VOLVO

Service Manual

Fault tracing

Repairs

Maintenance

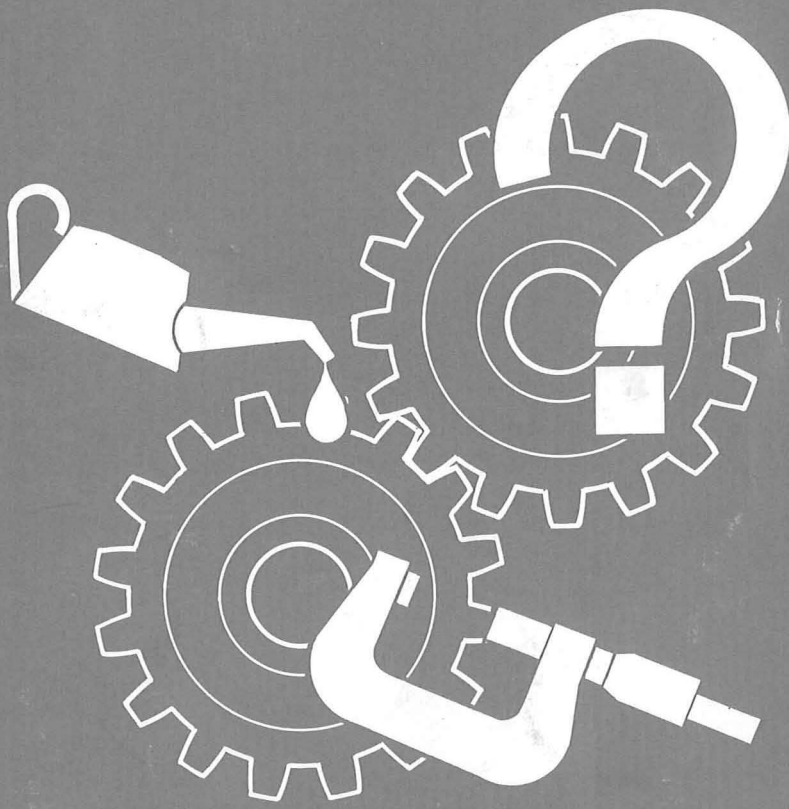
Section 0 (03)

Specifications

700 1982–1991
940/960 1991

TP 30518/10

SAN DIEGO VOLVO



Volvo Cars North America

Contents

General	2
Lubrication	12
B 19, B 23 Engines	15
B 200, B 230, B 204, B 234 Engines	35
B 28 Engine	69
B 280 Engine	86
B 6304 Engine	98
D 24, D 24 T, D 24 TIC Engines	108
Electrical System	118
Power Transmission	138
Brakes	153
Suspension and steering	155
Springs, dampers and wheels	159
Body and interior	160

Revisions and changes to the previous edition are indicated by a line in the margin.

Order No. TP 30518/10
Supersedes TP 30518/9

SAN DIEGO VOLVO
#5364

We reserve the right to make alterations without prior notification.

Section 0 General

General data
740

Modell year	Designation	Chassis number		Engine type	Gearbox	Final drive ratio
		744	745			
1984	E	33720–81679*		B 19 E, B 19 ET, B 23 E, D 24	AW 70, AW 71, M 46, M 47, ZF4HP22	3.54:1, 3.73:1 3.91:1
1985	F	81680–215754*	1-6969	B 200 K, B 200 E, B 200 ET, B 230 A, B 230 E, B 230 F, B 230 K, B 230 ET, B 230 FT, D 24, D 24 T	AW 70, AW 71, M 46, M 47, ZF4H22	3.31:1, 3.54:1 3.73:1, 3.91:1
1986	G	1-90199	6970–62099	B 200 K, B 200 E, B 200 ET, B 230 A, B 230 E, B 230 F, B 230 K, B 230 ET, B 230 FT, D 24, D 24 T	AW 70, AW 71, M 46, M 47, ZF4HP22	3.31:1, 3.54:1 3.73:1, 3.91:1 4.10:1
1987	H	90200–190699	62100–116099	B 200 K, B 200 E, B 200 ET, B 230 E, B230 ET, B230 F, B 230 FT, B 230 K, D 24, D 24 T, D 24 TIC	AW 70, AW 71, M 46, M 47 ZF4HP22	3.31:1, 3.54:1 3.73:1, 3.91:1 4.10:1
1988	J	190700–294099	116100–176799	B 200 K, B 200 E, B 200 ET, B 230 E, B 230 ET, B 230 F, B 230 FT, B 230 K, D 24, D 24 T, D 24 TIC	AW 70, AW 71, M 46, M 47, ZF4HP22	3.31:1, 3.54:1, 3.73:1, 3.91:1, 4.10:1
1989	K** France: 0 (zero)	294100–396999	176800–242699	B 200 K, B 200 E, B 200ET, B 204 E, B 230E, B 230 ET, B 230 F B 230 FT, B 234 F, B 230 K D 24, D 24 T, D 24 TIC	AW 70, AW 71, AW 72, M 46, M 47, ZF4HP22	3.31:1, 3.54:1, 3.73:1, 3.91:1, 4.10:1
1990	L France: 0 (zero)	397000–499199	242700–316299	B 200 E, B 200 F, B 204 E, B 204 GT, B 230E, B 230 F, B 230 FT, B 230 GT, B 234 F, B 230 K D 24, D 24 T, D 24 TIC	AW 70, AW 71, AW 72, M 46, M 47, ZF4HP22	3.31:1, 3.54:1, 3.73:1, 3.91:1, 4.10:1
1991	M France: 0 (zero)	499200–	316300–	B 200 E, B 200 F, B 200 FT, B 230 E, B 230 F, B 230 FB, B 230 FT, D 24, D 24 T, D 24 TIC	AW 70, AW 71, M 46, M 47, ZF4HP22	3.31:1, 3.54:1, 3.73:1, 3.91:1, 4.10:1

* 744 and 764 models from 1984 and 1985 were grouped in same chassis number series.
** Sweden: K from chassis number 342255/208548.

760

Model year	Designation	Chassis number		Engine type	Gearbox	Final drive ratio
		764	765			
1982	C	1–3799		B 28 E	AW 71, M 46	3.31:1, 3.54:1
1983	D	3800–33719		B 28 A, B 28 E, B 28 F, D 24 T, B 23 ET	AW 71, BW 55 M 46	3.31:1, 3.54:1
1984	E	33720–81679*		B 28 A, B 28 E, B 28 F, D 24 T, B 23 ET	AW 71, BW 55, M 46, ZF4HP22	3.31:1, 3.54:1 3.73:1, 3.91:1
1985	F	81680–215754*	1–999	B 28 A, B 28 E, B 28 F, B 230 K, B 230 ET, B 230 FT, D 24 T	AW 71, M 46, M 47, ZF4HP22	3.54:1, 3.73:1 3.91:1
1986	G	1–16999	1000–8499	B 28 A, B 28 E, B 28 F, B 230 K, B 230 ET, B 230 FT, D 24 T	AW 71, M 46, M 47, ZF4HP22	3.54:1, 3.73:1 3.91:1
1987	H	17000–37399	8500–16299	B 230 K, B 230 ET, B 230 FT, B 280 E, B 280 F, D 24 T, D 24 TIC	AW 71, M 46, M 47, ZF4HP22	3.54:1, 3.73:1 3.91:1
1988	J	37400–58499	16300–23499	B 230 ET, B 230 FT, B 280 E, B 280 F, D 24 TIC	AW 71, M 46, M 47, ZF4HP22	3.54:1, 3.73:1, 3.91:1
1989	K** France: 0 (zero)	58500–76899	23500–31119	B 230 ET, B 230 FT, B 280 E, B 280 F, D 24 TIC	AW 71, M 46, ZF4HP22	3.54:1, 3.73:1, 3.91:1
1990	L France: 0 (zero)	76900–	31200–	B 230 FT, B 230 GT B 280 E, B 280 F, D 24 TIC	AW 71, M 46, ZF4HP22	3.54:1, 3.73:1, 3.91:1

* 744 and 746 models from 1984 and 1985 were grouped in the same chassis number series.
** Sweden: K from chassis number 67303/27155.

780

Model year	Designation	Chassis number	Engine type	Gearbox	Final drive ratio
1986	G	1–1199	D 24 TIC	M 46	3.54:1
1987	H	1200–3299	B 200 ET, B 280 E B 280 F, D 24 TIC	M 46, AW 71	3.54:1, 3.73:1 3.91:1
1988	J	3300–6499	B 200 ET, B 280 E, B 280 F, D 24 TIC	M 46, AW 71	3.54:1, 3.73:1, 3.91:1
1989	K* France: 0 (zero)	6500–8999	B 230 FT, B 280 F, D 24 TIC	M 46, AW 71	3.54:1, 3.73:1
1990	L France: 0 (zero)	9000–11299	B 230 FT, B 280 F,	M 46, AW 71 D 24 TIC	3.54:1, 3.73:1
1991	M	11300–	B 230 FT, B 280 F	AW 71	3.73:1

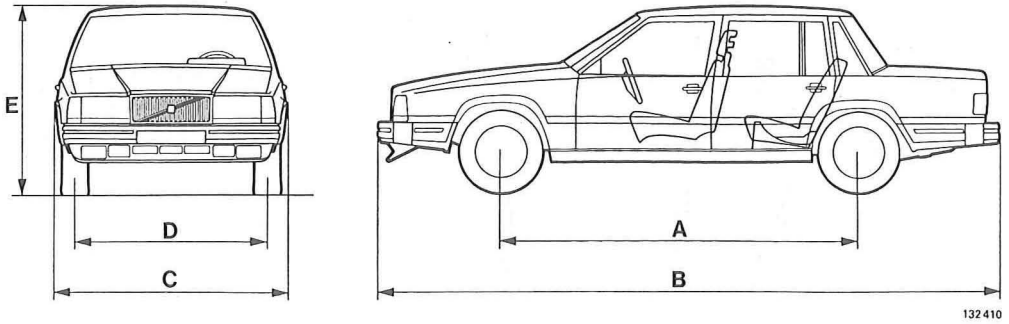
* Sweden: K from chassis number 7509.

940

Model year	Designation	Chassis number		Engine type	Gearbox	Final drive ratio
		944	945			
1991	M France: 0 (zero)	1–	1–	B 200 E, B 200 F, B 200 FT, B 204 E, B 230 E, B 230 FB, B 230 FT, B 230 GT, B 234 F, B 234 G, D 24, D 24 T, D 24 TIC	M 46, M 47, AW 70, AW 71, ZF4HP22	3.54:1, 3.73:1 3.91:1, 4.10:1

960

Model year	Designation	Chassis number		Engine type	Gearbox	Final drive ratio
		964	965			
1991	M France: 0 (zero)	1–	1–	B 204 FT, B 230 GT, B 230 FT, B 280 E, B 280 F, B 6304 F, D 24 TIC	M 46, AW 71, AW 30–43	3.54:1, 3.73:1 3.91:1



Dimensions

	740/760 mm	740/760 in	780 mm	780 in	944/964 mm	944/964 in	945/965 mm	945/965 in
A. Wheelbase	2770	109	2770	109	2770	109	2770	109
B. Overall length	4785	188.4	4794	189	4871	191.8	4844	190.7
C. Overall width	1760	69.3	1770	69.7	1750	68.9	1750	68.9
D. Track, front	1470[1]	57.9	1470	57.9	1471	57.9	1471	57.9
rear	1460[2]	57.5	1460[2]	57.5	1460	57.5	1460	57.5
E. Overall height[3]	1410	55.5	1400	55.1	1410	55.5	1440	56.7

[1] – Dec. 1984: wheelbase = 1460 mm.
[2] 760/960 4-door, 780 1988– Track rear 1520 mm 59.9 in
[3] Depending on type of tyre.

Weight

740	760	780
1270–1460 kg (2798–3120lb)	1330–1500 kg (2930–3305lb)	1500 kg (3305 lb)

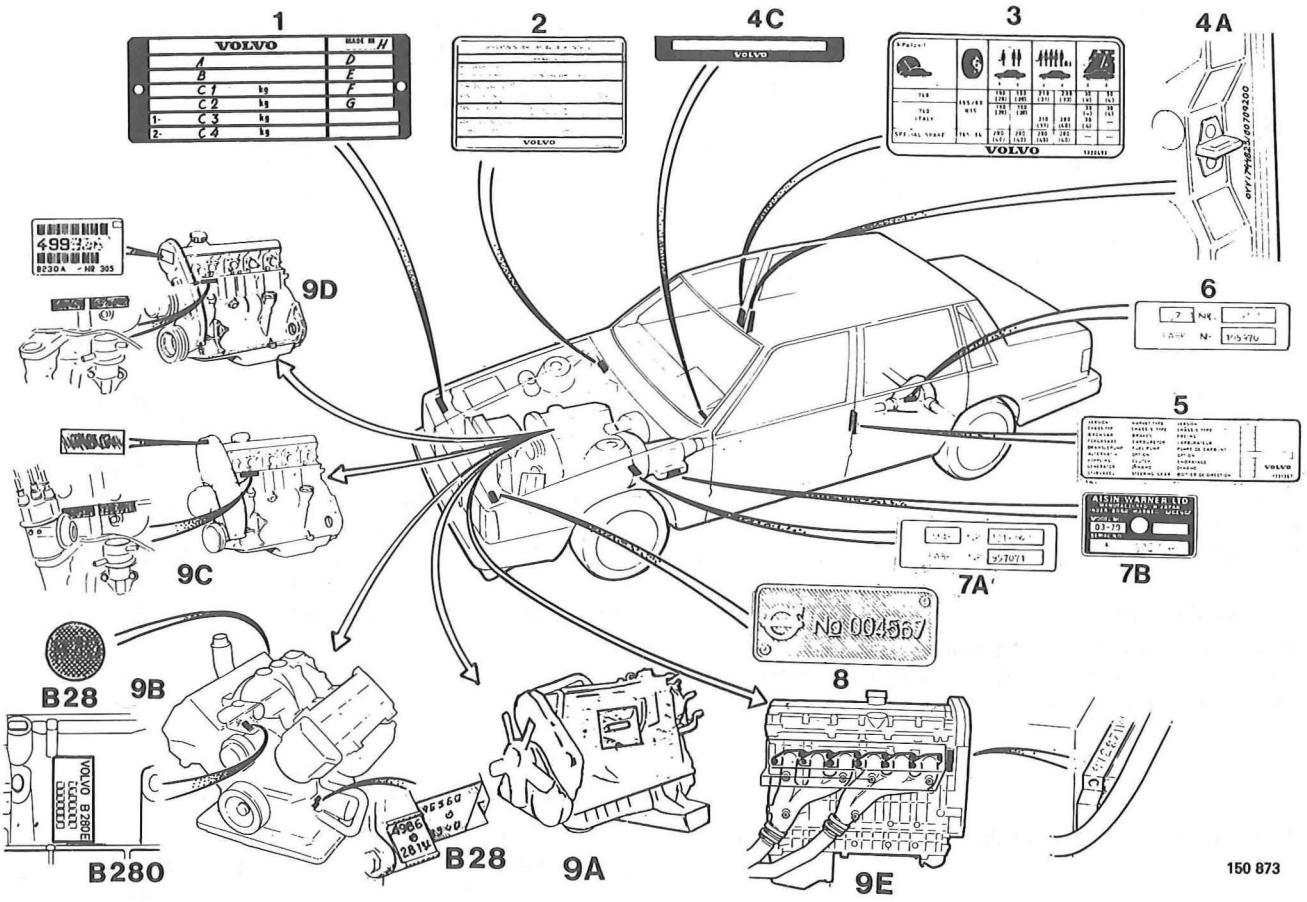
Approximate weight of car without occupants, full fuel tank

944	945	964	965
1327–1463 (2924–3223lb)	1363–1496 (3003–3296lb)	1484–1576 (3270–3472lb)	1438–1527 (3168–3364lb)

The weight varies depending on variant and equipment

Fuel tank

	Litres	US. gal
760/780 –1987, 740, standard, 944/945/965	60	15.8
increased-capacity	82	21.6
760 4-door., 780 1988–, 964	80	21.1



740, 760, 940, 960

Type plates

1. Product plate

Located on right spring turret (–1984) or above right side headlamp (1985–). See page 8.

2. Information on exhaust emission controls

Sweden, Switzerland, USA, Canada and Australia.

Located on bulkhead. Shows idling speed, valve clearances, ignition timing and CO content.*
760 1988–: located on left side suspension tower.

* USA & Canada: not all details included.

3. Tyre pressures

1982: Located on inside of glove compartment lid.
1983–: Rear edge of right front door.

4. Type, model year designations and chassis number

A. All markets
Stamped on RH centre door post.

B. Scandinavia:
Sedan: Attached to rear boot member.
Estate: Located on rear right of wheelhouse

C. USA & Canada
Located on top left of dashboard.

5. Service plate (1982–1989)

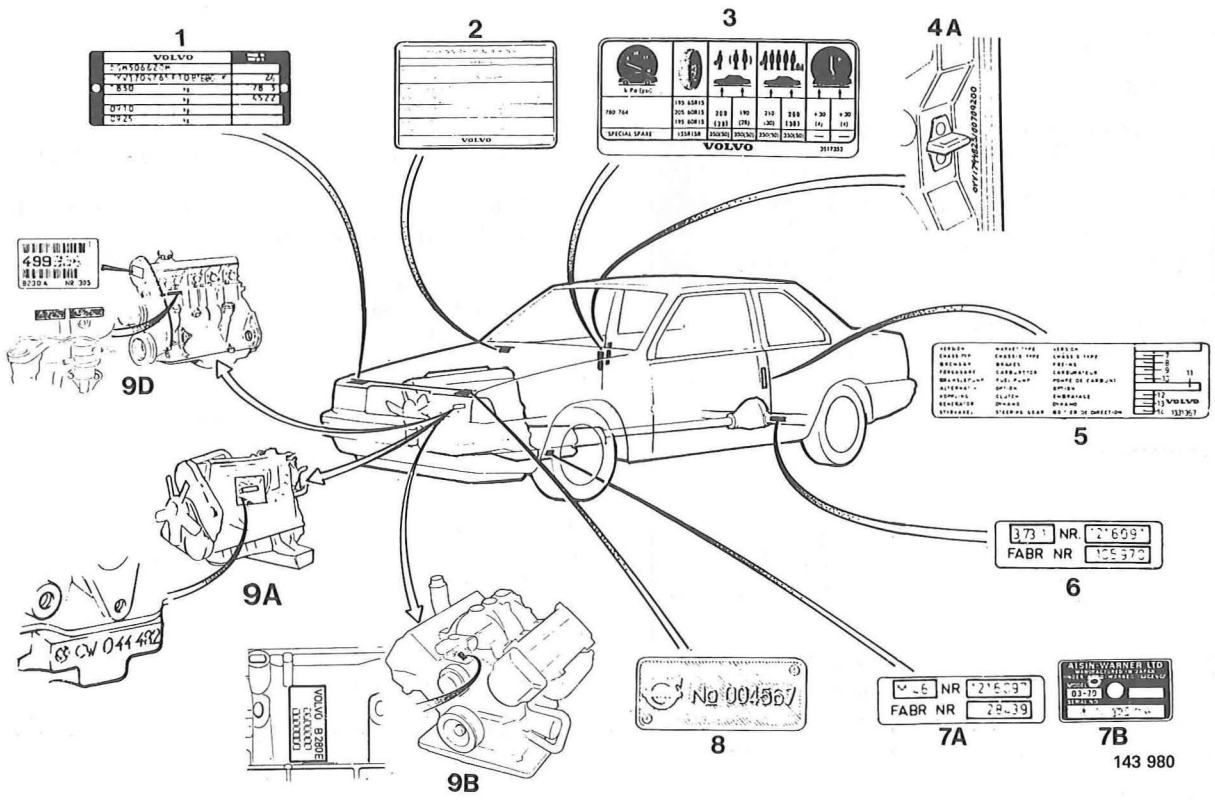
740/760

Early models: Located on front upper member of luggage compartment.

Later models: Rear left door pillar.

780: Located on post behind left side door.

Part	Manufacturer	Code
Brakes	Girling front and rear	1
	Girling front and ATE rear	2
	DBA front, ATE rear	3
	760, 1988–:	
	Girling, front and rear	4
	DBA front and Girling rear	5



780

Carburettor	SU	2
	Pierburg	3
	Solex	5
Fuel pump	Pierburg	2
	Bosch	3
	AC-Delco	4
	Sofabex	5
Clutch	Fichtel & Sachs	2
	Verto/Valeo	3
Alternator	Bosch	1
Steering box	Cam Gear	2
	Zahnrad Fabrik (ZF)	3

6. Final drive ratio, part and serial numbers

Located on rear axle.

7. Gearbox type designation, part number and serial number

A. Manual: On bottom of gearbox.

B. Automatic:
BW 55, AW 55/70/71/72: On LH side of gearbox.
AW 30–43: On RH side of gearbox.

8. Body number plate

Located above left headlamp.

9. Engine type designation, serial number and part number

A. D 24, D 24 T, D 24 TIC
Stamped on cylinder block, beneath vacuum pump.

B. B 28
Located on plate in front of oil filter. On B 28 E/F engines: a decal on the right rear side of cylinder head shows last three digits of part number.

B 280
Stamped on cylinder block. (Some models: decal)
Early type: between cylinder banks, to rear.
Late type: front right side, between inlet manifold and water pump.

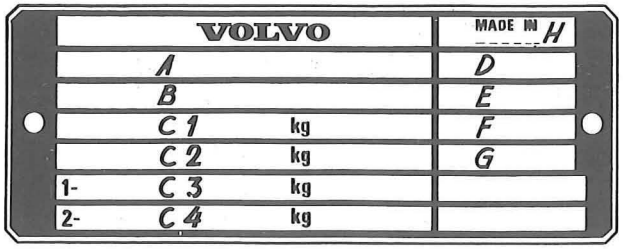
C. B 19, B 23
Stamped on left side of engine, behind distributor. Last three digits of part number are shown on transmission gearcase.

D. B 200, B 230
Located on timing gearcase. Also stamped in left side of cylinder block.

E. B 6403
Decal on timing gearcase. Also stamped in right side of cylinder block, above water pump housing, between timing gearcase and manifold.

Product plate

1982–1989

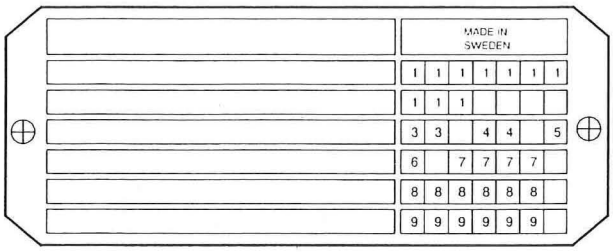


147 941

A Type approval*
B Vehicle identification number (type designation)**
C_1 Gross vehicle weight
C_2 Max train weight
C_3 Max axle load: front
C_4 Max axle load: rear
D Special vehicle numbers
E Market code
F Colour code
G Interior code
H Country of manufacture

* Certain countries.
** Type designation codes, see next spread.

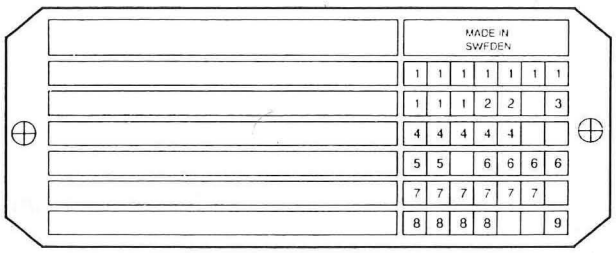
1990 –W 944



148 098

A–C_4 As before
1 = Version
2 = Chassis type
3 = Market code
4 = Emission
5 = Steering gear
6 = Brakes
7 = Interior fittings code
8 = Colour code
9 = Special variant (if applicable)

1990 W 945–
1991–



148 099

A–C_4 As before
1 = Version
2 = Market code
3 = Brakes
4 = Chassis code (see below)
5 = Emission
6 = Interior fittings code
7 = Colour code
8 = Special variant (if applicable)
9 = Steering gear

The chassis code has seven positions:

pos 1–2 Front spring, shock absorber, brake disc and caliper
pos 3 Front anti-roll bar
pos 4 Rear shock absorber
pos 5 Rear spring
pos 6 Rear anti-roll bar
pos 7 Bump rubber

the chassis code should be interpreted as follows:

9 X 2 7 A 2 4

Bump rubber:	1 330 853-1
Rear anti-roll bar:	3 516 572-9
Rear spring:	1 273 977-7
Rear shock absorber:	1 329 507-6
Front anti-roll bar:	1 330 218-7
front spring:	1 329 822-9
shock absorber:	274 040-5
brake disc:	1 359 906-3
brake caliper:	1 359 557-4, 1 359 558-2

Volvo P/N for each code

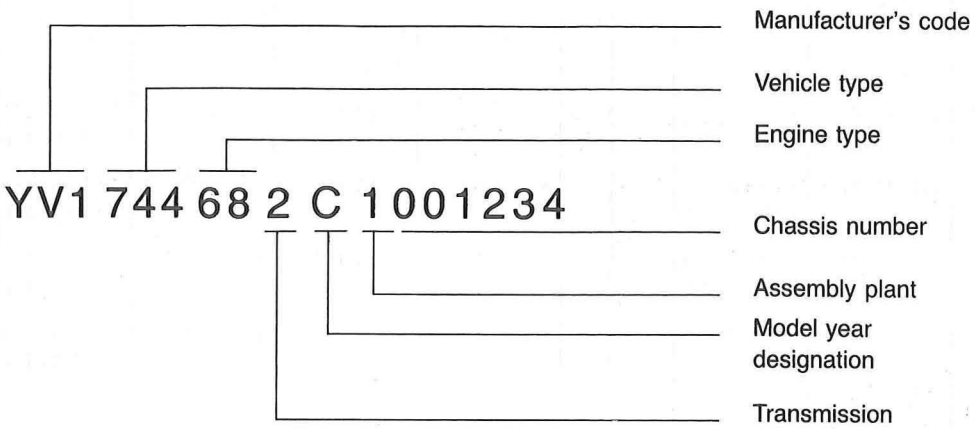
Pos 1, 2	Front spring	Shock absorber, front	Brake disc	Brake caliper
31	1 329 822-9	274 040-5	1 359 906-3	1 329 640-5 1 329 641-3
42	1 329 822-9	1 329 648-8	1 359 908-9	1 329 642-1 1 329 643-9
44	1 329 824-5	3 530 274-4	1 359 908-9	1 329 642-1 1 329 643-9
54	1 329 822-9	274 040-5	1 359 906-3	1 329 866-6 1 329 867-4
5L	1 329 824-5	271 105-9	1 359 906-3	1 329 866-6 1 329 867-4
5M	1 293 449-3	271 105-9	1 359 906-3	1 329 866-6 1 329 867-4
5P	1 329 823-7	271 105-9	1 359 906-3	1 329 866-6 1 329 867-4
5Y	1 329 822-9	274 040-5	1 359 906-3	1 329 866-6 1 329 867-4
9A	1 329 822-9	274 040-5	1 359 906-3	1 359 557-4 1 359 558-2
9F	1 329 823-7	271 105-9	1 359 906-3	1 359 557-4 1 359 558-2
9X	1 329 822-9	274 040-5	1 359 906-3	1 359 557-4 1 359 558-2
A2	1 329 822-9	1 329 648-8	3 516 567-9	3 516 565-3 3 516 566-1
A3	1 329 823-7	3 530 274-4	3 516 567-9	3 516 565-3 3 516 566-1
A4	1 329 824-5	3 530 274-4	3 516 567-9	3 516 565-3 3 516 566-1
A5	1 387 678-4	3 530 274-4	3 516 567-9	3 516 565-3 3 516 566-1
A9	1 387 677-6	3 530 274-4	3 516 567-9	3 516 565-3 3 516 566-1
D3	1 329 824-5	271 105-9	1 359 908-9	3 516 517-4 3 516 518-2
D7	1 329 823-7	271 105-9	1 359 908-9	3 516 517-4 3 516 518-2
DC	1 329 823-7	3 530 274-4	1 359 908-9	3 516 517-4 3 516 518-2
E2	1 329 823-7	3 530 273-6	1 359 908-9	3 516 513-2 3 516 514-1
EE	1 329 824-5	271 105-9	1 359 908-9	3 516 513-2 3 516 514-1
EJ	1 293 449-3	271 105-9	1 359 908-9	3 516 513-2 3 516 514-1

Pos 1, 2	Spring, front	Shock absorber, front	Brake disc	Brake caliper
EG	1 329 822-9	271 105-9	1 359 908-9	3 516 513-2 3 516 514-1
EN	1 329 823-7	271 105-9	1 359 908-9	3 516 513-2 3 516 514-1
ER	1 387 677-6	271 105-9	1 359 908-9	3 516 513-2 3 516 514-1
ET	1 387 678-4	271 105-9	1 359 908-9	3 516 513-2 3 516 514-1

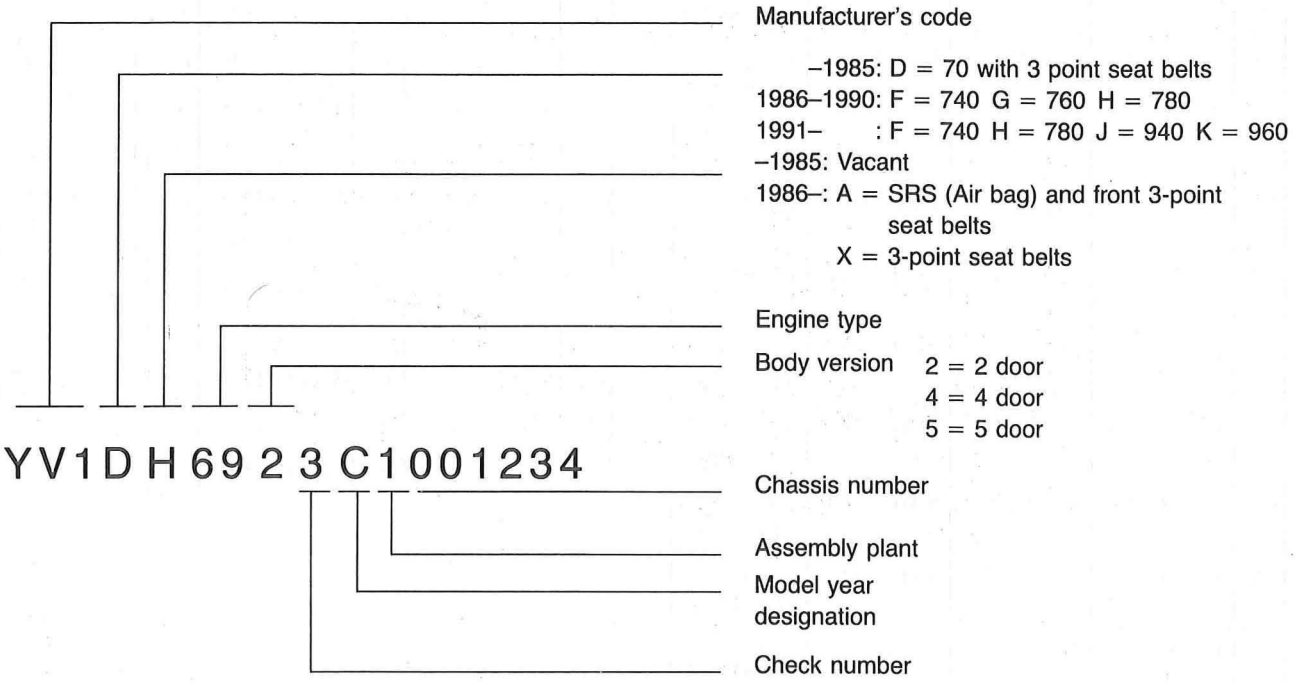
Pos 3	Anti-roll bar, front	Pos 4	Shock absorber, rear	Pos 5	Spring, rear
1	1 330 220-3	1	1 329 501-9	4	1 273 759-9
2	1 330 218-7	5	1 329 505-0	7	1 273 977-7
3	1 330 221-1	7	1 329 507-6	A	1 273 977-7
4	1 330 219-5	9	1 329 504-3	C	1 359 710-9
5	1 359 808-1	C	1 329 500-1	E	3 530 199-3
6	1 359 807-3	F	1 330 332-6	9	1 387 836-8
7	3 530 276-9	G	1 330 702-0		
8	3 530 277-7	H	3 516 668-5		
A	3 516 447-4	J	3 530 200-9		
B	3 516 446-6	N	3 542 466-2		
		M	3 530 283-5		

Pos 6	Anti-roll bar, rear	Pos 7	Bump rubber
1	3 516 573-7	4	1 330 853-1
2	3 516 572-9	5	1 359 653-1
3	3 530 751-1	6	1 387 181-9

Identification number, other markets (not USA/CAN)

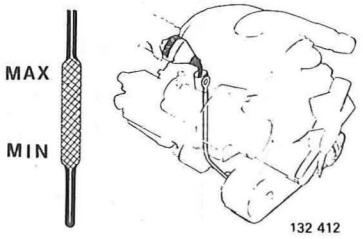


Vehicle identification number, USA & Canada

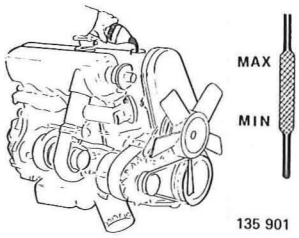


Engine type		Assembly plant	Model year designation	Transmission
21 = B 200 FT	77 = D 24	0 = Sweden (VKAV)	C = 1982	2 = M 46
23 = B 200 K	81 = B 230 A, B 234 G	1 = Sweden (VTV)	D = 1983	3 = M 47
24 = B 19 E, B 200 E	82 = B 230 GT	2 = Belgium (VEC)	E = 1984	5 = ZF4HP22, AW 71L –87
25 = B 204 FT	83 = B 230 K	3 = Canada (VCL)	F = 1985	6 = AW 70L, AW 71L, AW 72L, AW 30–43
26 = B 19 ET, B 200 ET	84 = B 23 E, B 230 E	4 = Thailand (TSA)	G = 1986	
27 = B 200 F	85 = B 230 FB	5 = Malaysia (SMA)	H = 1987	7 = AW 70, AW 71
28 = B 204 GT	86 = B 23 ET, B 230 ET	6 = Australia	J = 1988	8 = BW 55
29 = B 204 E	87 = B 230 FT	7 = Indonesia (ISMAC)	K = 1989	
62 = B 28 A	88 = B 230 F		L = 1990	
68 = B 28 E, B 280 E	89 = B 234 F	A = Sweden (Uddevalla)	M = 1991	
69 = B 28 F, B 280 F	95 = B 6304 F			
75 = D 24 TIC		D = Italy, Bertone		
76 = D 24 T				

Section 1 Service and maintenance
Group 16 Lubrication



132 412



135 901

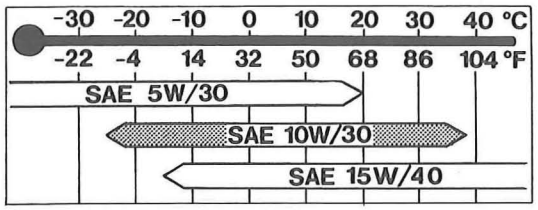
Petrol (gasoline) engines

USA, Canada, Japan

Oil quality According to API..... min SG*

* Oils with designations SG/CC and SG/CD fulfill this requirement.

Viscosity (stable ambient temperatures)



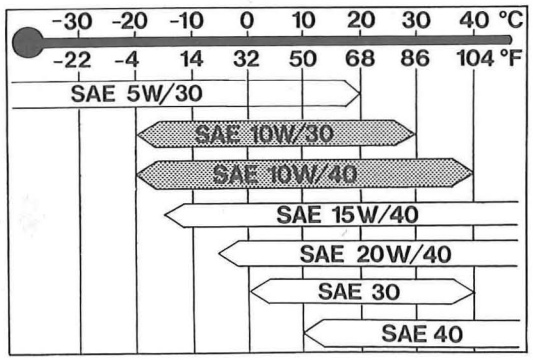
141 375

Other markets

Oil quality According to API..... min SG*
According to CCMC..... class G4/G5*

* Oils with designations SG/CC and SG/CD fulfill this requirement.

Viscosity (stable ambient temperatures)



137 642

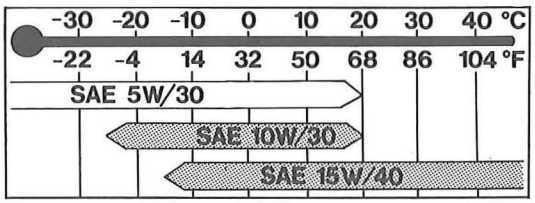
Diesel engines

USA, Canada, Japan

Oil quality According to API Service ..... min CD*

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

Viscosity (stable ambient temperatures)



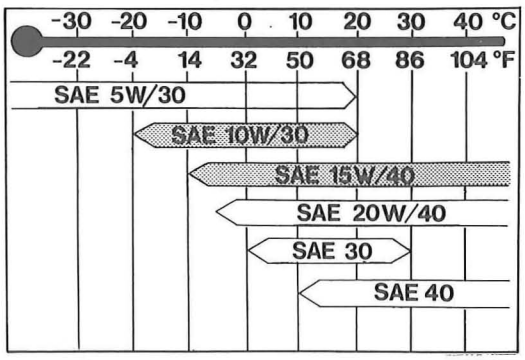
141 381

Other markets

Oil quality According to API..... min CD*
According to CCMC..... class D2/PD1*

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

Viscosity (stable ambient temperatures)



142 444

Synthetic or semisynthetic oils may be used if their specifications comply with the oil quality requirements.
Volvo does not recommend additional oil additives, as they can adversely affect the engine.

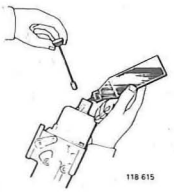
Note! SAE 15W/40 and SAE 20 W/40 engine oils are recommended for use in extreme driving conditions which involve high oil consumption eg. mountain driving with frequent deceleration or fast motorway driving.
Note however the lower temperature limits.

Engine oil, capacity, litres (US qts)

	Excl. oil filter	Incl. oil filter	Difference in volume max.–min.
B 19, B 23, B 200, B 230*	3.35 (3.6)	3.85 (4.1)	1.0 (1.1)
B 204, B 234	3.5 (3.7)	4.0 (4.2)	1.0 (1.1)
B 6304	5.0 (5.2)	5.75 (6.1)	1.0 (1.1)
B 28	6.0 (6.3)	6.5 (6.9)	1.0 (1.1)
B 280	5.5 (5.8)	6.0 (6.3)	1,0 (1.1)
D 24, D 24 T, D 24 TIC**	5.0 (5.2)	6.0 (6.3)	1.0 (1.1)

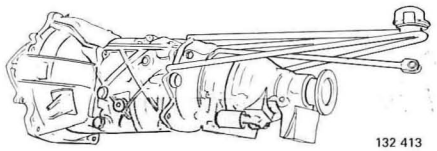
* Turbo: Add extra 0.6 litres if oil cooler is drained.
** Turbo Intercooler: Add extra 0.7 litres (air oil cooler).

Carburettor



Oil for damper cylinder, B 28 A	SAE 10W-40 (or SAE 10W-50) Engine oil
B 230 A	ATF

Manual gearbox

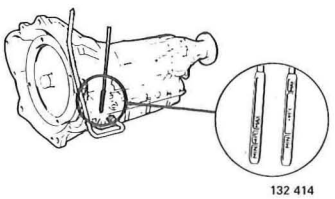


Lubricating oil	ATF type F or G
Oil change quantity, M 46, early type –1990	2.3 litres (2.4 US qts)
late type 1991–	2.6 litres (2.8 US qts)
M 47, early type	1.3 litres (1.4 US qts)
late type	1.6 litres (1.7 US qts)
Tightening torque, oil drain plugs	27–40 Nm (10–29 ft lb)

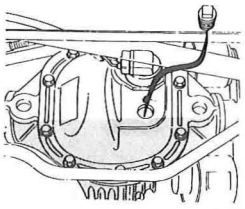
* Volvo Thermo Oil (P/N 1 161 243-9) is recommended for vehicles driven in areas where ambient temperature seldom drops below –10°C (+14°F), or high mileage vehicles such as taxis.
NOTE! Do not mix oil types.

Do not use ATF Dexron as vibration damper and overdrive may slip.

Automatic transmission

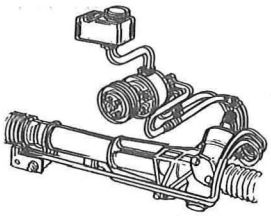


Lubricating oil AW/BW 55, AW 70/AW 71 –1983	ATF-type G (or F)
AW 70/AW 71/AW 72/AW 30–43/ZF4HP22	ATF type Dexron II D
Oil change quantity (drained only) AW 70, AW 71/AW 72	3.9 litres (4.1 US qts)
AW 30–43	3.0 litres (3.3 US qts)
BW 55	3.5 litres (3.7 US qts)
ZF4HP22	2.0 litres (2.2 US qts)


134 142

Rear axle

Lubricating oil	Final drive oil
grade, without limited-slip differential or with automatic differential lock (Eaton)	API-GL-5(6) or MIL-L-2105 B(C) Low-friction oil Volvo P/N 1 161 329-6 0.5 litre/US qt
with limited-slip differential (Dana)	API-GL-5(6) or MIL-L-2105 B(C) with additive Volvo P/N 1 161 129-0 0.5 litre/US qt
viscosity, above –10°C (+14°F)	SAE 90
below –10°C (+14°F)	SAE 80
Oil change quantity, 1030	1.3 litres (1.4 US qts)
1031, –1990	1.6 litres (1.7 US qts)
1031, 1991–	1.75 litres (1.85 US qts)
1035	1.4 litres (1.5 US qts)
1041, –1990	1.45 litres (1.55 US qts)
1041, 1991–	1.6 litres (1.7 US qts)
1045	1.3 litres (1.4 US qts)

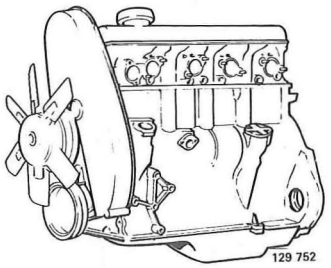

134 143

Steering gear

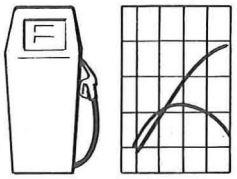
Lubricant	Grease, Volvo P/N 1 161 001-1	
quantity	approx 100 grams (3.5 ozs)	
Power steering fluid	ATF type A, F or G*	
	litres	(US qts)
quantity, B 28	1.0	(1.1)
B 19, B 23	0.8	(0.9)
B 200, B 230	0.8	(0.9)
B 280	0.8	(0.9)
B 6304	0.8	(0.9)
D 24, D 24 T –1986	0.8	(0.9)
D 24, D 24 T, D 24 TIC 1987–	0.5	(0.5)

* Volvo power steering fluid (P/N 1 161 317-1 is recommended if temperature is below –20°C (–4°F).

Section 2 B 19, B 23 Engines


129 752

Group 20 General 15
Group 21 Engine assembly 16
Group 22 Lubricating system 20
Group 23 Fuel system 21
Group 25 Intake and exhaust systems 31
Group 26 Cooling system 32
Group 28 Ignition system 33


129 750

Group 20 General

Performance, compression ratios, octane requirements

Engine type	Remarks	Compression ratio	Octane requirement	Output		Max torque	
				kW at r/s	hp at r/min	Nm at r/s	kpm at r/min
B 19 E		10.0:1	98	86/100	117/6000	158/50	16.1/3000
B 19 ET		7.5:1	98	110/92	150/5500	230/60	23.4/3600
B 23 E	Scandinavia, Switzerland Other markets	10.3:1 10.0:1	96 98	95/88 96/90	129/5250 131/5400	190/50 190/60	19.4/3000 19.4/3600
B 23 ET		9.0:1	98[1]	127/95	173/5700	250/57	25.5/3400
B 23 FT		8.7:1	91[2, 3]	117/88	160/5300 157[5]/5300	250/48	25.5/2900 184[4]/2900

[1] Australia 97–98 octane
[2] Unleaded petrol (gasoline) 91 octane RON (Research Octane Number). AKI = 87, according to $\frac{R+M}{2}$ where M stands for Motor Octane Number
[3] Fill with premium unleaded petrol (gasoline) (AKI = 91) to improve performance and driveability at altitudes in excess of 2000 ft (600 m) in warm climates
[4] Ft lb
[5] Horse power.

Other general data

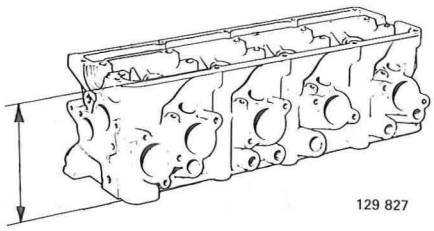
	B 19	B 23
No. of cylinders	4	4
Bore ..... mm (in)	88.9 (3.503)	96 (3.782)
Stroke ..... mm (in)	80 (3.152)	80 (3.152)
Displacement ..... dm^3 (litre)	1.99	2.32
Firing order	1-3-4-2	1-3-4-2
Compression pressure[1] ..... MPa (psi)	0.9 (128)	0.9 (128)
Max. deviation between cylinders ..... MPa (psi)	0.2 (28)	0.2 (28)
Approx. weight ..... kg (lb)	165 (363)	165 (363)
Turbocharged versions ..... kg (lb)	170 (375)	170 (375)

[1] With hot engine, throttle wide open and starter motor cranking at 4.2–5.0 r/s (250–300 r/min).

Group 21 Engine block

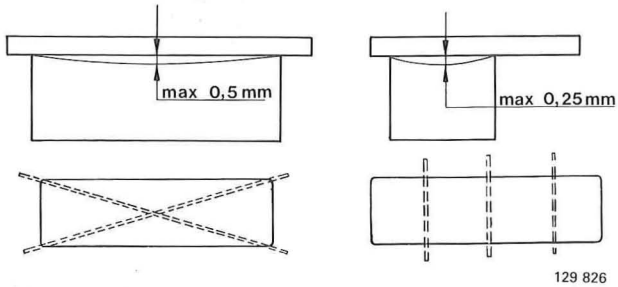
Cylinder head

Height, new ..... mm (in) 146.1 (5.756)
min (after machining) ..... mm (in) 145.6 (5.737)


129 827

Max warp .....

NOTE: If warp is greater than 1.0 mm (0.094 in) lengthwise or 0.5 mm (0.097 in) crosswise, cylinder head must be replaced.



