

At full throttle pulley should contact full throttle stop.



120 406

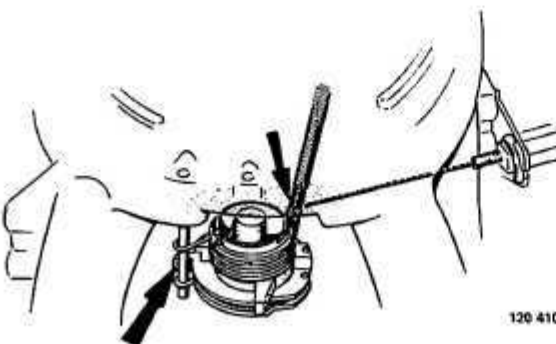
AX7

Adjust kick-down cable (automatic)

Depress accelerator to floor.

Note! Do not operate control by hand otherwise setting will be incorrect.

At full throttle, distance between clip on cable and cable sleeve = 50.4–52.6 mm (1.98–2.07 in).



120 410

AX8

Attach/adjust link rod

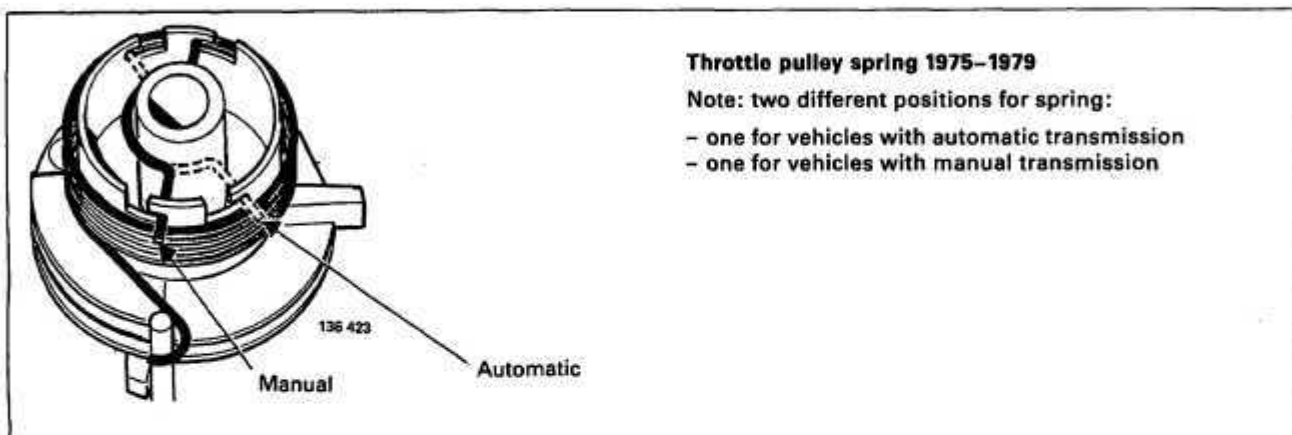
Attach link rod and place a 1 mm (0.039 in) feeler gauge between pulley arm and end stop.

Adjust link rod so that pulley is just free from end stop. Throttle adjustment screw should touch lever.

AY. Throttle control, adjusting

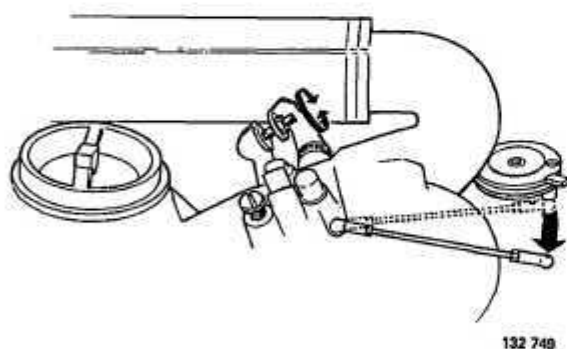
Includes: basic setting of throttle valve.
See also general instructions on page 154.

B 27 E 1979–1980 B 28 E 1981–1983
B 27 F 1976–1979 B 28 F 1980
B 28 F 1981 USA Federal + Canada



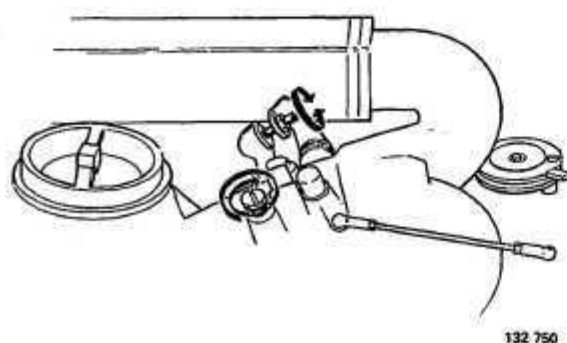
AY1

Connect tachometer. Warm-up engine
Warm-up engine at 25 r/s (1500 r/min).