129 826

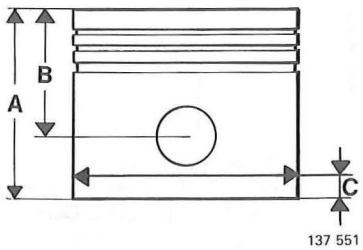
Cylinder block

Bore		B 19	B 23
Standard C	mm	88.90–88.91	96.00–96.01
	(in)	(3.5027–3.5031)	(3.7824–3.7828)
D	mm	88.91–88.92	96.01–96.02
	(in)	(3.5031–3.5034)	(3.7828–3.7832)
E	mm	88.92–88.93	96.02–96.03
	(in)	(3.5034–3.5038)	(3.7832–3.7836)
G	mm	88.94–88.95	96.04–96.05
	(in)	(3.5042–3.5047)	(3.7840–3.7844)
Oversize 1	mm	89.29–89.30	96.3
	(in)	(3.5180–3.5184)	(3.7942)
2	mm	89.67–89.68	96.6
	(in)	(3.5330–3.5334)	(3.8060)

Rebore if wear exceeds 0.1 mm (0.004 in) and oil consumption is very high.

Pistons

A = Overall height
B = From gudgeon (piston) pin to crown
C = Diameter to be measured at right angles to gudgeon pin at distance C from bottom of piston.



137 551

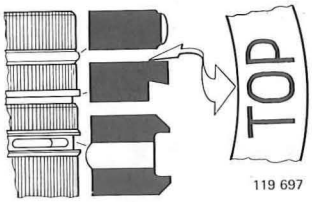
Engine type	Weight in gms[1] (oz)	Dimension mm (in)		
		A	B	C
B 19 E	515±6 (18.4±0.2)	73.9 (2.912)	46.7 (1.840)	7 (0.276)
B 19 ET	510±6 (18.2±0.2)	71.0 (2.797)	46.0 (1.812)	7 (0.276)
B 23 E	570±7 (20.4±0.3)	76.4 (3.010)	46.4 (1.828)	8 (0.315)
B 23 ET	562±7 (19.8±0.3)	8.4 (2.657)	46.4 (1.828)	12 (0.423)
B 23 FT	562±7 (19.8±0.3)	8.7 (2.657)	46.7 (1.840)	12 (0.423)

[1] Max weight difference in same engine = 12 gms (0.43 oz)

Piston running clearance

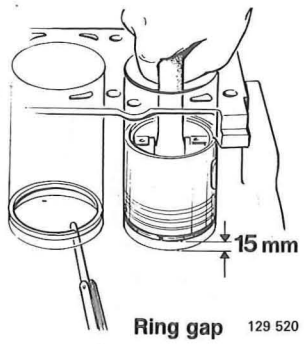
B 19 E, B 23 E ..... mm (in) 0.01–0.04 (0.0004–0.0016)
B 19 ET ..... mm (in) 0.03–0.06 (0.0012–0.0024)
B 23 ET, B 23 FT ..... mm (in) 0.05–0.07 (0.0020–0.0028)

Piston rings





Clearance in piston groove

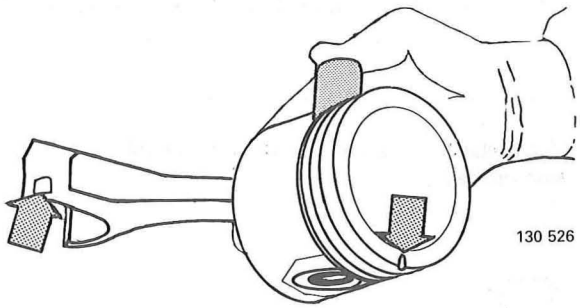


Ring gap

		Upper Comp. rings	Lower Comp. rings	Oil scraper rings
Clearance in piston groove				
B 19 E, B 19 ET, B 23 E	mm	0.040–0.072	0.040–0.072	0.030–0.062
	(in)	(0.0016-0.0028)	(0.0016-0.0028)	(0.0012-0.0024)
B 23 ET, B 23 FT	mm	0.060–0.092	0.040–0.072	0.030–0.065
	(in)	(0.0024-0.0036)	(0.0016-0.0028)	(0.0018-0.0026)
Ring gap (see above)				
B 19 E, B 19 ET, B 23 E	mm	0.35–0.65	0.35–0.55	0.25–0.60
	(in)	(0.0014-0.0026)	(0.0014-0.0022)	(0.0010-0.0024)
B 23 ET, B 23 FT	mm	0.40–0.65	0.40–0.65	0.30–0.60
	(in)	(0.0158-0.0256)	(0.0016-0.0256)	(0.0118-0.0236)

Gudgeon (Piston) pins

Fit, in connecting rod	Light thumb pressure (close running fit)
in piston	Thumb pressure (push fit)



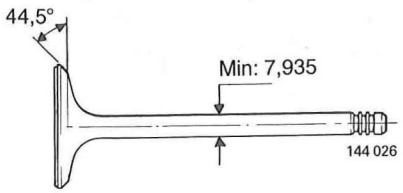
Valves

Valve clearance		Checking	Adjusting
Inlet and exhaust valves			
cold engine	mm	0.30–0.40	0.35–0.40
	(in)	(0.012–0.016)	(0.014–0.016)
warm engine	mm	0.35–0.45	0.40–0.45
	(in)	(0.014–0.018)	(0.016–0.018)
Adjusting shim, thickness	mm	3.30–4.50	
	(in)	(0.1300–0.1773) in increments of 0.05 (0.002)	

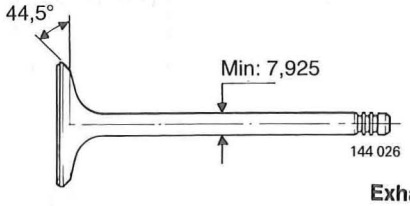
Valves

IMPORTANT: Valves are stellite-flashed and must not be machined. They may only be ground in against seat.

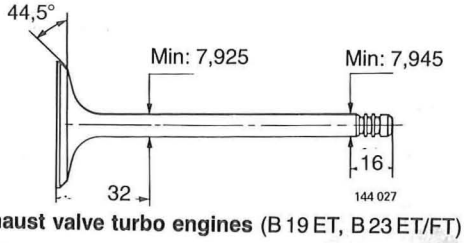
IMPORTANT! Scrapping valves. Exhaust valves in turbo engines are sodium filled and must not be mixed with ordinary scrap iron without first removing the sodium.



Inlet valve

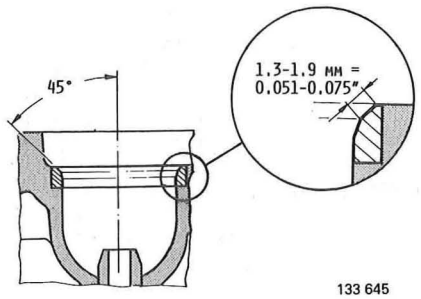


Exhaust valve E-engines (B 19 E, B 23 E)



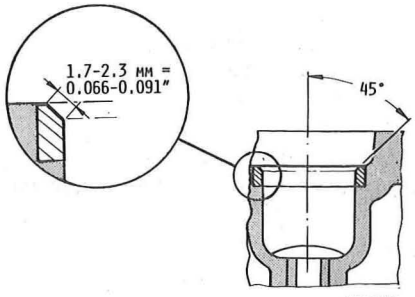
Exhaust valve turbo engines (B 19 ET, B 23 ET/FT)

Valve seat



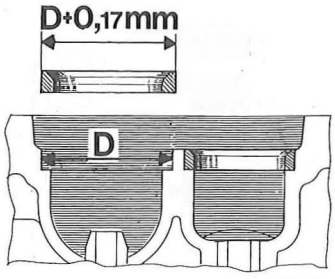
133 645

Inlet



133 646

Exhaust



113 945

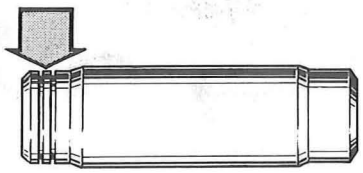
When replacing valve seats the interference between the seat and its bore should be 0.17 mm (0.0067 in) i. e. valve seat diameter should be 0.17 mm greater than the diameter of bore in cylinder head.

Valve guides

		Inlet valve	Exhaust valve
Inner diameter	mm	8.000–8.022 mm	8.000–8.022
	(in)	(0.3152–0.3161)	(0.3152–0.3161)
Height above upper face of cylinder head	mm	15.4–15.6	17.9–18.1
	(in)	(0.6068–0.6146)	(0.7053–0.7131)
Clearance, valve stem-guide (measured with new valve), new	mm	0.030–0.060	0.060–0.090
	(in)	(0.0012–0.0021)	(0.0024–0.0035)
max	mm	0.15	0.15
	(in)	(0.0059)	(0.0059)

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

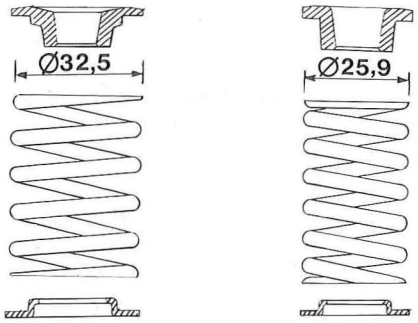
	Marking	Reamer for seat
Standard	No groove	–
Oversize 1	1 groove	5161
Oversize 2	2 grooves	5162
Oversize 3	3 grooves	5163



113 946

NOTE! The force used when pressing in valve guides must be at least **9000 N** (1980 lb). If the pressing force used is lower then the recess for the guide must be reamed out to the nearest oversize and a guide of the corresponding size pressed in.

Valve springs mm (in)



Type 1 Type 2

135 065

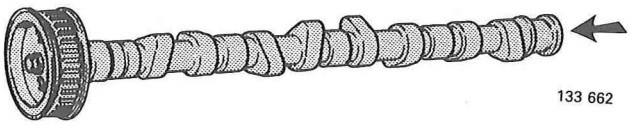
B 19 E, B 23 E, B 23 ET		B 19 ET, B 23 FT	
Type 1		Type 2	
Length mm (in)	Load N (lb)	Length mm (in)	Load N (lb)
45.0 (1.77)	0	45.5 (1.79)	0
38.0 (1.50)	280–320 (62–70)	38.0 (1.50)	280–320 (62–70)
27.0 (1.06)	710–790 (156–174)	27.5 (1.08)	702–782 (154–172)

Adjusting shims mm (in)

Thickness	3.30–4.50 (in increments of 0.05) (0.1300–0.1773) (in increments of 0.0020)

Timing gears

Camshaft



Engine type	Camshaft		Check valves (cold engine)	
	Marking	Max lift height mm (in)	Valve clearance No. 1 intake valve mm (in)	Intake valve should open at
B 19 E	A	10.5 (0.4137)	0.7 (0.0276)	13° B.T.D.C
B 19 ET	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C
B 23 E	A	10.5 (0.4137)	0.7 (0.0276)	13° B.T.D.C
B 23 ET	B	10.6 (0.4176)	0.7 (0.0276)	19° B.T.D.C
B 23 FT	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C

Radial clearance	0.030–0.071	(0.0012–0.0028)
max	0.15	(0.0012–0.0028)
Axial clearance	0.1–0.4	(0.0344–0.0158)

Intermediate shaft

Radial clearance	0.020–0.075 (0.0008–0.0030)
Axial clearance	0.20–0.46 (0.0079–0.0181)

Crankshaft assembly

Crankshaft

Max out-of-true	mm (in)	0.05 (0.0020)
Axial clearance, max	mm (in)	0.25 (0.098)
Radial clearance (main bearings)	mm (in)	0.028–0.083 (0.0011–0.0033)
Connecting rod bearings,		
axial clearance	mm (in)	0.15–0.35 (0.0059–0.0138)
radial clearance	mm (in)	0.024–0.070 (0.0009–0.0028)

Main bearing journals

Out-off-round, max	mm (in)	0.07 (0.0028)
Taper, max	mm (in)	0.05 (0.0020)
Diameter, Standard	mm (in)	63.451–63.464 (2.5000–2.5005)
undersize 1	mm (in)	63.197–63.210 (2.4900–2.4905)
2	mm (in)	62.943–62.956 (2.4800–2.4805)

Taper

Connecting rod bearing journals

Out-of-round max	mm (in)	0.05 (0.020)
Taper, max	mm (in)	0.05 (0.020)
Diameter, standard	mm (in)	53.987–54.000 (2.1271–2.1276)
undersize 1	mm (in)	53.733–53.746 (2.1171–2.1176)
2	mm (in)	53.479–53.492 (2.1071–2.1076)

Connecting rods

Axial clearance at crankshaft	mm (in)	0.15–0.35 (0.0059–0.0138)
Max weight deviation between connecting rods in same engine		10 gms

Out-of-round

Flywheel

Axial throw, max	mm (in)	0.02 mm/100 mm (0.0008/3.94 in diameter)

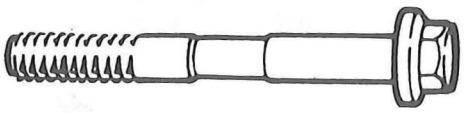
Tightening torques

Apply to oiled nuts and bolts.
Degreased (washed) parts must be oiled prior to assembly.

	Nm	ft lb
Main bearings	110	80
Connecting rod bearings, old bolts	63	46
new bolts	70	51
Flywheel (use new bolts)	70	51
Spark plugs (unoiled)	25±5	18±3.5
Camshaft sprocket	50	36
Intermediate shaft sprocket	50	36
Camshaft bearing caps	20	15
Crankshaft center bolt	165	120

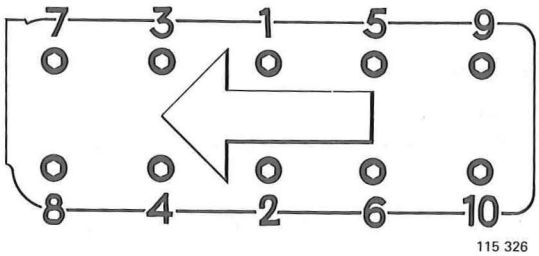
Cylinder head, tighten in stages:

1 = **20 Nm** (14 ft lb)
2 = **60 Nm** (43 ft lb)
3 = Angle-tighten **90°** in one motion



134 266

Bolts should be replaced if center section shows signs of extension. Do not re-use bolts more than 5 times. If in doubt, fit new bolts.



115 326

Tightening sequence for cylinder head bolts

Group 22 Lubricating system

General

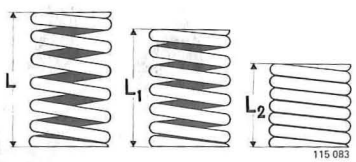
Oil capacity and quality, see page 12.

Oil pressure at 33 r/s (2,000 r/min) with warm engine and new oil filter ..... MPa (psi)	0.25–0.60 (35–85)	

Oil pump

Axial clearance ..... mm (in)	0.02–0.12	(0.0008–0.0047)
Radial clearance (excluding bearing clearance) ..... mm (in)	0.02–0.09	(0.0008–0.0035)
Backlash (excluding bearing clearance) ..... mm (in)	0.15–0.35	(0.0059–0.0138)
Bearing clearance, drive shaft ..... mm (in)	0.032–0.070	(0.0013–0.028)
idling shaft ..... mm (in)	0.014–0.043	(0.0006–0.0017)

Relief valve spring length under different loads



115 083

Lengths	Load
39.2 mm (1.5445 in)	0
26.25 mm (1.0343) in)	46–54 N (10.1–11.9 lb)
21.0 mm (0.8274 in)	62–78 N (13.6–17.2 lb)

Group 23 Fuel system

CO-content, idle speed





135 528

- Selector lever must be in position P (and handbrake applied) when checking/adjusting CO or idle speed
- CO should be checked/adjusted when engine is warm and idling
- CO content outside check values shown below = adjust to specified setting value
- CO content within check values need not be adjusted provided engine is operating satisfactorily

Engine type	Remarks	CO content		Idle speed r/s (r/min)
		CO meter % Adjusting (checking)	Volvo Monotester	
B 19 E		1.0 (0.5–2.0)	–	15.0 (900)
B 19 ET		2.0 (1.0–3.0)	–	15.0 (900)
B 23 E		1.0 (0.5–2.0)[1]	–	15.0 (900)
B 23 ET		1.5 (1.0–2.5)	–	14.2 (850)
B 23 FT	USA + Canada Japan	0.6 (0.4–0.8)[2] 0.6 (0.4–0.8)[2]	20–70°[3] 20–70°[3]	12.5 (750)[4] 15.0 (900)

[1] Pulsair system disconnected and plugged.
[2] Lambda-sond disconnected.
[3] Lambda-sond connected.
[4] AC switched off. Engine speed increases to 15.0 r/s (900 r/min) when AC is reconnected.

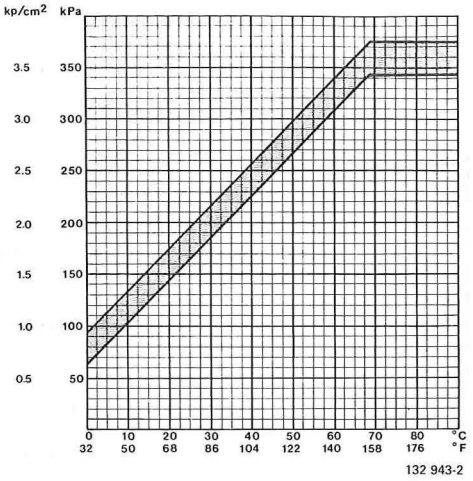
	Page
CI system (B 19 E/ET, B 23 E)	22
Motronic (B 23 ET)	25
LH-Jetronic (B 23 FT)	28

CI system (B 19 E, B 19 ET, B 23 E)

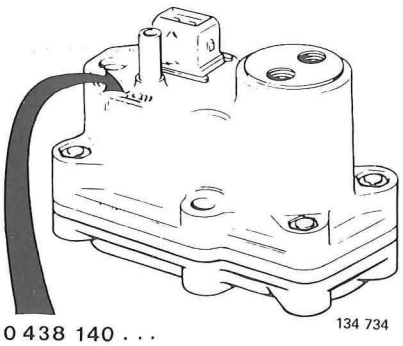
Pressures

		B 19 E, B 23 E	B 19 ET
Line pressure	kPa (psi)	450–530 (64–75)	520–580 (74–82)
Rest pressure	kPa (psi)	150–240 (21–34)	240–320 (34–46)
Control pressure			
warm engine	kPa (psi)	345–375 (49–53)	345–375 (49–53)
warm engine and charge pressure of 45 kPa (6.4 psi)	kPa (psi)	–	295–325 (42–46)

cold engine (see diagram)



Control pressure regulator

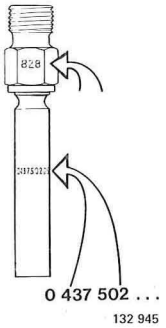


Type of control pressure regulator fitted to vehicles depends on engine type. Identification number (last three digits of part number) is stamped on top of regulator.

	Bosch number	Volvo P/N
B 19 E, B 23 E . . .	. . .004	463 971-2
B 19 ET	. . .117	1 336 077-1

Resistance . . . . . 20–30 Ω

Injectors

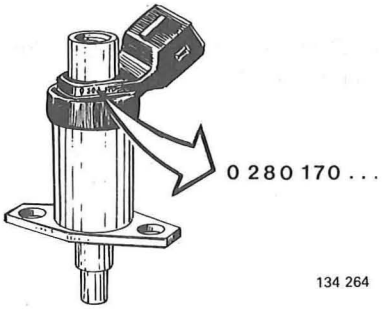


Type of injector fitted to engine depends on engine type. Identification number (last three digits of part number) is stamped on side of injector.

	Bosch number	Volvo P/N
B 19 E, B 23 E . . .	. . .015	1 276 037-7
B 19 ET	. . .020	1 306 499-9

Opening pressure . . . . . kPa (psi) 350–410 (50–58)
No leakage permissible below . . . . . kPa (psi) 290 (41)

Start injector



Type of start injector fitted to vehicle depends on engine type. Identification number (last three digits of part number) is stamped on side of injector.

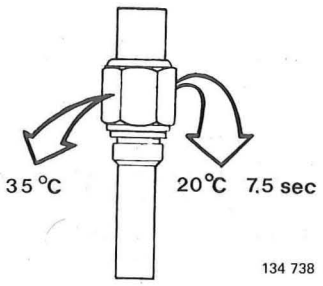
Injection time is controlled by thermal timer

B 19 ET: injection time is also controlled via an impulse relay which causes extra fuel to be injected during warm starts.

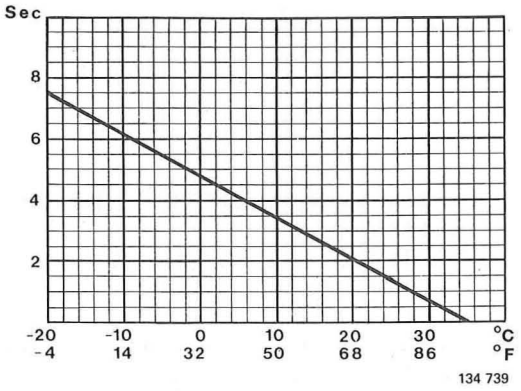
Impulse relay engages injector after approx. 1.5 secs., after which: injection 0.1 secs. – pause 0.3 secs. – injection 0.1 secs. – pause 0.3 secs. – etc etc.

	B 19 E, B 23 E	B 19 ET
Start injector Bosch No	**. . .413**	**. . .415**
Volvo P/N	1 276 498-1	1 269 585-4
Injected quantity	85 cm^3/min	135 cm^3/min

Thermal time switch



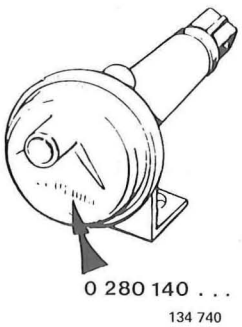
Cut-out temperature and engagement time are stamped on side of switch.



Engagement time at different temperatures

Tolerance, time . . . . . 2 secs
temperature . . . . . 4°C (7.2°F)

Auxiliary air valve



Type of auxiliary air valve fitted to engine depends on engine type.

Identification number (last three digits of part number) is stamped on side of valve.

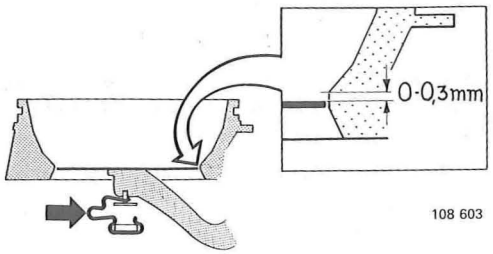
	Automatic	Manual
Bosch number	**. . .114**	**. . .106**
Volvo P/N	1 346 477-1	1 346 476-3

Resistance . . . . . 40–60 Ω
Fully open at . . . . . –30°C
Fully closed at . . . . . +70°C

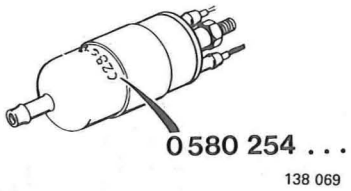
Auxiliary air valve is controlled electrically and should be fully closed after 5 minutes driving at 20°C (68°F) ambient temperature.

Air-flow sensor

Metering disc rest position



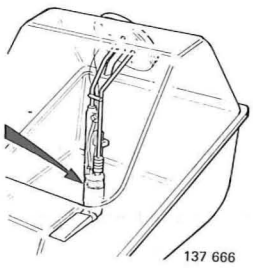
Fuel pump



Pump capacity at line pressure of 500 kPa (71 psi),
+20°C and 12 V .....
11 V .....
10 V .....

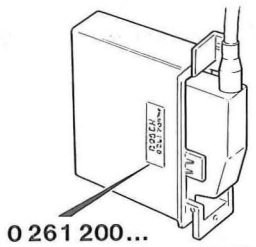
Current consumption at line pressure of 500 kPa (71 psi)
+20°C and 12 V .....

Tank pump



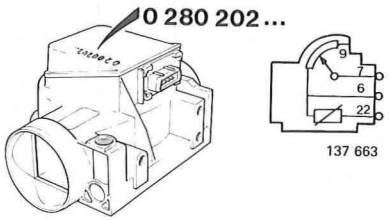
Motronic (B 23 ET)

Control unit



Bosch number ..... **...012**
Volvo P/N 1 317 025-3

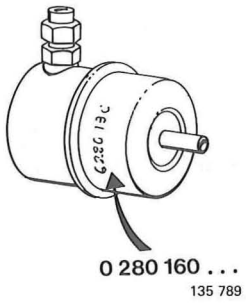
Air flow meter



Bosch number ..... **...035**
Volvo P/N 1 306 967-9

Resistance:
- between terminals 6 & 22 of temperature sensor:
  at −10°C (14°F) ..... 8 260–10 560 Ω
  +20°C (68°F)..... 2 280–2 720 Ω
  +50°C (122°F)..... 760–910 Ω
- between terminals 6 & 9 ..... 500–1 100 Ω
- between terminals 6 & 7 ..... 8–200 Ω

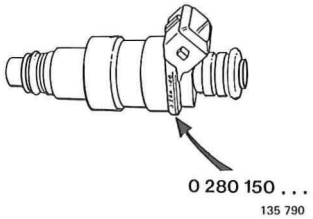
Line pressure, pressure regulator



Bosch number ..... **...213**
Volvo P/N 1 306 965-3

Line pressure
(fuel pressure above intake
manifold pressure)..... 300 kPa (42 psi)

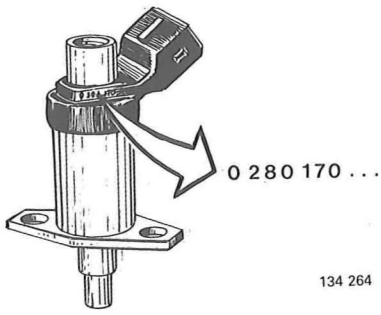
Injector



Bosch number ..... **...355**
Volvo P/N 1 306 966-1

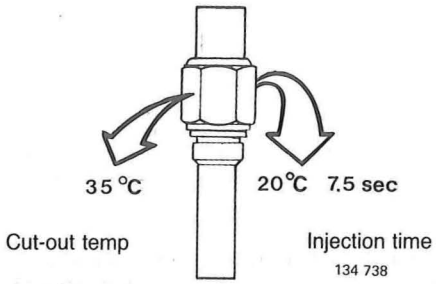
Injected quantity at a line pressure of
300 kPa (42 psi)..... 300 cm^3/min

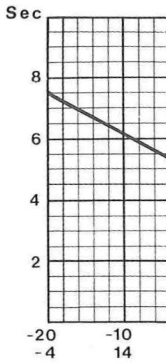
Start injector



Bosch number .....
Volvo P/N.....
Injected quantity....
Injection time control

Thermal time switch

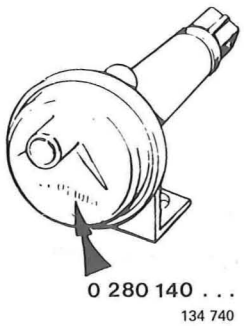




Injection ti

Tolerance, time.....
temperature

Auxilary air valve

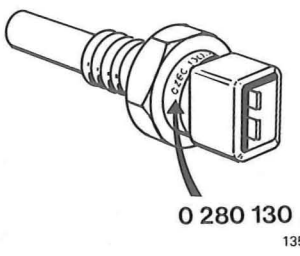


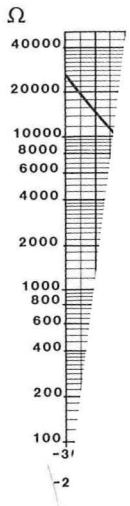
Bosch number.....
Volvo P/N, early typ
late type

Resistance.....
Fully open at ....
Fully closed at...

The auxiliary air v
be fully closed af
bient temperature

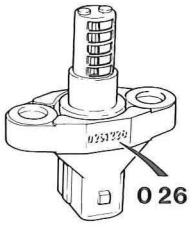
Coolant temperature sensor

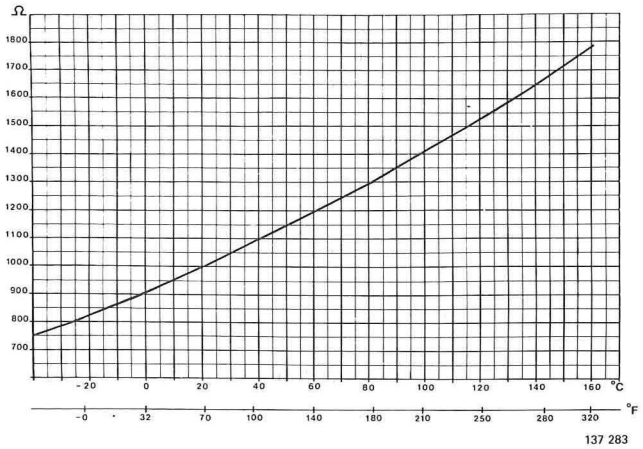




Bosch number ..... **. . .026**
Volvo P/N 1 332 396-9
Resistance at:
−10°C (−14°F)..... 8 260−10 560 Ω
+20°C (68°F)..... 2 280−2 720 Ω
+80°C (175°F) ..... 290−364 Ω

Temperature sensor, charge air

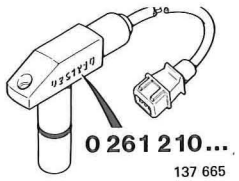




Bosch number ..... **...001**
Volvo P/N 1 317 273-9

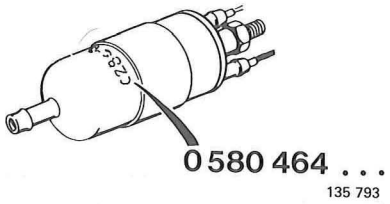
Resistance at:
+20°C (68°F) ..... 985–1 015 Ω
+40°C (104°F)..... 1 080–1 110 Ω
+130°C (266°F) ..... 1 550–1 620 Ω

Impulse sender (crankshaft position & engine rpm)



Bosch number ..... **...003**
Volvo P/N 1 317 030-3

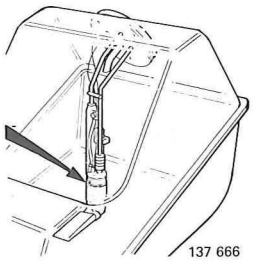
Fuel pump



Bosch number ..... **...025**
Volvo P/N 1 336 679-4

Capacity at a line pressure of 300 kPa (42 psi)
+20°C (68°F) & 12 V ..... 130 litres/hr (1.08 litres/30 secs)
11 V ..... 108 litres/hr (0.9 litres/30 secs)
10 V ..... 86 litres/hr (0.7 litres/30 secs)
Current consumption at 300 kPa (42 psi).
+20°C (68°F) & 12 V ..... max 6.5 A

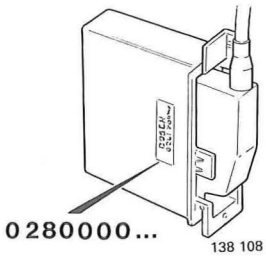
Tank pump



Current consumption ..... 1–2 A

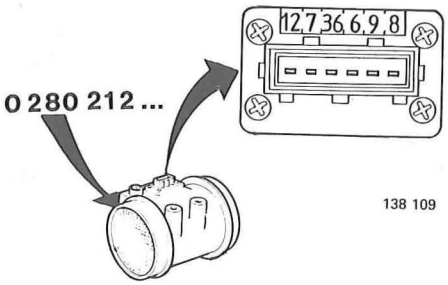
LH-Jetronic (B 23 FT)

Control unit



Bosch number ..... **...507**
Volvo P/N 1 332 184-9

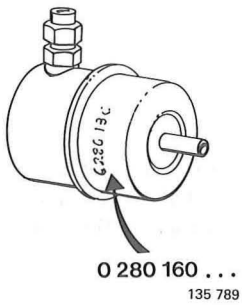
Air mass meter



Bosch number ..... **...002**
Volvo P/N 1 326 065-8

Resistance:
- between terminals 6 and 7 ..... 3.7 Ω
- between terminals 7 and 12 ..... 0–1 000Ω

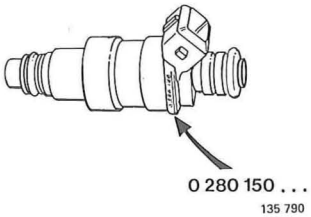
Line pressure, pressure regulator



Bosch number ..... **...213**
Volvo P/N 1 306 965-3

Line pressure (fuel pressure above inlet manifold pressure) ..... 300 kPa (42 psi)

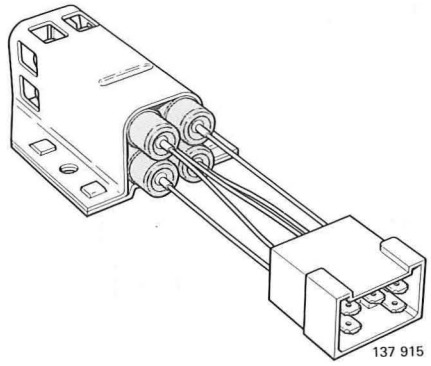
Injectors



Bosch number ..... **...357**
Volvo P/N 1 332 337-3

Injected quantity at a line pressure of 300 kPa (42 psi) ..... 300 cm^3/min

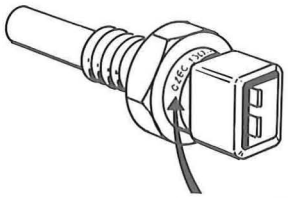
Injector ballast resistor pack



Bosch number 0 280 159 **001**
Volvo P/N 1 336 810-5

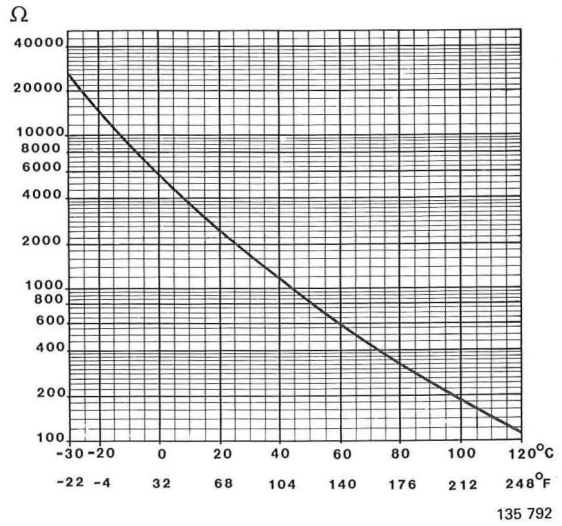
Four resistors (1 per injector)
Resistance ..... 5.5–6.5 Ω

Coolant temperature sensor

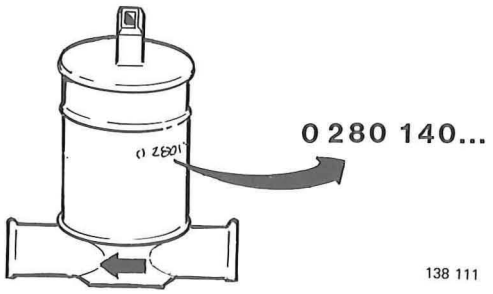


Bosch number ..... **. . . 026**
Volvo P/N 1 332 396-9

Resistance at:
–10°C (–14°F) ..... 8 260–10 560 Ω
+20°C (68°F) ..... 2 280–2 720 Ω
+80°C (175°F) ..... 290–364 Ω



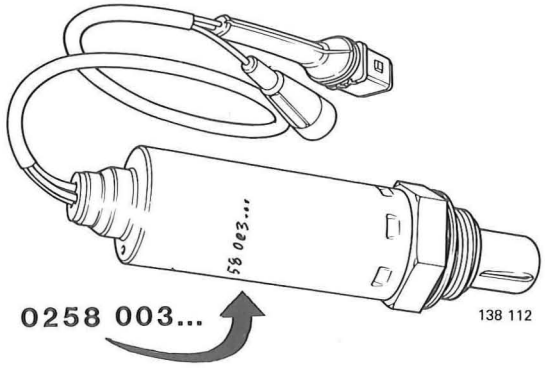
Air control valve



Bosch number ..... **. . . 501**
Volvo P/N 1 317 957-7

Resistance between terminals 3 and 4
and between 4 and 5 ..... approx. 20 Ω

Lambda-sond



Bosch number ..... **. . . 006**
Volvo P/N 1 346 738-6

Resistance of ballast resistor at:
Cold sond (20°C = 68°F) ..... 3 Ω
Warm sond (above 350°C = 660°F) ..... 13 Ω

Tightening torque ..... 55 Nm (40 ft lb)*

* Apply "Never Seez" (P/N 1 161 035-9) to entire length of thread.

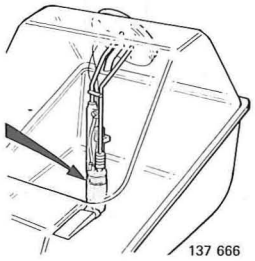
Fuel pump



Bosch number ..... **. . . 025**
Volvo P/N 1 336 679-4

Pump capacity at a line pressure of 300 kPa (42 psi),	
+20°C and 12 V	130 litres/hr (1.08 litres/30 secs)
11 V	108 litres/hr (0.9 litres/30 secs)
10 V	86 litres/hr (0.7 litres/30 secs)
Current consumption at a line pressure of 300 kPa (42 psi),	
+20°C and 12 V	max 6.5 A

Tank pump



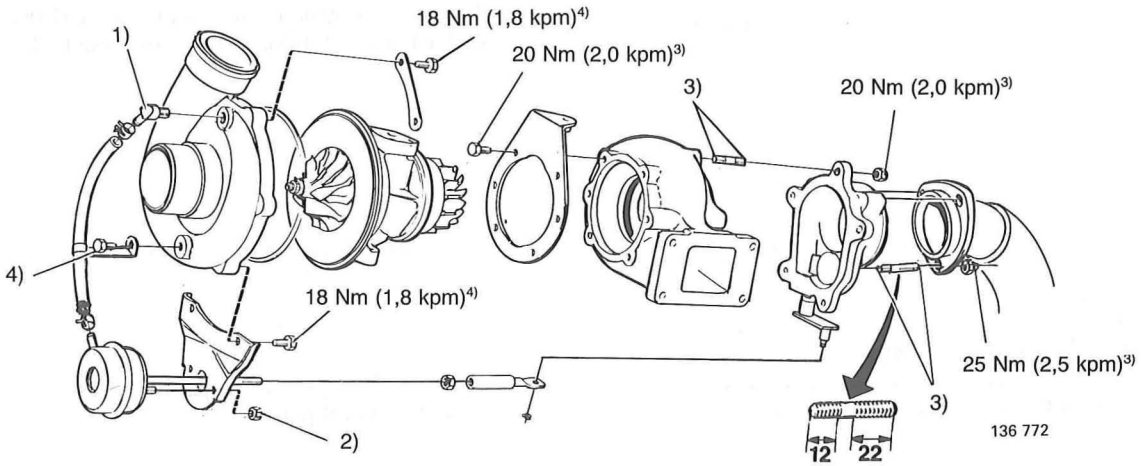
Current consumption ..... 1–2 A

Group 25 Intake and Exhaust systems

Turbocharged engines

Engine type	B19ET	B23ET	B23FT
Charge pressure, at full load ..... r/min	3500	3500	3000
checking ..... kPa (psi)	60–70 (8.5–10.0)	45–53 (6.4–7.5)	46–54 (615–717)
adjusting ..... kPa (psi)	64–70 (9.1–10.0)	50 (7.1)	48–54 (6.8–7.7)
Charge air overpressure, switch, opens at ..... kPa (psi)	85–95 (12.1–13.5)	65–75 (9.2–10.7)	85–95 (12.1–13.5)
Charge air pressure, switch, closes at .. kPa (psi)	–	15–25 (2.1–3.6)	–

Tightening torque data

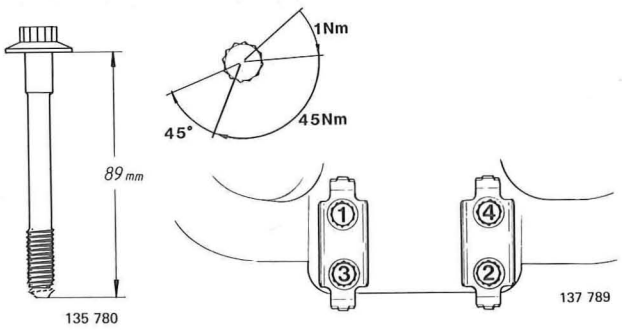


1) Apply sealer (P/N 1 161 053-2).
2) Use new nuts.
3) Use sealer (P/N 1 161 035-9).
4) Use new bolts. (Old bolts can if absolutely necessary be reused if they are smeared with sealer P/N 1 161 053-2).

Mounting bolts, turbocharger – exhaust manifold

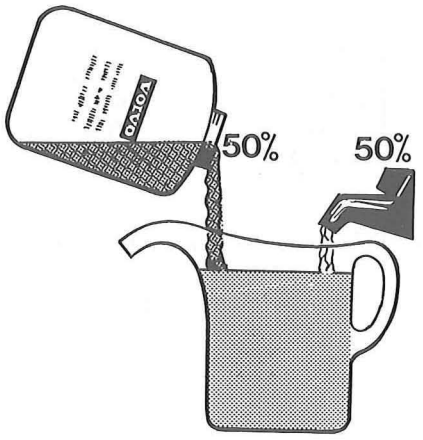
- Measure length of bolt. Bolts can be reused if shorter than **89 mm**.
- Apply assembly paste P/N 1 161 078-9 to mating surfaces and threads
- Fit **new** locking plates
- Tighten bolts in three stages according to below

Stage I = 1 Nm (0.7 ft lb)
II = 45 Nm (32.5 ft lb)
III = 45° in one movement without stopping



Group 26 Cooling system

General



128 187

Coolant – composition – guarantee

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

Use genuine Volvo coolant, **type C (blue-green)**, diluted with **clean** water in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage.

- Never top-up the cooling system with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- The coolant should be changed every 40,000 km (25,000 miles) since the corrosion-protective additives in the coolant lose their effect in time.
- The cooling system should be cleaned using solvent P/N 1 161 328-8 prior to filling new coolant.

Capacity	approx 9.5 litres (10.05 US qts)

Expansion tank

Pressure valve in filler cap opens at:	
overpressure	65–85 kPa (9.2–12 psi)
underpressure	7.0 kPa (1.0 psi)

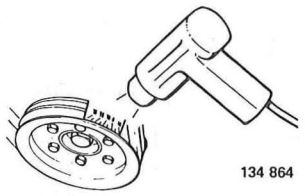
Thermostat

	Type 1	Type 2
Marking	87	92
Starts to open at	86–88°C (187–190°F)	91–93°C (196–199°F)
Fully open at	97°C (207°F)	102°C (216°F)

Fan belts

	1983	1984
Designation (Volvo P/N), early type	HC 38×925	HC 38×913
late type	HC 38 cog×925	HC 38 cog×913

Group 28 Ignition system

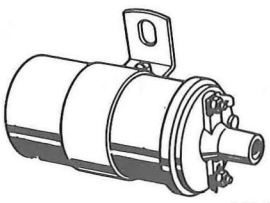

134 864

Type ..... Breakerless
Firing order 1-3-4-2

Ignition setting (B.T.D.C.)		
Engine type	**12.5 r/s** 750 r/min	**41.7 r/s** 2 500 r/min
B 19 E* B 19 ET* B 23 E*	10° 15° 10°	28–33 23–26° 28–33°
B 23 ET B 23 FT	10°[1] 12°[2]	– –

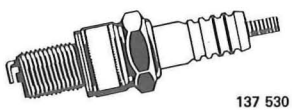
* Vacuum unit disconnected.
[1] At idle = 14.1 r/s (850 r/min).
[2] At 15 r/s (900 r/min).

Ignition coil


131 753

	B 19 E, B 19 ET, B 23 E, B 23 FT	B 23 ET
Resistance of primary coil (terminals 1 and 15)	0.6–0.9 Ω	0.5 Ω
Reistance of secondary coil (terminal 1 to HT terminal)	6.5–8.5 kΩ	6.0 kΩ

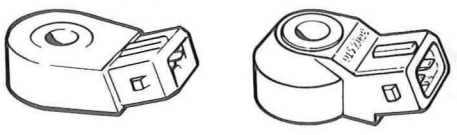
Spark plugs, glow plugs


137 530

Engine type	**Designation**		
		P/N	**Kit number**
B 19 E, B 19 ET, B 23 E	W6DC	1 306 604-8	273 596-7
B 23 ET	W7DC	1 306 605-5	273 597-5
B 23 FT	WR7DC	1 346 541-4	271 409-5

Electrode gap ..... 0.7–0.8 mm (0.0276–0.0315 in)
Tightening torque, (unoiled plugs) ..... 25 Nm (18 ft lb.)

Knock sensor


I II 146 804

Tightening torque, type I ..... 11 Nm (8 ft lb.)
type II ..... 20 Nm (14.5 ft lb.)

Distributor

Engine type	Ignition system	Distributor	
		Volvo P/N	Bosch No
B 19 E, B 23 E	TZ-28 H	1 336 689**	0 237 020 075
B 19 ET	TZ-28 H	1 336 694	0 237 020 031
B 23 ET	Motronic*	1 317 298	0 237 501 003
B 23 FT	EZ-K*	1 332 587	0 237 506 001

* Computerized ignition system (i.e. distributor does not have a mechanical advance or vacuum unit).
** Modified distributor: same values as 1 336 690 (B 230 A).

	B 19 E, B 23 E	B 19 ET
Bosch number	0 237 020 075	0 237 020 031
Volvo P/N	1 336 689	1 336 694
Direction of rotation	Clockwise	Clockwise

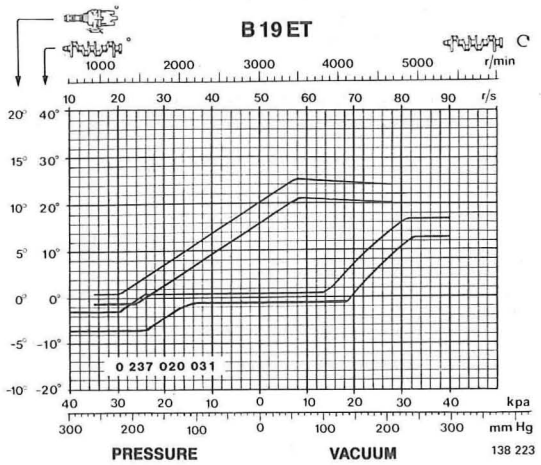
Centrifugal governor

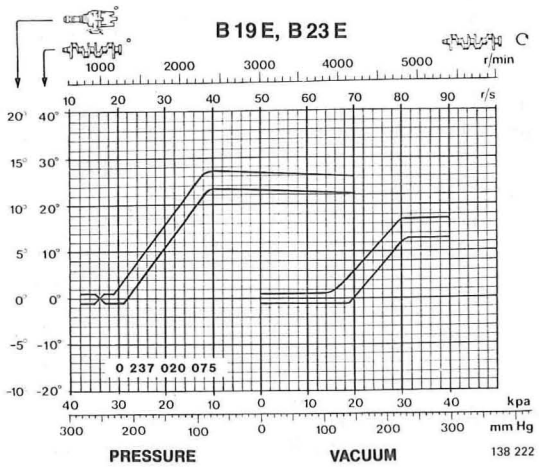
Advance, total, degress (distributor)	12.5±1.5	12.5±1.5
Advance begins at distrib. rev/secs	6.7–9.2	6,7–11,7
distrib. rev/min)	(400–550)	(400–700)
Data: 5° at distrib. rev/secs	20–26	12,8–16
(distrib. rev/min)	(1 200–1 560)	(770–960)
10° at distrib. rev/secs	33.3–39	17.5–22.3
(distrib. rev/min)	(2 000–2 340)	(1 050–1 340)
Advance max at distrib. rev/secs	26.7	40
(distrib. rev/min)	(1 600)	(2 400)

Vacuum governor

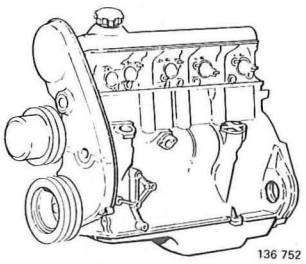
Control direction	Positive	Positive
Control, total degrees (distributor)	7.5±1	7.5±1
Control commences at mm Hg	105–140	105–145
Data: 5° at mm Hg	175–215	175–220
max control at mm Hg.	235	250
Direction of rotation	–	Negative
Max control, distr. degrees	–	2.5±1
Control begins at mm Hg	–	105–180
Data: 1° at mm Hg	–	135–210
Max control mm Hg	–	225

Ignition advance



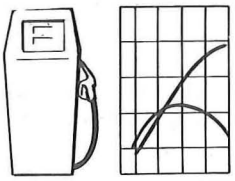


Section 2 B 200, B 230 Engines


136 752

Group 20 General 31
Group 21 Engine block 32
Group 22 Lubricating system 38
Group 23 Fuel system 39
Group 25 Intake and exhaust systems 60
Group 26 Cooling system 62
Group 28 Ignition system 63

Group 20 General


129 750

Performance, compression ratio, octane requirements

Engine type	Remarks	Compression ratio	Octane requirement RON*	Output		Max torque	
				kW at r/s	hp at r/min	Nm at r/s	kpm at r/min
B 200 K	Europe, manual automatic Overseas	10.0 10.0 8.5	98 98 93	76/90 78/90 74/90	103/5400 106/5400 100/5400	165/45 170/45 165/45	16.8/2700 17.3/2700 16.8/2700
B 200 E		10.0	95[1,7]	89/95	121/5700	158/80	16.1/4800
B 200 F	1990 1991	10.0 10.0	95[2] 95[2]	80/98 82/95	110/5900 111/5700	155/48 158/57	15.8/2900 16.1/2800
B 200 ET		8.5	98	118/92	160/5500	245/58	25.0/3500
B 204 E		9.7	95[1]	102/100	139/6000	181/80	18.4/4800
B 204 FT		8.2	95[2]	140/88	190/5300	280/49	28.5/2950
B 204 GT		8.2	95[1]	147/88	200/5300	290/49	29.6/2950
B 230 A	Scandinavia	10.3	98	82/83	112/5000	192/42	19.6/2500
B 230 K	–1986 Europe Overseas 1987–	10.3 9.0 10.5	98 93[1] 95[1]	84/87 80/87 86/87	114/5200 109/5200 117/5200	192/42 185/42 194/42	19.6/2500 18.9/2500 19.8/2500
B 230 E		10.3	95[1,7]	96/92	131/5500	190/55	19.4/3300
B 230 ET		9.0	98	134/97	182/5800	260/57	26.5/3400
B 230 F	USA, Canada Other markets	9.8 9.8	95[2] 95[2]	85/90 85/90	114[3]/5400 116/5400	183/42[5] 183/42[5]	135[4]/2500[6] 18.7/2500[6]
B 230 FB		9.3	95[2]	96/92	130/5500	185/49	18.9/2950
B 230 FT	USA, Canada, Japan –1989 Other markets –1989 USA, Canada 1990– Other markets 1990–	8.7 8.7 8.7 8.7	95[2] 95[2] 95[2] 95[2]	119/88 115/80 121/80 121/80	160[3]/5300 156/4800 162[3]/4800 165/4800	253/48 242/55 264/57 264/57	187[4]/2900 24.7/3300 195[4]/3450 26.9/3450
B 230 GT		8.7	95[1]	125/80	170/4800	265/57	27.0/3450
B 234 F	USA, Canada	10.0	95[2]	114/95	153[3]/5700	203/75	150[4]/4450
B 234 F/G	Other markets LH-drive, man gearbox –1989	10.0 10.0	95[2,8] 95[2]	114/95 117/97	155/5700 159/5800	203/75 210/74	20.7/4450 21.4/4450

[1] Unleaded fuel can also be used.
[2] Unleaded fuel only. 91 octane unleaded fuel can be used.
[3] Horse power.
[4] Ft lb.
[5] With Regina-Rex I: 182/42.
[6] With Regina-Rex I: 134/2500 and 18.6/2500.
[7] –1986: 98 octane.
[8] B 234 G: Leaded fuel can be used.

* RON stands for Research Octane Number, and is a measure of the ability of a fuel to withstand knocking.
MON stands for Motor Octane Number and is another way of measuring the same property.
(R+M)/2, also called AKI (Anti Knock Index) combines these two measurements.
95 RON is equivalent to 91 (R+M)/2.
91 RON is equivalent to 87 (R+M)/2.

Other General Data

		B 200 B 204	B 230 B 234
Number of cylinders		4	4
Bore	mm	88.9	96
Stroke	mm	80	80
Displacement	dm^3 (litres)	1.99	2.32
Firing order		1-3-4-2	1-3-4-2
Compression pressure	MPa (psi)	0.9 (128)	0.9 (128)
Max deviation between cylinders	MPa (psi)	0.2 (28)	0.2 (28)
Weight	kg	140–150	140–150
	(lb)	(308–330)	(308–330)
with turbocharger	kg	165 (363)	160–165 (352–363)

[1] With hot engine throttle wide open and starter motor cranking at 4.2–5.0 r/s (250–300 r/min).

Group 21 Engine block

Cylinder block

Bore		B 200	B 230
Standard, C	mm	88.90–88.91	96.00–96.01
	(in)	(3.5027–3.5031)	(3.7824–3.7828)
D	mm	88.91–88.92	96.01–96.02
	(in)	(3.5031–3.5034)	(3.7828–3.7832)
E	mm	88.92–88.93	96.02–96.03
	(in)	(3.5034–3.5038)	(3.7832–3.7836)
G	mm	88.94–88.95	96.04–96.05
	(in)	(3.5042–3.5047)	(3.7840–3.7844)
Oversize 1	mm	89.29–89.30	96.30–96.31
	(in)	(3.5180–3.5184)	(3.7942–3.7946)
2	mm	89.67–89.68	96.60–96.61
	(in)	(3.5303)	(3.8060–3.8064)

Rebore if wear exceeds 0.1 mm (0.004 in) and oil consumption is very high.

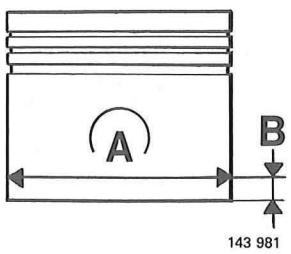
Pistons

Piston diameter (A)

	B 200	B 230
Standard (C) mm	88.88–88.89	95.98–95.99
(D) mm	88.89–88.90	95.99–96.00
(E) mm	88.90–88.91	96.00–96.01
(G) mm	88.92–88.93	96.02–96.03
Oversize 1 mm	89.27–89.28	96.28–96.29
2 mm	89.65–89.66	96.58–96.59

Diameter measured at right angles to pin at distance 'B' from bottom of piston

	B
B 200/204	13.4 mm
B 230 K 1987–	13.5 mm
B 230 others	7 mm
B 234	11 mm
Max weight difference in same engine B 200/230	16 g
B 204/234	14 g

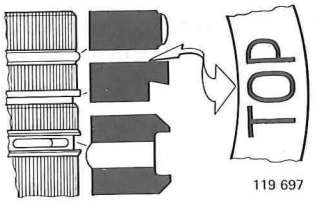


143 981

Piston running clearance

B 200 1985	mm (in)	0.003–0.027 (0.0001–0.0011)
B 200 1986–, B 204/230/234	mm (in)	0.010–0.030 (0.0004–0.0012)

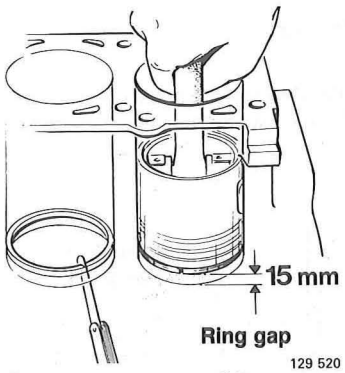
Piston rings



119 697


129 521

Axial clearance

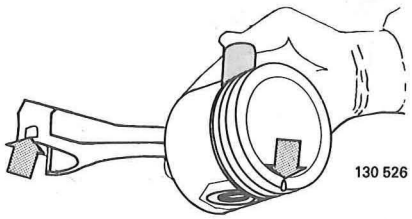


Ring gap
129 520

		Upper Comp. rings	Lower Comp. rings	Oil scraper rings
Side clearance measured with ring on piston	B 200 mm	0.060–0.092	0.030–0.062	0.020–0.055
	(in)	(0.0024–0.0036)	(0.0012–0.0024)	(0.0008–0.0022)
	B 204 mm	0.040–0.072	0.030–0.062	0.020–0.050
	(in)	(0.0016–0.0028)	(0.012–0.0024)	(0.008–0.0019)
	B 230/234 mm	0.060–0.092	0.040–0.072	0.030–0.065
	(in)	(0.0024–0.0036)	(0.0016–0.0028)	(0.0012–0.0026)
Ring gap (checked in 88.9, 96.0 mm bore)	B 200/204 mm	0.30–0.50	0.30–0.55	0.20–0.50
	(in)	(0.0118–0.0236)	(0.0118–0.0217)	(0.0098–0.0197)
	B 230/234 mm	0.30–0.55	0.30–0.55	0.30–0.65
	(in)	(0.0118–0.0217)	(0.0118–0.0217)	(0.0118–0.0256)

Gudgeon (Piston) pins

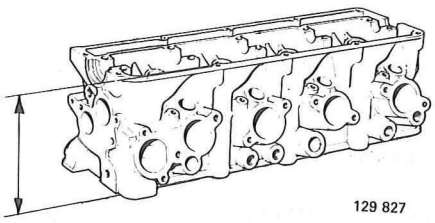
Fit, in connecting rod ..... Light thumb pressure (close running fit)
in piston ..... Thumb pressure (push fit)


130 526

Cylinder head

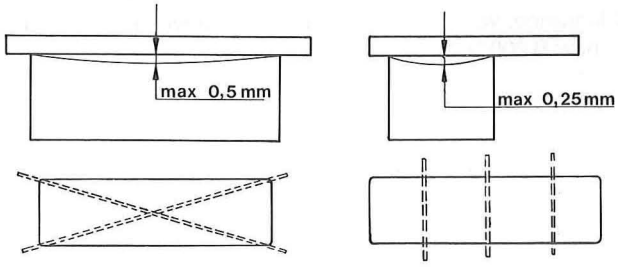
		B 204/234	B 200/230
Height, new	mm	103.5	146.1
	(in)	(4.078)	(5.756)
after machining	mm	102.7*	145.6
	(in)	(4.078)	(5.737)

* Max machining 0.3 mm


129 827

Max warp .....

NOTE: If warp is greater than 1.0 mm (0.0394 in) lengthwise or 0.5 mm (0.0197 in) crosswise, cylinder head must be replaced.



129 826

Valve clearance

B 200/230		Checking	Adjusting
Inlet and exhaust valves			
cold engine	mm	0.30–0.40	0.35–0.40
	(in)	(0.012–0.016)	(0.014–0.016)
warm engine	mm	0.35–0.45	0.40–0.45
	(in)	(0.014–0.018)	(0.016–0.018)

Adjusting shim, thickness ..... mm (in) 3.30–4.50 (0.1300–0.1773) in increments of 0.05 (0.002)

Valve stem, B 204/234

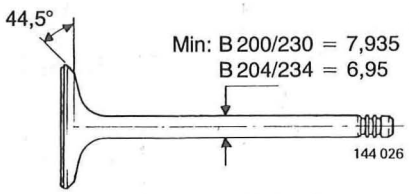
Valve stem height ..... **49.4±0.04 mm**
(measured with gauge 5222) ..... **1.946±0.002 in**

Note: Valve stem height **must be as specified.** Otherwise tappets will not function properly.

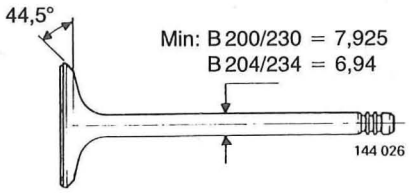
Valves

IMPORTANT: Exhaust valves are stellite-flashed and must not be machined. They may only be ground in against seat.

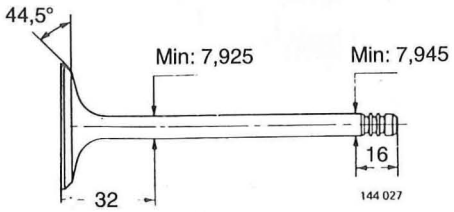
IMPORTANT: Scrapping exhaust valves. The exhaust valves on turbo engines are sodium filled and must not be mixed with ordinary scrap iron before first removing the sodium.



Inlet valve

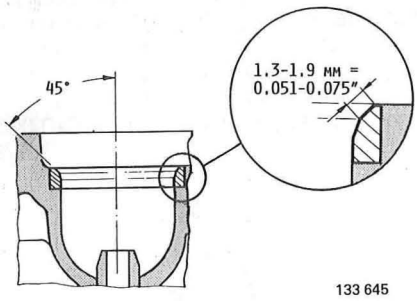


Exhaust valve (Not Turbo)

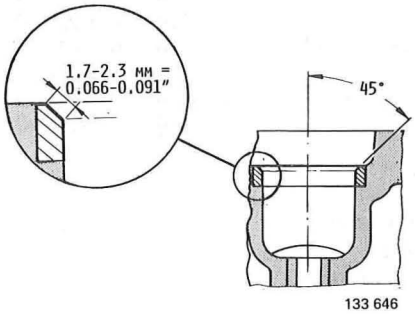


Exhaust valve turbo engines

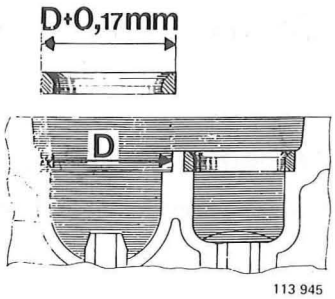
Valve seats



Inlet



Exhaust



Note: When replacing valve seats the interference between the seat and its bore should be 0.17 mm (0.0067 in) ie valve seat diameter should be 0.17 mm greater than diameter of bore in cylinder head. B 204/234: 0.10–0.14 mm (0.0039–0.0055 in).

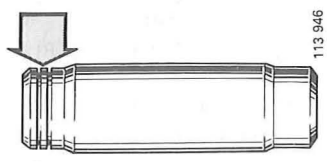
Valve guides

		Inlet valve	Exhaust valve
Inner diameter	mm	8.000–8.022	8.000–8.022
	(in)	(0.3152–0.3161)	(0.3152–0.3161)
Height above upper face of cylinder head	mm	15.4–15.6	17.9–18.1
	(in)	(0.6068–0.6146)	(0.7053–0.7131)
Clearance, valve stem-guide (measured with new valve), new B 200/B 230	mm	0.03–0.06	0.06–0.09
	(in)	(0.0012–0.0024)	(0.0024–0.0036)
B 204/234	mm	0.03–0.06	0.04–0.07
	(in)	(0.0012–0.0024)	(0.0016–0.0028)
max	mm	0.15	0.15
	(in)	(0.0059)	(0.0059)

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

	Marking	Reamer
Standard	No groove	–
Oversize 1	1 groove	5161*
Oversize 2	2 grooves	5162
Oversize 3	3 grooves	5163

*B 204/234: 5373



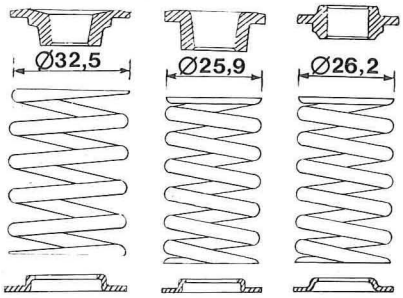
Note: The force used when pressing in valve guides must be at least 9000 N (1980 lb). If the pressing force used is lower then the recess for the guide must be reamed out to the nearest oversize and a guide of the corresponding size pressed in.

Adjusting shim

Thickness	mm (in)	3.3–4.5 (0.13–0.18) at increments of 0.05 (0.002)

Valve springs

Different types of valve springs are in use as follows.

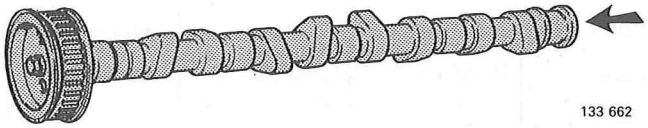


Type 1: B 200 K and E, B 230 A, K, E and ET
Type 2: B 200 ET, B 200 F, B 230 F, K 1989– and FT
Type 3: B 204 and B 234

Type 1		Type 2		Type 3	
Length mm (in)	Load N (lb)	Length mm (in)	Load N (lb)	Length mm (in)	Load N (lb)
45.0 (1.77)	0	45.5 (1.79)	0	43.0 (1.69)	0
38.0 (1.50)	280–320 (62–70)	38.0 (1.50)	280–320 (62–70)	37.0 (1.46)	212–252 (48–56)
27.0 (1.06)	710–790 (160–178)	27.5 (1.08)	702–782 (154–163)	26.5 (1.04)	600–680 (135–153)

Timing gears

Camshaft



Profile letter stamped on end of camshaft

Engine type	Camshaft		Checking camshaft setting (cold engine)	
	Profile	Max lift height mm (in)	Valve clearance for number 1 inlet	Inlet/exhaust valve should open at*
B 200 K	Y	10.35 (0.4078)	0.7 (0.0276)	8° B.T.D.C.
B 200 E	V	11.37 (0.4480)	0.7 (0.0276)	11° B.T.D.C.
B 200 ET	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C.
B 200 F	M	9.5 inlet	0.7 (0.0276)	6° A.T.D.C.
		10.5 exhaust	0.7 (0.0276)	44° B.B.D.C.
B 204 E	u_1 (inlet)	9.38 (0.3696)	0.7 (0.0276)	5.1° B.T.D.C
	u (exhaust)	9.38 (0.3696)	0.7 (0.0276)	37.1° B.B.D.C.
B 204 FT/GT	F I (inlet)	6.81 (0.0268)	0.7 (0.0276)	12.9° A.T.D.C.
	F A (exhaust)	7.45 (0.0294)	0.7 (0.0276)	31.2° B.B.D.C.
B 230 A	A	10.5 (0.4137)	0.7 (0.0276)	13° B.T.D.C.
B 230 K –1986	X	10.65 (0.4196)	0.7 (0.0276)	10° B.T.D.C.
1987–	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C.
B 230 E	V	11.37 (0.4480)	0.7 (0.0276)	11° B.T.D.C.
B 230 ET	A	10.5 (0.4137)	0.7 (0.0276)	13° B.T.D.C.
B 230 F	M	9.5 (0.374) inlet	0.7 (0.0276)	6° A.T.D.C.
		10.5 (0.4137) exhaust	0.7 (0.0276)	44° B.L.D.C.
B 230 FB	VX3	11.37 (0.4480) inlet	0.7 (0.0276)	7.7° B.T.D.C.
		10.65 (0.4196) exhaust	0.7 (0.0276)	50.1° B.L.D.C.
B 230 FT	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C.
B 234 F	u_1 – (inlet)	9.38 (0.3696)	0.7 (0.0276)	5.1° B.T.D.C.
	u – (exhaust)	9.38 (0.3696)	0.7 (0.0276)	37.1° B.B.D.C.

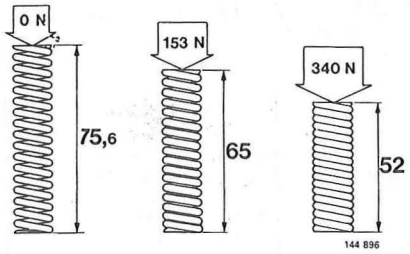
* B.T.D.C. = before top dead centre, A.T.D.C. = after top dead centre, B.L.D.C. = before lower dead centre

Radial clearance, new	mm (in)	0.030–0.071 (0.0012–0.0028)
max	mm (in)	0.15 (0.0059)
Axial clearance, B 200/230	mm (in)	0.1–0.4 (0.0344–0.0158)
B 204/234	mm (in)	0.05–0.40 (0.0019–0.0158)

Intermediate shaft B 200/230

Radial clearance	mm (in)	0.020–0.075 (0.0008–0.0030)
Axial clearance	mm (in)	0.20–0.46 mm (0.0079–0.0181)

Camshaft belt, springs, B 204/234



Length	Load
75.6 mm (2.979 in)	0
65.0 mm (2.561 in)	153 N
52.0 mm (2.049 in)	340 N

Balance shafts, B 204/234

Axial clearance..... 0.06–0.19 mm (0.0024–0.0075 in)

Belt tension, B 204/234

	Camshaft belt			Balance shaft belt	
Coolant temp.	Checking limits*	Used belt	New belt	Used belt	New belt
20°C	< 2.5 or > 3.5	3.2±0.3	3.8±0.3	3.4±0.2	3.8±0.2
40°C	< 3.2 or > 4.2	3.9±0.3	4.4±0.3	4.0±0.2	4.3±0.2
87°C	< 4.6 or > 5.3	5.1±0.2	5.5±0.2	4.7±0.2	4.9±0.2

* Carry out at **10,000 km** (6,000 miles) after belt replacement.

< = less than
> = more than

Crankshaft assembly

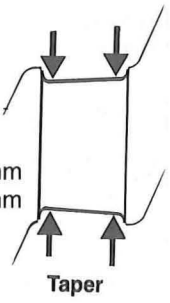
Crankshaft

Max out-of-true	mm (in)	0.040 (0.0016)
Axial clearance, max	mm (in)	0.080–0.270 (0.0032–0.0106)
Radial clearance (main bearings) early type	mm (in)	0.024–0.072 (0.0009–0.0028)
late type	mm (in)	0.024–0.064 (0.0009–0.0025)
Connecting rod bearings, radial clearance	mm (in)	0.023–0.067 (0.0009–0.0026)

Main bearing journals

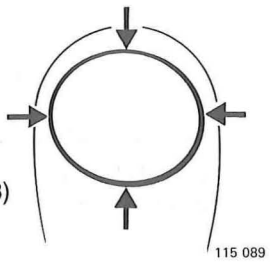
Out-of-round, max	mm (in)	0.006 (0.0002)
Taper, max.	mm (in)	0.006 (0.0002)

		Early type	Late type
Diameter, standard	mm (in)	55 (2.1574)	63 (62.987–63.000) mm
undersize 1	mm (in)	54.75 (2.1572)	62.75 (62.737–62.750) mm
2	mm (in)	54.50 (2.1473)	62.50 (62.487–62.500) mm

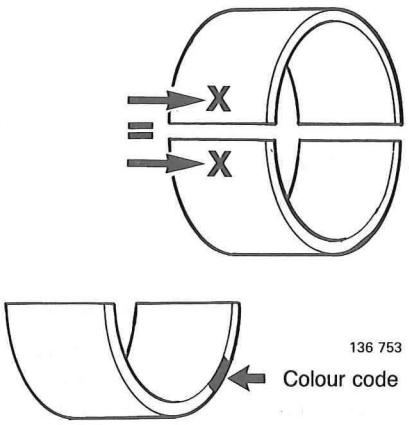

Taper

Connecting rod bearing journals

Out-of-round max	mm (in)	0.025 (0.0010)
Taper, max.	mm (in)	0.025 (0.0010)
Diameter, standard	mm (in)	49.00 (1.9306)
	mm (in)	48.984–49.005 (1.9300–1.9308)
undersize 1	mm (in)	48.75 (1.9207)
	mm (in)	8.734–48.755 (1.9208–1.9209)
2	mm (in)	48.50 (1.9109)
	mm (in)	48.484–48.505 (1.9103–1.9111)



Out-of-round



Bearings

Main bearings

Two types of main bearings are in use. Upper and lower shells on same journal must be same type.

Connecting rod bearings

Matched shells are used in production.*
Shells are colour-coded (red, blue, yellow) as follows:

Assembly 1 Two yellow shells.
Assembly 2 One blue and one red.
Blue shell in con-rod and red in cap.

Note that only yellow-coded shells are kept in stock.

* Late type: also main bearing shells.

Connecting rods

Axial clearance at piston ..... mm (in)	0.15–0.45 (0.0059–0.0177)
Max weight deviation between connecting rods in same engine ..... gms (oz.)	20 (0.7)

Flywheel

Axial throw, max ..... mm (in)	0.02/100 diameter (0.0008/3.9400)

Tightening torque data

The tightening torques apply to oiled nuts and bolts.
Degreased (washed) parts must be oiled prior to use.

	Nm	ft lb
Main bearing	110	80
Connecting rod bearings*, step 1	20	14
step 2	angle-tighten 90°	
Flywheel/carrier plate (use new bolts)	70	51
Spark plug (do not oil)	25	18
Camshaft gear	50	37
Intermediate shaft gear, B 200/230	50	37
Camshaft cap	20	15
Crankshaft, centre bolt pulley, step 1	60	43
step 2	angle-tighten 60°	

B 204/234

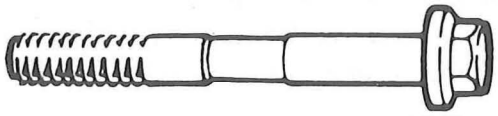
Reinforcing strut	25	18
Camshaft – idler pulley	25	18
Camshaft – tension roller	50	37
Balance shaft housing, assembly on bench	5	35
Balance shaft housing, installation, stage 1	20	18
stage 2	Slacken	
stage 3	10	7
stage 4	Angle-tighten 90°	
Balance shaft pulley	20	15
Balance shaft – tension roller	50	48
Crankshaft pulley, stage 1	60	44
stage 2	Angle-tighten 60°	

* Bolts can be reused provided length does not exceed 55.5 mm (2.187 in)

B 204/234

Cam carrier (centre fasteners)	20	15
Oil pump	11	7
Oil pump, inlet	11	8
Oil pump – pulley, step 1	20	15
step 2	angle-tighten 60°	

Cylinder head, tighten in stages:



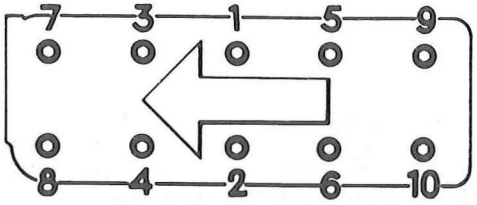
134 266

B 200/230

1 = **20 Nm** (14 ft lb)
2 = **60 Nm** (43 ft lb)
3 = angle tighten **90°** in one movement

B 204/234

1 = **20 Nm** (15 ft lb)
2 = **40 Nm** (30 ft lb)
3 = Angle tighten **115°**



115 326

Tightening sequence for cylinder head bolts

Bolts should be replaced if centre section shows signs of extension.
Do not reuse bolts more than 5 times. If in doubt fit new bolts.

Group 22 Lubricating system

General data

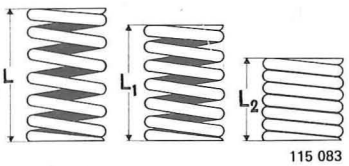
Oil capacity and quality, see page 12.

Oil pressure at 33 r/s (2 000 r/min), warm engine and new oil filter	MPa (psi)	0.25–0.60 (35.6–85.3)

Oil pump

		B 200/230	B 204/234
Axial clearance	mm	0.02–0.12	0.05–0.10 (0.0020–0.0040)
	(in)	(0.0008–0.0047)	
Radial clearance (excluding bearing clearance)	mm (in)	0.02–0.09	
	(in)	0.0008–0.0035)	
Backlash (excluding bearing clearance)	mm	0.15–0.35	
	(in)	(0.0059–0.0138)	
Bearing clearance, drive shaft	mm	0.032–0.070	
	(in)	(0.0013–0.028)	
idling shaft	mm	0.014–0.043	
	(in)	(0.0006–0.0017)	

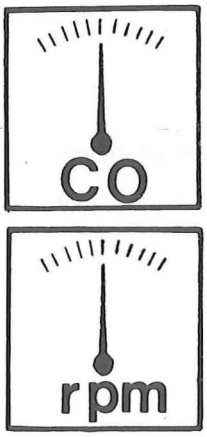
Relief valve spring length under different loads:



115 083

B 200/230		B 204/234	
Length	**Load**	**Length**	**Load**
39.2 mm (1.5445 in)	0	47.6 mm (18.8 in)	0
26.25 mm (1.0343 in)	46–54 N (10.12 lb)	32.0 mm (1.3 in)	(40–48 N (9–11 lb)
21.0 mm (0.8274 in)	62–78 N (14–17 lb)	26.0 mm (1.0 in)	55–67 N (12–15 lb)

Group 23 Fuel system



Petrol/gasoline engines. CO content, idle speed

- Selector lever must be in position P (and handbrake applied) when checking/adjusting CO or idle speed
- CO should be checked/adjusted when engine is warm and idling
- CO content outside check values shown below = adjust to specified setting value
- CO content within check values need not be adjusted provided engine is operating satisfactorily

Engine type	Remarks	CO level[1]			Idle speed r/s (r/min)	
		Co-meter % Setting	Checking	Volvo Mono Tester	Manual	Automatic
B 200 K		1.5	1.0–2.5		15.0 (900)	
B 200 E		1.0	0.5–2.0		15.0 (900)	
B 200 F	not adjustable	–	0.4–0.8[2]		12.9 (775)	
B 200 ET		1.5	1.0–2.5		15.0 (900)	
B 204 E		0.8	0.6–1.0		15.0 (900)	
B 204 FT	not adjustable	–	0.4–0.8[2]		13.3 (800)	
B 204 GT	not adjustable (1990)	–	0.4–0.8[5]		13.3 (800)	
B 230 A		2.0	1.5–3.0		15.0 (900)	
B 230 K	Switzerland –1986 Other markets –1986 1987–	1.5 1.0 1.0	1.0–2.5 0.5–2.0 0.5–1.5		13.3 (800) 13.3 (800) 13.3 (800)	15.0 (900) 15.0 (900) 15.0 (900)
B 230 E		1.0	0.5–2.0		15.0 (900)	
B 230 ET	Scandinavia, Switzerland, Australia Other markets	1.5[4] 1.0	1.0–2.5[4] 0.5–2.0		15.0 (900) 15.0 (900)	
B 230 F	Japan –1988 Other markets –1988 1989– not adjustable	0.6 0.6 –	0.4–0.8[3] 0.4–0.8[3] 0.4–0.8[2]	20–70°[4] 20–70°[4]	15.0 (900) 12.5 (750)[6] 12.9 (775)	
B 230 FB	not adjustable	–	0.4–0.8[2]		12.9 (775)	
B 230 FT	Japan –1988 Other markets –1989 1990– not adjustable	0.6 0.6 –	0.4–0.8[3] 0.4–0.8[3] 0.4–0.8[2]	20–70°[4] 20–70°[4]	15.0 (900) 12.5 (750)[6] 12.5 (750)	
B 230 GT	(1990 not adjustable)	1.0	0.5–2.0[5]		12.5 (750)	
B 234 F	not adjustable	–	0.4–0.8[2]		14.2 (850)	
B 234 G		0.8	0.5–1.1		14.2 (850)	

[1] Pulsair system disconnected and plugged, as applicable
[2] Connected Lambdasond. Measured in front of catalytic converter.
[3] Disconnected Lambdasond. Measured in front of catalytic converter
[4] 1988– only for 760 with manual gearbox.
[5] 1990, connected Lambdasond.
[6] AC switched off. Idle speed should rise to 15.0 r/s (900 rpm) when AC is switched on again

Page
Carburetted engines (B 200 K, B 230 A/K) 44
CI-system (B 200/230 E) 48
Motronic (B 200/230 ET) 51
Constant idle speed system (B 200/230 ET) 54
LH-Jetronic (B 200/230 F/FT/GT) 55
Regina (B 230 F USA) 58
LH-Jetronic 2.4
(B 204 E, B 204 GT, B 204 FT, B 234 F/G) 61

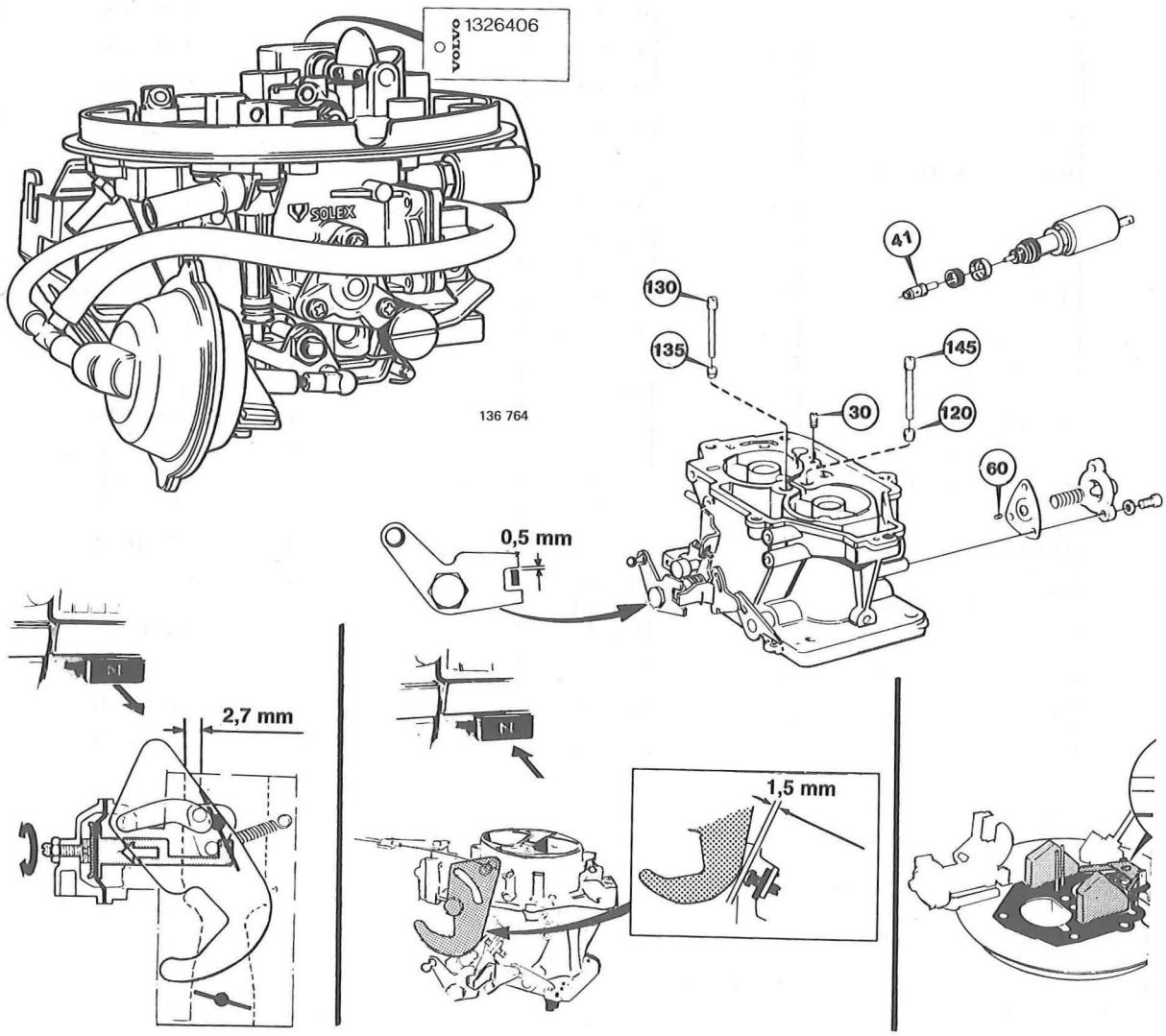
CARBURETTED ENGINES (B 200 K, B 230 A/K)

Fuel pump

Fuel pressure measured at same level as pump
at 16.6 r/s (1 000 r/min). . . . . kPa (psi) 15–27 (2.1–3.8)

B 200 K

Solex-Cisac carburettor



Adjusting vacuum servo

- Choke fully out
- Vacuum servo rod fully in (ie at bottom)

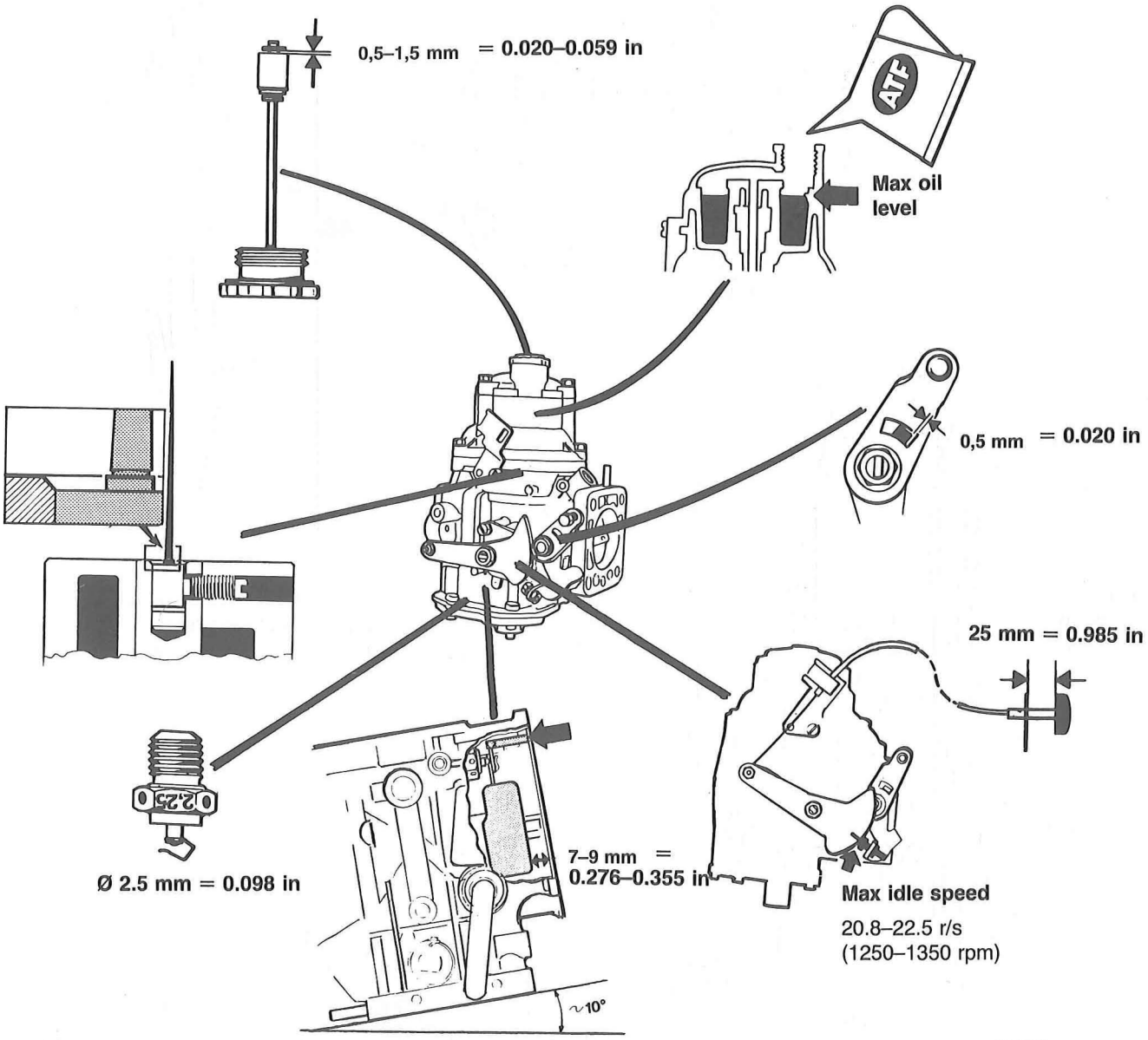
Adjusting max engine speed

- Choke fully in

ENGINE B 230 A

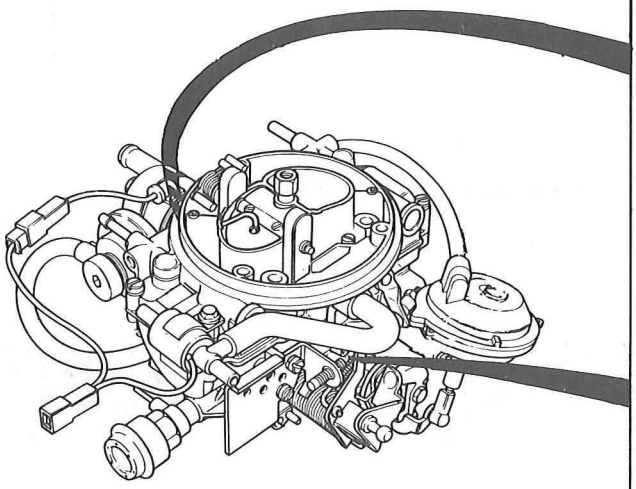
Pierburg (DVG) 175 CDUS Carburettor

Metering needle designation
NC

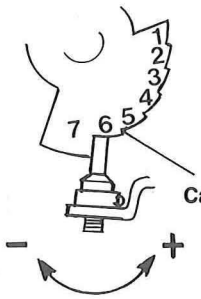


ENGINE B 230 K 1985–1986

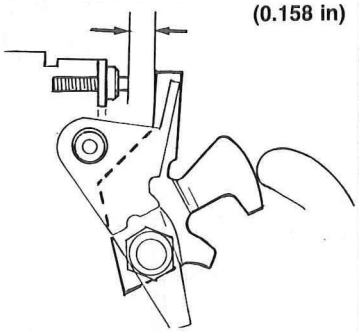
Pierburg 2 B 5 carburettor



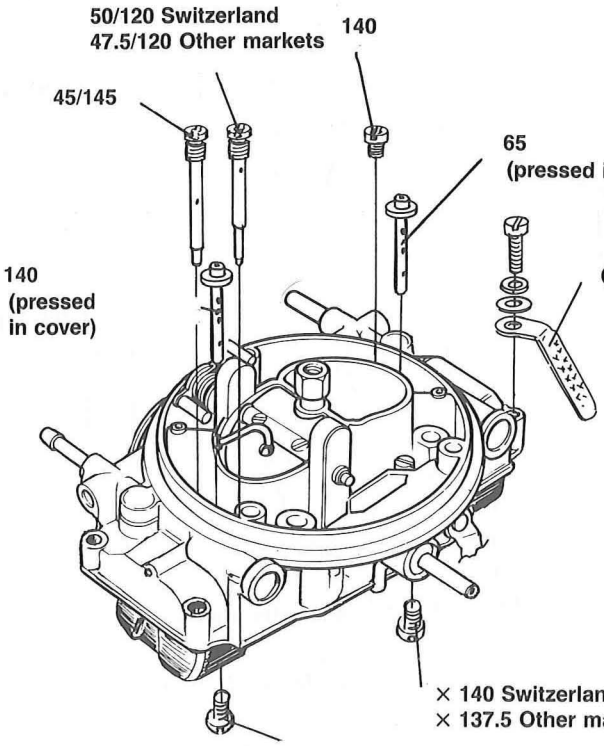
Max idle speed



Switzerland automatic ..... **4.8 mm (0.189 in)**
Other markets ..... **4.0 mm (0.158 in)**



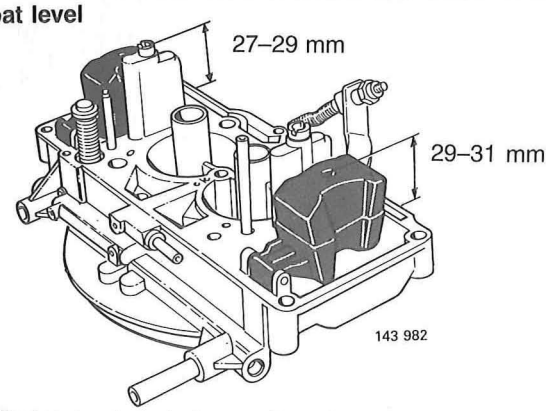
136 782



141 376

Carburettor	Switzerland	Other markets
designation	7.17952.44	7.17952.40
P/N	1 332 364-7	1 317 036-0

Float level

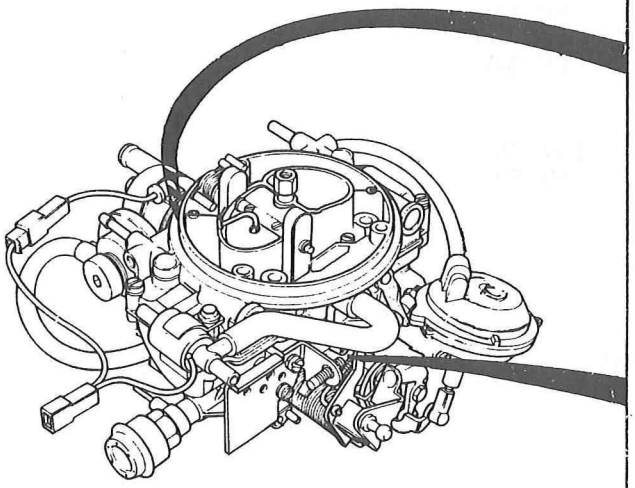


143 982

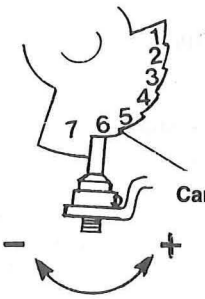
- Spring-loaded pin in needle valve **must not be depressed**
- Float level is not adjustable. If level not to spec. fit new float and needle valve pin.