AY2

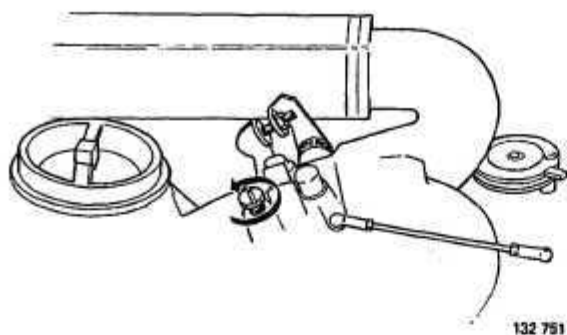
Detach link rod from throttle pulley
Check that throttle pulley moves freely.



AY3

Basic-set throttle
Check that throttle valve operates smoothly.
Screw in idle adjustment screw to bottom.
Adjust engine rpm with screw on throttle lever to 11.7 r/s (700 r/min).

AY4

**Adjust idle**

Adjust with idle adjustment screw (arrowed).

B 27 E 1979-1980

manual	15.0 r/s (900 r/min)
automatic	16.7 r/s (1 000 r/min)

B 28 E 1981-1983

manual	15.0 r/s 900 r/min
automatic 1981	16.7 r/s (1 000 r/min)
automatic 1982 S + Aus	16.7 r/s (1 000 r/min)
automatic 1982- other markets	15.0 r/s (900 r/min)

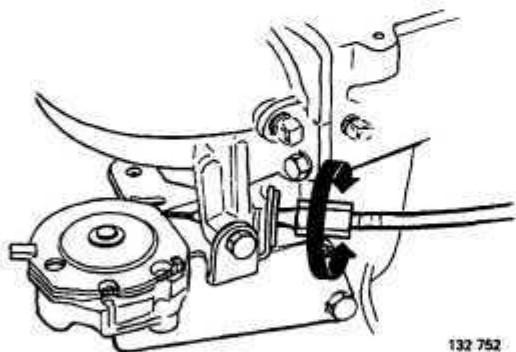
B 27 F 1976-1979

California 1977	15.8 r/s (950 r/min)
Other markets	15.0 r/s (900 r/min)

B 28 F

1980	15.8 r/s (950 r/min)
1981	15.0 r/s (900 r/min)

AY5

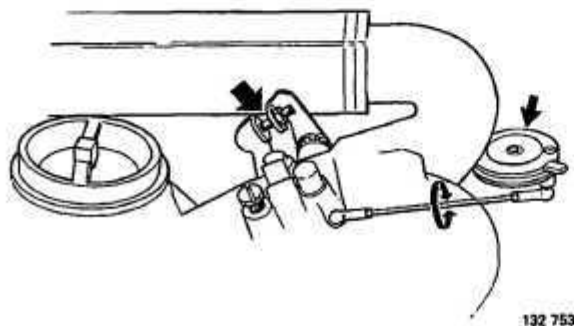
Turn off engine. Disconnect tachometer

AY6

Adjust throttle cable

Pulley should contact end stop in idle position. Cable must be taut, but must not move throttle pulley.

At full throttle, pulley should contact full throttle stop.



AY7

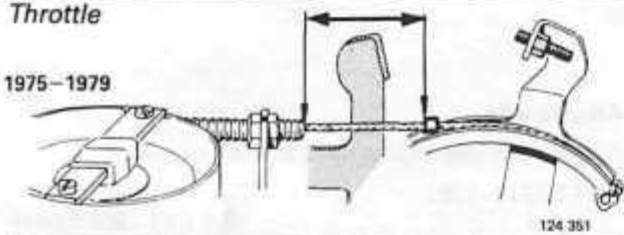
Attach/adjust link rod

Attach link rod to ball on throttle pulley without moving pulley or lever.