ENGINE B 230 K 1987–

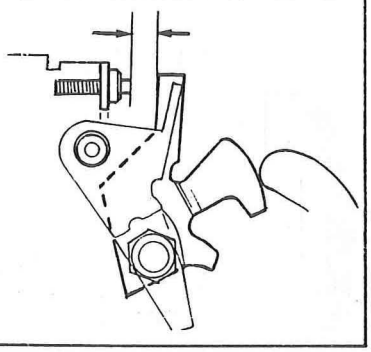
Pierburg 2 B 7 carburettor



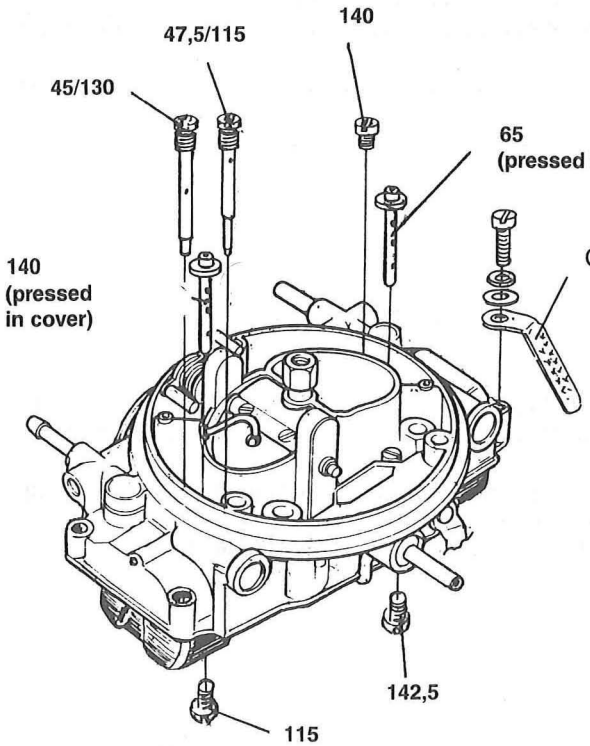
Max idle speed



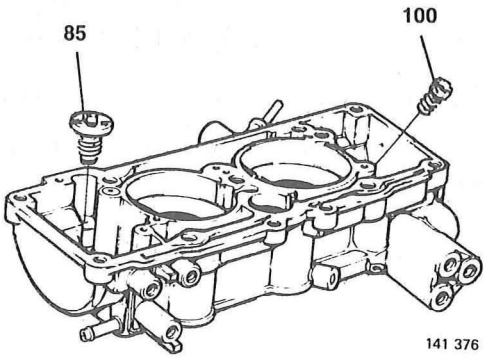
Automatic ..... **5.6 mm**
Manual ..... **5.0 mm**



136 782

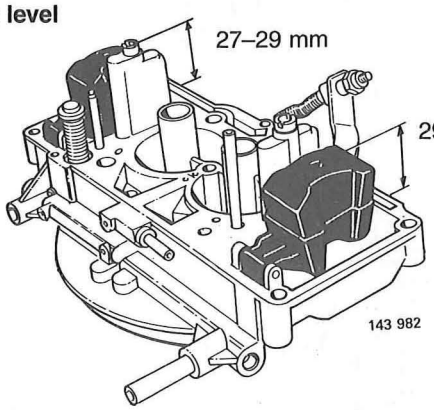


Carburettor
designation. 7.17952.51
P/N 1 357 108-8



141 376

Float level



143 982

- Spring-loaded pin in needle valve **must not be depressed.**
- Float level is not adjustable. If level not to spec. fit new float and needle valve pin.

B 200 E, B 230 E: CI System

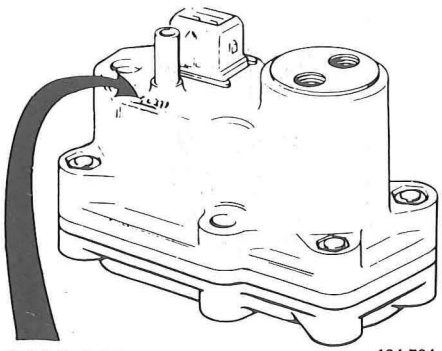
Pressures

Line pressure ..... kPa (psi) 450–530 (64–75)
Rest pressure ..... kPa (psi) 150–240 (21–34)

Control pressure
warm engine ..... kPa (psi) 345–375 (49–53)

cold engine, see diagram

Control pressure regulator



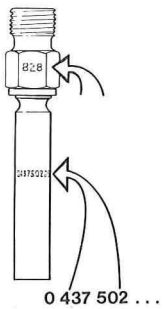
0 438 140 . . .

134 734

Bosch No ..... **. . .004**
Volvo P/N 463 971-2

Resistance ..... 20–30 Ω

Injectors



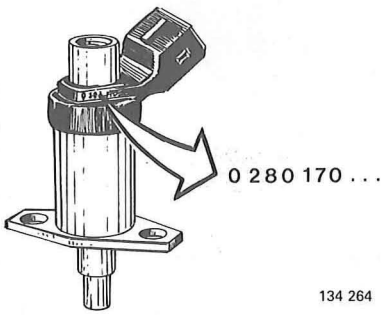
0 437 502 . . .

132 945

Bosch No ..... **. . .015**
Volvo P/N 1 276 037-7

Opening pressure..... kPa (psi) 350–410 (50–58)
No leakage permissible
below ..... kPa (psi) 290 (41)

Start injector



0 280 170 . . .

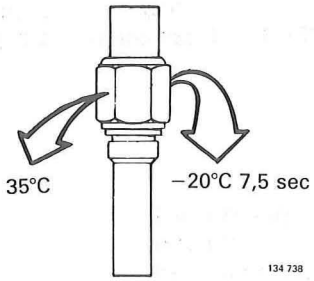
134 264

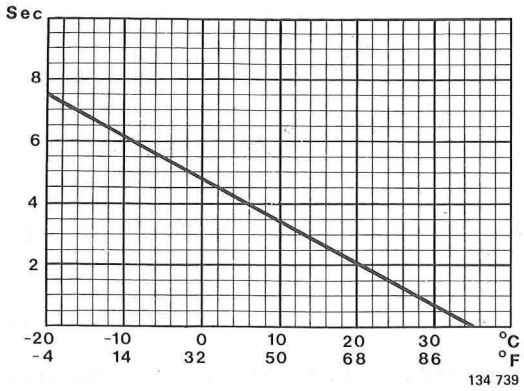
	Early type	Late type
Bosch No.	**. . .413**	**. . .445**
Volvo P/N	1 276 498-1	3 517 065-3

Injected quantity ..... 85 cm^3/min

Injection time is controlled by a thermal timer (see diagram on next page.)

Thermal time switch



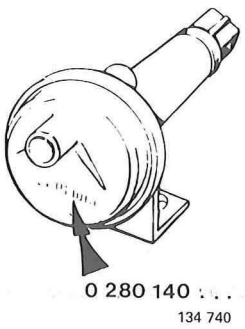


Cut-out temperature and injection time at –20°C (–4°F) is stamped in side of switch.

Injection time at different temperatures

Tolerances: time ..... ±2 sec
temperature ..... ±4°C (7.2°F)

Auxiliary air valve



Type of auxiliary air valve fitted to engine depends on engine type.
Identification number (last three digits of part number) is stamped on side of valve.

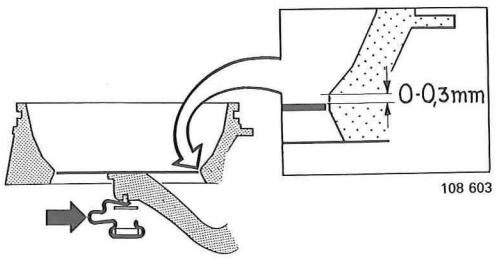
	Bosch No	Volvo P/N
B200E, manual	**...106**	1 346 476-3
automatic ...	**...114**	1 346 477-1
B230E, manual	**...112**	1 346 478-9
automatic ...	**...118**	1 357 448-8

Resistance ..... 40–60 Ω
Fully open at..... –30°C (–22°F)
Fully closed at..... +70°C (158°F)

The auxiliary air valve is controlled electrically and should be fully closed after 5 minutes driving at 20°C (68°F) ambient temperature.

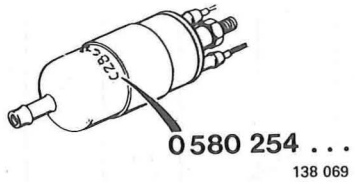
Air flow sensor

Metering disc rest position



Carry out check at maximum control pressure (in hot engine, fuel pump running).

Fuel pump

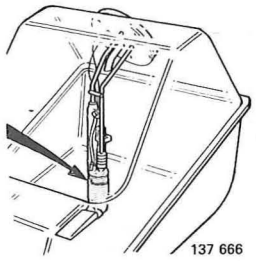


	Type I	Type II	Type III
Bosch No.....	**. . .948**	**. . .935**	**. . .934**
Volvo P/N.....	1 336 677-8	1 389 448-0	1 389 447-2

Pump capacity at a line pressure of 500 kPa (71 psi), 20°C (68°F)
and 12 V..... 145 litres/hr (1.2 litres/30 sec)
11 V..... 125 litres/hr (1.0 litres/30 sec)
10 V..... 105 litres/hr (0.9 litres/30 sec)

Current consumption at a line pressure of 500 kPa (71 psi),
20°C (68°F) and 12 V..... max 8.5 A

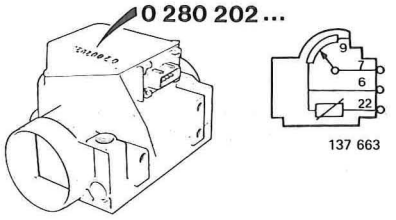
Tank pump



Current consumption..... 1–4 A

B 200 ET, B 230 ET: MOTRONIC

Air flow meter

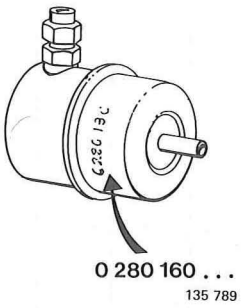


	B 200 ET	B 230 ET
Bosch No.	...067	...035
Volvo P/N	1 346 698-2	1 306 967-9

Resistance:

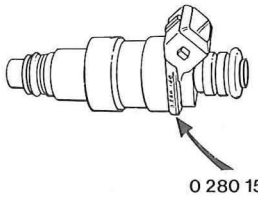
- between terminals 6 and 22 of temperature sensor
  at −10°C (14°F) ..... 8 260–10 560 Ω
  +20°C (68°F) ..... 2 280–2 720 Ω
  +50°C (122°F) ..... 760–910 Ω
- between terminals 6 & 9 ..... 500–1 100 Ω
- between terminals 6 & 7 ..... 8–200 Ω

Line pressure, pressure regulator



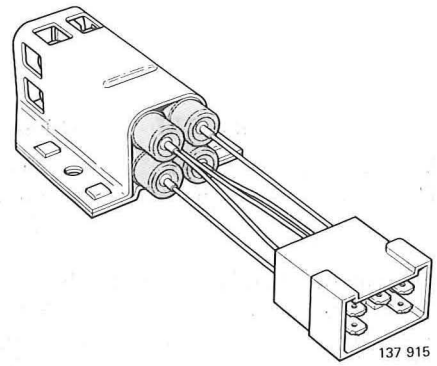
	B 200 ET	B 230 ET
Early type		
Bosch No.	...225	...226
Volvo P/N	1 357 705-1	1 357 710-1
Late type		
Bosch No.	...292	...294
Volvo P/N	3 517 063-8	3 517 064-6
Line pressure kPa (psi).	250 (36)	300 (42)
Rest pressure kPa (psi)	150–250 (21–36)	200–300 (28–43)
Avstängningstryck	150–250 kPa (1,5–2,5 kp/cm²)	200–300 kPa (2,0–3,0 kp/cm²)

Injectors



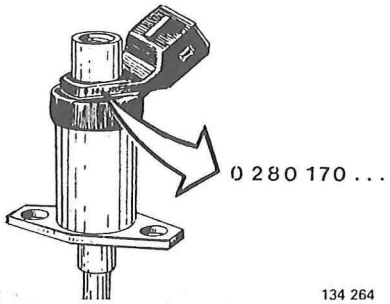
	B 200 ET	B 230 ET
Bosch No.	...802	...357
Volvo P/N	1 346 699-0	1 332 337-3
Injected quantity.....	271 cm³/min	300 cm³/min
at a line pressure of ...	250 kPa (36 psi)	300 kPa (42 psi)

Injector ballast resistor pack



Four resistors (1 per injector)
Resistance ..... 5.5–6.5 Ω

Start injector

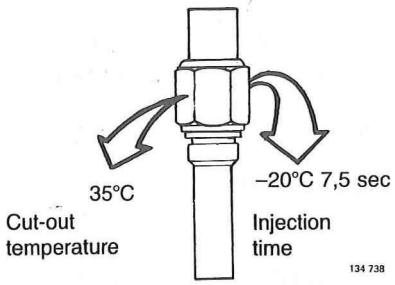


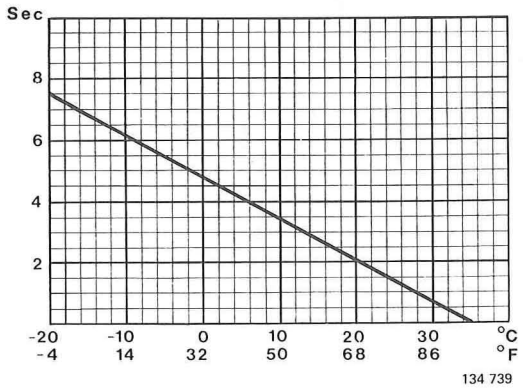
	Early type	Late type
Bosch No.	**... 400**	**... 444**
Volvo P/N	269 292-9	3 517 066-1

Injected quantity ..... 165 cm³/min

Injection time is controlled by a thermal time switch (see below).

Thermal time switch

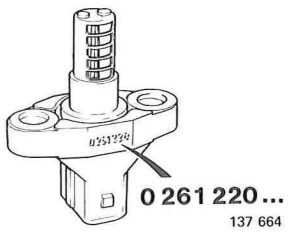




Injection time at different temperatures

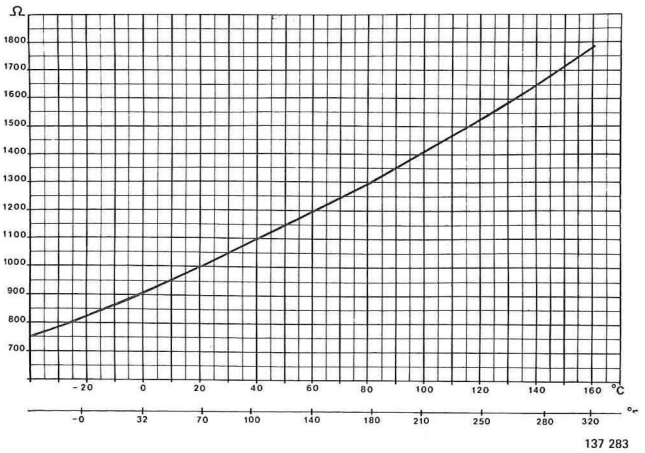
Tolerances: time ..... ± 2 secs
temperature ..... ±4°C (7.2°F)

Charge air temperature sensor

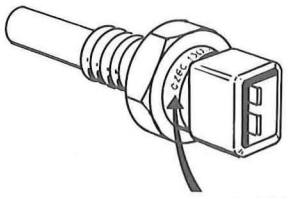


Bosch No ..... **... 001**
Volvo P/N 1 317 273-9

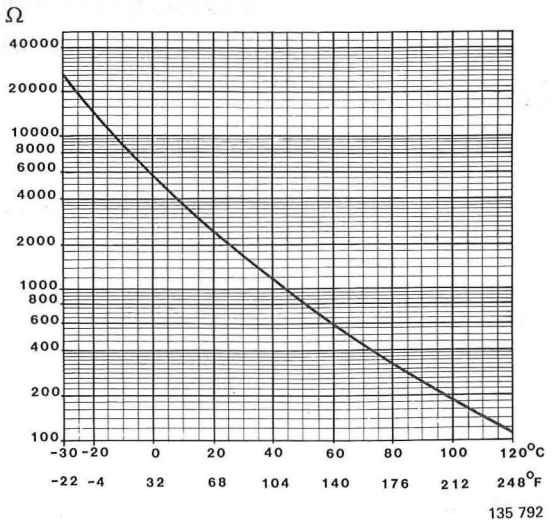
Resistance:
+20°C (68°F) ..... 985–1015 Ω
+40°C (104°F) ..... 1080–1110 Ω
+130°C (266°F) ..... 1550–1620 Ω



Coolant temperature sensor



135 791



135 792

Bosch No ..... **. . . 032**
Volvo P/N 1 346 030-8

Sensor incorporates 2 resistors: One is connected to Motronic system the other to an idle speed compensation system.

Resistance:
−10°C (14°F) ..... 8 100–10 770 Ω
+20°C (68°F) ..... 2 280–2 720 Ω
+80°C (176°F) ..... 292–364 Ω

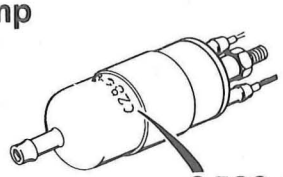
Impulse sender (crankshaft position and engine rpm senders)



137 665

Bosch No ..... **. . . 003**
Volvo P/N 1 317 030-3

Fuel pump

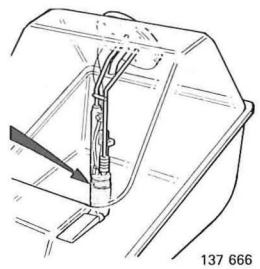


135 793

Bosch No ..... **. . . 025**
Volvo P/N 1 336 679-4

Capacity at a line pressure of 300 kPa (42 psi),
+20°C (68°F) and 12 V ..... 130 litres/hr (34.3 US Galls. per hr)
11 V ..... 108 litres/hr (28.5 US Galls. per hr)
10 V ..... 86 litres/hr (22.7 US Galls. per hr)
Current consumption at a line pressure of 300 kPa (42 psi),
+20°C (68°F) and 12 V ..... max 6.5 A

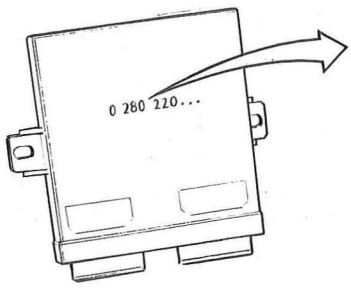
Tank pump


137 666

Current consumption ..... 1–4 A

CONSTANT IDLE SPEED SYSTEM (CIS), (B 200 ET, B 230 ET)

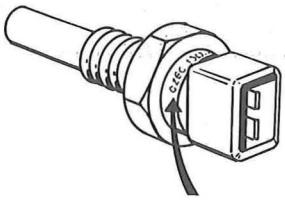
Control unit



136 607

Bosch No ..... **...016**
Volvo P/N 1 346 567-9

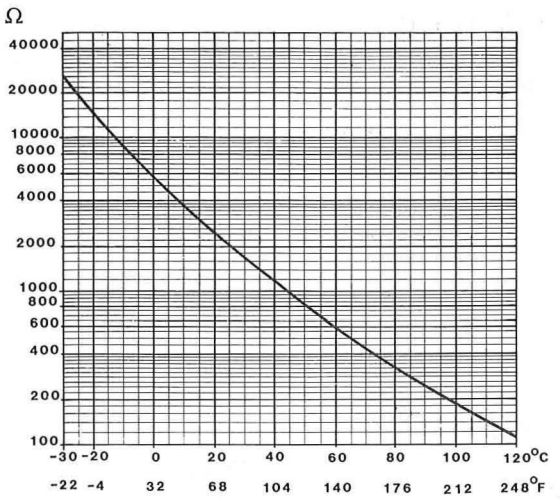
Coolant temperature sensor



135 791

Bosch No ..... **...032**
Volvo P/N 1 346 030-8

Sensor incorporates 2 resistors: One is connected to Motronic system the other to an idle speed compensation system.

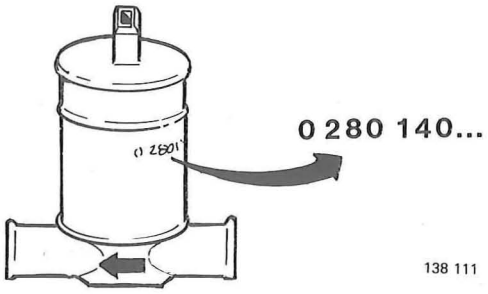


135 792

Resistance:

–10°C (14°F)	8100—10770 Ω
+20°C (68°F)	2280–2720 Ω
+80°C (176°F)	292–364 Ω

Air control valve



138 111

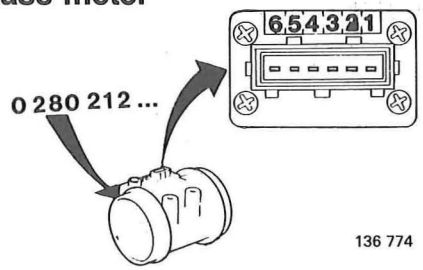
	Early type	Late type
Bosch No	**...501**	**...520**
Volvo P/N	1 317 957-7	3 517 067-9
Resistance between terminals 3 and 4, 4 and 5	approx 20 Ω	

LH-JETRONIC 2.2/2.4 B 200 F, B 230 F, B 230 FT, B 230 GT

B 230 F –1988: LH-Jetronic 2.2 (LH 2.2)
1989–: LH-Jetronic 2.4 (LH 2.4)

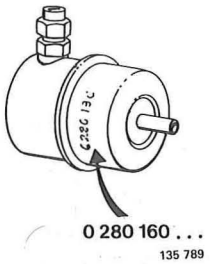
B 230 FT –1989: LH-Jetronic 2.2 (LH 2.2)
B 230 FT/GT 1990–: LH-Jetronic 2.4 (LH 2.4)

Air mass meter



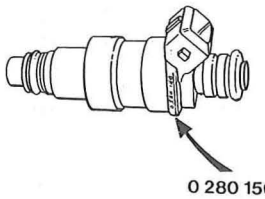
	LH 2.2	LH 2.4
Bosch No.	. . .007	. . .016
Volvo P/N	1 346 645-3	3 517 020-8
Resistance:		
• between terminals 2 and 3	3.5–4.0 Ω	2.5–4.0 Ω
• between terminals 2 and 6	0–1000 Ω	–

Pressure regulator



	B 230 F (LH 2.2)	B 200 F B 230 FT/GT B 230 F (LH 2.4)
Early type		
Bosch No.	. . . 225	. . . 226
Volvo P/N.	1 357 705-1	1 357 710-1
Late type		
Bosch No.	. . . 292	. . . 294
Volvo P/N.	3 517 063-8	3 517 064-6
Line pressure kPa (psi).	250 (36)	300 (43)
Rest pressure	150–250 (21–36 psi)	200–300 (28–43 psi)

Injectors

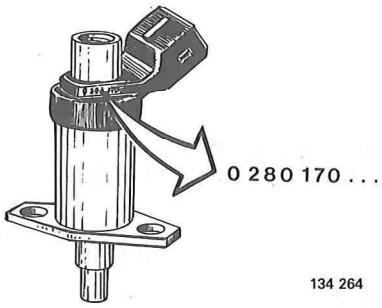


	B 230 F (LH 2.2) Early type	B 230 F (LH 2.2) Late type
Bosch No.	. . . 209	. . . 734
Volvo P/N.	1 326 427-9	1 389 844-0
Injected quantity at a line	170 cm³/min	170 cm³/min
pressure of	250 kPa (36 psi)	250 kPa (36 psi)

	B 200 F/B 230 F (LH 2.4)
Bosch No.	. . . 762
Volvo P/N.	3 517 572-8
Injected quantity at a line	185 cm³/min
pressure of	300 kPa (43 psi)

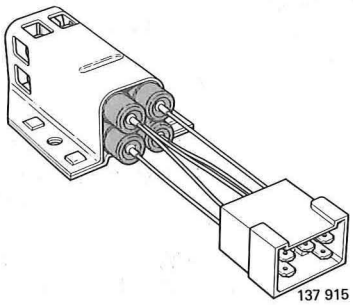
	B 230 FT (LH 2.2)	B 230 FT/GT (LH 2.4)
Bosch No.	. . . 357	. . .804
Volvo P/N.	1 332 337-3	3 517 283-2
Injected quantity at a line	300 cm³/min	300 cm³/min
pressure of	300 kPa (43 psi)	300 kPa (43 psi)

Start injector (LH 2.4)



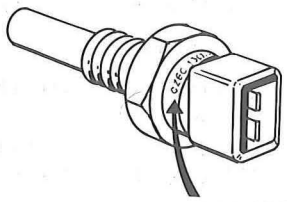
Bosch No	**. . . 446**
Volvo P/N	3 517 130-5
Injected quantity	160 cm³/min
Insprutningsmängd	160 cm³/min

Injector ballast resistor pack (B 230 FT only)



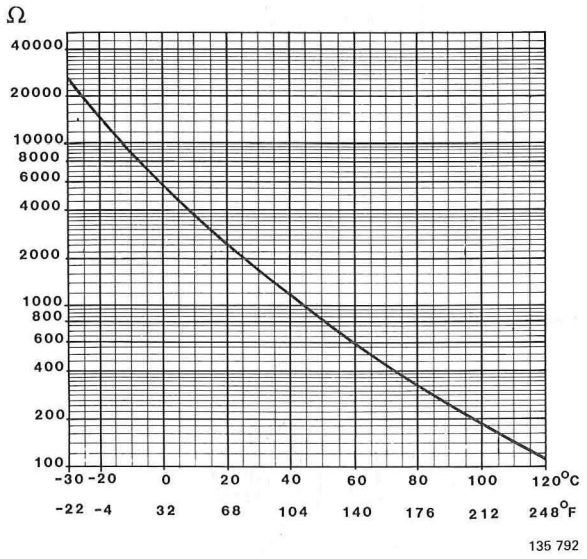
Four resistors (1 per injector)
Resistance . . . . . 5.5–6.5 Ω

Coolant temperature sensor

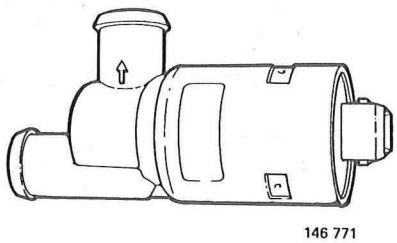


	LH 2.2	LH 2.4
Bosch No.	**. . . 026**	**. . .032**
Volvo P/N	1 332 396-9	1 346 030-8

Resistance:
–10°C (14°F) . . . . . 8.10–10.77 kΩ
+20°C (68°F) . . . . . 2.28–2.72 kΩ
+80°C (176°F) . . . . . 290–364 Ω



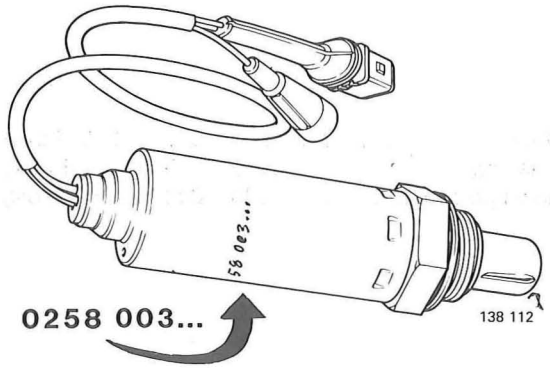
Air control (idle) valve



	LH 2.2		LH 2.4
	Early type	Late type	
Bosch No.	**. . . 501**	**. . . 520**	**. . . 516**
Volvo P/N	1 317 957-7	3 517 067-9	1 389 618-8

Resistance (LH 2.2:
between terminals
3 and 4, 4 and 5) . . . . . approx 20 Ω approx 8 Ω

Lambda-sond



	B230F LH 2.2	B200F B230F LH 2.4
Bosch No	**...009**	**...034**
Volvo P/N	1346962-2	3501753-2
Replacement part	**(...006)**	

	B230FT LH 2.2	B230FT LH 2.4	B230GT 1990
Bosch No	**...006**	**...090**	**...085**
Volvo P/N	1346738-6	3531400-4	3517778-1

Resistance of preheating resistors:
cold Lambda (20°C = 68°F) ..... 3 Ω
warm Lambda sond (above 350°C = 662°F) .... 13 Ω

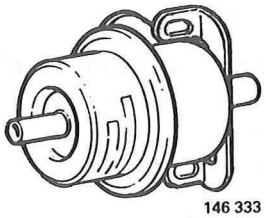
Tightening torque ..... 55 Nm (40 ft lb)*

* Apply Sealer (P/N 1161035-9) to threaded section of sond.

B 230 F: REGINA

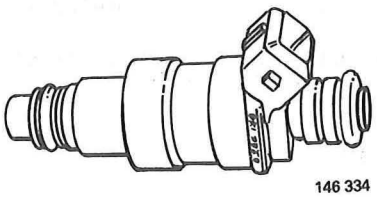
(USA only)

Pressure regulator


146 333

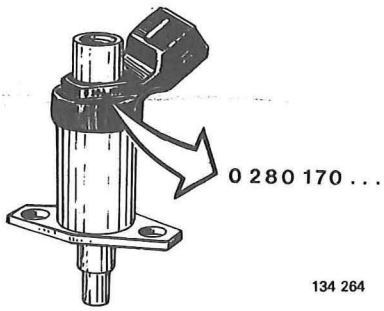
Volvo P/N..... 1 389 564-4
Line pressure..... 300 kPa (43 psi)
Shut-down pressure..... 200–300 kPa (28–43 psi)

Injectors


146 334

Volvo P/N..... 1 389 563-6
Injected quantity..... approx. 170 cm^3/min
at a line pressure of..... 300 kPa (43 psi)

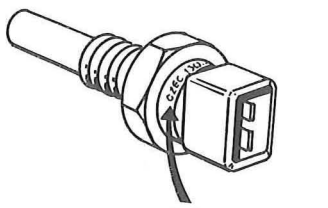
Start injector



134 264

Bosch No..... **. . . 446**
Volvo P/N..... 3 517 130-5
Injected quantity..... 160 cm^3/min

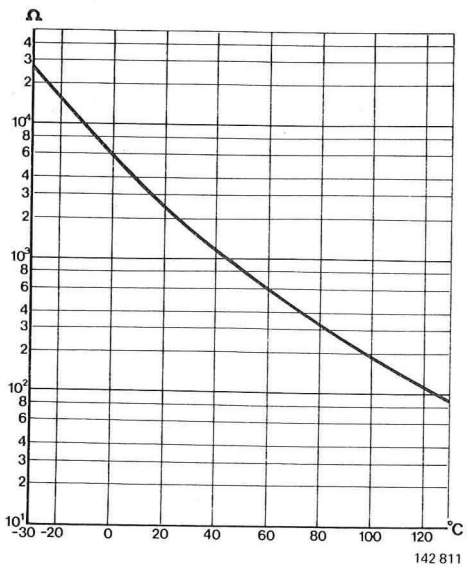
Coolant temperature sensor



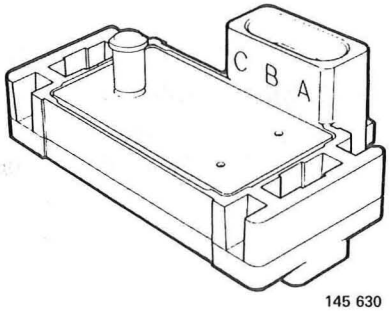
135 791

Bosch No..... **. . . 032**
Volvo P/N..... 1 346 030-8

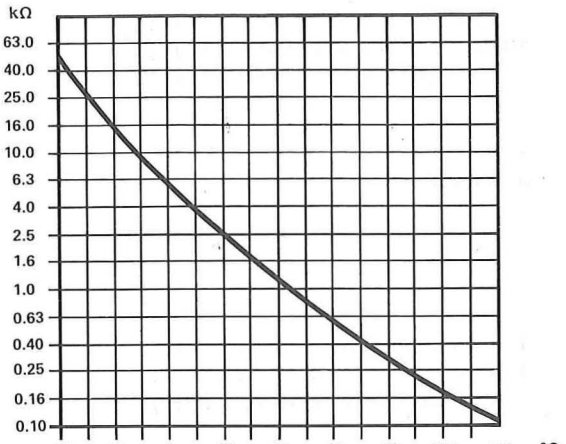
Resistance:
–10°C (14°F)..... 8.10–10.77 kΩ
+20°C (68°F)..... 2.28–2.72 kΩ
+80°C (176°F)..... 290–364 Ω



142 811



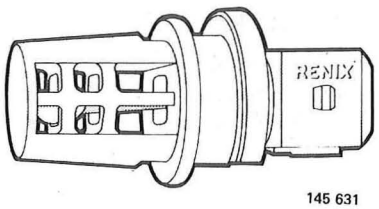
145 630



145 720

Air pressure sensor

Volvo P/N	1 378 162-0
Signal strength about 4.4 V at	100 kPa
3,2 V at	80 kPa
2,1 V at	60 kPa
1,1 V at	40 kPa
0,5 V at	20 kPa



145 631

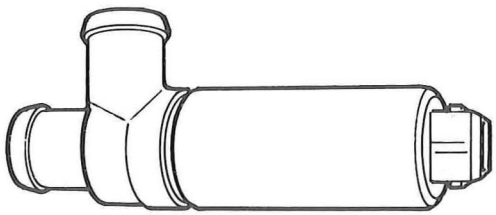
Air intake temperature sensor

Volvo P/N.....1 389 556-0
Approximate resistance values in Ωs:

-40°C (–40°F)	45,000
–20°C (–4°F)	15,000
0°C (32°F)	5,800
+20°C (68°F)	2,500
+80°C (176°F)	330

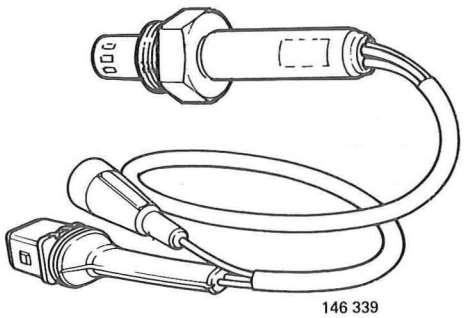
For other resistance values, see chart.

Air control (idle) valve


146 338

Volvo P/N..... 1 389 557-8
Resistance..... approx 4 Ω

Lambda-sond


146 339

Volvo P/N..... 3 517 394-7

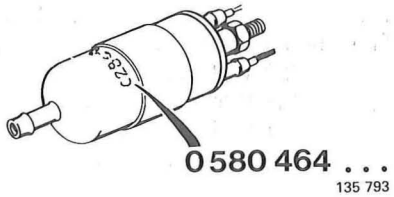
Resistance of preheating resistors:

cold Lambda (20°C = 68°F)	3 Ω
warm Lamds sond (above 350°C = 662°F)	13 Ω

Tightening torque..... 55 Nm (40 ft lb)*

* Apply Sealer (P/N 1 161 035-9) to threaded section of sond.

Fuel pump



	B 230 F		B 230 FT/GT
	Early type	Late type	
Bosch P/N	. . . 022	. . . 039	. . . 025
Volvo P/N	1 306 932-3	1 389 449-8	1 336 679-4

B 230 F early type, B 230 FT

Capacity at a line pressure of 300 kPa (42 psi)

+20°C (68°F) and 12 V	130 litres/hr (34.3 US Galls. per hr)
11 V	108 litres/hr (28.5 US Galls. per hr)
10 V	85 litres/hr (22.4 US Galls. per hr)

Current consumption at a line pressure of 300 kPa (42 psi)

+20°C (68°F) and 12 V	max 6.5 A

B 230 F late type

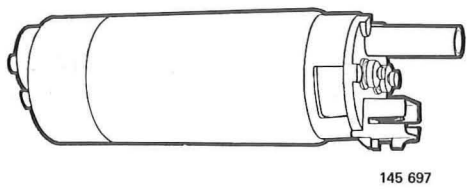
Capacity at a line pressure of 250 kPa (36 psi)

+20°C (68°F) and 12 V	140 litres/hr (37.0 US Galls. per hr)
11 V	120 litres/hr (31.7 US Galls. per hr)
10 V	95 litres/hr (25.1 US Galls. per hr)

Current consumption at a line pressure of 300 kPa (36 psi),

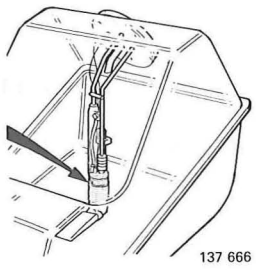
+20°C (68°F) and 12 V	max 5.0 A

B 230 F, Regina 1990
(Pump in tank)



Volvo P/N	3 531 165-3
Pump capacity at a line pressure of 350 kPa (50 psi)	
+20°C (68°F) and 13.5 V	95 litres/hr (25.1 US Galls. per hr)
Current consumption at a line pressure of 350 kPa (50 psi)	
+20°C (68°F) and 13.5 V	8.8 A

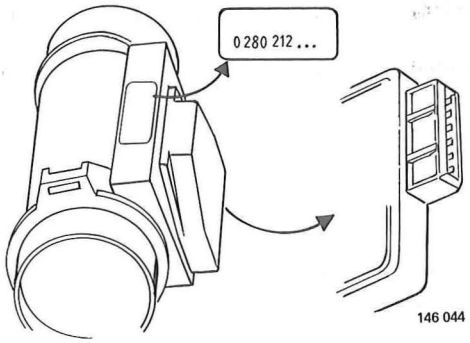
Tank pump



Current consumption	1–4 A

B 204 E/B 204 GT/B 204 FT/B 234 G/B 234 F: LH-JETRONIC 2.4

Air mass meter

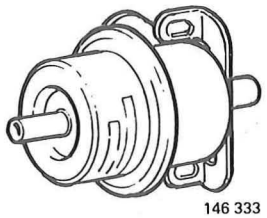


	B 204 E	B 204 GT/FT
Bosch P/N	**...007**	**...012**
Volvo P/N	1 346 645-3	3 517 569-4
Resistance:		
• between terminals 2 and 3	3.5–4.0 Ω	2.5–4.0 Ω
• between terminals 2 and 6	0–1000 Ω	–

	B 234 F Type I*	B 234 F Type II**
Bosch P/N	**...016**	**..010**
Volvo P/N	3 517 020-8	3 501 987-6
Resistance:		
• between terminals 2 and 3	2.5–4.0 Ω	2.5–4.0 Ω

* Type I = 1989: All automatics, right hand drive as well as USA/Canada manual. 1990–: All models and markets.
** Type II = 1989: All other manuals.

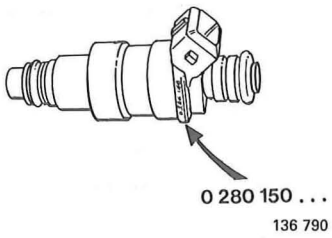
Line pressure, pressure regulator



	B 204 FT	Others
Bosch P/N	**...730**	**...294**
Volvo P/N	3 547 368-5	3 517 064-6

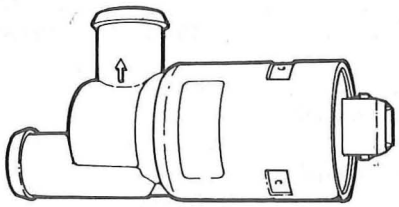
Line pressure..... 300 kPa (42 psi)
Shut-down pressure..... 200–300 kPa (28–42 psi)

Injector



	B 204 E	B 204 GT/FT	B 234 F/G
Bosch P/N	**...762**	**...804**	**...749**
Volvo P/N	3 517 572-9	3 517 283-2	3 501 986-8
Injected quantity at a... line pressure of.....	185 cm^3/min 300 kPa (42 psi)	300 cm^3/min 300 kPa (42 psi)	214 cm^3/min 300 kPa (42 psi)

Air control (idle) valve

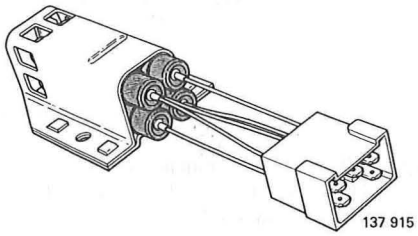


146 771

Bosch P/N ..... **...516**
Volvo P/N 1 389 618-8

Resistance ..... approx 8 Ω

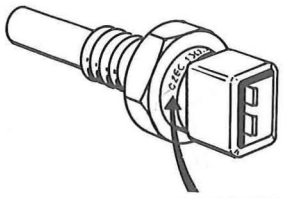
Injector ballast resistor pack



137 915

Four resistors (1 per injector)
Resistance ..... 5.5–6.5 Ω

Coolant temperature sensor

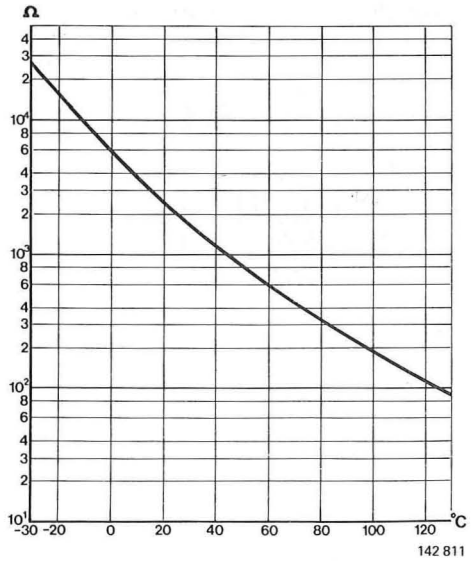


0 280 130 ...

135 791

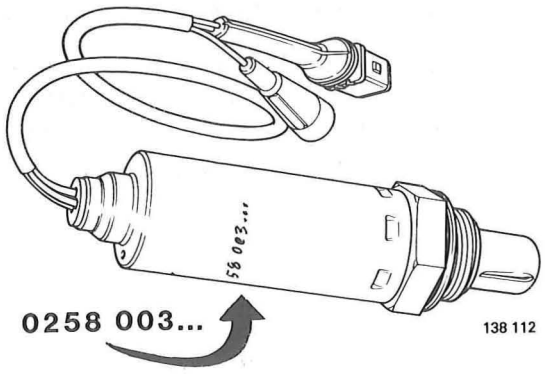
Bosch P/N ..... **...032**
Volvo P/N 1 346 030-8

Resistance:
10°C (14°F) ..... 8.10–10.77 kΩ
20°C (68°F) ..... 2.28–2.72 kΩ
+80°C (176°F) ..... 290–364 Ω



142 811

Lambda-sond



138 112

	B 204 GT	B 204 FT	B 234 F
Bosch P/N	**...085**	**...090**	**...034**
Volvo P/N	3 517 778-1	3 531 400-4	3 501 753-2

Resistance of preheating resistors:
cold Lambda (20°C = 68°F) ..... 3 Ω
warm Lambda sond (above 350°C = 662°F) .... 13 Ω

Tightening torque ..... 55 Nm (40 ft lb)*

* Apply Never seez (P/N 1 161 035-9) to threaded section of sond.

Fuel pump



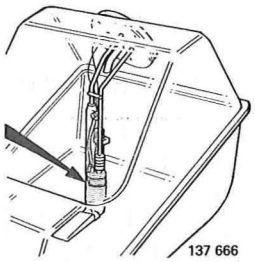
135 793

Bosch P/N. . . . . **. . . 039**
Volvo P/N. 1 389 449-8

Pump capacity at 300 kPa (42 psi) line pressure.
+20°C
12 V . . . . . 130 litres/hour
11 V . . . . . 108 litres/hour
10 V . . . . . 65 litres/hour

Current consumption at 300 kPa (42 psi) line pressure.
+20°C & 12 V . . . . . max 6.5 A

Tank pump


137 666

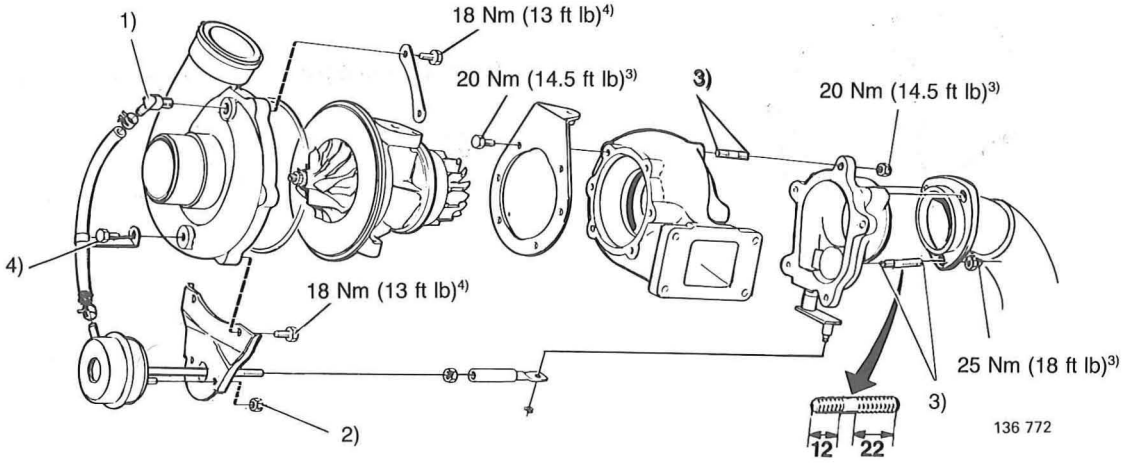
Current consumption . . . . . 3–4 A

Group 25 Intake and exhaust systems

Turbo engines –1989

Engine type	B 200/230 ET	B 230 FT
Charge pressure, at full load and r/min	3 500	3 000
checking kPa (psi)	45–53 (6.4–7.5)	46–54 (6.5–7.7)
setting kPa (psi)	50 (7.1)	48–54 (6.8–7.7)
Charge air overpressure, switch opens at kPa (psi)	65–75 (9.2–10.7)	85–95 (12.1–13.5)
Charge air pressure, switch closes at kPa (psi)	15–25 (2.1–3.6)	–

Tightening torques

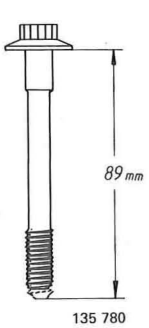


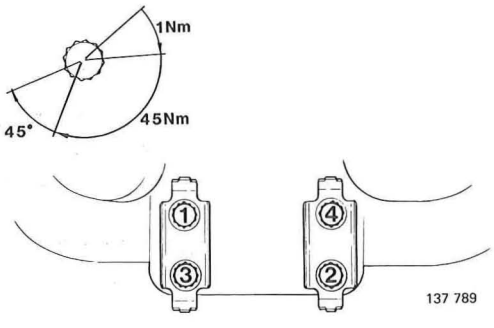
1) Apply sealer P/N 1 161 053-2.
2) Use new nuts
3) Use sealer P/N 1 161 035-9.
4) Use new bolts. If absolutely necessary, old bolts can be reused if they are smeared with sealer P/N 1 161 053-2.