Group 27 Engine controls

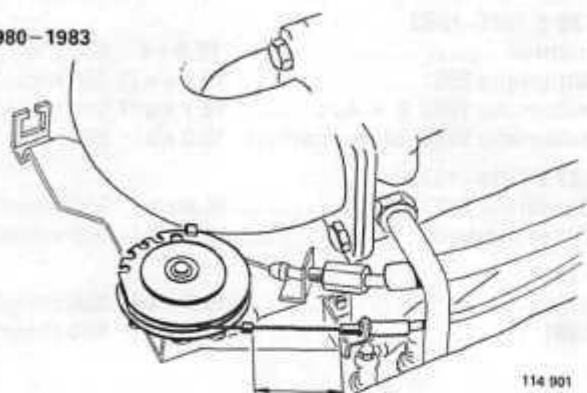
Throttle

1975-1979



124 351

1980-1983



114 901

AY8

Adjust kick-down cable (automatic)

Depress accelerator to floor. **Note!** Do not operate control by hand otherwise setting will be incorrect.

At full throttle, distance between clip on cable and cable sleeve = **50.4-52.6 mm (1.98-2.07 in)**.

*B 27 F 1976 USA California
1976-1977 Japan*

AY9

Adjust microswitch for exhaust gas recirculation system (EGR)

Connect a test lamp in series between microswitch and wire to solenoid valve.

Turn on ignition.

Place a **1.5 mm (0.039 in)** feeler gauge between throttle adjustment screw and end stop.

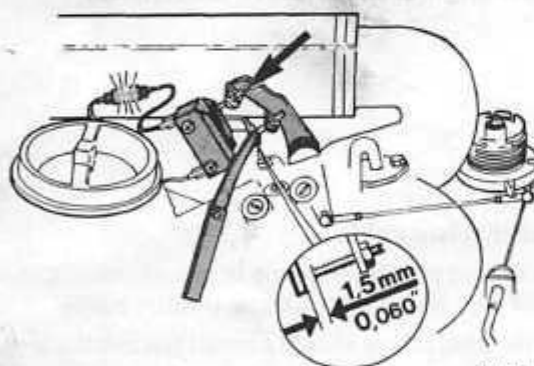
Lock nut and unscrew **upper** adjustment screw until test lamp goes out.

Screw in adjustment screw until test lamp just lights.

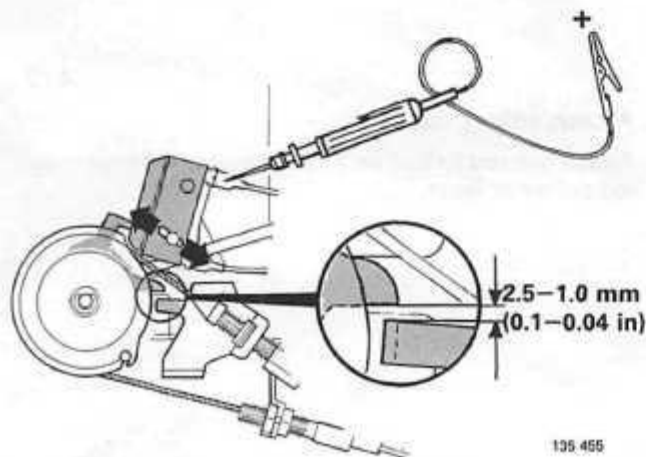
Tighten lock nut.

Check adjustment with a 2 mm (0.079 in) feeler gauge. Lamp should be off.

Disconnect test lamp. Turn off ignition.



136 356



135 455

B 28 F 1980-1981

AY10

Check/adjust microswitch for Lambda-sond system

Connect a test lamp between the green wire on switch and a 12V power supply.

Check that microswitch is on (lamp lights) **2.5-1.0 mm (0.1-0.04 in)** before throttle pulley contacts full throttle stop.

Adjust if necessary.

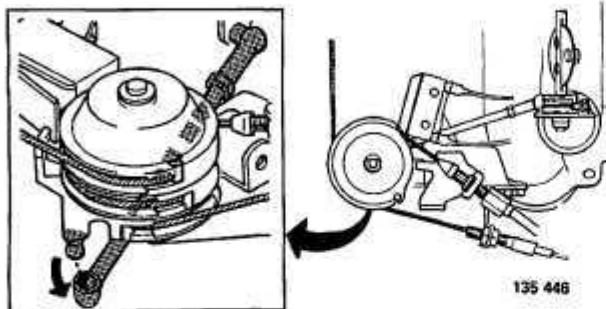
IMPORTANT!

B 28 F vehicles for high altitude use: disconnect microswitch before carrying out above test. See page 140.