Mounting bolts, turbocharger – exhaust manifold

- Measure length of bolt. Bolts can be reused if shorter than 89 mm (3.5 in)
- Apply assembly paste P/N 1 161 078-9 to mating surfaces and threads
- Fit **new** locking plates
- Tighten bolts in three stages according to below

Stage I = 1 Nm (0.7 ft lb)
II = 45 Nm (33 ft lb)
III = 45° in one motion without stopping

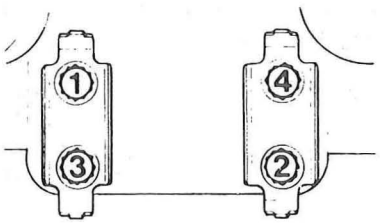




Turbo engines
1990–

Engine type	B 230 FT/GT
Charge pressure, at full load and ..... r/min	3 000
checking ..... kPa (psi)	48–54 (6.8–7.7)
setting ..... kPa (psi)	51 (7.3)
Pressure sensor, leak test kPa (psi)	60–70 (8.5–10.0)
Relief valve, fully open at pressure difference kPa (psi)	22 (3.1)

Tightening torques



147 943

Tightening sequence
(Turbocharger – exhaust manifold)

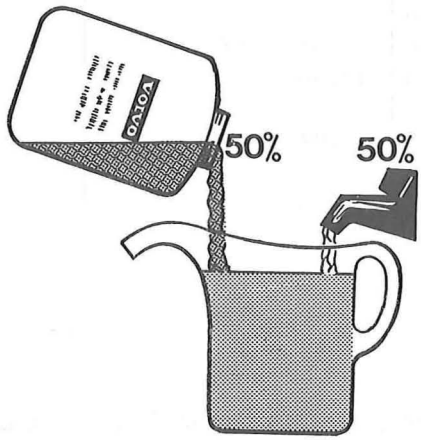
Turbocharger – exhaust manifold* ..... **30 Nm** (22 ft lb)
Use special tool 5411 (at 90° angle to torque wrench)

Turbocharger – exhaust pipe* ..... **30 Nm** (22 ft lb)

* Use sealer P/N 1 161 035-9.

Group 26 Cooling system

General



128 187

Coolant – composition – guarantee

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

Use genuine Volvo coolant, **type C (blue-green)**, diluted with **clean** water in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage.

- Never top-up the cooling system with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- The coolant should be changed every 25,000 miles (40,000 km) since the corrosion-protective additives in the coolant lose their effect in time.
- Clean cooling system with solvent (P/N 1 161 328-8 prior to filling new coolant.

Capacity, B 200/230	approx 8.5 litres US qts 9.0
B 204/234	approx 9.5 litres US qts 10.0

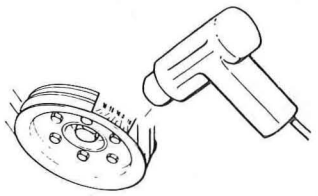
Expansion tank

	kPa	psi
Pressure valve in filler cap opens at:		
overpressure, early type	75	11
late type without turbo	100	14
with turbo and B 204/234	150	21
underpressure	7.0	1.0

Thermostat

	Type 1	Type 2
Marking	87	92
Starts to open at	86–88°C (187–190°F)	91–93°C (196–199°F)
Fully open at	97°C (207°F)	102°C (216°F)

Group 28 Ignition system



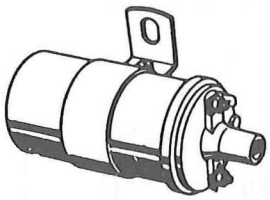
Type ..... Breakerless
Firing order 1-3-4-2

Engine type	Ignition timing b.t.d.c.	Speed r/s (rpm)
B 200 K	15°	**12.5** (750)
B 200 F	12°	**12.1–13.8** (725–825)
B 200 E	12°	**14.2–15.8** (850–950)
B 200 ET	14°	**14.7–15.3** (880–920)
B 204 E	15°	**14.2–15.8** (850–950)
B 204 FT/GT	10°	**13.0–13.7** (780–820)
B 230 A*	7°	**11.7–13.3** (700–800)
B 230 K	15°	**13.3** (800)

Engine type	Ignition timing b.t.d.c.	Speed r/s (rpm)
B 230 E	12°	**14.2–15.8** (850–950)
B 230 ET	10°	**14.7–15.3** (880–920)
B 230 F –1988	12°	**12.2–12.8** (730–770)**
1989–	12°***	**12.1–13.8** (725–825)
B 230 FB	12°	**12.9** (775)
B 230 FT/GT	12°	**12.2–12.8** (730–770)**
B 234 F/G	15°	**13.3–15.0** (800–900)

* Vacuum regulator disconnected.
** Japan –1988: 15 r/s (900 rpm).
*** Ignition system Rex, USA/Canada: 10°.

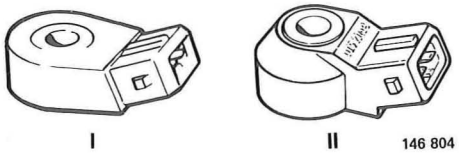
Ignition coil



131 753

	B 230 A	B 200E, B 200 K, B 230 E B 230 F, B 230 FB, B 230 K, B 230 FT, B 204 E, B 204 FT/GT, B 234 F/G	B 200 ET, B 230 ET	B 230 F Rex
Resistance of primary coil (terminals 1 and 15)	0.6–0.9 Ω	0.6–0.8 Ω	0.5 Ω	0.5 Ω
Resistance of secondary coil (terminal 1 to HT terminal	6.5–8.5 kΩ	6.9–8.5 kΩ	6.0 kΩ	5.0 kΩ

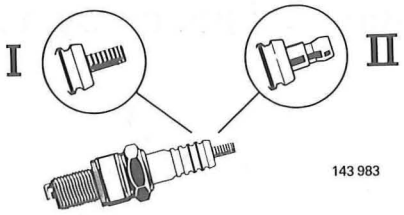
Knock sensor



I II 146 804

Tightening torque, type I ..... 11 Nm (8 ft lb)
type II ..... 20 Nm (14.5 ft lb)

Spark plugs, glow plugs



Engine type	Designation	Type I		Type II	
		P/N	Set number	P/N	Set number
B 200 K, B 200 ET, B 200 F, B 230 A, B 230 K –1986, B 230 ET	WR7DC**	1 306 605-5	273 597-5	1 367 528-5	270 746-1
B 200 E, B 204 E/FT/GT, B 230 K 1987–, B 230 E, B 234 F/G	WR6DC**	1 306 604-8	273 596-7	1 367 529-3	270 747-9
B 230 F, B 230 FB, B 230 FT/GT	WR7DC	1 346 541-4	271 409-5	1 367 528-5	270 746-1
B 230 FT Europe	WR6DC	1 367 015-3	271 415-2	1 367 529-3	270 747-9

* Type II spark plugs are standard on B 200/230 1988– but can also be used on earlier engines (provided HT leads and ground lead are replaced at same time).
** Up to 1987 W7DC (W6DC, type I).

Electrode gap ..... 0.7–0.8 mm (0.0276–0.315 in)
Tightening torque, (unoiled plugs)..... 25 Nm (18 ft lb)

Distributor

Engine type	Ignition system	Distributor	
		Volvo P/N	Bosch No
B 200 E, B 230 K	EZ-K	1 336 087	0 237 502 001
B 230 E, B 230 F –1988, B 230 FT –1989	EZ-K	1 336 087	0 237 502 001
B 200 K	Renix	1 336 132	0 237 502 002
B 200 F	EZ 116 K	1 336 132	0 237 502 002
B 230 F 1989–, B 230 FB, B 230 FT/GT 1990	EZ 116 K (Rex*)	1 336 132	0 237 502 002
B 200 ET, B 230 ET	Motronic	1 336 132	0 237 502 002
B 230 A	TZ-28 H	1 336 690	0 237 024 013
B 204 E/FT/GT, B 234 F/G	EZ 116 K	1 367 197	0 237 502 003

*USA only

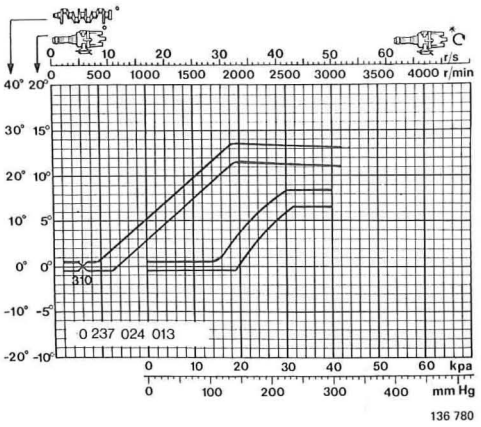
Centrifugal governor

Advance, total degrees (distributor) ..... 12,5±1
Advance begins at distrib. rev/secs 7.5–10.5
distrib. rev/min ..... (450–630)
Data: 5° at distrib. rev/secs 16.5–20.5
(distrib. rev/min)..... (1000–1250)
10° at distrib. rev/secs 25–29
(distrib. rev/min)..... (1500–1750)
Advance max at distrib. rev/secs 31.7
(distrib. rev/min)..... (1900)

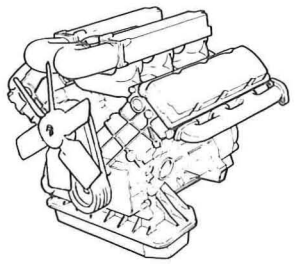
Vacuum governor

Control direction..... Positive
Control, total degrees (distributor) ..... 7.5±1
Control commences at mm Hg 105–145
Data: 5° at mm Hg..... 165–210
max control at mm Hg 240

Ignition advance, B 230 A

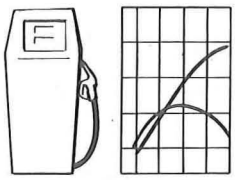


Section 2 B 28 Engine



129 756

Group 20 General 69
Group 21 Engine 70
Group 22 Lubricating system 74
Group 23 Fuel system 75
Group 25 Intake and exhaust systems 82
Group 26 Cooling system 83
Group 28 Ignition system 84



129 750

Group 20 General

Performance, compression ratios, octane requirements

Engine type	Compression ratio	Octane requirement	Output		Max torque	
			kW at r/s	hp at r/min	Nm at r/s	kpm at r/min
B 28 A	8.8:1	91–93	96/88	130/5250	212/50	21.6/3000
B 28 E	9.5:1	98[1]	115/95	156/5700	235/50	24.0/3000
B 28 F	8.8:1	91[2]	100/92	136/5500 134[4]/5500	215/46	21.9/2750 159[3]/2.700

[1] Australia 97–98 octane
[2] According to research method (RON). Unleaded gasoline
According to formula (R+M/2) = 87 octane
[3] ft. lb.
[4] Horse power

Other general data

Number of cylinders	6
Bore	91 mm (3.582 in)
Stroke	73 mm (2.874 in)
Displacement	2.849 dm^3 (litres)
Firing order	1-6-3-5-2-4
Compression (normal rating)[1]	0.8–1.1 MPa (114–156 psi)
Weight, approx	150 kg (330 lb)

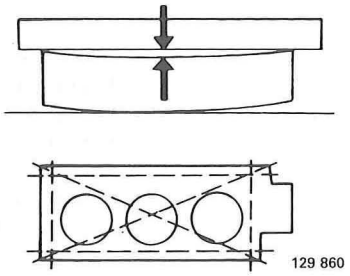
[1] With hot engine, throttle wide open and starter motor cranking at 4.2–5.0 r/s (250–300 r/min).

Group 21 Engine block

Cylinder head

Max warp:

Maxium warp is 0.05 mm (0.002 in) per 100 mm (4 in) length.
Note: Do not level a warped cylinder head, replace it!

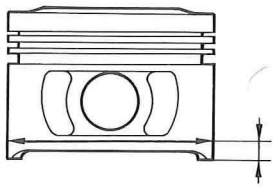


Cylinder liners

Bore, liners marked 1 (A-marked piston)	91.00–91.01 mm	3.5826–3.5830 in
2 (B-marked piston)	91.01–91.02 mm	3.5830–3.5835 in
3 (C-marked piston)	91.02–91.03 mm	5.5835–5.5838 in
Liner height above block face:		
checking (runing engine, old shims)	0.14–0.23 mm	0.0055–0.0091 in
adjusting (new shims)	0.16–0.23 mm	0.0063–0.0091 in

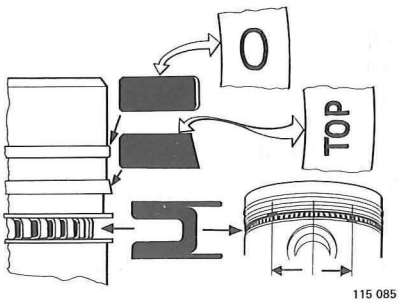
Pistons

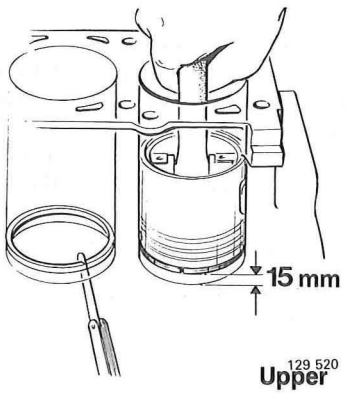
Max weight difference between pistons in same engine	6 grams	
Piston float	0.020–0.040 mm	0.0007–0.0015 in
Piston diameter A-marked pistons	90.970–90.980 mm	3.5814–3.5818 in
B-marked pistons	90.980–90.990 mm	3.5818–3.5822 in
C-marked pistons	90.990–91.000 mm	3.5822–3.5826 in



Piston diameter is measured at right-angles to gudgeon pin bore, **8 mm** from bottom edge.

Piston rings





Ring gap measured 15 mm (0.6 in) from lower edge of cylinder

		Upper compression ring	Lower compression ring	Oil ring
Side clearance (measured with ring on piston)	mm	0.045–0.074	0.025–0.054	0.009–0.233
	in	0.0017–0.0029	0.0009–0.0212	0.0003–0.0091
Ring gap when checked in 91 mm (3.5826 in) cylinder, (see fig)	mm	0.40–0.60	0.40–0.60	0.40–1.45
	in	0.0157–0.0236	0.0157–0.0236	0.0157–0.0570

Gudgeon (piston) pins

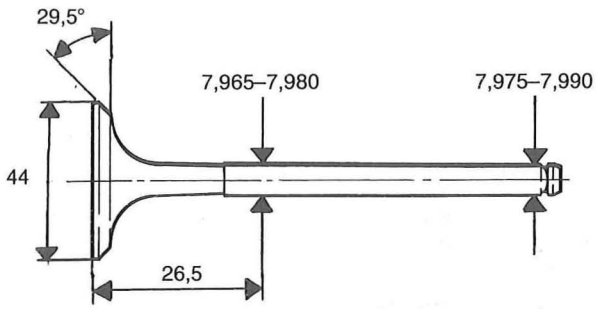
Clearance in connecting rod	0.020–0.041 mm	0.0007–0.0016 in
piston	0.010–0.016 mm	0.0003–0.0006 in

Valve system

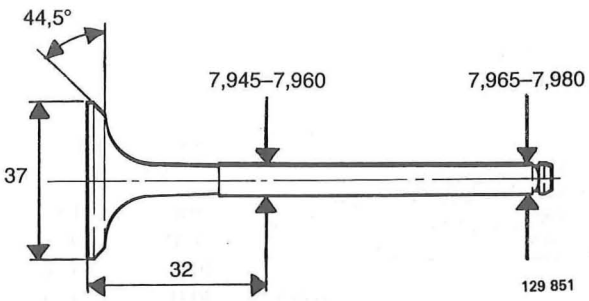
Valve clearance

Inlet valves, cold engine	0.10–0.15 mm	0.004–0.006 in
warm engine	0.15–0.20 mm	0.006–0.008 in
Exhaust valves, cold engine	0.25–0.30 mm	0.010–0.012 in
warm engine	0.30–0.35 mm	0.012–0.014 in

Valves (sizes in mm)

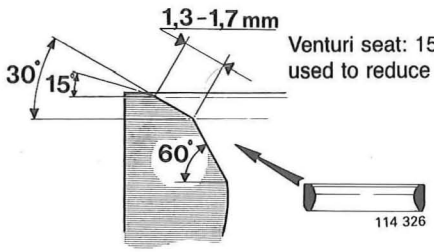


Inlet valve



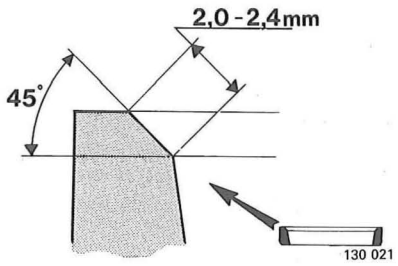
Exhaust valve

Valve seats

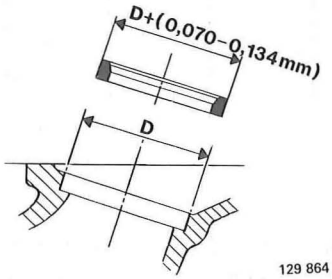


Venturi seat: 15° and 60° angles can be used to reduce seat width.

Seat for inlet valve



Seat for exhaust valve

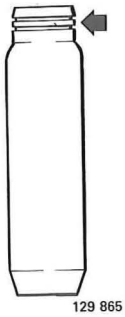


When replacing valve seats: the interference between the valve seat and its bore in the cylinder head shall be 0.070–0.134 mm (0.0028–0.0053 in), i.e. valve seat diameter must be 0.070–0.134 mm greater than the diameter of the bore in the cylinder head.

Valve seats are available in three oversizes.

Valve guides

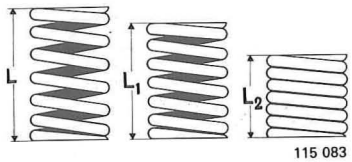
Inner diameter	8.000–8.022 mm	0.3149–0.3158 in
Press-in measurement to cylinder head contact surface against block:		
inlet	39.5–40.5 mm	1.5551–1.5944 in
exhaust	36.9–37.9 mm	1.4527–1.4921 in
Clearance in cylinder head	0.052–0.095 mm	0.0020–0.0037 in


129 865

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

	Marking	Reamer
Standard	No groove	–
Oversize 1	1 groove	5166
Oversize 2	2 grooves	5167
Oversize 3	3 grooves	5168

Valve springs



115 083

Springs marked green			
Length		Load	
mm	in	N	lb.
47.1	1.85	0	0
40.0	1.57	230–266	52–60
30.0	1.18	613–689	137–154

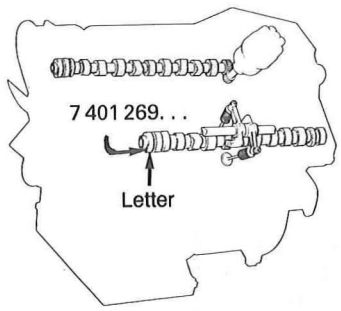
Rocker arm mechanism

The rocker arm tips are surface hardened and must not be ground.

Clearance, shaft–rocker arm..... 0.012–0.054 mm (0.0005–0.0021 in)

Timing gears

Camshaft



Engine type.....	B 28 A, E		B 28 F	
	Left	Right	Left	Right
Marking.....	F	F	G	G
Part number (last three digits),				
early type.....	...615	...616	...486	...487
late type.....	...977	...978	...979	...980

	B 28 A, E	B 28 F
Max lobe lifting height, left and right, inlet.....	5.96 mm (0.2348 in)	5.44 mm (0.2142 in)
exhaust.....	5.96 mm (0.2348 in)	5.94 mm (0.2339 in)
Checking camshaft settings (cold engine):		
adjust valve clearance on 1st and 6th inlet valves to	0.7 mm (0.0275 in)	0.7 mm (0.0275 in)
The inlet valves should then open at:		
1st.....	8±3° B.T.D.C.	1±3° B.T.D.C.
6th.....	8±3° B.T.D.C.	1±3° B.T.D.C.
Journal clearance.....	0.035–0.085 mm (0.0013–0.0033 in)	
End play, new.....	0.070–0.144 mm (0.0027–0.0056 in)	
max.....	0.5 mm (0.0196 in)	

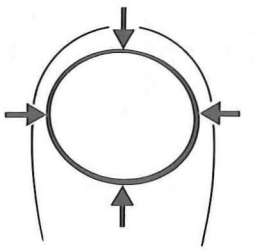
Crank mechanism

Crankshaft

Max run-out (measured on two centre main bearing journals)	0.02 mm	0.0007 in
Crankshaft, end float	0.070–0.270 mm	0.0027–0.0106 in
clearance (main bearings)	0.038–0.088 mm	0.0014–0.0034 in
Crank journals, side clearance	0.20–0.38 mm	0.0078–0.0149 in
clearance	0.030–0.080 mm	0.0011–0.0031 in

Main bearing journals

Out of round, max	0.007 mm	0.0002 in
Taper, max	0.01 mm	0.0003 in
Diameter, standard	70.043–70.062 mm	2.7575–2.7583 in
undersized	69.743–69.762 mm	2.7457–2.7465 in

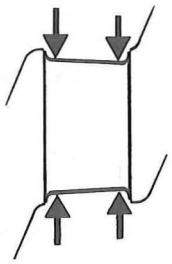


115 089

Out-of-round

Connecting rod bearing journals

Out of round, max	0.007 mm	0.0002 in
Taper, max	0.01 mm	0.0003 in
Diameter, standard	52.267–52.286 mm	2.0577–2.0585 in
undersized	51.967–51.986 mm	2.0456–2.0466 in



Taper

Connecting rods

End float on crankshaft (both con rods fitted)	0.20–0.38 mm	0.0078–0.0149 in
Max weight difference between con rods in same engine	2.5 grams	

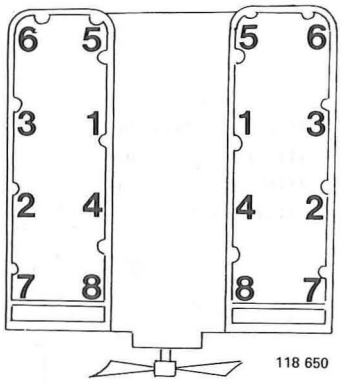
Flywheel

Axial throw, max	0.05 mm	0.0019 in

Tightening torque

Tightening torques apply to oiled nuts and bolts. Degreased (washed) parts must be oiled prior to assembly.

	Nm	ft lb
Connecting rod bearings	45–50	33–37
Crankshaft pulley	240–280	177–206
Camshaft gear	70–90	52–66
Flywheel (use new bolts)	45–50	33–37
Spark plugs (do not oil)	12±2	9±1.5
Valve cover	15	11

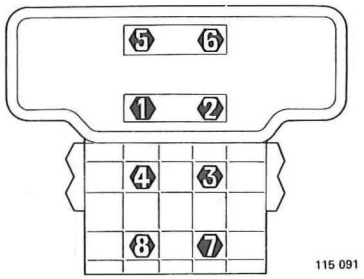


Tightening sequence for cylinder head bolts

Cylinder head

Tighten all bolts in stages:

1 Tighten bolts to 60 Nm (43 ft lbs)
2 a Loosen bolt 1, tighten it to 20 Nm (15 ft lbs)
b Angle-tighten to 106 degrees using special tool 5098. Repeat this for remaining bolts in sequence shown.
c **Loosen and tighten each bolt in turn.**
3 Adjust valves.
4 Warm-up engine.
5 Allow engine to cool for 2 hours.
6 Angle-tighten each bolt a **further 45 degrees**



Tightening sequence for main bearings (via lower crankcase)

Main bearings

Tighten all nuts in stages:

1 30 Nm (22 ft lbs)
2 Slacken nut 1
3 Tighten nut 1 30–35 Nm (22–26 ft lbs)
4 Angle-tighten nut 1 73°–77°
5 Slacken and retighten the other nuts in the order specified in stages 2–4.

Group 22 Lubricating system

General

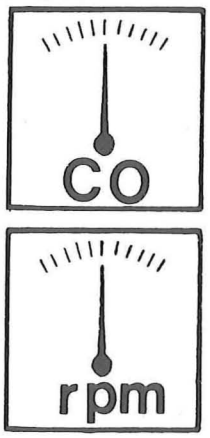
Oil capacity and quality, see page 12.

Oil pressure, warm engine new oil cleaner:		
at 15 r/s (900 r/min), minimum	0.1 MPa	(14.2 psi)
50 r/s (3 000 r/min)	0.4 MPa	(57 psi)

Lubricating oil pump

End float	0.025–0.084 mm	0.0009–0.0033 in
Clearance between tooth tip and pump housing wall (excl. bearing clearance)	0.110–0.185 mm	0.0043–0.0072 in
Backlash (excl bearing clearance)	0.17–0.27 mm	0.0066–0.0106 in
Bearing clearance, driveshaft	0.015–0.053 mm	0.0006–0.0021 in
idler shaft	0.015–0.051 mm	0.0006–0.0020 in
Relief valve spring, length under various loads:		
unloaded	89.5 mm	3.52 in
loaded to 88.3 N (8.83 kp)	56.5–60.5 mm	2.22–2.38 in

Group 23 Fuel system



135 528

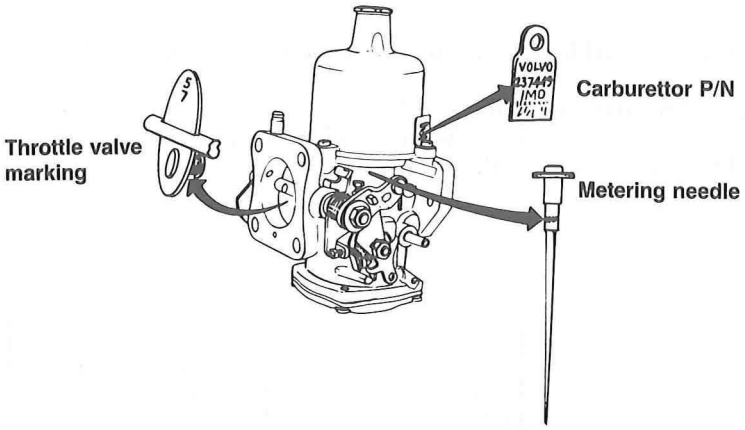
CO content, idle speed

- Selector lever must be in position P (and handbrake applied) when checking/adjusting CO or idle speed
- CO should be checked/adjusted when engine is warm and idling
- CO content **outside** check values shown below = adjust to specified setting value
- CO content **within** check values need not be adjusted provided engine is operating satisfactorily

Engine type	Market	CO%		Idling speed r/s (r/min)
		Adjusting (checking)	Volvo Mono-Tester	
B 28 A		2.5 (2.0–3.5)	–	15.0 (900)
B 28 E		2.0 (1.0–3.0)[1]	–	15.0 (900)
B 28 F	USA, Canada, Australia Japan	1.0 (0.7–1.3)[2] 1.0 (0.7–1.3)[2]	42° (39–45°)[3] 42° (39–45°)[3]	12.5 (750)[4] 15.0 (900)

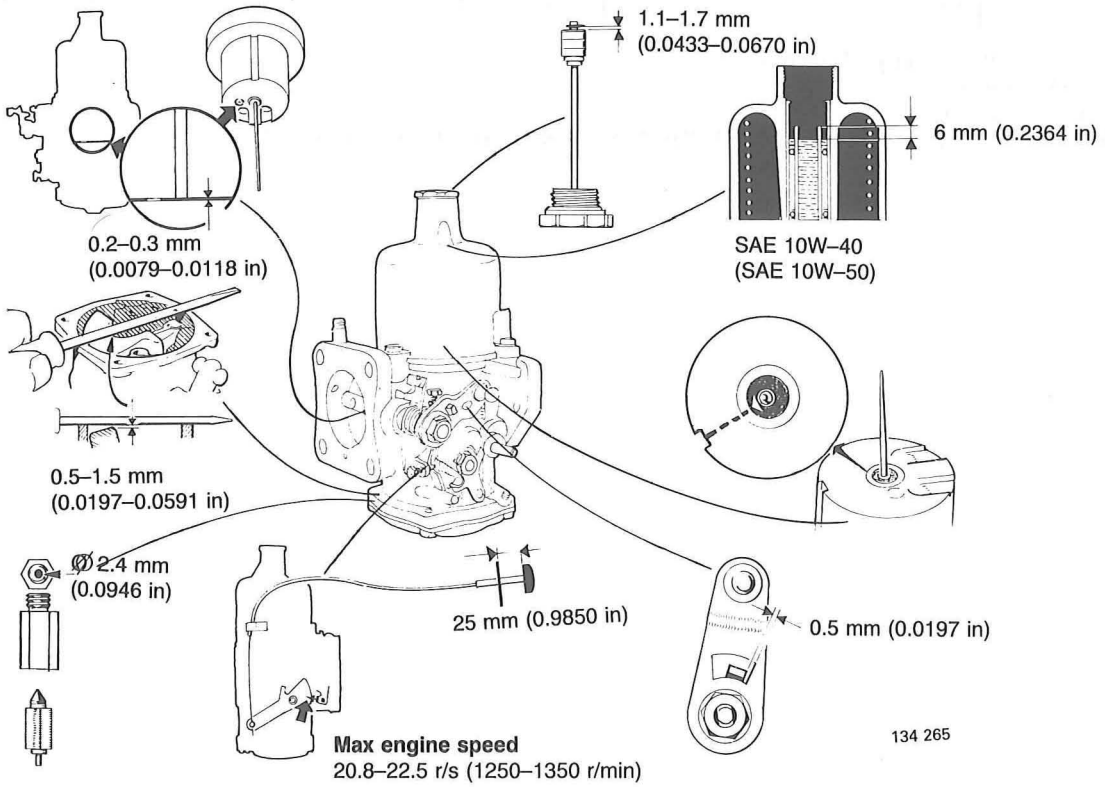
[1] Pulsair system disconnected and plugged.
[2] Lambda-sond disconnected.
[3] Lambda-sond connected.
[4] AC switched off. Idle speed increases to 15.0 r/s (900 r/min) when AC is switched on again.

Carburetted engine (B 28 A)



119 943

SU-HIF 6 carburettor



134 265

Fuel pump

Fuel pressure measured at same level as pump at 50 r/s (3000 r/min) ..... 15–27 kPa (2.1–3.8 psi)

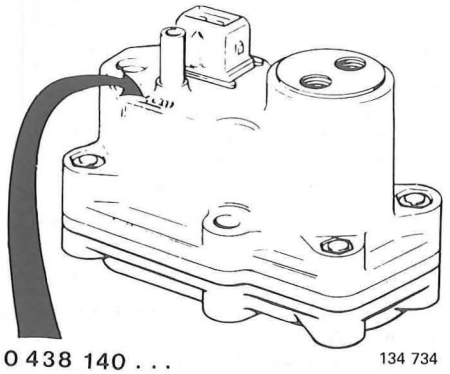
CI-SYSTEM (B 28 E, B 28 F)

Pressures

Line pressure ..... 470–550 kPa (67–78 psi)
Rest pressure ..... 240–320 kPa (34–45 psi)

Control pressure, see graphs.

Control pressure regulator



0 438 140 . . . 134 734

Type of control pressure regulator fitted to vehicle depends on engine type and model year. Identification number is stamped in top of regulator (last three numbers).

	Bosch P/N	Volvo P/N
B 28 E	**. . . 038**	269 837-1
B 28 F 1983	**. . . 099**	1 269 779-3
1984– USA	**. . . 128**	1 336 678-6
B 28 F 1984– Canada, Japan	**. . . 099**	1 269 779-3

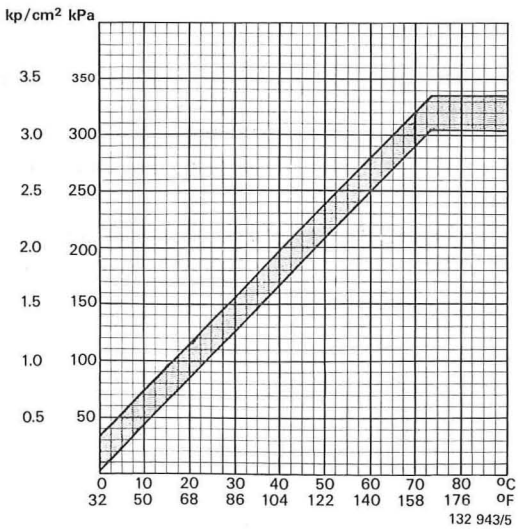
CONTROL PRESSURE REGULATOR . . . 038

Control pressure, warm engine
engine off ..... 305–335 kPa (43–48 psi)
engine on ..... 345–375 kPa (49–53 psi)

Control pressure cold engine see diagram.

Note: Diagram shows control pressure with engine turned off.

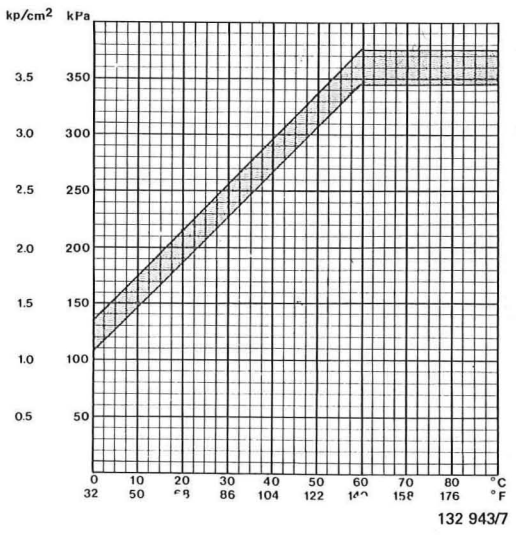
Resistance ..... 20–24 Ω



CONTROL PRESSURE REGULATOR. . . 099

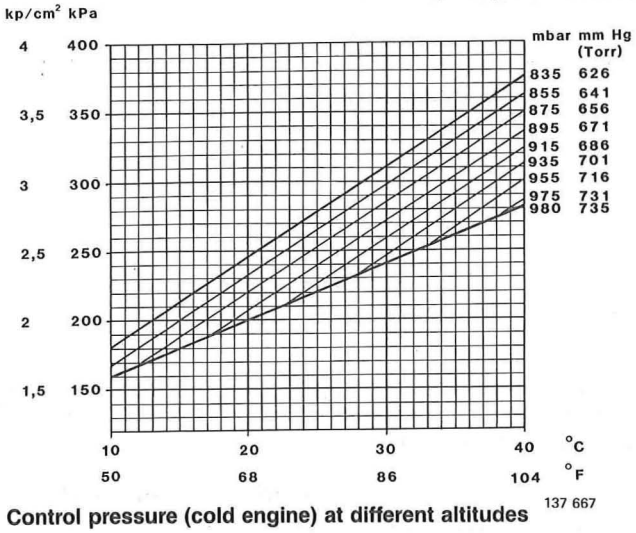
Control pressure, warm engine ..... 345–375 kPa (49–53 psi)
cold engine ..... see diagram

Resistance,
at temp below 12°C (53°F) ..... 31.5–38.5 Ω
at temp above 18°C (64°F) ..... 12.6–15.4 Ω

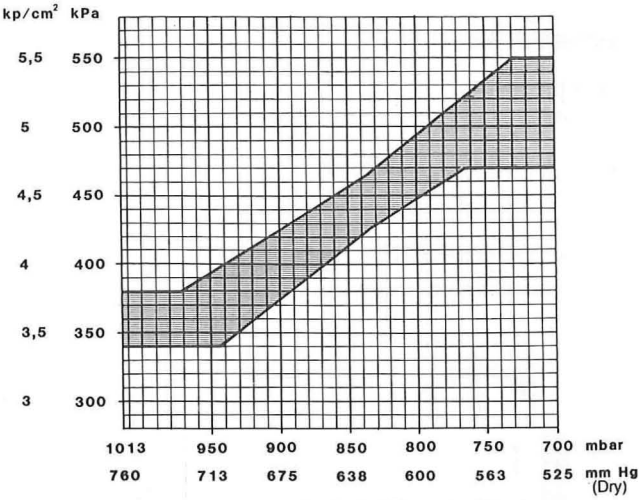


Control pressure regulator . . . 128 (altitude compensated)

Resistance at temperatures below 12°C (53°F) ..... 19.5–21.7 Ω
above 18°C (64°F) ..... 9.8–11.0 Ω



Control pressure (cold engine) at different altitudes

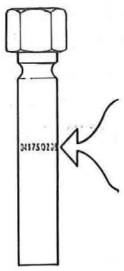


Control pressure (warm engine) at different altitudes

Tolerance: ±25 kPa (0.25 kp/cm² = 3.6 psi)

The above graphs apply to air pressure at sea level and up to altitudes of approx. 600 m = 2,000 ft (947 mbar or higher). For higher altitudes it is necessary to know the prevailing air pressure to be able to calculate the correct control pressure.

Injectors

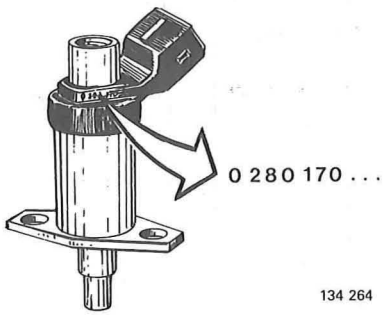


Identification number
on side of injector.
Bosch number
0 437 502 **022**
Volvo P/N
1 269 713-2

127 182

Opening pressure..... kPa (psi) 350–410 (50–58)
No leakage permissible below 290 (41)

Start injector



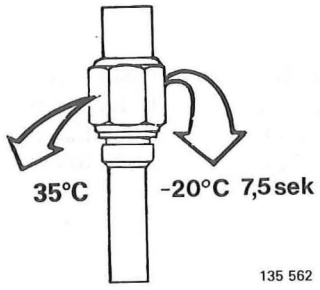
134 264

Injection time. (Controlled by thermal timer during cold starting and by impulse relay during hot starting.)
Cold starting, below +35°C (95°F). Max time (at –20°C (–4°F), 7.5 secs. The hotter the engine, the shorter the time.

Hot starting: Engaged after about 1.5 seconds after which: injection 0.1 sec-pause 0.3 sec-injection 0.1 sec-pause 0.3 sec etc.

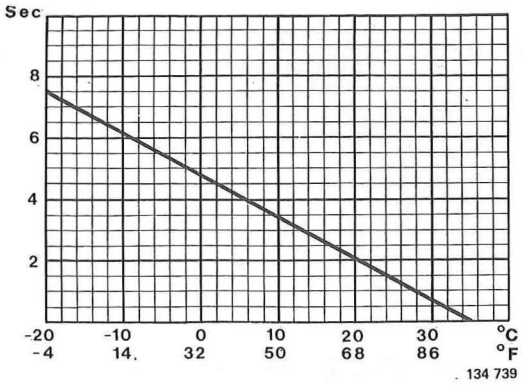
	B 28 E	**B 28 F**
Bosch No	**. . . 404**	**. . . 400**
Volvo P/N	462 865-7	269 292-9
Injected quantity	115 cm³/min	165 cm³/min

Thermal time switch



135 562

Cut-out temperature and engagement time are stamped on side of switch.



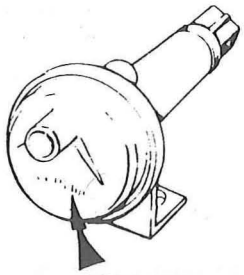
134 739

Engagement time at different temperatures

Tolerance, time ..... ±2 secs
temperature ..... ±4°C (7.2°F)

Auxiliary air valve, B 28 E

(B 28 E without constant idle speed system).



134 740

Various types of auxiliary air valves with different apertures are used. Make sure that the correct valve is fitted.

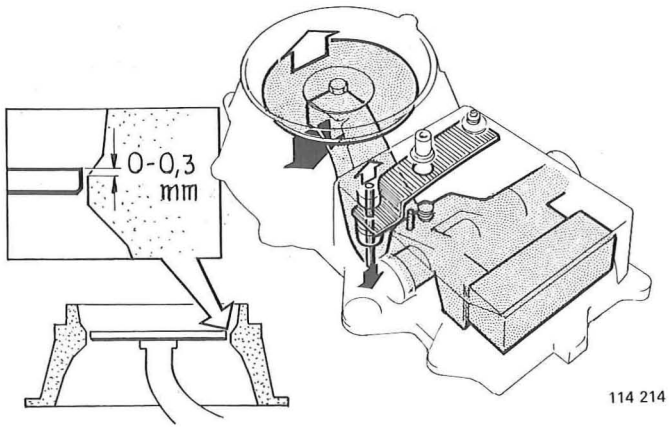
Identification number on side of valve.

	Bosch No	Volvo P/N
Automatic, early type .	. . . 114	1 266 910-7
late type . .	. . . 114	1 346 477-1
Manual	. . . 110	1 269 319-8

Resistance ..... 40–60 Ω
Fully open at..... –30°C (–22°F)
Fully closed at..... +70°C (158°F)

The auxiliary air valve is controlled electrically and should be fully closed after 5 minutes driving at +20°C (68°F), ambient temperature.

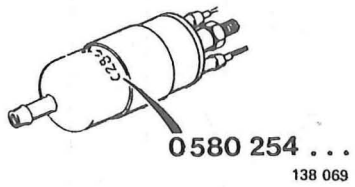
Air flow sensor



114 214

Metering disc rest position. Carry out check at maximum control pressure (i.e. hot engine, fuel pump running).

Fuel pump



138 069

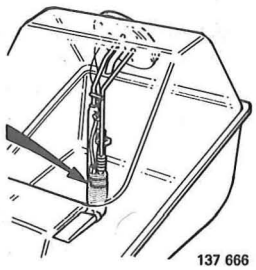
	Bosch No	Volvo P/N
B28E, early type	**. . . 963**	1 306 028-0
late type.....	**. . . 948**	1 336 677-8
B28F	**. . . 948**	1 336 677-8

Capacity at 500 kPa (71 psi), 20°C = 68°F and:

12 V.....	120 litres/hour (1.0 litres/30 secs)
11 V.....	96 litres/hour (0.8 litres/30 secs)
10 V.....	75 litres/hour (0.6 litres/30 secs)

Current consumption max..... max 9.5 A

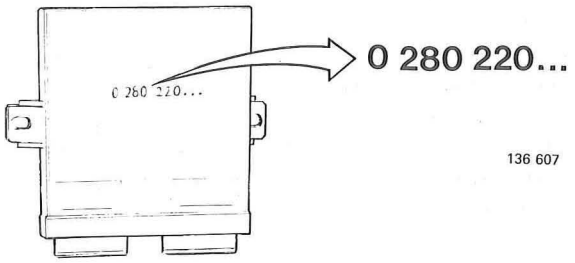
Tank pump


137 666

Current consumption ..... 1–4 A

CONSTANT IDLE SPEED SYSTEM (CIS) (B 28 E/F)

Control unit

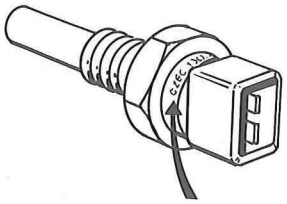


136 607

Type of control unit fitted to engine depends on engine type.
Identification number is stamped on side of cover.

	Bosch No	Volvo P/N
B 28 E, early type	... 008	1 274 452-0
late type.....	... 020	1 274 711-9
B 28 F	... 008	1 274 452-0

Temperature sensor

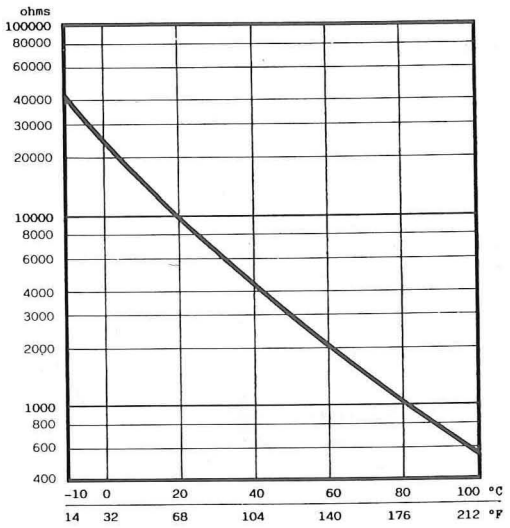


0 280 130 . . .

135 791

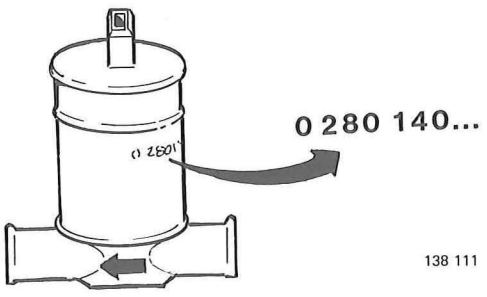
Bosch No 028
Volvo P/N 1 306 024-9

Resistance at:
−10°C (14°F)..... 32 000–53 000 Ω
+20°C (68°F)..... 8 500–11 500 Ω
+80°C (176°F) ..... 770–1 320 Ω



133 374

Air control valve



138 111

Type of valve fitted to engine depends on engine type.
Identification number is stamped on side of valve.

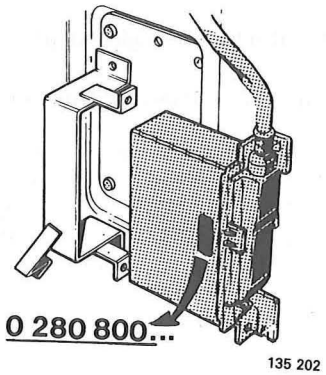
	Bosch No	Volvo P/N
B 28 E	... 501	1 317 957-7
B 28 F, early type.....	... 500	1 276 871-9
late type.....	... 501	1 317 957-7

Resistance between terminals 3 and 4,
5 and 4..... approx 20 Ω

Group 25 Intake and exhaust systems

LAMBDA-SOND SYSTEM (B28F ONLY)

Control unit



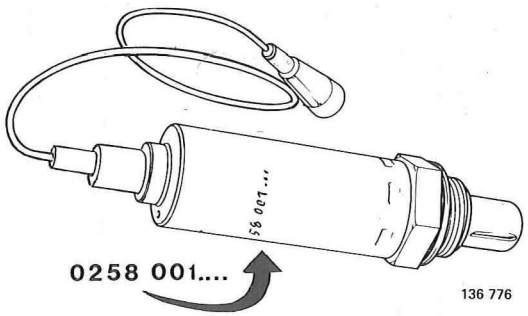
135 202

Bosch No ..... **...050**
Volvo P/N 1 274 368-8

Duty cycle
- disconnected sond ..... 42–48°
- grounded thermal switch ..... 51–57°
- grounded microswitch* ..... 51–57°
- grounded pressure differential switch ..... 82°→

* B28F USA 1983 models designed for high altitude use: microswitch must be disconnected at all times.

Lambda-sond



136 776

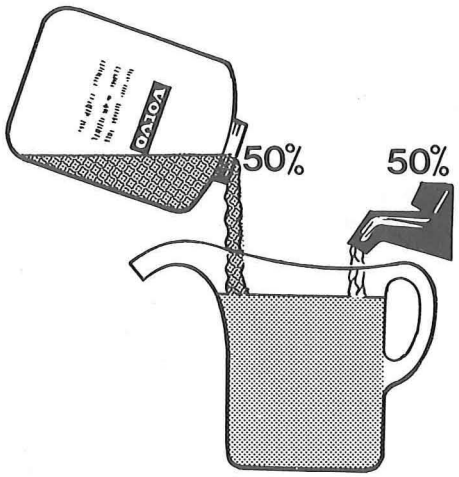
Bosch No ..... **...037**
Volvo P/N 1 274 367-0

Tightening torque ..... 55 Nm (40 ft lb)*

* Apply 'Never-Seez' P/N 1 161 035-9 to entire thread length.

Group 26 Cooling system

General



128 187

Coolant – composition – guarantee

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

Use genuine Volvo coolant, **type C (blue-green)** diluted with **clean** water in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage.

- Never top-up the cooling system with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- The coolant should be changed every 25,000 miles (40,000 km) since the corrosion-protective additives in the coolant lose their effect in time.
- Clean cooling system with solvent (P/N 1 161 328-8) prior to filling new coolant.

	litres	US qts
Capacity	10.0	10.5

Expansion tank

	kPa	psi
Pressure valve in cap opens at:		
overpressure, early type	75	11
late type	150	21
underpressure	7.0	1.0

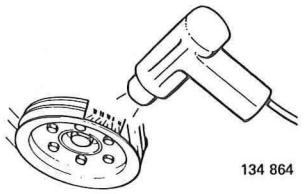
Thermostat

Marking	92
Starts opening at	91–93°C (196–199°F)
Fully open at	102°C (216°F)

Fan belts

Designation, type 1	HC 38 × 1100
type II	HC 38 cog × 1100
type III (not B28F USA)	HC 38 cog × 1075

Group 28 Ignition system

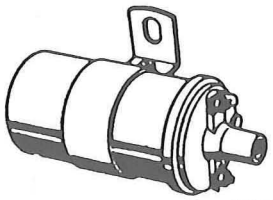

134 864

Type..... Breakerless
Firing order..... 1-6-3-5-2-4

Engine-type	Ignition timing b.t.d.c.	Speed r/s (rpm)
B 28 A*	10°	**11.7–13.3** (700–800)
B 28 E*	10°	**11.7–13.3** (700–800)
B 28 F*	23°	**41.7** (2500)

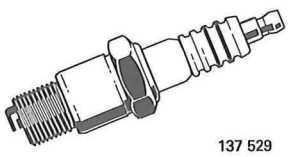
* Vacuum regulator disconnected.

Ignition coil


131 753

Resistance of primary coil
(terminals 1 and 15)..... 0.5 Ω
Resistance of secondary coil
(terminal 1 to HT terminal) ..... 9.5 kΩ

Spark plugs, glow plugs


137 529

Engine type	Designation	P/N	Kit number
B 28 A, B 28 E, B 28 F	HR6DC	1 269 915-2	273 599-1

Electrode gap ..... 0.6–0.7 mm ((0.0236–0.276 in)
Tightening torque, (unoiled plugs)..... 12 Nm (9 ft lb)

Distributor

Engine type	Ignition system	Distributor	
		Volvo P/N	Bosch No
B 28 A, B 28 E	TSZ-4	1 269 191	0 237 402 013
B 28 F	TSZ-4	1 269 380	0 237 402 017

	B 28 A, E	B 28 F
Bosch number	0 237 402 013	0 237 402 017
Volvo P/N	1 269 191	1 269 380
Direction of rotation	Clockwise	Clockwise
Resistance of impulse sender coil, Ω	540–660	540–660
Air gap, rotor – stator, min	0.3 mm	0.3 mm

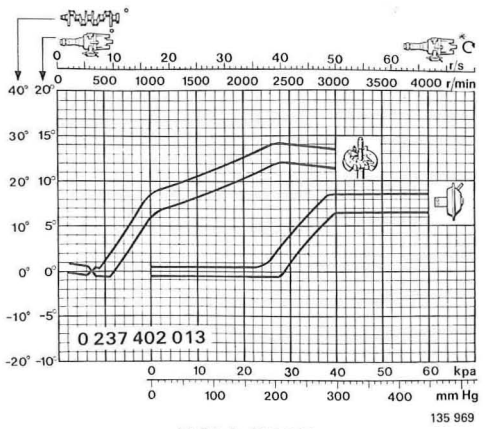
Centrifugal governor

Advance, total, degrees (distributor)	13±1	11±1
Advance begins at distrib. rev/secs	7.5–9.6	8.5–10
distrib. rev/min	(450–575)	(500–600)
Data: 5° at distrib. rev/secs	12.5–15.4	12.4–15.3
(distrib. rev/min)	(750–925)	(740–920)
10° at distrib. rev/secs	23.3–32.5	30–50
(distrib. rev/min)	(1 400–1 950)	(1 800–3 000)
Advance max at distrib. rev/secs	40	33.3
(distrib. rev/min)	(2 400)	(2 000)

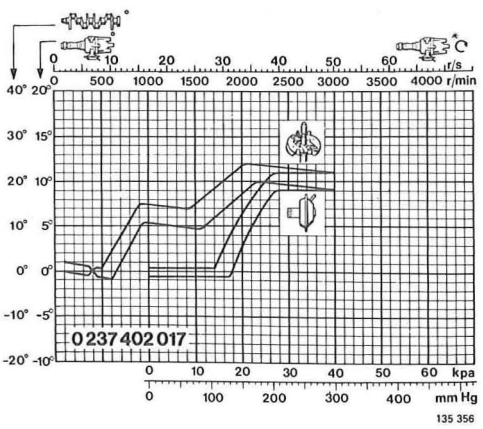
Vacuum governor

Control direction	Positive	Positive
Control, total degrees (distributor)	7,5±1	10±1
Control commences at mm Hg	160–210	105–135
Data: 2° at mm Hg	200–240	115–145
max control at mm Hg	300	210

Ignition advance

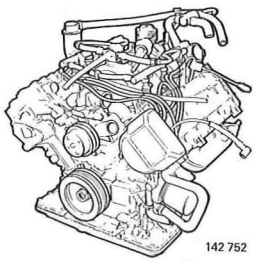


B 28 A, B 28 E



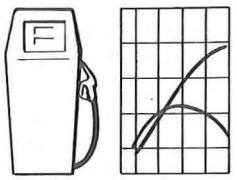
B 28 F

Section 2 B 280 Engine


142 752

Group 20 General 86
Group 21 Engine 87
Group 22 Lubricating system 92
Group 23 Fuel system 93
Group 26 Cooling system 96
Group 28 Ignition system 97

Group 20 General


129 750

Performance, compression ratios, octane requirements

Engine type	Compression ratio	Octane requirement	Output		Max torque	
			kW at r/s	hp at r/min	Nm at r/s	kpm at r/min
B 280 E Scandinavia	10.0:1	Min 95[1]	115/88	156/5 250	245/53	25.0/3 200
B 280 E Other markets	10.0:1	Min 95[1]	125/90	170/5 400	240/75	24.5/4 500
B 280 F	9.5:1	Min 91[2]	108/85	147/5 100 145/5 100[3]	235/63	24.0/3 750 173/3 750[4]

[1] Unleaded fuel can be used
[2] Unleaded fuel only
[3] Horse power
[4] Ft lb.

Other general data

Number of cylinders	6
Bore	91 mm (3.582 in)
Stroke	73 mm (2.874 in)
Displacement	2.849 dm^3 (litres)
Firing order	1-6-3-5-2-4
Compression (normal rating)[1]	0.8–1.1 MPa (114–156 psi)
Weight, approx	150 kg (330 lb)

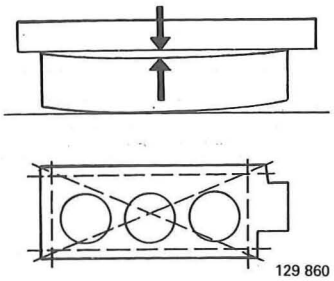
[1] With hot engine, throttle wide open and starter motor cranking at 4.2–5.0 r/s (250–300 r/min).

Group 21 Engine block

Cylinder head

Max warp:

Maximum warp is 0.05 mm (0.002 in) per 100 mm (4 in) length.
Note: Do not level a warped cylinder head, replace it!

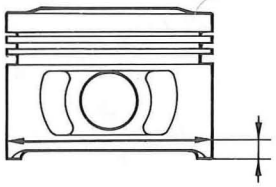


Cylinder liners

Bore liners marked 1 (A-marked piston)	91.00–91.01 mm	(3.5826–3.5830 in)
2 (B-marked piston)	91.01–91.02 mm	(3.5830–3.5835 in)
3 (C-marked piston)	91.02–91.03 mm	(3.5835–3.5838 in)
Liner height above block face	0.14–0.21 mm	(0.0055–0.0083 in)
Shims for adjustment of liner height:		
thickness, orange paint marking	0.098–0.134 mm	(0.0039–0.0053 in)
white paint marking	0.118–0.154 mm	(0.0046–0.0061 in)
blue paint marking	0.138–0.194 mm	(0.0054–0.0076 in)

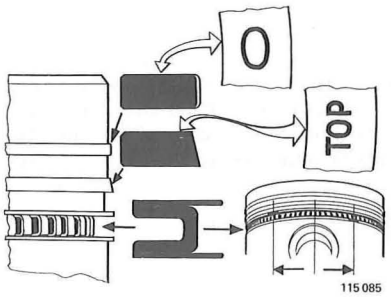
Pistons

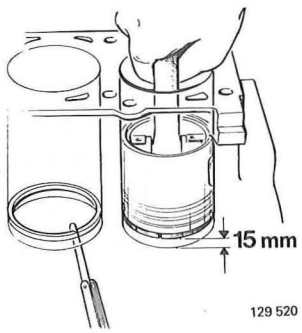
Max weight difference between pistons in same engine	6 grams	
Piston float	0.070–0.090 mm	(0.0028–0.0035 in)
Piston diameter, A-marked pistons	90.920–90.930 mm	(3.5822–3.5826 in)
B-marked pistons	90.930–90.940 mm	(3.5826–3.5830 in)
C-marked pistons	90.940–90.950 mm	(3.5830–3.5834 in)



Piston diameter is measured at right-angles to gudgeon pin bore, **13 mm** (0.512 in) from bottom edge.

Piston rings





Ring gap measured 13 mm (0.51 in) from lower edge of cylinder

		Upper compression ring	Lower compression ring	Oil ring
Side clearance (measured with ring on piston)	mm	0.045–0.074	0.025–0.054	0.009–0.233
	in	0.0017–0.0029	0.0009–0.0212	0.0003–0.0091
Ring gap when checked in 91 mm (3.5826 in) (cylinder, see fig)	mm	0.40–0.60	0.40–0.60	0.40–1.45
	in	0.0157–0.0236	0.0157–0.0236	0.0157–0.0570

Gudgeon (piston) pins

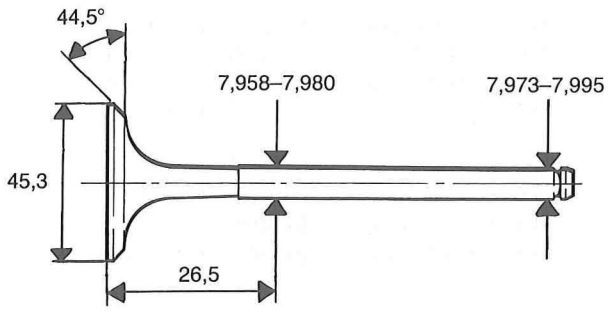
Piston	0.007–0.017 mm	(0.0003–0.0007 in)

Valve system

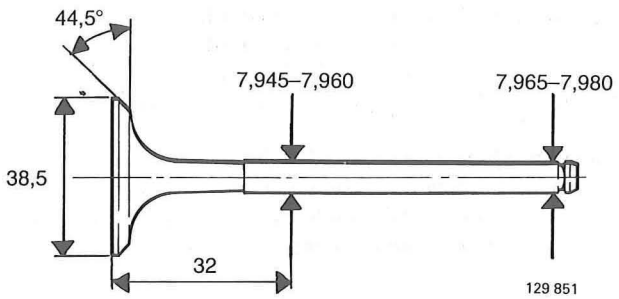
Valve clearance

Inlet valves, cold engine	0.10–0.15 mm	(0.004–0.006 in)
warm engine	0.15–0.20 mm	(0.006–0.008 in)
Exhaust valves, cold engine	0.25–0.30 mm	(0.010–0.012 in)
warm engine	0.30–0.35 mm	(0.012–0.014 in)

Valves (sizes in mm)

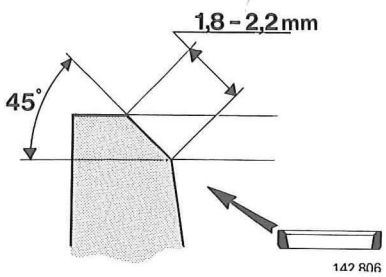


Inlet valves

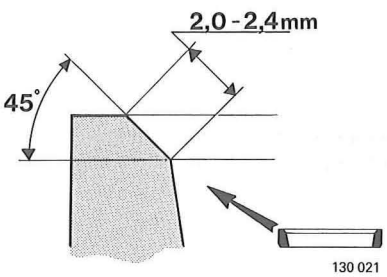


Exhaust valves

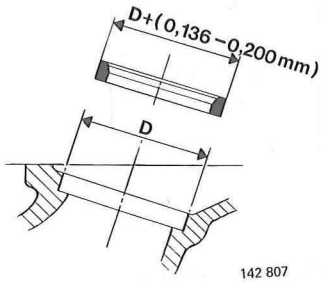
Valve guides



Seat for inlet valve



Seat for exhaust valve

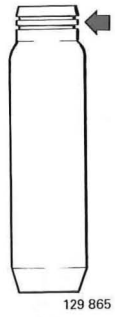


When replacing valve seats: the interference between the valve seat and its bore in the cylinder head shall be 0.136–0.200 mm (0.0054–0.0079 in), i.e. valve seat diameter must be 0.136–0.200 mm greater than the diameter of the bore in the cylinder head.

Valve seats are available in three oversizes.

Valve guides

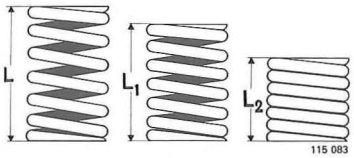
Inner diameter	8.000–8.022 mm	(0.3149–0.3158 in)
Press-in measurement to cylinder head contact surface against block:		
inlet	46–47 mm	(1.8124–1.8518 in)
exhaust	36.9–37.9 mm	(1.4527–1.4921 in)
Clearance in cylinder head	0.053–0.098 mm	(0.0020–0.0037 in)


129 865

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

	Marking	Reamer
Standard	No groove	–
Oversize 1	1 groove	5166
Oversize 2	2 grooves	5167
Oversize 3	3 grooves	5168

Valve springs



115 083

Springs marked green

Length		Load	
mm	in	N	lbs.
47.1	1.85	0	0
40.0	1.57	230–266	52–60
30.0	1.18	613–689	137–154

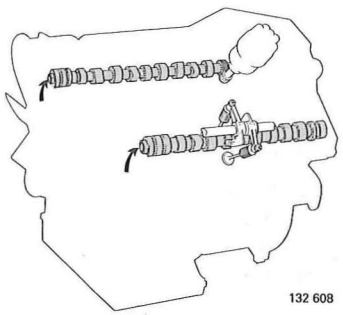
Rocker arm mechanism

The rocker arm tips are surface hardened and must not be ground

Clearance, shaft–rocker arm ..... 0.012–0.054 mm (0.0005–0.0021 in)

Timing gears

Camshaft


132 608

Engine type	B 280 E		B 280 F	
	Left	Right	Left	Right
Marking	R	R	S	S
Colour code	White	White	Green	Green
Part number (last three digits)	. . . 957	. . . 959	. . . 958	. . . 960

	B 280 E	B 280 F
Max lobe lifting height, left and right, inlet	6.08 mm (0.2396 in)	5.96 mm (0.2348 in)
exhaust	5.85 mm (0.2305 in)	5.43 mm (0.2139 in)
Checking camshaft settings (cold engine):		
adjust valve clearance on 1st and 6th inlet valves to	0.7 mm (0.0275 in)	0.7 mm (0.0275 in)
The inlet valves should then open at:		
1st	4.5° B.T.D.C.	5° B.T.D.C.
6th	4.5° B.T.D.C.	5° B.T.D.C.
Journal clearance	0.035–0.085 mm (0.0013–0.0033 in)	

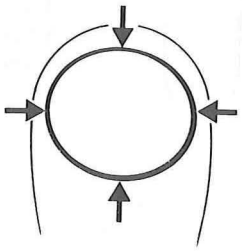
Crank mechanism

Crankshaft

Max run-out (measured on two centre main bearing journals)	0.02 mm	(0.0007 in)
Crankshaft, end float	0.070–0.270 mm	(0.0027–0.0106 in)
Crank journals, side clearance	0.20–0.38 mm	(0.0078–0.0149 in)

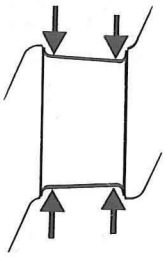
Main bearing journals

Out of round, max	0.007 mm	(0.0002 in)
Taper, max	0.01 mm	(0.0003 in)
Diameter	70.043–70.062 mm	(2.7575–2.7583 in)



115 089

Out of round



Taper

Connecting rod bearing journals

Out of round, max	0.007 mm	(0.0002 in)
Taper, max	0.01 mm	(0.0003 in)
Diameter	59.971–59.990 mm	(2.3629–2.3636 in)

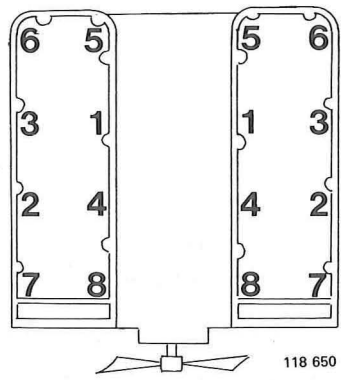
Connecting rods

End float on crankshaft	0.18–0.32 mm	(0.0071–0.0126 in)
Max weight difference between con rods in same engine	2.5 grams	

Tightening torque

Tightening torques apply to oiled nuts and bolts. Degreased (washed) parts must be oiled prior to assembly.

	Nm	ft. lb.
Crankshaft pulley	240–280	177–206
Camshaft gear	70–90	52–66
Carrier plate (use new bolts)	45–50	33–37
Spark plugs (do not oil)	12±2	9±1.5
Valve cover	15	11
Connecting rod bearings	1 Oil threads 2 Tighten No. 1 bolt to 25 Nm (18 ft.lb) 3 Tighten No. 2 bolt to 25 Nm (18 ft.lb) + angle-tighten 75° 4 Angle-tighten No. 1 bolt 75° 5 Check/tighten both bolts to 50 Nm (37 ft.lb)	

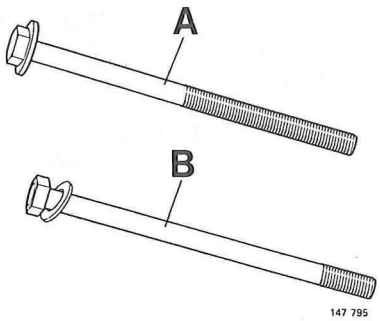


Tightening sequence for cylinder head bolts

Cylinder head

Tighten all bolts in stages:

1 Tighten bolts to 60 Nm (43 ft lb).
2 a Loosen bolt 1, tighten it to 20 Nm (15 ft lb).
b Angle-tighten to 106° using special tool 5098.
c Repeat this for remaining bolts in sequence shown.
c **Loosen and tighten each bolt in turn.**
3 Adjust valves.
4 Warm-up engine.
5 Allow engine to cool for 2 hrs.
6 Angle-tighten each bolt a **further 45°.**



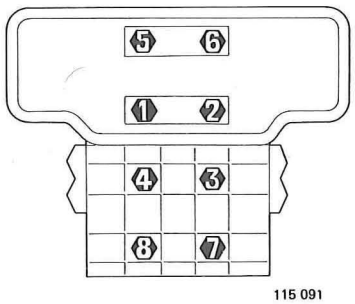
A. 1900– **B. Earlier type**

1990–

Asbestos-free gaskets, fixed-washer bolts (fig. A).

Tighten all bolts in stages

1 Tighten bolts to 60 Nm (44 ft.lb)
2 a Loosen bolts
b Tighten bolts to 40 Nm (30 ft.lb)
c Angle-tighten bolts 160°–180°
3 Adjust valves

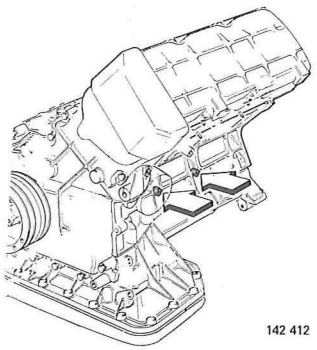


Tightening sequence for main bearings (via lower crankcase)

Main bearings

Tightening all nuts in stages:

1 = 30 Nm (22 ft lb)
2 = Slacken nut 1
3 = Tighten nut 1 30–35 Nm (22–26 ft lb)
4 = Angle-tighten nut 1 73°–77°
5 = Slacken and retighten the other nuts in the order specified in stages 2–4



Side fastening screws

Tightening torques

The 4 fasteners which hold No. 2 and 3 main bearings to engine block should be tightened to 20–25 Nm (15–18 ft) **after the main bearing nuts have been tightened to the specified torque.**

Group 22 Lubricating system

General

Oil capacity and quality, see page 12.

Oil pressure, warm engine, new oil cleaner:		
at 15 r/s (900 r/min), minimum	0.1 MPa	(14.2 psi)
50 r/s (3 000 r/min)	0.4 MPa	(57 psi)

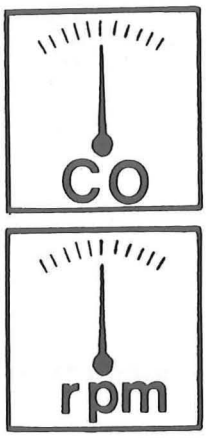
Lubricating oil pump

End float	0.025–0.084 mm	(0.0010–0.0033 in)
Clearance between tooth tip and pump housing wall (excl. bearing clearance)	0.020–0.095 mm	(0.0008–0.0037 in)
Backlash (excl. bearing clearance)	0.17–0.27 mm	(0.0066–0.0106 in)
Bearing clearance, driveshaft	0.015–0.053 mm	(0.0006–0.0021 in)
idler shaft	0.015–0.051 mm	(0.0006–0.0020 in)
Relief valve spring, length under various loads:		
unloaded	89.5 mm	(3.52 in)
loaded to 90 N (9.0 kp)	56.5–60.5 mm	(2.22–2.38 in)

Group 23 Fuel system

CO content, idle speed

- Selector lever must be in position P (and handbrake applied) when checking/adjusting CO or idle speed
- CO should be checked/adjusted when engines is warm and idling
- CO content outside check values shown below = adjust to specified setting value
- CO content within check values need not be adjusted provided engine is operating satisfactorily



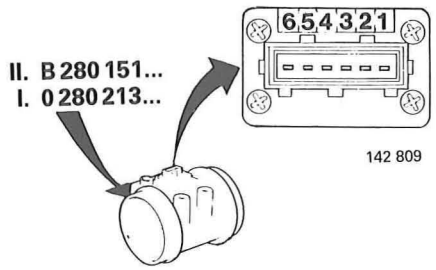
135 528

Engine type	CO %[1]		Idling speed r/s (r/min)
	Adjusting (checking)	Volvo Mono-Tester	
B 280 E	1.0 (0.5–2.0)	–	12.5 (750)
B 280 F	0.6 (0.2–1.0)[2]	20°–70°[3]	12.5 (750)

[1] Pulsair system disconnected and plugged.
[2] Lambda-sond disconnected. Measured in front of converter.
[3] Lambda-sond connected.

LH JETRONIC 2.2

Air mass meter

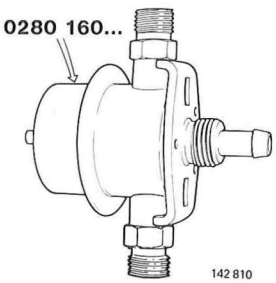


142 809

Manufacturer's No type I ..... **...006**
II ..... **...615**
Volvo P/N 1 336 354-4

Resistance:
- between terminals 2 and 3 ..... 2.5–4.0 Ω
- between terminals 2 and 6 ..... 0–1000 Ω

Line pressure, pressure regulator

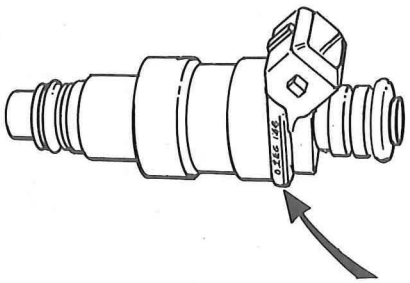


142 810

Bosch No ..... **...215**
Volvo P/N 1 271 135-4

Line pressure	kPa (psi)	250 (36)
Rest pressure	kPa (psi)	150–250 (28–43)

Injectors

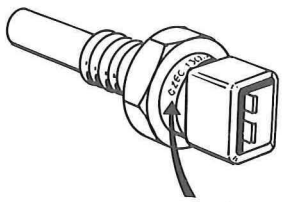


0 280 150 . . .

135 790

	Early type	Late type
Bosch No.	. . . 725	. . . 734
Volvo P/N	1 271 100-8	1 389 844-0
Injected quantity	170 cm³/min	170 cm³/min
at a line pressure of	250 kPa (36 psi)	250 kPa (36 psi)

Coolant temperature sensor

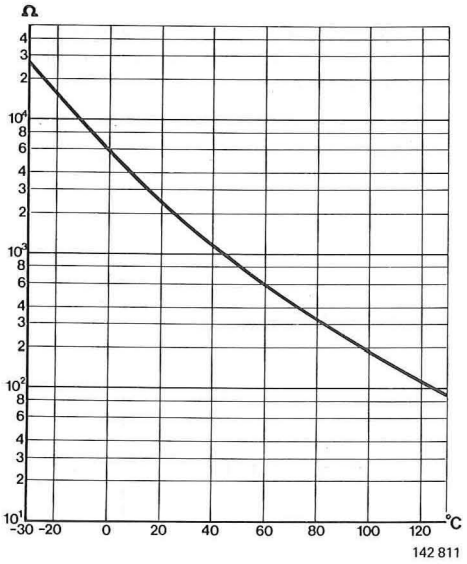


0 280 130 . . .

135 791

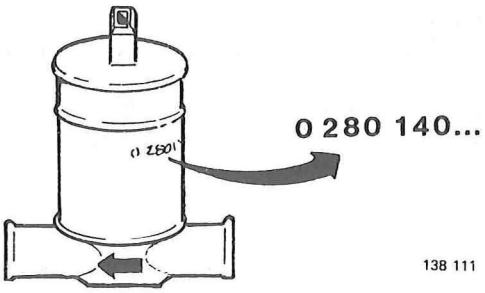
Bosch No . . . . . **. . . 032**
Volvo P/N 1 346 030-8

Resistance at:
−10°C (14°F) . . . . . 8.10–10.77 kΩ
+20°C (68°F) . . . . . 2.28–2.72 kΩ
+80°C (176°F) . . . . . 290–364 Ω



142 811

Air control valve



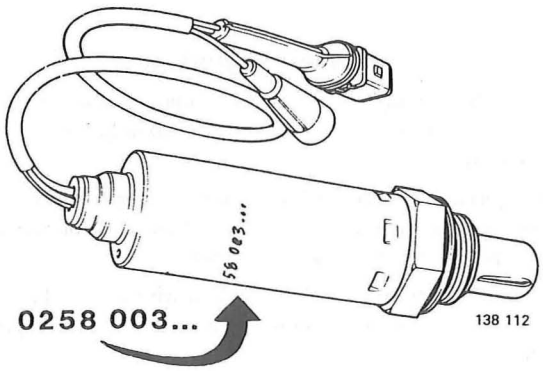
0 280 140...

138 111

Bosch No . . . . . **. . . 501**
Volvo P/N 1 317 957-7

Resistance between terminals 3 and 4,
and 4 and 5 . . . . . approx 20 Ω

Lambda-sond



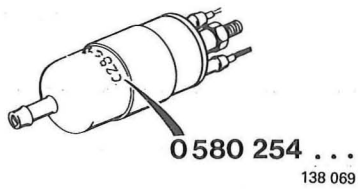
	Early type	Late type
Bosch No.	**. . . 020**	**. . . 034**
Volvo P/N	1 378 123-2	3 501 753-2

Resistance of preheating resistors:
cold Lambda sond (20°C = 68°F) ..... 3 Ω
warm Lambda sond (above 350°C = 662°F) .... 13 Ω

Tightening torque ..... 55 Nm (40 ft lb)*

* Apply Never seez (P/N 1 161 035-9) to threaded section of sond.

Fuel pump

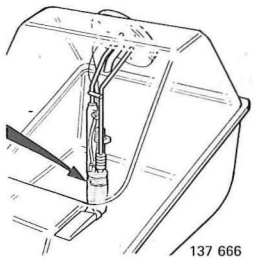


	Type I	Type II
Bosch No.	**. . . 948**	**. . . 039**
Volvo P/N	1 336 677-8	1 389 449-8

Capacity at a line pressure of 250 kPa (36 psi)
+20°C (68°F) and 12 V ..... 140 litres/hr (37.0 US Galls. per hr)
11 V ..... 120 litres/hr (31.7 US Galls. per hr)
10 V ..... 95 litres/hr (25.0 US Galls. per hr)

Current consumption at a line pressure of 300 kPa (42 psi),
+20°C (68°F) and 12 V ..... max 5.0 A

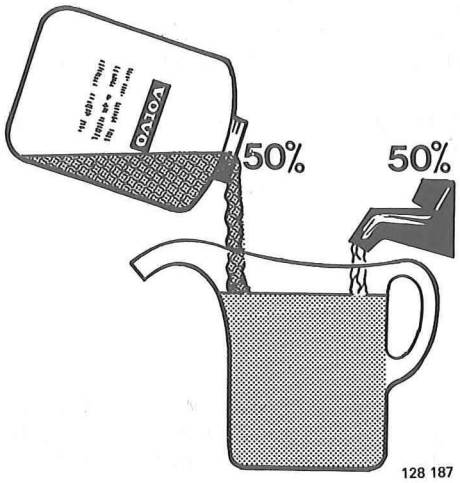
Tank pump



Current consumption ..... 3–4 A

Group 26 Cooling system

General



Coolant – composition – guarantee

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

Use genuine Volvo coolant, **type C (blue-green)** diluted with **clean** water in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage.

- Never top-up the cooling system with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- The coolant should be changed every 25,000 miles (40,000 km) since the corrosion-protective additives in the coolant lose their effect in time.
- Clean cooling system with solvent (P/N 1 161 328-8) prior to filling new coolant.

	litres	**US qts**
Capacity	10.0	10.5

Expansion tank

	kPa	**psi**
Pressure valve in cap opens at:		
overpressure	150	21
underpressure	7.0	1.0

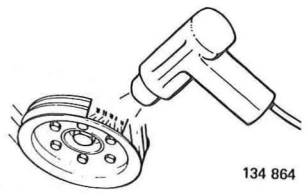
Thermostat

Marking	87
Starts opening at	86–88° (187–190°F)
Fully open at	97° (207°F)

Fan belts

Designation, 760	HC 38 cog × 1075
780	HC 38 cog × 1100

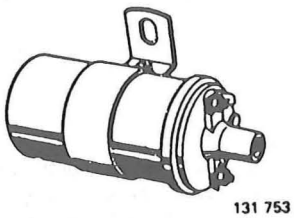
Group 28 Ignition system


134 864

Type EZ115K
Firing order 1-6-3-5-2-4

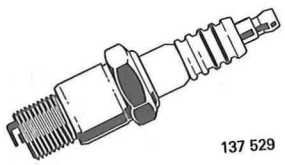
Engine type	Ignition timing b.t.d.c.	Speed r/s (rpm)
B280E	10°	**12.2–12.8** (730–770)
B280F	16°	**12.2–12.8** (730–770)

Ignition coil


131 753

Resistance of primary coil
(terminals 1 and 15) ..... 0.6–0.8 Ω
Resistance of secondary coil
(terminal 1 to HT terminal) ..... 6.9–8.5 kΩ

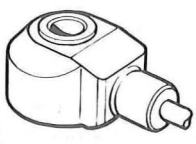
Spark plugs, glow plugs


137 529

Engine type	Designation	P/N	Kit number
B280E Scandinavia, B280F	HR6DC	1 269 915-3	273 599-1
B280E Other markets	HR5DC	1 389 896-0	270 590-3

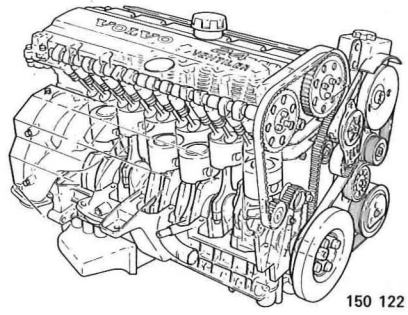
Electrode gap ..... 0.6–0.7 mm (0.0236–0.0276 in)
Tightening torque, (unoiled plugs) ..... 12 Nm (9 ft lb)

Knock sensor


146 805

Tightening torque ..... 20 Nm (14.5 ft lb)

Section 2 B 6304 Engine


150 122

Group 20 General 98
Group 21 Engine 98
Group 22 Lubricating System 101
Group 23 Fuel system 102
Group 26 Cooling system 106
Group 28 Ignition system 107

Group 20 General

Performance, compression ratios, octane requirements

Engine type	Notes	Compression Ratio	Octane requirement RON*	Output		Max torque	
				kW at r/s	hp at r/m	Nm at r/s	kpm at r/m
B 6304 F		10,7[1)]	95	150/100	204/6 000	267/72	27.2/4 300

Notes:

[1)] Unleaded fuel only. Can be run on 91 octane unleaded.
* RON stands for Research Octane Number, and is a measure of the ability of the fuel to withstand knocking.
MON stands for Motor Octane Number, another way of measuring the same property.
(R+M)/2, also called AKI (Anti Knock Index) is a combination of these two measurements.
95 RON is equivalent to 91 (R+M)/2.
91 RON is equivalent to 87 (R+M)/2.

Other general data

Number of cylinders	6
Bore	83.00 mm (3.268 in)
Stroke	90.00 mm (3.543 in)
Displacement	2.922 dm^3 (litres)
Firing order	1-5-3-6-2-4
Compression (normal rating)[1)]	1.3–1.5 MPa (184–213 psi)
Weight, approx	180 kg (397 lb)

[1)] With hot engine, throttle wide open and starter motor cranking at 4.2–5.0 r/s (250–300 r/m)

Group 21 Engine Block

Cylinder head

Height, new	mm (in)	129.00±0.05	(5.0787±0.0020)
Max machining	mm (in)	0.3	(0.0012)
Max warp:			
along	mm (in)	0.020	
across	mm (in)	0.008	

Cylinder block

Bore

Standard (marked C)	mm (in)	83.00–83.01	(3.2677–3.2681)
(marked D)	mm (in)	83.01–83.02	(3.2681–3.2685)
(marked E)	mm (in)	83.02–83.03	(3.2685–3.2689)
(marked G)	mm (in)	83.04–83.05	(3.2693–3.2697)

Rebore if wear exceeds 0.1 mm and oil consumption is abnormally high.

Pistons

Piston diameter

Diameter to be measured at right angles to gudgeon pin and 16 mm from bottom of piston.

Standard (marked C)	mm (in)	82.98–82.99	(3.2669–3.2673)
(marked D)	mm (in)	82.99–83.00	(3.2673–3.2677)
(marked E)	mm (in)	83.00–83.01	(3.2677–3.2681)
(marked G)	mm (in)	83.02–83.03	(3.2685–3.2689)
Piston weight	g (oz)	350 ± 5	(12.5 ± 0.2)
Max weight difference between pistons in same engine	g	10	(0.4)

Piston rings

		Upper comp. rings	Lower comp. rings	Oil scraper rings
Axial clearance in piston groove	mm	0.05–0.085	0.03–0.065	0.02–0.055
	in	0.0020–0.0033	0.0012–0.0026	0.0008–0.0022
Ring gap (measured in cylinder, bore 83.00 mm)	mm	0.2–0.4	0.2–0.4	0.25–0.5
	in	0.008–0.016	0.008–0.016	0.009–0.020

Gudgeon (Piston) pins

Fit in connecting rod	Light thumb pressure (close running fit)
in piston	Thumb pressure (push fit)

Valve system

Hydraulic

Valves

Length inlet	mm (in)	104.05±0.18	(4.096±0.007)
exhaust	mm (in)	103.30±0.18	(4.067±0.007)
Matching surface angle	°	45.5	
Edge height, new valve	mm (in)	1.5	(0.059)
min after machining	mm (in)	1.2	(0.047)
Max machining of valve stem	mm (in)	0.4	(0.016)

Valve Seats

		inlet	exhaust
Diameter standard	mm (in)	32.61 (1.284)	28.61 (1.126)
oversize	mm (in)	33.11 (1.304)	29.11 (1. 146)
Matching surface angle	°	45.25	45.25
Reduction angle, upper	°	20.25	15.25
lower	°	60.25	60.25
Width	mm (in)	1.4–1.8 (0.055–0.071)	1.8–2.2 (0.071–0.087)

Valve Guides

		inlet	exhaust
Diameter standard	mm (in)	12.00 (0.4724)	12.00 (0.4724)
oversize 1	mm (in)	12.1 (0.4764)	12.1 (0.4764)
oversize 2	mm (in)	12.2 (0.4803)	12.2 (0.4803)
Clearance, valve stem-guide (measured with new valve)	mm (in)	0.06 (0.0024)	0.06 (0.0024)
Min	mm (in)	0.03 (0.0012)	0.03 (0.0012)

Valve Springs

External diameter	mm (in)	27.90±0.20	(1.098±0.008)
Internal diameter	mm (in)	20.10±0.20	(0.791±0.008)
Length at 270 ± 15 N	mm (in)	34.00	(1.339)
Length at 670 ± 32 N	mm (in)	24.50	(0.965)

Timing gear

Camshaft

Marking

Inlet		PC I	
Exhaust		PC E	
Max lift height	mm (in)	9.00	(0.354)
Axial clearance	mm (in)	0.05–0.20	(0.002–0.008)

Crankshaft assembly

Crankshaft

Max out-of-true	mm (in)	0.004	(0.00016)
Axial clearance	mm (in)	0.08–0.19	(0.003–0.0075)
Radial clearance (main bearings)	mm (in)	0.024–0.047	(0.00094–0.0019)

Main bearing journals

Diameter	mm (in)	65.00	(2.559)
Out-of-round, max	mm (in)	0.004	(0.00016)

Connecting rod bearing journals

Diameter	mm (in)	50.00	(1.969)
Out-of-round, max	mm (in)	0.004	(0.00016)

Connecting rods

Axial clearance at crankshaft	mm (in)	0.15–0.45	(0.0059–0.0177)

Tightening torques

Tightening torques apply to oiled nuts and bolts. Degreased (washed) parts must be oiled prior to assembly.

Cylinder head (stage 1)	Nm (ft lb)	20	(15)
(stage 2)	Nm (ft lb)	60	(44)
(stage 3) angle-tightening	°	150	
Bolts should be tightened in sequence from center towards ends...			
Middle section M 10 (stage 1)	Nm (ft lb)	20±2	(15±1.5)
M 10 (stage 2)	Nm (ft lb)	45±4	(33±3)
M 8 (stage 3)	Nm (ft lb)	24±4	(18±3)
M 7 (stage 4)	Nm (ft lb)	17±3	(12±2)
M 10 (stage 5) angle-tightening	°	90	
Bolts should be tightened in sequence from center towards ends.			

Connecting rod bearing caps (stage 1)	Nm (ft lb)	20	(15)
(stage 2) angle-tightening	°	90	
Crankshaft pulley (vibration damper), center bolt	Nm (ft lb)	300±30	(221±22)
Flange bolts, vibration damper (stage 1)	Nm (ft lb)	35	(26)
(stage 2) angle-tightening	°	60	
Driver plate (stage 1)	Nm (ft lb)	45	(33)
(stage 2) angle-tightening	°	50	
Camshaft wheel	Nm (ft lb)	20±2	(15±1.5)
Tensioning pulley, camshaft timing belt	Nm (ft lb)	39±5	(29±4)
Damper unit, camshaft timing belt	Nm (ft lb)	24±4	(18±3)
Angle pulley, camshaft timing belt	Nm (ft lb)	24±6	(18±4)
Water pump	Nm (ft lb)	17±3	(13±2)
Pin bolts, exhaust manifold (in cylinder head)	Nm (ft lb)	20±3	(15±2)
(to front pipe)	Nm (ft lb)	35±5	(26±4)
Oil sump pan	Nm (ft lb)	17±3	(13±2)
Plug, oil sump	Nm (ft lb)	38±5	(28±4)
Oil suction line	Nm (ft lb)	17±3	(13±2)
Oil cooler, connector block	Nm (ft lb)	17±3	(13±2)
Oil trap	Nm (ft lb)	15±2.5	(11±2)
Nipple, oil filter	Nm (ft lb)	40±2	(29±1.5)
Oil pressure switch	Nm (ft lb)	40±5	(29±4)
Impulse sensor	Nm (ft lb)	8±2	(6±1.5)
Knock sensor	Nm (ft lb)	20±2	(15±1.5)
Temperature sensor, rear edge of top cover	Nm (ft lb)	20±2	(15±1.5)
Temperature sensor, thermostat	Nm (ft lb)	10±2.5	(7±2)
Plug, 0-adjustment tool	Nm (ft lb)	38±6	(28±4)
Spark plugs	Nm (ft lb)	25	(18)

Group 22 Lubricating System

General

Oil fill volume and type, see p. 12.

Oil pressure with warm engine and new oil filter:			
at 12,5 r/s (750 r/m), at least	Mpa (psi)	0.1	(14)
at 50 r/s (3 000 r/m), at least	Mpa (psi)	0.3	(43)
max	Mpa (psi)	0.5	(71)

Lubricating oil pump

Relief valve spring, length under various loads			
unloaded	mm (in)	82.13	(3.233)
loaded to 52±4 N (5.2 kp)	mm (in)	56.1	(2.21)
loaded to 85±8 N (8.5 kp)	mm (in)	39.9	(1.57)

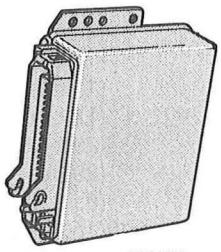
Group 23 Fuel System

CO content, idle speed

Check values for CO content	%	0.4–0.8
Idling speed	r/s (r/m)	12.5 (750)

CO content and idling speed can not be adjusted, only checked. Shift selector to be in position P when checking.

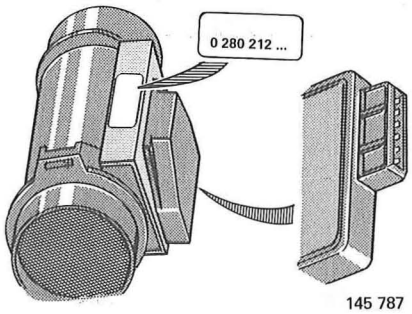
Motronic 1.8



150 362

Control unit

Bosch number 0 261 200 **362**
Volvo part number 3 517 623-9

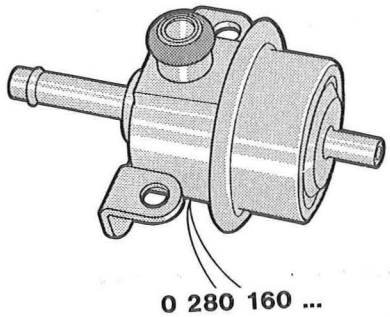


145 787

Air mass meter

Bosch number 0 280 213 **012**
Volvo part number 3 517 569-4

Resistance:
between terminals 2 and 3 ..... 2.5–4 Ω



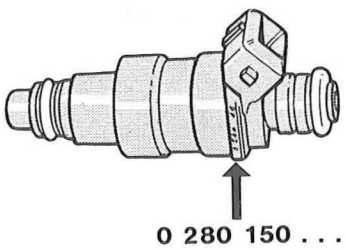
145 789

Pressure regulator

Early type
Bosch number 0 280 160 **294**
Volvo part number 3 517 064-6

Line pressure ..... 300 kPa (43 psi)

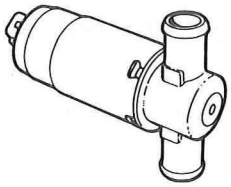
Late type
Bosch number 0 280 160 **731**
Volvo part number 3 547 653



145 677

Injector

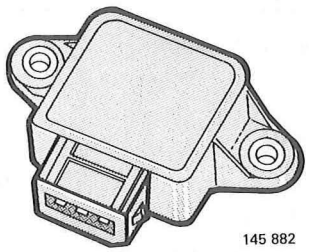
Bosch number 0 280 150 **762**
Volvo part number 3 517 572-8
Injected quantity ..... 185 cm^3/min
at line pressure ..... 300 kPa (43 psi)


150 426

Idling valve

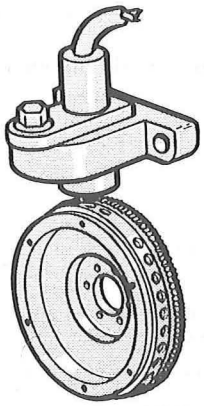
Bosch number 0 280 140 **527**
Volvo part number 3 517 886-2

Resistance:
between terminals 1 and 3 ..... 25 Ω


145 882

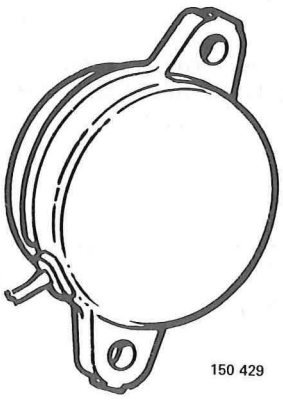
Throttle position sensor

Bosch number 0 280 122 **001**
Volvo part number 1 336 385-8


145 688

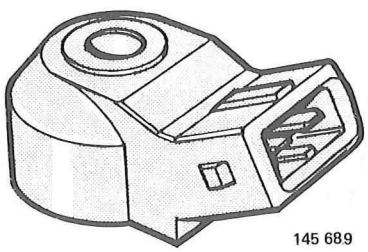
Speed and position sensor

Volvo part number 1 389 254-2


150 429

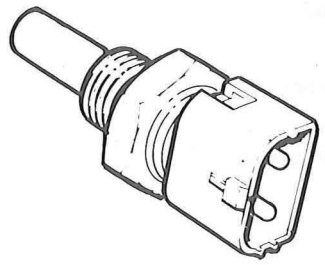
Camshaft sensor

Bosch number 0 232 101 **009**
Volvo part number 1 383 966-7


145 689

Knock sensor

Bosch number 0 261 231 **006**
Volvo part number 1 367 644-0



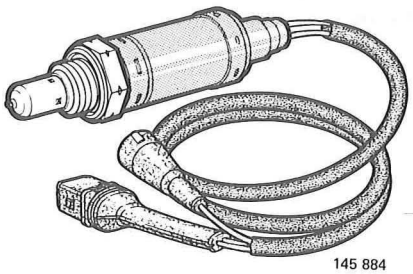
150 425

Temperature sensor, coolant

SWF number 601.605
Volvo part number 1 362 643-7

Resistance at:
0°C (32°F) ..... 7 300 Ω
+ 20°C (68°F) ..... 2 800 Ω
+ 40°C (104°F) ..... 1 200 Ω
+ 80°C (176°F) ..... 300 Ω
+100°C (212°F) ..... 150 Ω

See diagram for other values



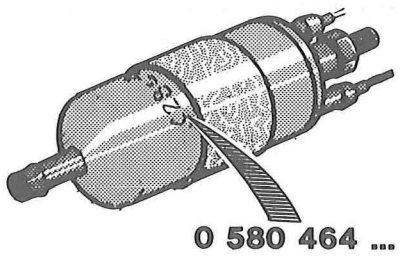
145 884

Lambda-sond

Bosch number 0 280 003 **119**
Volvo part number 3 531 251-1

Resistance in preheating resistor:
cold sond, 20°C (68°F) ..... 3 Ω
hot sond, above 350°C (660°F) ..... 13 Ω
Tightening torque ..... 55 Nm
(40 ft lb)

Apply 'Never-Seez', Volvo part number 1 161 035-9, to entire thread length.