AZ. Throttle control, adjusting

Includes: basic setting of throttle valve.
See also general instructions on page 154.

B 28 F 1981 USA California + Japan
B 28 F 1982 all

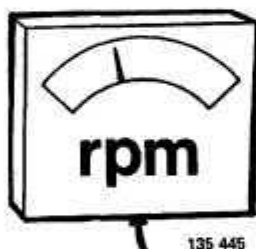


Connect tachometer. Warm-up engine

AZ1

Detach link rod from throttle pulley
Check that throttle pulley moves freely.

AZ2



Check idle

15.0 /s (900 r/min)

Tolerance:

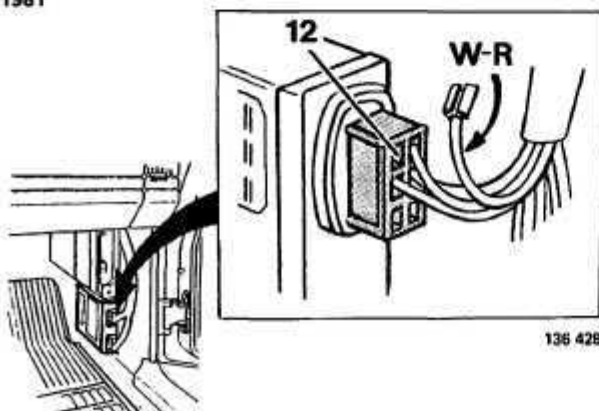
1981	14.2–15.8 r/s (850–950 r/min)
1982	14.7–15.3 r/s (800–920 r/min)

Correct idle, proceed to

AZ9

Incorrect idle, basic-set throttle according to AZ4–8.

1981



Basic setting of throttle
Operations AZ4–8

AZ4

Disconnect control unit for constant idle speed system

Air control valve should move to rest position.

1981:

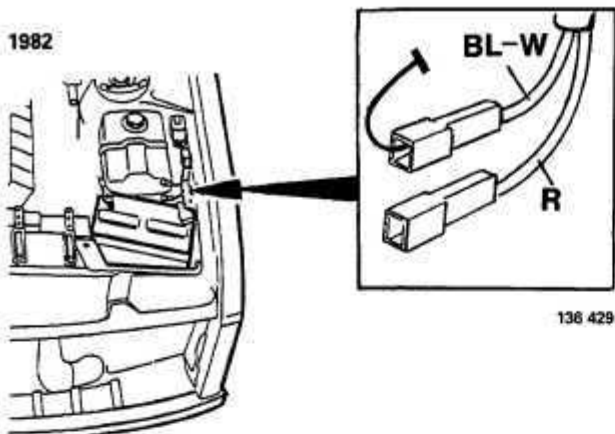
Turn off ignition.

Disconnect the white-red wire (terminal 12) from the blue connector on the control unit.

Turn on engine.

Throttle

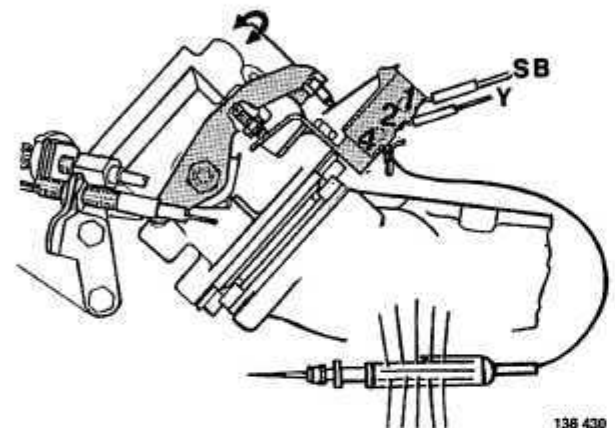
1982



136 429

1982:

Ground blue-white wire (test point).
(The red wire is connected to Lambda-sond system).



136 430

AZ5

Connect a test lamp to microswitch

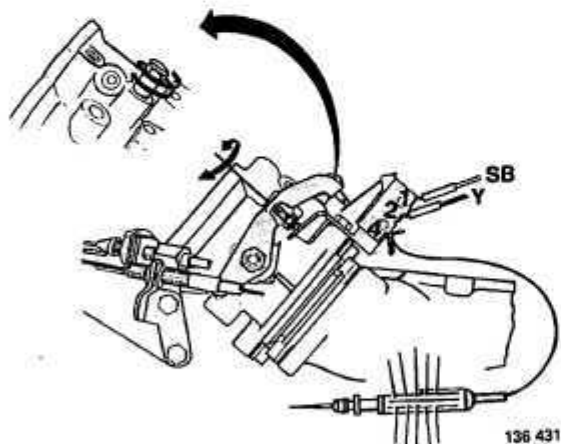
1982 version shown adjacent.
1981 version is slightly different.