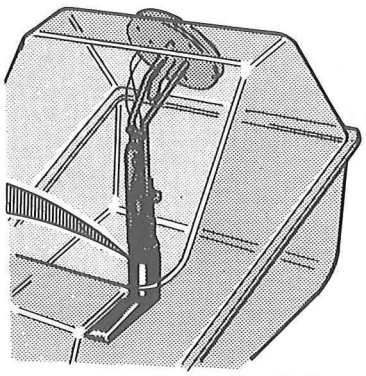
145 791

Fuel pump

Bosch number 0 580 464 **039**
Volvo part number 1 389 449-8

Pump capacity at 300 kPa
(43 psi) and +20°C (68°F):
–12 V ..... 130 litres/hour
(1.1 litres/30 secs)
–11 V ..... 108 litres/hour
(0.9 litres/30 secs)
–10 V ..... 86 litres/hour
(0.7 litres/30 secs)

Current consumption at line pressure
300 kPa (43 psi), +20°C (68°F) and 12 V:
max ..... 6.5 amp

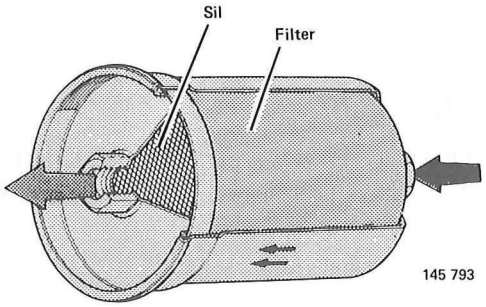


145 792

Tank pump

VDO number 92151034
Volvo part number 3 501 928-0

Current consumption ..... 3–4 amp

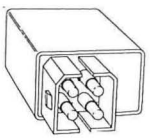


145 793

Fuel filter

Bosch number 0 450 905 **601**
Volvo part number 1 389 450-6

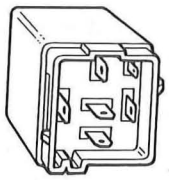
Filters particles down to ..... 0.002 mm (0.00008 in)
Tightening torque ..... 20–35 Nm
(15–26 ft lb)



148 680

Main relay

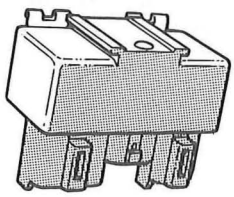
Volvo part number..... 1 323 592-4



150 599

Relay, fuel pump

Volvo part number..... 1 362 914-2



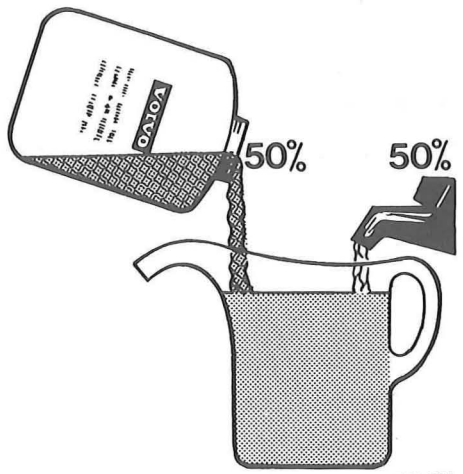
150 432

Relay, electric cooling fan

Volvo part number..... 1 523 872-4

Group 26 Cooling System

General



128 187

General

Coolant-composition-warranty

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

Use genuine Volvo coolant, type C (blue-green) diluted with clean water in proportions of 50/50. This mixture helps to prevent corrosion and frost damage and is the only coolant warrantied by Volvo.

- Never top-up with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- Under normal conditions the coolant will not need to be replaced. However, after larger repairs requiring draining of coolant, refill with new coolants, as the old will have been exposed to oxidation and contamination.
- Clean cooling system with solvent (P/N 1 161 328-8) prior to filling new coolant.

Capacity	approx 10.7 litres	(11.3 US qt)

Expansion tank

Pressure valve in cap opens at:

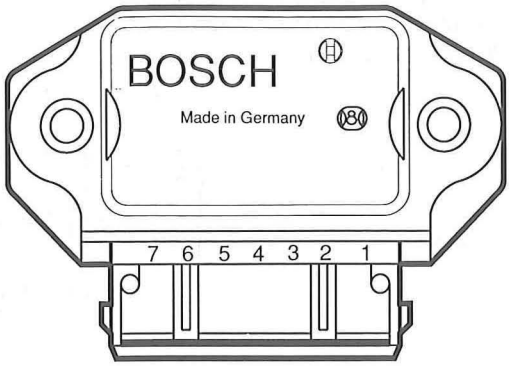
overpressure	150 kPa	(21 psi)
underpressure	7 kPa	(1 psi)

Thermostat

Marking	87	
starts opening at	87°C	(189°F)
fully open at	102°C	(216°F)

Group 28 Ignition System

Type	Motronic 1.8
Firing sequence	1-5-3-6-2-4
Ignition timing at 12.5 r/s (750 r/m)	5°

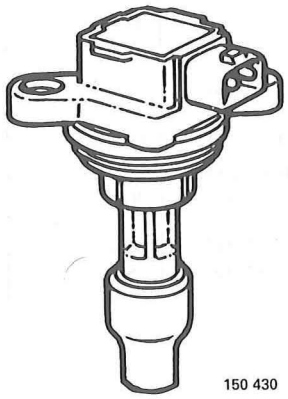


150 365

COMPONENTS

Power stage

Bosch number	0 227 100 **203**
Volvo part number	1 367 776-0



150 430

Ignition coil

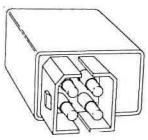
Nippon Denso number	029 700-7260
Volvo part number	1 531 300-6
Resistance of primary coil (between terminals 1 and 15)	0.5 Ω



150 431

Spark plugs

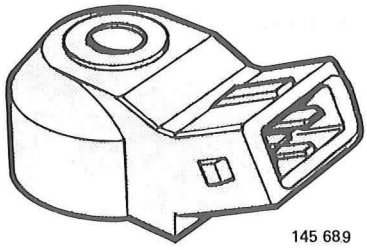
Designation, Bosch	FR 6 DC
Champion	RC 7 YC
Volvo part number	1 517 629-6
kit number	271 427-7
Electrode gap	0.7–0.8 mm (0.0276–0.0315 in)
Tightening torque, unoiled threads	25 Nm (18 ft lb)



148 680

Relay, ignition

Volvo part number	3 323 592-4

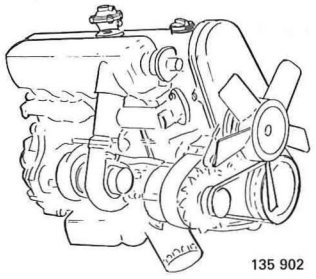


145 689

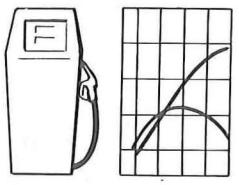
Knock sensor

Bosch number	0 261 231 **006**
Volvo part number	1 367 644-0

Section 2 D24, D24T, D24TIC Engines


135 902

Group 20 General 108
Group 21 Engine 109
Group 22 Lubricating system 114
Group 23 Fuel system 114
Group 25 Intake and exhaust systems 116
Group 26 Cooling system 117


129 750

Group 20 General

Performance, compression ratios

Engine type	Market	Compression ratio	Output, DIN		Max torque, DIN	
			kW at r/s	hp at r/min	Nm at r/s	kpm at r/min
D24		23:1	60/78	82/4700	145/33	14.8/2000
D24T	USA+Canada, Austria 1987–	23:1	79/80	108/4800 106[1]/4800	190/40	19.4/2400 140[2]/2400
	Other markets	23:1	80/80	109/4800	205/42	20.9/2500
D24TIC	740/760	23:1	90/80	122/4800	235/40	24.0/2400
	780	23:1	95/78	129/4650	250/40	25.5/2400

[1] Horsepower
[2] Ft lb

General data

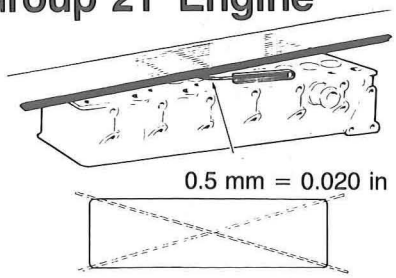
Number of cylinders	6	
Cylinder bore	76.5 mm	3.0118 in
Stroke	86.4 mm	3.4015 in
Displacement	2.383 dm^3 (litres)	
Firing order	1-5-3-6-2-4	
Compression:		
new	3.2 MPa (455 psi)	
min	2.4 MPa (341 psi)	
max. difference between cylinders	0.8 MPa (114 psi)	
Weight, approx., complete engine including engine mounts alternator and starter motor		
D24 approx.	200 kg (440 lb.)	
D24T approx.	210 kg (463 lb.)	

Group 21 Engine

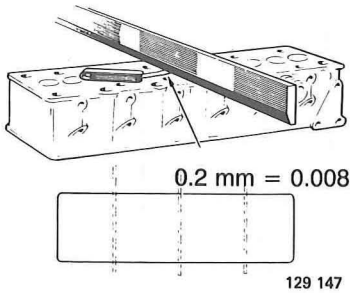
Cylinder head

Max. warp.....

Cylinder head may not be machined. It must be replaced if warp exceeds maximum.



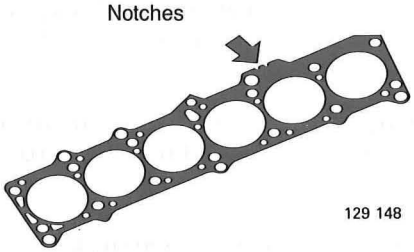
129 146



129 147

Cylinder head gasket

Three different gaskets are used depending on height of piston above cylinder block.



129 148

Height of piston above cylinder block		Gasket number of notches	Gasket thickness	
mm	in		mm	in
0.67–0.80	0.026–0.031	1*	1.4	0.055
0.81–0.90	0.032–0.35	2	1.5	0.059
0.91–1.02	0.036–0.040	3	1.6	0.063

Piston height in same engine must not extend over more than two classes.

Piston height is measured at the front and back of piston (along the gudgeon (piston) pin).

* Not D24 T/D24 TIC

Cylinder block

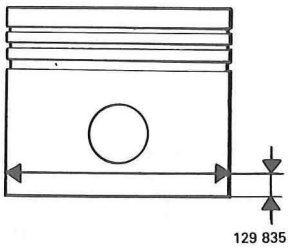
Bore	Marking (honing group)	Piston diameter mm	Piston diameter in	Cylinder bore mm	Cylinder bore in
Standard	651	76.48	3.0110	76.51	3.0122
	652	76.49	3.0114	76.52	3.0125
	653	76.50	3.0118	76.53	3.0130
Oversize 1	676	76.73	3.0209	76.76	3.0220
(0.25 mm = 0.010 in)	677	76.74	3.0213	76.77	3.0224
	678	76.75	3.0216	76.78	3.0228
Oversize 2	701	76.98	3.0307	77.01	3.0318
(0.50 mm = 0.020 in)	702	76.99	3.0311	77.02	3.0322
	703	77.00	3.0315	77.03	3.0326
Oversize 3	751	77.48	3.0504	77.51	3.0515
(1.00 mm = 0.040 in)	752	77.49	3.0508	77.52	3.0519
	753	77.50	3.0512	77.53	3.0523

Max wear (compared with specified diameter) ..... 0.04 mm (0.0016 in)

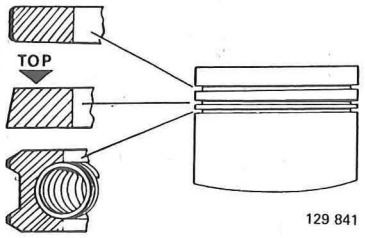
Pistons

Max. weight deviation between pistons in same engine	12 grams	
Piston float, new	0.03–0.05 mm	0.0012–0.0019 in
max.	0.13 mm	0.0051 in
Piston diameter, see cylinder bore table		
Max wear (compared with specified diameter)	0.04 mm	0.0016 in

Piston diameter is measured at right-angles to gudgeon piston lower edge.

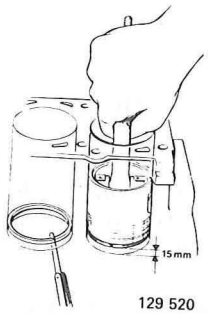

129 835

Pistons rings





Side clearance



Ring gap

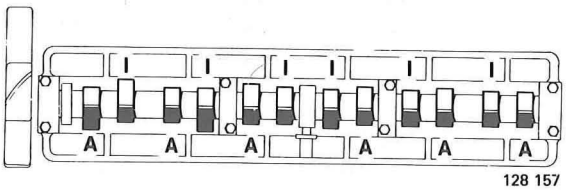
	Piston rings					
	Upper compression		Lower compression		Oil scraper	
	mm	in	mm	in	mm	in
Side clearance (measured with ring on piston) new	0.11–0.14	0.0043–0.0055	0.07–0.10	0.0028–0.0039	0.03–0.07	0.0012–0.0028
max	0.2	0.008	0.2	0.008	0.15	0.006
Ring gap (measured in cylinder, see illustration) new	0.3–0.5	0.012–0.020	0.3–0.5	0.012–0.020	0.25–0.50	0.010–0.0197
max	1.0	0.040	1.0	0.040	1.0	0.040

Gudgeon (piston) pins

Fit, in connecting rod	Light thumb pressure (close running fit)
in piston	Thumb pressure (push fit)

Valve system

Valve clearances



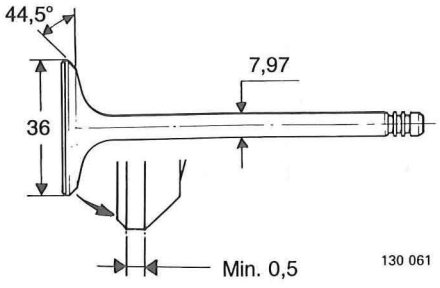
Cold engine = engine at room temperature

I = intake valves
A = exhaust valves

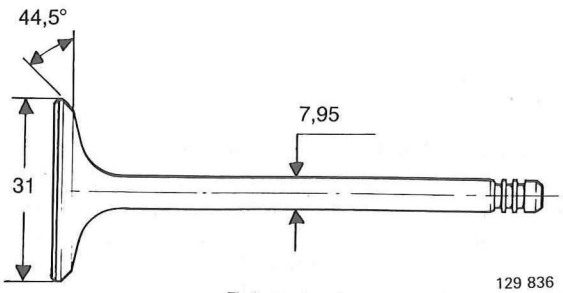
Check/adjust valves in this order: 1-5-3-6-2-4

	Valve clearances			
	Checking		Setting	
	mm	in	mm	in
Intake valve, warm engine	0.20–0.30	0.008-0.012	0.25	0.010
cold engine	0.15–0.25	0.006–0.010	0.20	0.008
Exhaust valve, warm engine	0.40–0.50	0.016–0.020	0.45	0.018
cold engine	0.35–0.45	0.014–0.018	0.40	0.016
Shims, thickness	3.00 to 4.25 at intervals of 0.05 mm (0.012 to 0.167 at intervals of 0.002 in)			

Valves (dimensions in mm)



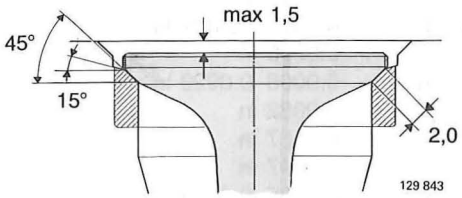
Intake valve



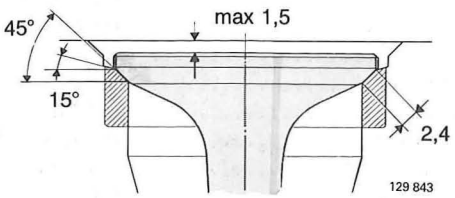
Exhaust valve

Note: Exhaust valves are stellite plated. Only the valve face may be ground.

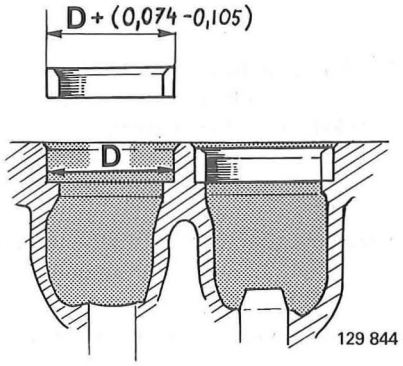
Valve seats (measured in mm)



Intake valve seat



Exhaust valve seat

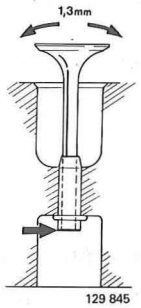


When replacing valve seats: the interference between the valve seat and its bore in the cylinder head shall be 0.074–0.105 mm (0.0029–0.0041 in) i.e. valve seat diameter must be 0.074–0.105 mm greater than the diameter of the bore in the cylinder head.

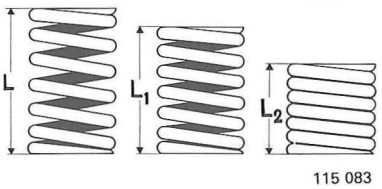
Valve guides

Inner diameter	8.000–8.015 mm	0.3149–0.3155 in
Height above cylinder head lower surface	40.1–40.5 mm	1.5787–1.5944 in
Clearance valve stem – guide (see illustration),		
new	0.3 mm	0.0118 in
max	1.3 mm	0.0511 in

Clearance is measured with new valve and with valve stem flush with valve guide.



Valve springs



Inner valve springs		Outer valve springs	
Length	**Load**	**Length**	**Load**
33.9 mm	0	40.2 mm	0
28.6 mm	67–77 N (15–17.5 lb)	32.6 mm	167–185 N (38–42 lb)
18.3 mm	209–231 N (47–52.2 lb)	22.3 mm	433–479 N (98–108.3 lb)

Shims (for valve clearance)

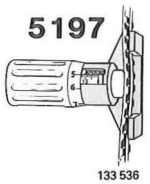
Thickness	3.00–4.25 at intervals of 0.05 mm (0.012–0.167 at intervals of 0.002 in)

Timing gears

Toothed belts

Belt tension (measured with tool 5197)

Check value	12–13
Setting	12.5



Camshaft

Max. lift height, intake	8.5 mm	0.334 in
exhaust	9.0 mm	0.354 in
Bearing clearance, new	0.05–0.10 mm	0.0019–0.0039 in
End clearance, max.	0.15 mm	0.006 in

Camshaft setting is checked by using gauge 5190

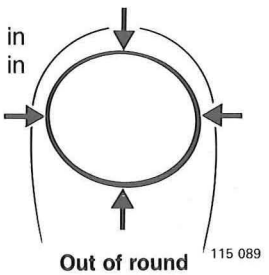
Crankshaft

Max[1] runout, two centre bearings	0.06 mm	0.0023 in
others	0.04 mm	0.0015 in
Crankshaft, end clearance, new	0.07–0.18 mm	0.0027–0.0071 in
max.	0.25 mm	0.0098 in
main bearing clearance, new	0.016–0.075 mm	0.0006–0.0029 in
max.	0.16 mm	0.0062 in
Connecting rod bearings, side clearance, max	0.4 mm	0.0157 in
bearing clearance, max	0.12 mm	0.0047 in
new	0.015–0.062 mm	0.0005–0.0024 in

[1]Measured with two outer main bearings in V-blocks.

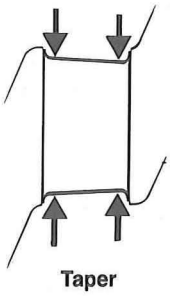
Main bearing journals

Out of round, max	0.03 mm	0.0012 in
Taper, max	0.05 mm	0.0020 in
Diameter, standard	58.00 (57.955–57.975) mm	
	2.2834 (2.2816–2.2824) in	
undersize 1	57.75 (57.705–57.725) mm	
	2.2736 (2.2718–2.2726) in	
2	57.50 (57.455–57.475) mm	
	2.2637 (2.2620–2.2627) in	
3	57.25 (57.205–57.225) mm	
	2.2539 (2.2521–2.2529) in	



Connecting rod bearing journals

Out of round, max	0.03 mm	0.0012 in
Taper, max	0.05 mm	0.0002 in
Diameter, standard	47.80 (47.758–47.778) mm	
	1.8818 (1.8802–1.8810) in	
undersize 1	47.55 (47.508–47.528) mm	
	1.8720 (1.8703–1.8711) in	
2	47.30 (47.258–47.278) mm	
	1.8622 (1.8605–1.8613) in	



Connecting rods

Only to be replaced in sets.

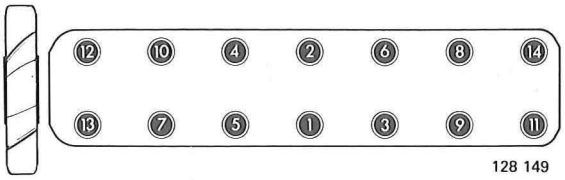
Side clearance on crankshaft, max	0.4 mm	0.0157 in
Max. weight deviation between connecting rods in same engine	6 grams	

Flywheel

Warp, max	0.05 mm at 150 mm diameter
	0.0019 in at 5.90 in. diameter

Tightening torques

Tightening torques apply to oiled bolts and nuts. Degreased (washed) parts should be oiled prior to assembly.



Tighten sequence for cylinder head bolts

Note: Loosen the bolts in the reverse order when removing the cylinder head.

Retorquing of cylinder head bolts

Retorque after 1 000–2 000 km (600–1200 miles). The engine should be cold or almost cold.

Tighten each bolt separately in correct sequence (see above illustration).

Tighten bolt **90°**. **Note:** This should be done in one movement without stopping. Bolts **should not be slackened** first.

Tighten cylinder head bolts in stages

Remove oil and dirt from bolt holes. Oil left in holes will reduce the pressure on the cylinder head gasket.

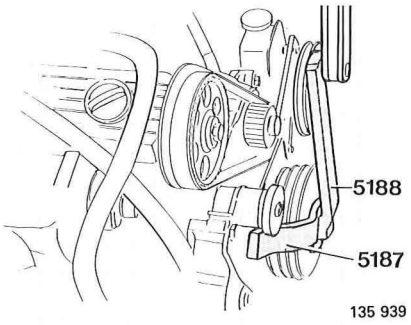
Bolt threads and washers must however be oiled, otherwise frictional forces will be too large.

Use **new bolts**.

Tighten in six stages in sequence shown above

Stage 1 = **40 Nm** (30 ft lb)
2 = **60 Nm** (44 ft. lb)
3 = **75 Nm** (55 ft. lb)
4 = tighten **180°**. **Note:** This should be done in one movement without stopping.
5 = run engine until oil temperature is at least +50°C (112°F).
6 = tighten **90°**. **Note:** This should be done in one movement without stopping

	Nm	ft lb.
Crankshaft pulley (vibration damper)		
center bolt[1]	350	258
Allen bolts	20	15
Flywheel (use new bolts and locking fluid, Volvo P/N 277 961-9)	75	55
Camshaft gear, front	45	33
rear	100	74
Camshaft bearing caps	20	15
Main bearing caps	65	48
Connecting rod bearing caps (use new nuts)	45	33



[1] Tightening torque 350 Nm (258 ft. lb.) applies when using special tool 5188.

Threads and bolt head contact surface to be smeared with locking compound (Volvo P/N 277 961-9).

If a torque wrench is used directly on the centre bolt (without 5188), the bolt must be tightened to 450 Nm (332 ft. lb.).

Glow plugs



P/N	1 257 889-4
Tightening torque	22 Nm (16 ft lb)

Group 22 Lubricating system

General

Oil capacity and quality, see page 12.

Oil pressure with an oil temperature of +80°C = 176°F and engine speed of 33.3 r/s (2000 r/min), at least ..... 200 kPa 28 psi

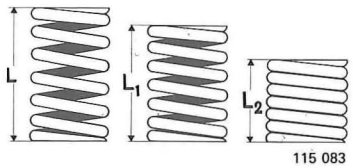
Oil pressure sensor

Cut-out point, indicator lamp goes out at ..... 15–45 kPa (2.1–6.4 psi)

Lubricating oil pump

Relief valve opens at ..... 600–700 kPa (85–99 psi)

Relief valve spring, length at different loads



D 24		D 24 T/TIC	
Length, mm (in)	**Load, N (lb)**	**Length, mm (in)**	**Load, N (lb)**
49 (1.93)	0	53.5 (2.11)	0
22 (0.87)	175–195 (39–44)	36 (1.42)	152–162 (34–36)
19.8* (0.78)	ca 200 (45)	28 (1.10)	229 (37)
		25.9* (1.02)	–

* Fully compressed

Group 23 Fuel system

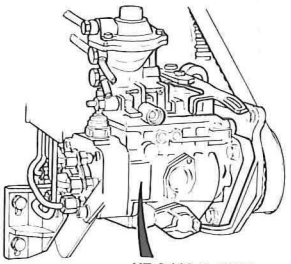
Injection timing, idle

Engine type	Market	Injecting timing,* mm Adjusting (checking)	Engine speed r/s (r/min)	
			Idle	Max
D 24	–1986	0.70 (0.65–0.73)	12.5 (750)	90 (5 400)**
	1987–	0.80 (0.77–0.85)	12.5 (750)	90 (5 400)
D 24 T	**USA+Canada**			
	1982–1983	0.80 (0.77–0.85)	12.5 (750)	90 (5 400)
	1984 Federal+Canada	0.85 (0.82–0.90)	12.5 (750)	90 (5 400)
	California	0.75 (0.72–0.80)	12.5 (750)	90 (5 400)
	1985–	0.75 (0.72–0.80)	13.8 (830)	90 (5 400)
	Austria 1987–	0.75 (0.72–0.80)	13.8 (830)	90 (5 400)
	Other markets	0.90 (0.87–0.95)	13.8 (830)	90 (5 400)
D 24 TIC		0.90 (0.87–0.95)	13.8 (830)	90 (5 400)

*Injection timing = pump piston stroke at t.d.c.
** –1985 = 87 (5 200).

Fuel injection pump

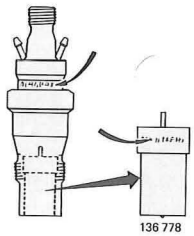
Type ..... Distributor pump
Model and designation ..... Bosch VE6/10 F 2400 + designation below


VE 6/10 F 2400...-.
136 777

Engine type	Market	Man	Aut
D24		L32-2	L32-3
D24T	**USA+Canada** 1982–83 Federal+Canada California **USA+Canada** 1984 Federal+Canada California **USA+Canada** 1985–, **Austria** 1987– **Other markets**	L116-3 L144 L144 L135 L194 L116	L116-2 L144-1 L144-1 L135-1 L194-1 L116-1
D24TIC	740/760 780 –86 780 87–	TIC 2 TIC 1 TIC 3	TIC 2–1 – –

Injectors

Model and designation: (complete) D24 ..... Bosch KCA 30 SD 27/4 (44)
D24T/TIC Engines ..... Bosch KCA 30 S 36/4


136 778

Engine type	Injector — complete		Distributor (Bosch)	
	Designation	Volvo P/N	Designation	Volvo P/N
D24	068 130 201 E	1 257 144	DNO SD 193	1 257 146
	068 130 201 E	1 328 336	DNO SD 293	1 328 298
	068 130 201 F	1 328 073	DNO SD 1930	1 328 096
D24T (USA+Can. Austria 1987–)	068 130 201 H	1 328 209	DNO SD 1930	1 328 096
D24T (Others)	068 130 201 B	1 328 208	DNO SD 1930	1 328 298
D24TIC	068 130 201 B	1 328 108	DNO SD 293	1 328 298

		D24	D24T, D24TIC
Injector opening pressure,			
checking	MPa (psi)	12.0–14.0 (1707–1991)	14.5–16.3 (2062–2318)
adjusting	MPa (psi)	13.0–13.8 (1849–1963)	15.5–16.3 (2205–2318)

Tightening torques

	Nm	ft lb
Injectors, in cylinder head	70	52
upper-lower sections	70	52
Fuel injection pump, pump gear	45	33

Group 25 Intake and exhaust systems

Turbocharger

Charge pressure

D 24 T, at 3 000 r/min (full load)	70–77 kPa	10–11 psi
Pressure sensor		
Cut-out point, approx	80–85 kPa	11–12 psi
D 24 TIC, at 2 400 r/min (full load)	90–100 kPa	13–14 psi
Overpressure safety valve, opens	110–130 kPa	13–18 psi

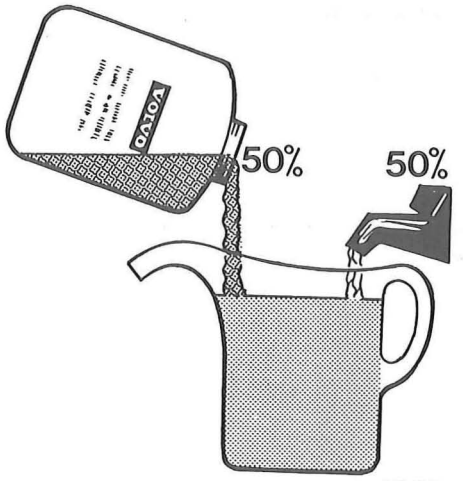
Tightening torques

Use sealing paste (P/N 1 161 035-9) on bolts below.

	Nm	ft lb
Mounting nuts, front exhaust manifold-turbo D 24 T	25	18
D 24 TIC	20	15
Mounting bolts, turbine housing	20	15
compressor housing	18	13
rear housing (with waste gate) D 24 T	20	15
D 24 TIC	25	18
D 24 TIC Lock nut, pull rod – pressure actuator	6	4
D 24 TIC Pressure actuator nuts	6	4
Mounting bolts, turbocharger – exhaust manifold	60	45

Group 26 Cooling system

General



128 187

	D24	D24T	D24TIC
Capacity,* with manual gearbox..... litres (US qts)	9.5 (9.9)	11.0 (11.6)	11.5 (12.2)
with aut. gearbox..... litres (US qts)	9.2 (9.7)	10.0 (10.6)	11.5 (12.2)

* If tropic type radiator is fitted add 0.6 (0.6) to above.

Coolant

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

Use genuine Volvo coolant **type C (blue-green)** diluted with **clean** water in proportions of **50/50**. This mixture helps to prevent corrosion and frost damage.

- Never top-up the cooling system with water alone. Use genuine Volvo coolant diluted with clean water in proportions of 50/50.
- The coolant should be changed every 25,000 miles (40,000 km) since the corrosion-protective additives in the coolant lose their effect in time.
- Clean cooling system with solvent (P/N 1 161 328-8) prior to filling new coolant.

Important: do not operate engine if cooling system is not topped-up. Failure to observe this may cause high local temperatures which could cause cylinder head to fracture.

Expansion tank

Pressure valve in cap opens at:		
overpressure, early type	kPa (psi)	100 (14.2)
late type	kPa (psi)	150 (21)
underpressure.....	kPa (psi)	10 (1.4)

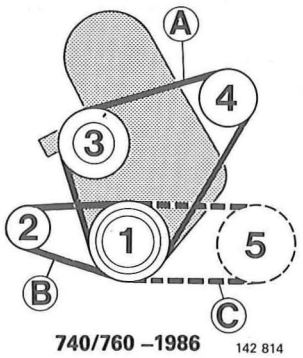
Thermostat

Marking.....	87°C	
Starts to open at.....	87°C	189°F
Fully open at	102°C	216°F
Opening dimension, min	8 mm	0.31 in

Drive belts

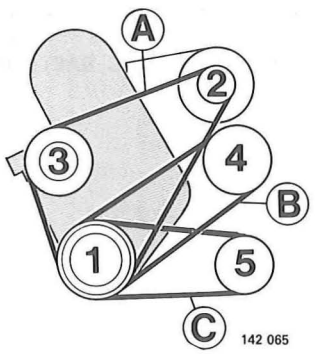
Profile × length:

A HC 38 × 1 238	A HC 47 cog × 1 150
B HC 38 × 750	B HC 38 cog × 1 013
C HC 50 × 913	C HC 50 cog × 913



740/760 –1986 142 814

1 Crankshaft pulley
2 Alternator
3 Fan
4 Power pump
5 AC compressor



142 065

780 1986 + 740/760 1987

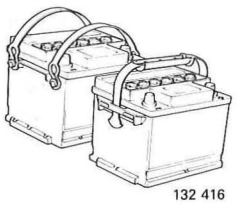
Tightening torque

	Nm	ft lb
Fan.....	9	6.6

Section 3 Electrical system

Group 31 Battery 118
Group 32 Alternator 118
Group 33 Starter motor 123
Group 35 Lighting 127
Group 37 Fuses 128
Group 38 Instrumentation 137

Group 31 Battery


132 416

System voltage ..... 12 V
Earth connection ..... Negative terminal

Battery capacity

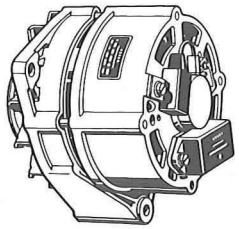
Model	Cold start current* CCA SAE	Reserve capacity* RC SAE (DIN)	Recommended charging current
B 23 ET, B 28 A/E, B 280 E		(66 Ah)	7 A
D 24, D 24 T –1986		(88 Ah)	9 A
D 24, D 24 T, D 24 TIC 1987–	600 A	125 min	9 A
B 19/23, B 200, B 230, France	330 A	70 min	5 A
B 19/23, B 200/230, not France, B 28 F, B 280 F	450 A	90 min (55 Ah)	6 A

1991– type and market adaption

Volvo P/N	Cold start current* CCA SAE	Reserve capacity* RC SAE (DIN)	Recommended charging current
3 515 893	440 AMP	85 min (50 Ah)	6 A
3 515 895	520 AMP	100 min (60 Ah)	7 A
3 515 897	600 AMP	125 min (70 Ah)	9 A

* **Cold start current (CCA, SAE)** is the discharge current that a battery can deliver for 30 sec at a temperature of –18°C (0°F) without dropping below 7.2 V.
Reserve capacity (RC, SAE) is the time required at +27°C (80°F) for a steady discharge current of 25 A to reduce the potential of a fully charged battery to 10.5 V.

Group 32 Alternator



132 417

Bosch K1 14 V 55 A 20

Max amperage	55 A	
Max output	770 W	
Max speed	225 r/s (13 500 r/min)	
Direction of rotation	Clockwise	
Diameter, slip rings, new	28 mm	1.102 in
min (after machining)	26.8 mm	1.055 in
Max permissible runout, slip rings	0.03 mm	0.0012 in
rotor body	0.05 mm	0.0019 in
Carbon brush spring force	3–4 N	0.6–0.9 lb
Min length, carbon brushes	5 mm	0.2 in
Tightening torque, attaching screws	4 Nm	3 ft lb
pulley nut	40 Nm	30 ft lb

Test values

Resistance, rotor winding	3.4–3.7 Ω
stator	0.14–0.15 Ω phase*
Amperage at 14 V (min value)	36 A at 33.3 r/s (2 000 rpm)
	47 A at 50 r/s (3 000 rpm)
	52 A at 66.7 r/s (4 000 rpm)

* A low range ohm meter should be used.

Bosch N1 14 V 70 A 20

Max amperage	70 A	
Max output	980 W	
Max speed	225 r/s (13 500 r/min)	
Direction of rotation	Clockwise	
Diameter, slip rings, new	28 mm	1.102 in
min (after machining)	27 mm	1.063 in
Max permissible runout, slip rings	0.03 mm	0.0012 in
rotor body	0.05 mm	0.0019 in
Carbon brush spring force	3–4 N	0.6–0.9 lb
Min length, carbon brushes	5 mm	0.2 in
Tightening torque, attaching screws	4 Nm	3 ft lb
pulley nut	35–45 Nm	30 ft lb

Test values

Resistance, rotor winding	3.4–3.7 Ω
stator	approx 0.1 Ω phase*
Amperage at 14 V (min value)	46 A at 33.3 r/s (2 000 rpm)
	58 A at 50 r/s (3 000 rpm)
	64 A at 66.7 r/s (4 000 rpm)

* A low range ohm meter should be used.

Bosch N1 14 V 31/80 A

Max amperage	80 A	
Max output	1 120 W	
Max speed	250 r/s (15 000 r/min)	
Direction of rotation	Clockwise	
Diameter, slip rings, new	28 mm	1.102 in
min (after machining)	26.8 mm	1.056 in
Max permissible runout, slip rings	0.03 mm	0.0012 in
rotor body	0.05 mm	0.0019 in
Carbon brush spring force	3–4 N	0.6–0.9 lb
Min length, carbon brushes	5 mm	0.2 in
Tightening torque, attaching screws	4 Nm	3 ft lb
pulley nut	45–55 Nm	33–40 ft lb

Test values

Resistance rotor winding	2.9 Ω
stator	approx. 0.09 Ω phase
Amperage at 14 V (min value)	31 A at 25 r/s (1 500 rpm) 80 A at 100 r/s (6 000 rpm)

Bosch N1 14 V 34/90 A 20

Max amperage	90 A	
Max output	1 260 W	
Max speed	225 r/s (13 500 rpm)	
Direction of rotation	Clockwise	
Diameter, slip rings, new	28 mm	1.102 in
min (after machining)	27 mm	1.063 in
Max permissible run-out, slip rings	0.03 mm	0.0012 in
rotor body	0.05 mm	0.0019 in
Carbon brush spring force	3–4 N	0.6–0.9 lb
Min length, carbon brushes	5 mm	0.2 in
Tightening torque, attaching screws	4 Nm	3 ft lb
pulley nut	35–45 Nm	30 ft lb

Test values

Resistance, rotor winding	2.8–3.1 Ω
stator	0.07–0.08 Ω*
Amperage at 14 V (min value)	34 A at 25 r/s (1 500 rpm) 60 A at 33.3 r/s (2 000 rpm) 90 A at 100 r/s (6 000 rpm)

* A low range ohm meter should be used.

Bosch N1 14 V 31/100 A

Max amperage	100 A	
Max output	1 400 W	
Max speed	250 r/s (15 000 rpm)	
Direction of rotation	Clockwise	
Diameter, slip rings, new	28 mm	
min (after machining)	27 mm	1.063 in
Max permissible run-out, slip rings	0.03 mm	0.0012 in
rotor body	0.05 mm	0.0019 in
Carbon brush spring force	3–4 N	0.6–0.9 lb
Min length, carbon brushes	5 mm	0.2 in
Tightening torque, attaching screws	4 Nm	3 ft lb
pulley nut	45–55 Nm	33–40 ft lb

Test values

Resistance, rotor winding	2.6 Ω
stator	ca 0.05 Ω
Amperage at 14 V (min value)	31 A at 25 r/s (1 500 rpm) 100 A at 100 r/s (6 000 rpm)

* A low range ohm meter should be used.

Bosch NC 14 V 60/120 A

Volvo P/N	3 523 420
Bosch number	0 120 465 006
Max amperage	120 A
Max output	1 680 W
Max speed	300 r/s (18 000 r/min)
Direction of rotation	Clockwise
Diameter, slip rings, new	15 mm (0.59 in)
min (after machining)	14 mm (0.55 in)
Max permissible run-out, slip rings	0,003 mm (0.0001 in)
rotor body	0,005 mm (0.0002 in)
Carbon brush spring force	3–5 N (0.3–0.5 kp)
Min length, carbon brushes	5 mm (0.2 in)
Tightening torque, attaching screws	4 Nm (3 ft lb)
pulley nut	45–55 Nm (33–40 ft lb)

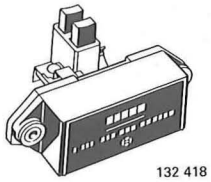
Test values

Resistance, rotor winding	2,6 Ω
stator	0,02 Ω
Amperage at 14 V (min value)	60 A vid 30 r/s (1 800 r/min) 120 A vid 100 r/s (6 000 r/min)

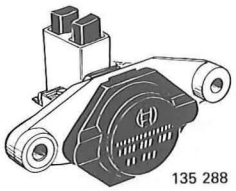
Nippon Denso 80 A

Volvo P/N	1 398 327
Nippon Denso number	100 211-8370
Max amperage	80 A
Max output	1 120 W
Max speed	300 r/s (18 000 r/min)
Direction of rotation	Clockwise

Charging regulator, 1982–1984



Early type



Late type

Designation, early type	Bosch 0 192 052 027
late type	Bosch 1 197 311 008

TEST CONDITIONS	In car	On test bench
State battery charge	min ¾	fully charged
Air temperature	+25°C (77°F)	+25°C (77°F)
Temperature, warm regulator	+60–80°C (140–176°F)	+60°C (140°F)

Test values

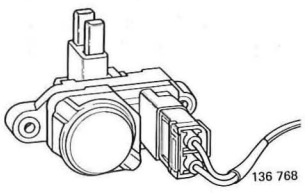
Alternator speed	100 r/s (6 000 rpm)	100 r/s (6 000 rpm)
Engine speed	approx 50 r/s (3 000 rpm)	–
Alternator load	30–50 A*	5 A
Control voltage, between B+ and D– alternator terminals:		
Cold regulator (reading taken within 1 min)	14.1–14.8 V	14.4–14.8 V
Warm regulator (run min. 15 min at 3000 r/min)	13.4–14.2 V	13.8–14.3 V

Control tolerance

Load 55 A alternator to	47 A (rated output × 0.85)
70 A	60 A (rated output × 0.85)
90 A	77 A (rated output × 0.85)

The control voltage should now be between 0 and 0.3 Volt lower than the previous reading.

* Load achieved when engine running.



Charging regulator, 1985–

TEST CONDITIONS	In car	On test bench
State of battery charge	min ¾	fully charged
Air temperature	+25°C (77°F)	+25°C (77°F)
Temperature, warm regulator	+60–80°C (140–176°F)	+60°C (140°F)

Test values

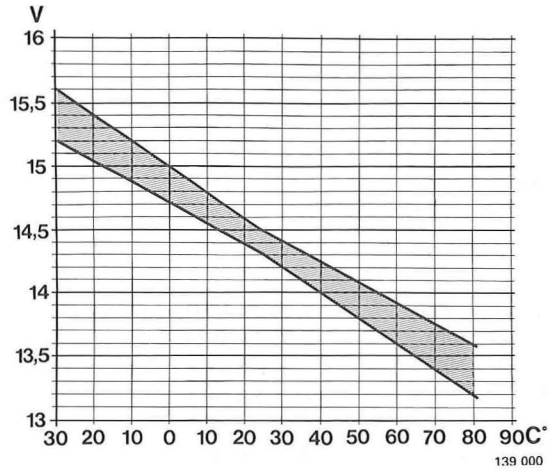
Alternator speed	100 r/s (6000 r/min)	100 r/s (6000 r/min)
Engine speed	approx 50 r/s (3000 r/min)	–
Alternator load	30–50 A*	5 A
Control voltage, between B+ and D– alternator terminals	13.8–14.6 V	14.1–14.9 V

* Load achieved when engine running.

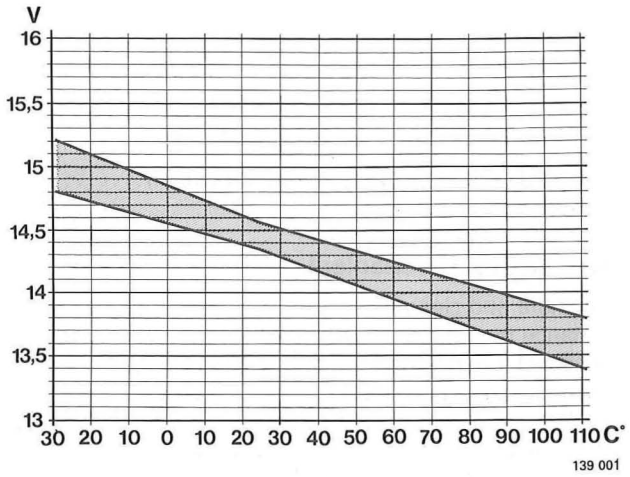
Control tolerance (on test bench)

Load 55 A alternator to	47 A (rated output × 0.85)
70 A	60 A (rated output × 0.85)
80 A	68 A (rated output × 0.85)
90 A	77 A (rated output × 0.85)

The control voltage should now be between 0 and 0.3 Volt lower than the previous reading.

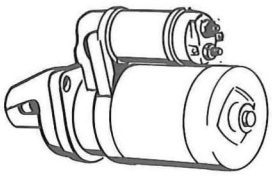


External voltage-temperature
5 A load



Internal voltage-temperature
5 A load

Group 33 Starter motor



Bosch GF 12 V 1.1 kW (0 001 311 1. .)

Volvo P/N 463 856, 464 316, 464 317, 1 346 707

Direction of rotation (viewed towards pinion)	Clockwise
Output	1.1 kW (1.5 hp)

Test values, mechanical

Armature end clearance	0.01–0.3 mm	0.0004–0.012 in
Brush spring force	18–21 N	4.1–4.7 lb
Distance from pinion to ring gear	1.0–3.8 mm	0.039–0.149 in
Frictional torque, armature brake	25–40 Ncm	2.2–3.5 in. lb.
Pinion idling torque	14–22 Ncm	1.7–2.6 in. lb.
Backlash	0.3–0.5 mm	0.0118–0.0196 in
Pinion modulus	2.12 mm	0.0835 in
Commutator, min. diameter	33.5 mm	1.319 in
Carbon brushes, min length	13 mm	0.512 in
Max radial runout, commutator and armature body	0.05 mm	0.0019 in

Test values, electrical

Unloaded starter motor: 11.5 V and max. 70 A	min 125 r/s (7 500 rpm)
Locked starter motor: 7.4 V and 480–560 A	0 r/s and min 16 Nm
6.5 V and 410–490 A	0 r/s and min 15 Nm
Minimum cut-in voltage, control solenoid	8 V

Bosch DW 12 V 1.4 kW (0 001 108 . . .)