Connect test lamp between 12V power supply and:

1981 yellow wire on microswitch
1982 terminal 4 on microswitch

Lamp should be on when carrying out following adjustment otherwise throttle setting will be incorrect.

If lamp is not on turn **upper** adjustment screw until it comes on.



136 431

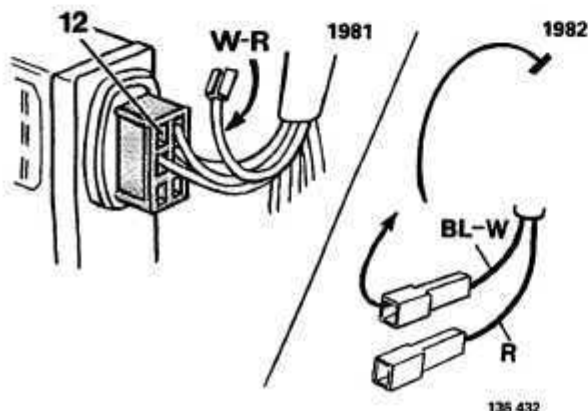
AZ6

Basic-set throttle

Ensure idle adjustment screw is screwed in fully i.e. bottoms. The screw is designed for engines without CIS system.

Adjust idle speed with **lower** adjustment screw on lever to **14.2 r/s (850 r/min)**.

Notel Test lamp must be on.



136 432

AZ7

Connect control unit

1981:

Turn on ignition.

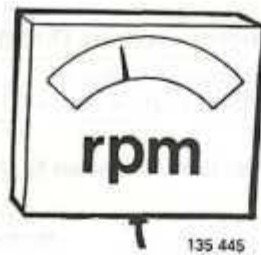
Connect white-red wire (terminal 12) to control unit.

Turn on engine.

1982:

Disconnect ground from test point.

AZ8



135 445

Check idle

Idle = **15.0 r/s** (900 r/min) when control unit is connected.

Tolerance:

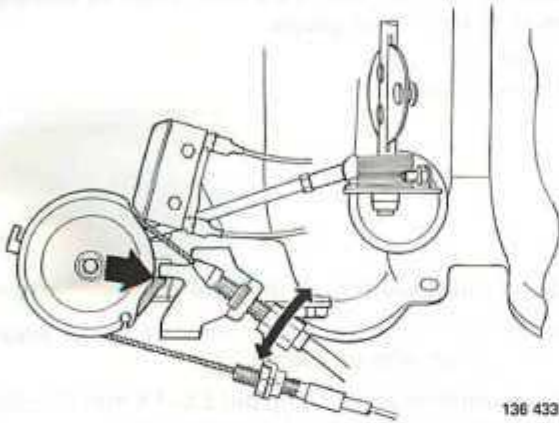
1981	14.2–15.8 r/s (850–950 r/min)
1982	14.7–15.3 r/s (880–920 r/min)

AZ9

Turn off engine. Disconnect tachometer
Adjust throttle cable

Pulley should contact end stop in idle position. Cable must be taut but must not move throttle pulley.

At full throttle, pulley should contact full throttle stop.



136 433

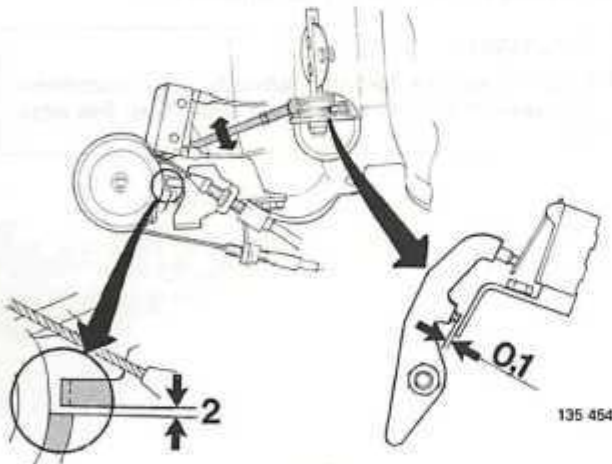
AZ10

Attach/adjust link rod

Place a 2 mm (0.080 in) feeler gauge between pulley and idle stop.

Adjust link rod to obtain a **0.1 mm** (0.004 in) clearance between lower adjustment screw and end stop.

Remove feeler gauge.



135 454

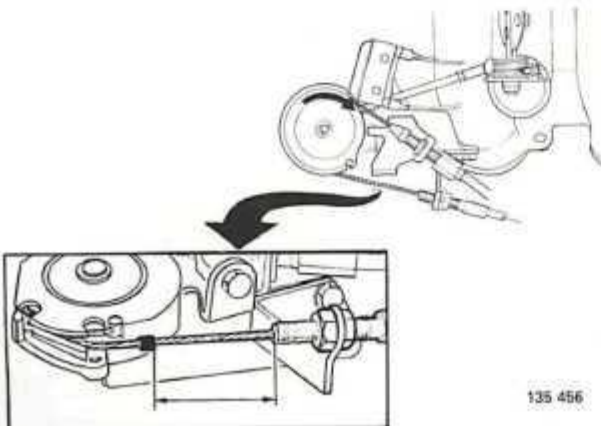
AZ11

Adjust kick-down cable (automatic)

Depress accelerator to floor.

Note! Do not operate control by hand otherwise setting will be incorrect.

At full throttle, distance between clip on cable and cable sleeve = **50.4–52.6 mm** (1.98–2.07 in).



135 456

AZ12

Adjust microswitch at throttle lever

1982 version shown adjacent.
1981 version is slightly different.

Connect test lamp between 12 V power supply and:

1981 yellow wire on microswitch
1982 terminal 4 on microswitch

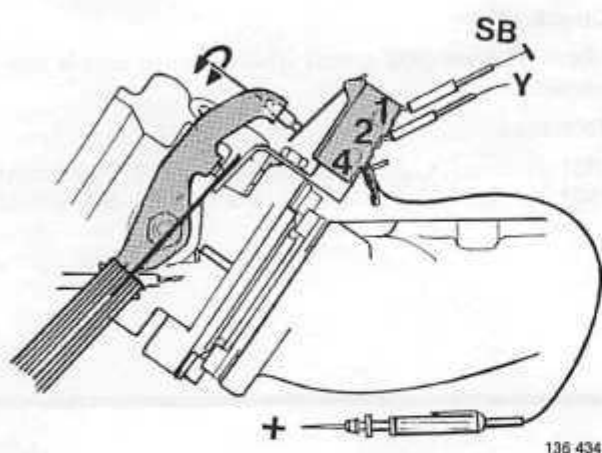
Place a **0.3 mm** (0.012 in) feeler gauge between **lower** adjustment screw and stop.

Unscrew **upper** adjustment screw until lamp goes out. Then turn in screw until lamp just lights.

Check adjustment with a **0.2 mm** (0.008 in) and a **0.6 mm** (0.024 in) feeler gauge.

0.2 mm = lamp on

0.6 mm = lamp off



AZ13

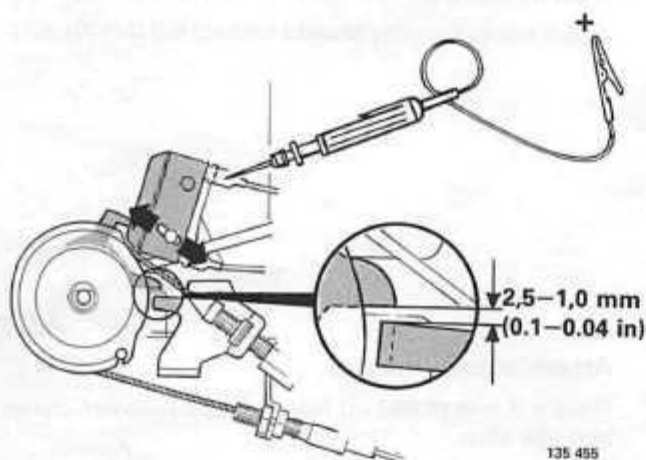
Adjust microswitch at throttle pulley

Connect a test lamp between the 12V power supply and the green wire on switch.

Adjust switch to close (lamp on) **2.5–1.0 mm** (0.1–0.04 in) before pulley touches full throttle stop.

IMPORTANT!

B 28 F vehicles for high altitude use: disconnect microswitch before carrying out above test. See page 140.



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