Volvo P/N 1 357 199, 1 398 702, 1 398 764
3 523 301, 3 523 302, 3 523 303

Direction of rotation (viewed towards pinion)	Clockwise
Output	1.4 kW (1.9 hp)

Test values, mechanical

Armature end clearance	0.05–0.4 mm	0.0020–0.0158 in
Distance from pinion to ring gear	2.0–3.0 mm	0.0788–0.1182
Frictional torque, armature brake	0.9–1.4 Nm	3.9–6.5 in. lb.
Pinion idling torque	0.12–0.18 Nm	2.4–3.4 in. lb.
Backlash	0.3–0.6 mm	0.014—0.023 in
Pinion modulus	2.12 mm	0.0835 in
Commutator, minimum diameter	31.2 mm	1.229 in
Carbon brushes, min length	8.0 mm	0.315 in
Max. radial run-out, commutator and armature	0.05 mm	0.0019 in

Test values, electrical

Unloaded starter motor 11.5 V and max. 75 A	min 48 r/s (2 900 rpm)
Starter motor locked, 4.5 V and 625–800 A	0 r/s and min 16 Nm
Lowest cut-in voltage, control solenoid	7.3 V

Bosch DW(R) 12 V 1,7 kW (0 001 110 063)

Volvo P/N 1 363 912

Direction of rotation (viewed towards pinion)	Clockwise
Output	1.7 kW (2.3 hp)

Test values, mechanical

Armature end clearance	0.05–0.04 mm	(0.002–0.016 in)
Distance from pinion to ring gear	2–3 mm	(0.08–0.12 in)
Frictional torque, armature brake	0.9–1.5 Nm	(8–13 in lb)
Pinion idling torque	0.12–0.18 Nm	(1.1–1.6 in lb)
Backlash	0.3–0.6 mm	(0.01–0.024 in)
Pinion modulus	2.11 mm	(0.831 in)
Commutator, minimum diameter	31.2 mm	(1.23 in)
Carbon brushes, min length	6 mm	(0.24 in)
Max. radial run-out, armature	0.05 mm	(0.002 in)
commutator	0.01 mm	(0.0004 in)

Test values, electrical

Unloaded starter motor, 11.2 V and max. 95 A	min 2 800 r/min
Starter motor locked, 3.8 V and 650–840 A	0 r/s
Lowest cut-in voltage, control solenoid	7.3 V

Bosch JF 12 V 2 kW (0 001 362. . .)

Volvo P/N 1 257 939

Direction of rotation (viewed towards pinion)	Clockwise
Output	2 kW (2.7 hp)

Test values, mechanical

Armature end clearance	0.01–0.3 mm	(0.0004–0.012 in)
Carbon brush spring force	23–25 N	(5.2–5.6 lb)
Distance from pinion to ring gear	2.5–3 mm	(0.1–0.12 in)
Frictional torque, armature brake	0.44–0.74 Nm	(3.9–6.5 in lb)
Pinion idling torque	0.27–0.39 Nm	(2.4–3.4 in lb)
Backlash	0.35–0.60 mm	(0.014–0.024 in)
Pinion modulus	2.12 mm	(0.0835 in)
Commutator, minimum diameter	42.5 mm	(1.67 in)
Carbon brushes, min length	8.5 mm	(0.33 in)
Max. radial run-out, commutator and armature	0.05 mm	(0.002 in)

Test values, electrical

Unloaded starter motor, 11.5 V and max. 95 A	min 108 r/s (6 500 rpm)
Starter motor locked, 4.5 V and 700–880 A	0 r/s and min 44 Nm
Lowest cut-in voltage, control solenoid	7.5 V

Bosch EV 12 V 2,2 kW (0 001 218. . .)

Volvo P/N 1 328 392

Direction of rotation (viewed towards pinion)	Clockwise
Output	2,2 kW (3.0 hp)

Test values, mechanical

Armature end clearance	0.05–0.3 mm	0.0020–0.0118 in
Distance from pinion to ring gear	2–3 mm	0.079–0.118 in
Frictional torque, armature brake	1.0–1.5 Nm	8.8–13.2 in lb
Pinion idling torque	0.27–0.35 Nm	2.4–3.1 in lb
Backlash	0.3–0.6 mm	0.0118–0.023 in
Pinion modulus	2.12 mm	0.0835 in
Commutator, minimum diameter	28.9 mm	1.139 in
Carbon brushes, min length	7.0 mm	0.276 in
Max. radial run-out, armature	0.05 mm	0.0019 in
commutator	0.01 mm	0.0004 in

Test values, electrical

Unloaded starter motor, 10.5 V and max. 160 A	min 70 r/s (4 200 rpm)
Starter motor locked, 3.0 V and 720–950 A	0 r/s and min 25 Nm
Lowest cut-in voltage, control solenoid	7.8 V

HITACHI 12 V 1.4 kW S114-232 A

(Volvo P/N 1 357 373)

Output	1.4 kW (1.9 hp)

Test values, mechanical

Armature axial clearance	0.03–0.1 mm (0.0012–0.0039 in)
Brush spring tension	13.7–17.7 N (1.4–1.8 kp)
Pinion modulus	2.12 mm
Idle clearance	0.3–1.5 mm (0.012–0.060 in)
Minimum diameter of commutator	39 mm (0.1536 in)
Minimum length of brushes	11 mm (0.433 in)

Test values, electrical

Unloaded starter motor, 12 V and max. 60 A	min. 117 r/s (7 000 rpm)
Starter motor under load: 10.3 V, 200 A	min 37 r/s (2 200 rpm) and min. 4.6 Nm
Starter motor locked: 6 V and max. 650 A	0 r/s and min. 19 Nm
Lowest cut-in voltage, control solenoid	8 V

HITACHI 12 V 2.0 kW S13-91

(Volvo P/N 1 328 391)

Direction of rotation (viewed towards)	Clockwise
Output	2.0 kW (2.7 hp)

Test values, mechanical

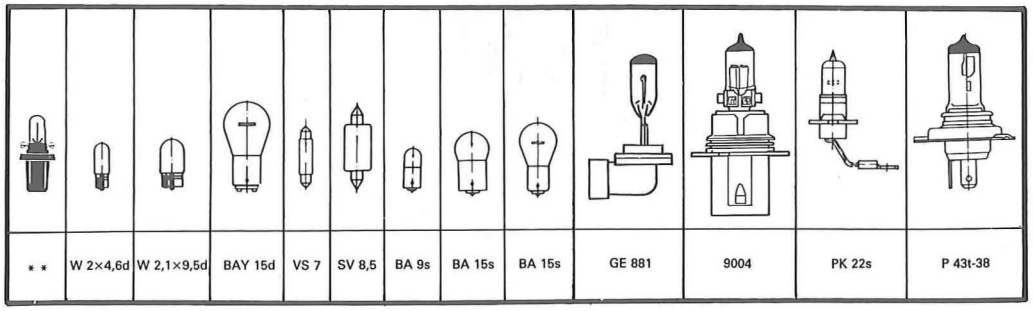
Armature end clearance	0.2–0.5 mm (0.0079–0.0197 in)
Brush spring force	26.5–32.4 N (6.0–7.3 lb)
Pinion modulus	2.12 mm (0.0835 in)
Pinion backlash	0.3–1.5 mm(0.0118–0.0591 in)
Commutator, min diameter	35.5 mm (1.40 in)
Carbon brushes, min length	9 mm (0.35 in)

Test values, electrical

Unloaded starter motor, 11 V & max 140 A	min 65 r/s (3 900 rpm)
Loaded starter motor, 8.8 V, 300 A	min 25 r/s (1 500 rpm) and min 8.3 Nm
Locked starter motor, 3 V, max 880 A	0 r/s & min 24.5 Nm
Minimum cut-in voltage, control solenoid	8 V

Group 35 Lighting

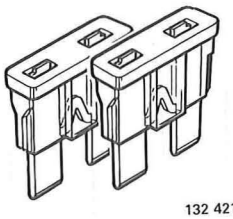
Bulbs



	Rating	Socket	USA	Qty
Headlight	60/55 W	P 45t–38 (H4)	–	2
Headlight USA, CDN, outer	35/35 W	"Sealed Beam"	H 4656	2
inner	50 W	"Sealed Beam"	H 4651	2
Headlight 760 1988–/780 USA, CDN	50/70 W	"Semi-sealed"	9004/HB1	2
Parking/day running lights (certain markets)	21/5 W	BAY 15d		2
Parking lights (other markets)	5 W (4 cp)	BA 15s		2
Parking lights, 780	4 W	BA 9s		2
Parking lights, 780 USA/Canada	4 W	W 2.1×9.5d		2
Turn signals, front	21 W (32 cp)	BA 15s		2
Turn signals, front USA/Canada	24/2.2 cp	BAY 15d	1157 NA	2
Turn signals, side (certain markets)	5 W	W 2.1×9.5d		2
Turn signals, rear	21 W (32 cp)	BA 15s	1156	2 (4*)
Fog/spot lights	55 W	PK 22s (H3)		2
Foglight 760 1988– USA, CDN	27 W	–	GE 881	2
Tail lights	5 W (4 cp)	BA 15s		2 (4*)
Brake lights	21 W (32 cp)	BA 15s		2
Brake lights/tail lights	21/5 W, (32/3 cp)	BAY 15d		2
High-level brake lights 1986	20 W	BA 9s		1
High-level brake lights 1987–	21 W	BA 15s		1
Rear foglight (brake light)	21 W (32 cp)	BA 15s		2
Reversing (back-up) lights	21 W (32 cp)	BA 15s		2
Side marker light, rear USA, CDN	4 W	BA 9s	–	2
Side marker lights, rear 780 USA/Canada	4 cp	BA 15s		2
Numberplate light	4 W	BA 9s		2
Courtesy lighting	10 W	SV 8.5		1
Reading light, front	5 W	W 2.1×9.5d		2
Reading light, rear	5 W	W 2.1×9.5d		2
Vanity mirror light	3 W	SV 7		2
Glove compartment light	2 W	BA 9s		1
Door open warning lights	3 W	W 2.1×9.5d		4
Engine bay/boot (trunk) light	10 W	SV 8.5		1
Door instep light, 780	5 W	SV 8.5		2
Instrument panel lighting				
Indicator and warning lights, VDO	1.2 W	**		16
Indicator and warning lights, Yazaki	1.2 W	W 2×4.6d		16
Lighting	3 W	W 2.1×9.5d		3
Control and panel lighting	1.2 W	W 2×4.6d		12

* 780.
** Inc. holder, see fig.

Group 37 Fuses



132 421

1982–1983

Fuse number	Circuits protected	Fuse rating
30 + feed (circuits always live, ignition off)		
1*	Fuel pumps E-engines (fuel injection B 23 ET) (via fuel pump relay)	25 A
2*	Four-way hazard warning lamps Headlight flasher (via fuses 17 and 18) Central locking system	25 A
3	Extra lights (spot/fog lamps in air dam/ front spoiler)	15 A
4	Brake lights	15 A
5	Clock Vanity mirror lamp Glove compartment lamp Engine and luggage compartment lamps Interior lamp Power aerial Door warning lamps Radio	15 A
15 + feed (ignition II & III) (fuses 6 a 7 via relay)		
6	Electric cooling fan	25 A
7	Power windows	30 A
8	Direction indicators Constant idling (E & F engines) Solenoid valve (carb) Hot start valve (carb) Overdrive relay Relay glow plugs, Diesel	15 A
9	Electrically heated rear window Power sun roof	30 A
10	Instrumentation Reversing (back-up) lights Heated front seats Seat belt reminder *Spade terminals + 15 in central electrical unit:* – Relay fuel pump – Relay power windows/electric cooling fan – Oil level sensor Delay valve AC Bulb failure warning Seat belt reminder (USA & Canada)	25 A
11	Day running lights Cruise control Heater fan, CU low speed ACC	25 A

1982–1983

Fuse number	Circuits protected	Fuse rating
X-feed (ignition I & II)		
12	Cigar lighter Radio Power door mirrors Power seats	15 A
13	Horn Windshield wash/wipe (intermittent relay) Headlamp wash/wire	25 A
14	Heater fan, other speeds	30 A
15	Tank pump E and F-engines via fuse number 1 (only in circuit when starting and when engine is running)	15 A
Main and dipped beams		
16	Rear fog lamps	15 A
17	Indicator lamp, main beam Main beam, left	15 A
18	Main beam, right Relay, spot lights	15 A
19	Dipped beam, left	15 A
20	Dipped beam, right	15 A
Feed from light switch (58)		
21	Instrument and control lighting, front Tail and parking lights, left Number (license) plate light Light warning buzzer	15 A
22	Seat belt lock and ashtray light, rear Lighting, switches on trans tunnel Tail and parking lights, right Relay, fog lamp (Sweden)	15 A

*Applies to 1983 models.
1982 models:

1	Four-way hazard warning lamps Headlight flasher (via fuses 17 and 18) Central locking system	25 A
2	Fuel pumps E-engine (via fuel pump relay)	25 A

1984

Fuse number	Circuits protected	Fuse rating
30 + feed (circuits always live)		
1	Fuel pumps E-engines + CI system (via fuel pump relay) Fuel injection ((B 23 ET)	25 A
2	Four-way hazard warning lamps Headlight flasher (via fuses 17 and 18) ABS	25 A
3	Extra lights (spot/fog lamps in air dam/ front spoiler) Rear fog lamp relay	15 A
4	Brake lights	15 A
5	Clock Vanity mirror lamp Glove compartment lamp Engine and luggage compartment lamps Interior lamp Power aerial Door warning lamps Radio	15 A
15+I-feed via relay (ignition II) (fuses 6&7 via relay)		
6	Electric cooling fan Fasten seat belt light Heated seats	25 A
7	Power windows	30 A
8	Day running lights Bulb failure sensor Relay, power windows + cooling fan	15 A
9	Heated rear window Power sun roof Air conditioning	30 A
15+R-feed (ignition II & III)		
10	Instrumentation Reversing (back-up) lights Ignition setting Cruise control *Spade terminals + 15 in central electrical unit:* – Oil level sensor – Seat belt reminder (USA) – Exhaust gas temp sensor – Relay, temp controlled ign. advance) – Converter (ABS)	15 A (25 A)
11	Direction indicators Overdrive relay Constant idle speed system Glow plug relay Hot spot relay Warm start-valve (carb. engines)	15 A (25 A)

1984

Fuse number	Circuits protected	Fuse rating
X-feed (ignition I & II)		
12	Cigar lighter Radio Power door mirrors Power driver's seat	15 A
13	Horn Windshield wash/wipe (intermittent relay) Headlamp wash/wipe	25 A
14	Fan motor Air conditioning	30 A
15	Tank pump E and F-engines via fuse number 1 (only in circuit when starting and when engine is running)	15 A
Main and dipped beams		
16	Rear fog lamps (UK + S) Headlamp cut-out	15 A
17	Indicator lamp, main beam Main beam, left	15 A
18	Main beam, right Relay, spot lights	15 A
19	Dipped beam, left	15 A
20	Dipped beam, right	15 A
Feed from light switch (58)		
21	Instrument and control lighting, front Tail and parking lights, left Number (license) plate light	15 A
22	Seat belt lock and ashtray light, rear Panel light, auto selector lever Lighting, switches on trans tunnel Tail and parking lights, right Relay, auxiliary lamps	15 A

760 1985–1987
740 1985–1988

Fuse number	Circuits protected	Fuse rating
1	Fuel pumps E-engines & CI system (via fuel pump relay) Fuel injection (B 200 ET, B 230 ET) ETC	25 A
2	Hazard warning lights Headlight flash (via number 17 & 18) Central lock ABS	25 A
3	Relay, auxiliary lights (spot/fog in front spoiler) Relay, rear fog lights	15 A
4	Brake lights Gear shift indicator (USA & CDN)	15 A
5	Clock Vanity mirror light Glove compartment light Engine compartment and boot (trunk) light Courtesy lighting Radio Power aerial Door-open warning lamps	15 A
6	Heated front seats	30 A (15 A)
7	Electric cooling fan	25 A (30 A)
8	Power windows	30 A
9	Direction indicators Fasten seat belt light Heated front seats Power windows AC Electric cooling fan	15 A
10	Heated rear window Power sun roof Power door mirrors	30 A
11	Tank pump Heated Lambda-sond	15 A

760 1985–1987
740 1985–1988

Fuse number	Circuits protected	Fuse rating
12	Reversing (back-up) lights Indicator lamp, low oil level Overdrive Ignition advance Cruise control ABS	15 A
13	Fuel valve, diesel CIS Glow plugs, diesel Automatic choke	15 A
14	Power door mirrors Cigar lighter Radio Tailgate wiper	15 A
15	Horn Windscreen wiper Headlight wash/wipe	25 A
16	Heater fan AC	30 A
17	Main beams, left	15 A
18	Main beams, right Spot lamps	15 A
19	Dipped beam, left	15 A
20	Dipped beam, right	15 A
21	Instrument and panel lighting Tail lights & parking lights, left Numberplate lighting	15 A
22	Seat belt light & ashtray light, rear Selector panel light, automatic trans. Lighting, trans. tunnel switches Tail lights & parking lights, right Relay, auxiliary lights	15 A
23	Power seats Day running lights 1988–	15 A
24	Supplementary restraint system (air bag)	30 A
25	Day running lights Rear fog lights (USA & CDN) Dim/Dip (UK)	15 A
26	Power driver's seat	30 A

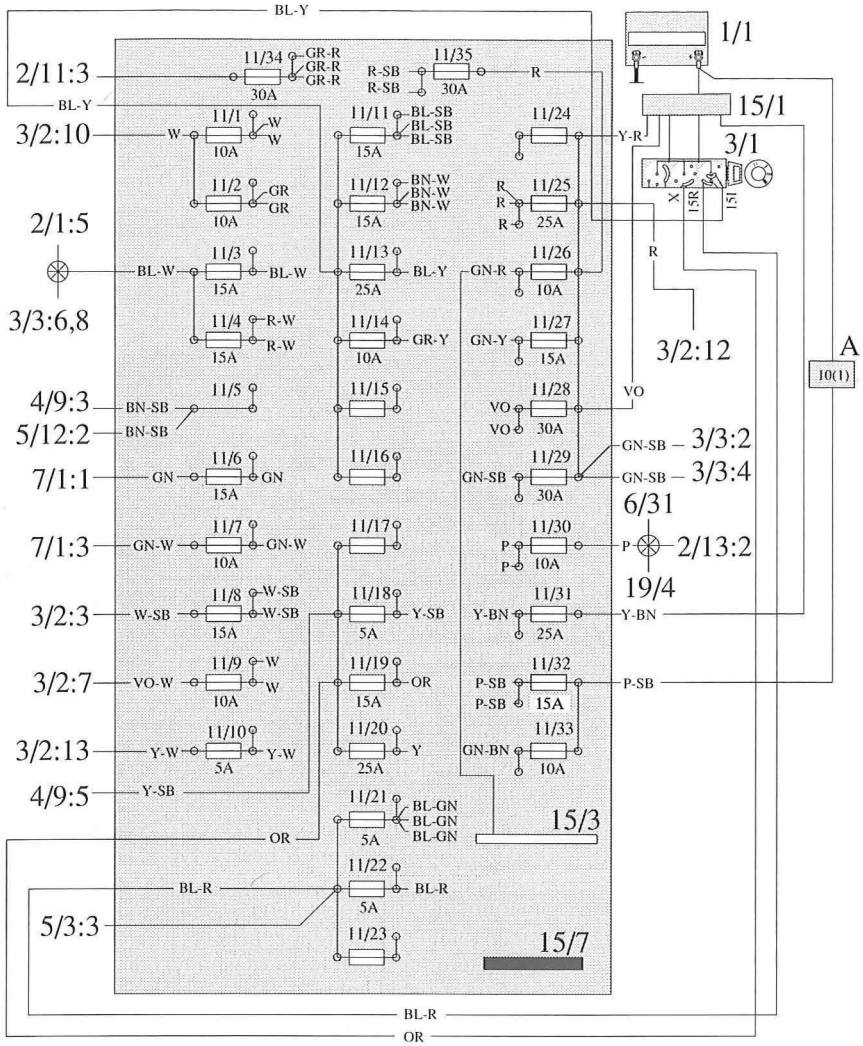
740 1989–1990

Fuse number	Circuits protected	Fuse rating
1	Fuel pumps, injection engines Relay, Motronic, LH-Jetronic	25 A
2	Hazard warning lights Headlight flash (via number 17 & 18) Central locking	25 A
3	Relay, auxiliary lights Relay, rear foglight	15 A
4	Brake lights Gear shift indicator	15 A
5	Clock Vanity mirror Glove compartment light Engine/boot lights Courtesy lighting Radio Power aerial Door-open warning lamps	15 A
6	Heated front seats (1989) ECC	30 A
7	Electric cooling fan (1989)	25 A
8	Power windows	30 A
9	Direction indicators AC, ACC Seat belt reminder (USA/CDN) Power windows/electric cooling fan Heater fan Power front seats Hot start valve	15 A
10	Heated rear window Power sunroof Power door mirrors	30 A
11	Fuel tank pump Heated Lambdasond	15 A
12	Reversing (back-up) lights Overdrive relay Spade connectors (+15), central electrical unit Exhaust gas temp. sensor Cruise control	15 A
13	Fuel valve, diesel Glow plugs, diesel Charge pressure limiter, Turbodiesel Hot spot Fuel cut-off valve Idle valve Idle advance PTC resistor	15 A

740 1989–1990

Fuse number	Circuits protected	Fuse rating
14	Power door mirrors Cigar lighter Radio Tailgate wiper, interval relay	15 A
15	Horn Windscreen wipers Headlight wipers	25 A
16	Heater fan	15 A
17	High beam, left Indicator lamp. high beam	15 A
18	High beam, right Relay, aux. lights Foglights	15 A
19	Low beam, left Foglights	15 A
20	Low beam, right	15 A
21	Parking lights, left front & back Number plate lighting Instrument & control lighting	15 A
22	Parking lights, right front & back Lighting for seat belt locks & ashtray, rear Auto.trans panel light	15 A
23	Day running lights (1989) Heated front seats (1990)	15 A
24	Spare (SRS)	
25	DIM-DIP	15 A
26	Radio, amplifier	30 A

760 1988–1990



1/1 Battery
2/1 Main headlight relay
2/11 Electric cooling fan, relay
2/13 Motronic, LH-Jetronic, relay
3/1 Ignition switch
3/2 Light switch
3/3 Main/dipped beam switch
4/9 SRS crash sensor
5/3 3-pole combined instrument connection
5/12 12-pole combined instrument connection
6/31 Fuel pump
7/1 Bulb failure sensor, rear
11/1 – 35 Fuses
15/1 Positive terminal
15/3 30–circuit in fusebox
15/7 Ground connection via door switch
19/4 Clock

A Connector, left A-post
(Connector, right A-post, B 280 E/F)

Fuse	Circuit protected
1	Left parking light Numberplate lights
2	Right parking light
3	Left main beam
4	Right main beam
5	SRS test point
6	Left dipped beam
7	Right dipped beam
8	Foglight, front
9	Foglight, rear
10	Instrument and control lighting
11	Reversing (back-up) light Turn signals Cruise control
12	DIM/DIP
13	Heated rear window Heated door mirrors

Fuse	Circuit protected
14	15–circuit in relay box – bulb failure sensor, rear – exhaust temperature sensor – overdrive – power windows – power sunroof – fasten seat belt reminder
16	Spare
17	Spare
18	Radio
19	ECC Power door mirrors Tailgate wiper Power seats Cigar lighter
20	Horn Windscreen wipers Headlight wipers
21	ETC Glow plugs, diesel CIS
22	Spare

Fuse	Circuit protected
23	Spare
24	Spare
25	Hazard warning lights Central locking
26	30–circuit in fusebox – clock – courtesy lighting – door warning lights
27	Brake lights
28	ECC heater fan ECC
29	Power aerial Towing bracket lights
30	Tank pump Lambdasond
31	Fuel injection Main fuel pump
32	Amplifier, radio
33	Radio
34	Power windows Power sunroof
35	Heated seats Power seats

780 1988

Fuse No.	Circuit protected	Rating
1	Main fuel pump	25 A
2	Central locking, system, hazard warning lights, rear foglamps	25 A
3	Dipped beams, rear foglamps	15 A
4	Brake lights	15 A
5	Glove compartment lighting, clock, radio, engine compartment lighting, interior lighting, boot lighting, electric aerial, door courtesy lights, vanity mirror	15 A
6	Electrically-heated front seats	30 A
7	Electronic climate control (ECC)	30 A
8	Electric window winders	30 A
9	Seat belt reminder, direction indicators, air conditioning, electrically-heated front seats, electric window winders	15 A
10	Electrically-heated rear window, electrically-heated rear-view mirrors, electric sun roof	30 A
11	Fuel pump (tank pump), electrically-heated oxygen sensor (Lambdasond) (B 280 F)	15 A
12	Reversing lights, cruise control ignition on, automatic transmission disengagement	15 A
13	Automatic idling controls	15 A

780 1988

Fuse No.	Circuit protected	Rating
14	Power rear-view mirrors, cigarette lighter, radio, heater fan, air conditioning	15 A
15	Horn, windscreen wipers, windscreen washers	25 A
16	–	
17	LH main beam	15 A
18	RH main beam, supplementary main beam	15 A
19	LH dipped beam	15 A
20	RH dipped beam	15 A
21	LH parking lights, front and rear, number plate light. Illumination of ashtray, heater controls, rear window heater switch, electric sunroof switch. Illumination of instruments and switches to left of steering wheel	15 A
22	Illumination of seat belt locks RH parking lights, front and rear. Illumination of storage pocket between front seats. Supplementary main beams.	15 A
23	Relay, power seats	15 A
24	Power passenger seat	30 A
25	Rear foglamps (USA/CDN)	15 A
26	Power driver's seat	30 A

N.B. The system also includes a 10 A fuse for the ABS (anti-lock braking system) function. This is incorporated in the transient surge protector at the pedal mounting.

780 1989–1990

Fuse No.	Circuit protected	Rating
1	Main fuel pump	25 A
2	Central lock, hazard warning lights, main beam flash	25 A
3	Foglights, front & rear	15 A
4	Brake lights, power boot (trunk) release	15 A
5	Glove box light, clock, radio engine comp. light, courtesy light, boot light, power radio, door open warning lights, vanity mirror light, door instep light, central lock relay	15 A
6	ECC ECC heater fan	30 A
7	Heated front seats	30 A
8	Power windows	30 A
9	Fasten seat belt reminder, turn signals, heated front seats, power windows	15 A
10	Heated rear window, heated door mirrors, power sunroof	30 A
11	Fuel tank pump, heated Lambdasond (B 280 F, B 230 FT)	15 A
12	Reversing (back-up) lights, cruise control, 15-circuit card in central electrical unit, overdrive	15 A
13	Glow plugs (diesel), fuel valve (diesel), boost pressure limiter (turbodiesel), electric cooling fan	15 A

780 1989–1991

Fuse No.	Circuit protected	Rating
14	Power door mirrors, cigar lighter, radio, reading lamps (rear), ECC, power fuel tank flap release	15 A
15	Horn, windscreen wash/wipe, headlight wiper, power front seats	25 A
16	Amplifier, front	15 A
17	Main beam (left), indicator lamp main beam	15 A
18	Main beam (right), foglight	15 A
19	Dipped beam, left	15 A
20	Dipped beam, right	15 A
21	Parking lights (left), front & rear, numberplate light, lighting for: ashtray (front), heater control panel switch, heated rear window switch, power sunroof switch, instrument lighting & switches to left of steering wheel	15 A
22	Parking lights (right), front & rear Relay, front & rear foglights, auto. trans selector panel light, lighting for: heated front seat switches, storage box between front seats, rear ashtray	15 A
23	Relay, power front seats (1989) Amplifier, rear	15 A (25)
24	Power driver seat	30 A
25	Rear foglight (USA/CDN)	15 A
26	Power passenger seat	30 A

Additional fuses

ABS: one 10 A fuse incorporated in the transient surge protector at the pedal mounting

Radio amplifier (front & rear); two 30 A fuses next to battery (not Italy)

B 230 FT high output: one 10 A fuse mounted on left suspension tower

740/940 1991

Fuse number	Fed by	Circuits protected	Fuse rating
1	Battery +	Fuel pump Relay, injection system Ignition system Lambda-sond preheating (not B 230 FT)	25 A
2		Hazard flash lights Main beam flash (via fuse 17 and 18) Central locking	25 A
3		Power seats (motors) (X-relay, main beam, not fused)	15 A
4		Brake light switch Bulb failure warning – brake lights P-shift lock, solenoid	15 A
5		Clock Radio Power antenna Door warning lights Courtesy lights Make-up mirror Glove compartment light Trunk light	15 A
6		ECC, heater fan ECC, controll unit	30 A
7	30-busbar (battery+) or X-relay, main beam	Fog lights (940) Rear fog lights	30 A
8	Main relay, power and heating, seats	Power windows (motors)	30 A
9	Ignition switch 15 I	Fasten seat belt reminder Turn indicators Magnetic clutch, ECC comp. Relay, electric cooling fan Main relay, power and heating, seats P-shift inhibitor (solenoid) (ABS surge protector not fused)	15 A
10		Heated rear window Heated mirrors Power sun roof	30 A
11	Relay, injection system	Tank pump Lambda-sond, pre-heating (not B 230 FT)	15 A
12	Ignition switch 15	Back-up lights Overdrive relay, M 46 Bulb failure warning Exhaust temp. warn. (Japan) OD, AW 71 Cruise control	15 A

740/940 1991

Fuse number	Fed by	Circuits protected	Fuse rating
13	Ignition switch 15	Automatic preheating, diesel Fuel valve, diesel Charge pressure limiter turbo diesel EGR, diesel (Control unit, fuel system, not fused) (Control unit, ignition system, not fused) (Power stage, fuel system, not fused) (Diagnostic connector, not fused)	15 A
14	Ignition switch X	Radio Power mirrors Tailgate wash/wipe Cigar lighter	15 A
15		Horn Windshield wash/wipe Headlight wash/wipe Power seats (controls) (SRS Airbag not fused)	25 A
16		Heater fan (not ECC) ECC, control unit ECC, solenoid valves	30 A
17	X-relay, main beam	Left main beam Indicator light, main beam	15 A
18		Right main beam	15 A
19	Bulb failure warning	Left dipped beam Relay, front foglight Beam length control	15 A
20		Right dipped beam Beam length control	15 A
21	Main light relay	Left parking lights, front and rear Licence plate light Panel lights	15 A
22		Right parking lights, front and rear Relay, foglight front Belt and ashtray lights back Shift selector light Lights, switches and compartment on tunnel	15 A
23	Main relay, power and heating, seats	Heated front seat (power)	25 A
24		Reserve (SRS diagnosis socket)	
25	Ignition switch 15 I or light switch	Rear fog lights USA/CDN Automatic dipped beam EU/OS (can be turned off) Radio, USA/CDN/GB (lights) (Switch, fog lights, 940 USA/CDN not fused)	15 A
26	Battery +	Radio, amplifier	15 A

960 1991

Fuse number	Fed by	Circuits protected	Fuse rating
1	Light switch	Left parking lights, Licence plate light Bulb failure waring – outer rear lights	10 A
2		Right parking lights, Bulb failure warning – inner rear lights	10 A
3	Main light relay	Left main beam Left auxiliary beam	15 A
4		Right main beam Right auxiliary beam	15 A
5		SRS diagnostic socket	
6	Bulb failure warning, 9-pole	Left dipped beam Beam length control, left	15 A
7		Right dipped beam Beam length control, right	15 A
8	Light switch	Foglights front	15 A
9		Foglights rear Indicator light, foglights rear	10 A
10		Lighting: – Instrument panel – Controls – Mode selector – Beam length control – Sun roof – ECC controls – Radio – Clock – Cigar lighter – Ashtray, front and rear – Shift selector scale – Seat heating – Seat belt locks	5 A
11	Ignition switch 15l	Back-up lights Turn indicators Cruise control	15 A
12		Reduced dip beam (Dim-dip) P-shift inhibitor (control circuit)	15 A
13		Heated rear window Heated mirrors	25 A
14		Exhaust temp. warn. (Japan) Overdrive (M 46, AW 70/71) Power windows (controls) Power sun roof (controls) Heated seats (controls) Fasten seat belt reminder Bulb failure warning, 14-pole	10 A
15		Reserve	
16		Reserve	
17	Ignition switch X	Reserve	
18		Radio (SRS Airbag not fused)	5 A

960 1991

Fuse number	Fed by	Circuits protected	Fuse rating
19	Ignition switch X	Control unit, ECC Power mirrors Power seats (controls) Tailgate wash/wipe Cigar lighter	15 A
20		Horn Windshield wash/wipe Headlight wash/wipe	25 A
21	Ignition switch 15	Automatic pre-heat, diesel Mode selector	5 A
22		ABS (control unit) (Combined instrument not fused)	5 A
23		Control unit, AW 30–43 (A/power) Control unit, fuel system Relay, electric cooling fan (B 230/B 280) Diagnostic socket (B 6304)	10 A
24	Battery +	Control unit, AW 30–43 (B/memory) Control unit, fuel system Control unit, ignition system	10 A
25		Hazard flash lights Central locking (Light switch not fused)	25 A
26		Clock Courtesy lights Door warning lights Engine compartment lighting Trunk lighting	10 A
27		Brake light switch Bulb failure warning sensor – brake lights P-shift inhibitor (solenoid)	15 A
28		Heater fan (ECC) ECC compressor	30 A
29		Power antenna Trailer (Turn indicator switch not fused)	30 A
30	Relay, fuel injection	Tank pump Lambda-sond	10 A
31	Battery +	Relay, fuel injection – Fuel pump	25 A
32	Battery +	Amplifier, radio	15 A
33		Radio	10 A
34	Relay, power windows	Power windows (motors) Power sun roof (motor)	30 A
35		Heated seats (power) Power seats (motor)	30 A

Group 38 Instrumentation

Fuel level sensor

Lever-type sensor (1982–86)

	Volume	Resistance
Empty	0 L	296±15 Ω
Full	60 L (16 US gals)	36±2 Ω

Lever-type sensor (1987–)
Tubular-type sensor (1986–)

	Volume	Resistance
Empty	0 L	0 Ω
Full	60 L (16 US gals)	280 Ω

Tubular-type sensor (760/780 1988–)

	Volume	Resistance
Empty	0 L	0 Ω
Full	80 L (21 US gals)	363–370 Ω

Lever-type sensor, increased-capacity tank (1982–85)

	Volume	Resistance
Empty	0 L	18 Ω
Full	20 L (5 US gals)	1 Ω

Lever-type sensor, increased-capacity tank (1986–)

	Volume	Resistance
Empty extra tank	0 L	0 Ω
Full extra tank		
– extra tank lever-type sensor	20 L (5 US gals)	60 Ω
– main tank lever-type sensor	20 L (5 US gals)	27.5 Ω

Coolant temperature sensor

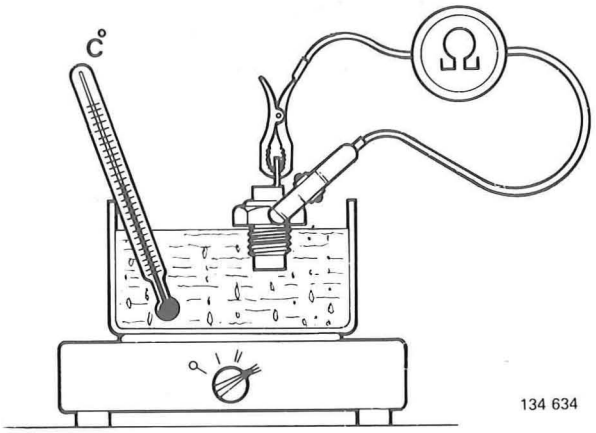
Resistance at different temperatures

(1982–86)

Temperature	Resistance
60°C (140°F)	217±35 Ω
90°C (194°F)	87±15 Ω
100°C (212°F)	67±11 Ω

(1987–)

Temperature	Resistance
60°C (140°F)	560 Ω
90°C (194°F)	206 Ω
100°C (212°F)	153 Ω



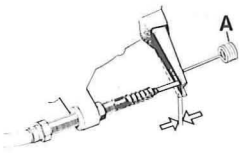
134 634

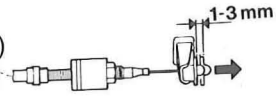
Section 4 Power Transmission

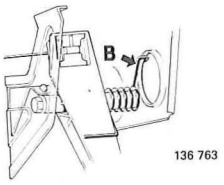
Group 41 Clutch 138
Group 43 Manual transmission 138
Group 43 Automatic transmission BW 55 140
AW 70/71/72 142
AW 30–43 LE 146
ZF 4HP 22 149
Group 45 Universal joint 151
Group 46 Rear axle 151

Group 41 Clutch


129 847





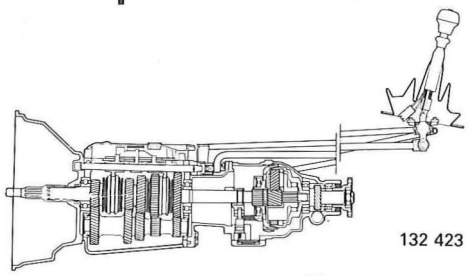


136 763

Pressure plate, max out-of-true	0.2 mm (0.008 in)
Clutch fork free travel:	
hydraulic	not adjustable
clutches with return spring (A)	1–3 mm (0.04–0.12 in) (to front)
clutches without return spring	1–3 mm (0.04–0.12 in) (to rear)
Clutch pedal travel	160 mm (6.23 in)

* Spring (B) attached to pedal carrier as illustrated.

Group 43 Gearbox


132 423

Manual gearbox

	M 46	M 47/M 47 II
Reduction ratios:		
1st gear	4.03:1*	4.03:1
2nd gear	2.16:1	2.16:1
3rd gear	1.37:1	1.37:1
4th gear	1:1	1:1
Overdrive (M 47: 5th gear)	0.79:1	0.83:1 (M 47 II: 0.82:1)
Reverse	3.68:1	3.68:1

* In some cases 3.71:1

Clearances

Clearance: reverse gear to gear selector	mm (in)	0.1–1.0 (0.004–0.040)	0.1–1.0 (0.004–0.098)
Axial clearance: input shaft	mm (in)	0.01–0.20 (0.0004–0.0079)	0.01–0.20 (0.0004–0.0079)
countershaft	mm (in)	0.03 (0.0012) to preload of 0.05 (0.0019)	0.01–0.10 (0.0004–0.0004)
main shaft	mm (in)	0.01–0.20 (0.0004–0.0079)	0.01–0.20 (0.0004–0.0079)
5th gear synchronizer hub	mm (in)	–	0.01–0.20 (0.0004–0.0079) (M 47)

Oil pressure, overdrive

Direct drive	approx 0.15 MPa (21.3 psi)
Overdrive engaged	**Type J**
D 24 T/TIC, with asbestos-free friction linings	2.8–3.1 MPa (400–440 psi)
Gasoline turbo with asbestos-free friction linings	2.8–3.1 MPa (400–440 psi)
Gasoline turbo with old type friction linings	3.9–4.2 MPa (555–600 psi)
Remaining, with old type friction linings	3.7–4.0 MPa (525–570 psi)
	Type P
All	2.8–3.1 MPa (400–440 psi)
	Type J/P-hybrid
Early type friction linings (1987)	3.7–4.0 MPa (526–569 psi)
Asbestos-free linings (1988–)	2.7–29 MPa (384–412 psi)

Tightening torque data

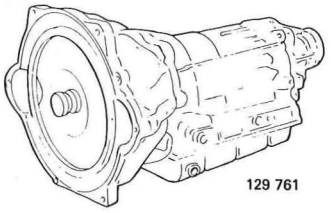
	Nm ft lb
Bellhousing	35–50 (25–35)
Gear lever mounting bracket bolts	40 (30)
Gearbox cover bolts	15–25 (10–20)
Countershaft, M 47	35–45 (25–30)
Drive flange nuts, M 47, M 16	70–90 (50–65)
M 20	90–110 (65–80)
M 46	165–180 (120–130)
Rear cover, M 46	12–18 (9–13)
Rear cover, 5th gear synchronization, M 47 II	120 (87)
Oil drain plugs	27–40 (20–29)

Lubricant

	Litres US qts
Type	ATF* type F or G
Capacity, M 46, early type, –1990 Litres (US qts)	2.3 (2.4)
late type, 1991– Litres (US qts)	2.6 (2.7)
M 47, early type, Litres (US qts)	1.3 (1.4)
late type, Litres (US qts)	1.6 (1.7)

* On complaints about gearbox noise, Volvo Thermo oil (P/N 1 161 243-9) can be used.
Volvo Thermo oil is only recommended for vehicles driven in areas where ambient temperature seldom drops below –10°C (+14°F), or high mileage vehicles such as taxis.
NOTE: Do not mix oil types.

Automatic transmission BW 55


129 761

Make and type	Borg Warner type 55	
Reduction ratios, 1st gear	2.45:1	x Converter ratios
2nd gear	1.45:1	
3rd gear	1:1	
Reverse	2.21:1	
Torque converter, type ratio	1–approx 2:1	
Lubricant	ATF, type G (or F)*	
Fluid capacity	6.9 litres = 7.2 US qts (incl. approx 2.5 litres = 2.6 US qts in torque converter)	

* ATF = automatic transmission fluid.

Engine type	Normal stall speed* r/s (r/min)	Type designation	Type plate colour
B 28 A	38.3 (2 300)	029	Light brown



131 755

* At sea level.
Stall speed drops 2 r/s (120 rpm) for each 1000 m increase in altitude.

Throttle cable setting

Distance between adjusting sleeve and stop		
at idling	0.25–1.0 mm	(0.001–0.040 in)
kick-down	$51\ ^{+1.6}_{-0.6}$ mm	$(2\ ^{+0.63}_{(-0.024}$ in)

Clearances

Oil pump: pump body – outer cog wheel	0.07–0.30 mm	(0.0027–0.118 in)
arc segment – large cog wheel	0.11–0.50 mm	(0.004–0.019 in)
axial clearance	0.02–0.10 mm	(0.0008–0.004 in)
Clutch C2, brakes B1 and B2: clearance between clutch assembly pressure plate and locking	0.3–1.2 mm	(0.0118–0.0472 in)
Input shaft, clutch C1 axial clearance	0.20–0.55 mm	(0.0078–0.0216 in)
Output shaft, axial clearance	0.20–0.55 mm	(0.0078–0.0216 in)

Line pressure

Idling D	0.53–0.63 MPa (75–90 psi)
R	0.74–0.91 MPa (105–129 psi)
Stall speed, D	1.12–1.37 MPa (159–195 psi)
R	1.54–1.96 MPa (219–279 psi)

Regulator pressure

Final drive ratio 3.31:1		
At 30 km/h (19 mph)	0.10–0.13 MPa	(14–18 psi)
At 60 km/h (38 mph)	0.14–0.18 MPa	(20–26 psi)
At 110 km/h (69 mph)	0.30–0.36 MPa	(43–51 psi)

Gear changing speeds

Limits for kick-down shift points, km/h (mph)	
1–2	71 (44)
2–3	128 (80)
3–2	117 (73)
3–1	approx. 60 (38)

Transmission brake and clutch plates

Min permissible thickness	2.1 mm	(0.083 in)

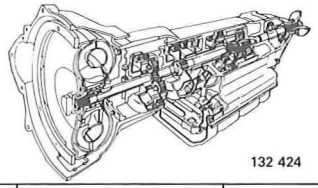
Tightening torque data

	Nm	ft lb
Drive plate – torque converter	41–50	(30–37)
Torque converter casing – engine, M 10	35–50	(26–37)
M 12	55–90	(41–66)
Center support – transmission housing tighten alternately in steps of 7 Nm (5 ft lb)	24–28	(18–21)
Pump cover – pump housing	6–9	(4–6)
Pump – transmission housing	22–28	(16–21)
Plate above parking detent	6–9	(4–6)

	Nm	ft lb
Torque converter casing – transmission housing		
4×M 10	26–40	(19–29)
2×M 12	47–60	(35–44)
Rear housing – transmission housing	26–40	(19–29)
Valve bodies – transmission casing	8–12	(7–9)
Valve bodies, for cam, M 6	6–9	(4–6)
Valve bodies, other bolts, M 5	5–6	(3–4)
Cover plate – gearbox housing	5–6	(4–6)
Strainer – lower valve housing M 6	6–9	(3–4)
Oil pan – transmission housing (yellow gasket)	6–10	(4–8)
Oil pan – transmission housing (blue gasket)	8–12	(7–9)
Drive plate – output shaft	40–50*	(29–37)
Blind plug, for pressure test	9–12	(6–9)

* Seal with Locking fluid 1 161 053-2 (1 161 054-2).

Automatic transmission AW 70/71/72


132 424



138 733

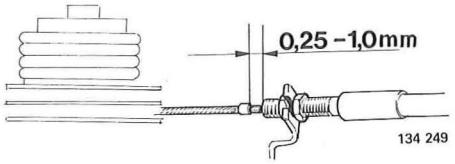
Engine	Type	Stall speed[1] r/s (rpm)	Volvo P/N	Plate colour	
B 19 E	AW 70		36.7 (2 200)	1 208 314	Silver
B 23 E	AW 71		35.0 (2 100)	1 208 300	Orange
B 23 FT	AW 71		41.7 (2 500)[2]	1 208 334	Pink
B 28 A	AW 71		35.0 (2 100)	1 208 360	Yellow
B 28 E	AW 71		35.0 (2 100)	1 208 310	Black
B 28 F	AW 71		33.0 (2 000)	1 208 248	Blue
B 200 K	AW 70		38.0 (2 300)	1 208 332	Red
B 200 E	AW 70		35.0 (2 100)	1 208 415	Green
B 200 F	AW 70		37.0 (2 200)	1 208 659	Pink
B 230 A	AW 71		35.0 (2 100)	1 208 304	Black
B 230 K	AW 71	–1986	42.0 (2 500)	1 208 371	Pink
	AW 71	1987–	42.0 (2 500)	1 208 417	Blue
B 230 F	AW 70	USA/CDN 5-door, Japan, Australia 1988	33.0 (2 000)	1 208 563	Dark brown
	AW 70	USA/CDN Japan/ Australia	33.0 (2 000)	1 208 604	Pink
	AW 70	Others	33.0 (2 000)	1 208 652	Red
B 230 FB	AW 71		33.0 (2 000)	1 208 682	White
B 234 F/G	AW 72	USA/CDN	30.0 (1 800)	1 208 637	White
			41.0 (2 450)	1 208 666	Orange
		Europe	30.0 (1 800)	1 208 638	Black
			41.0 (2 450)	1 208 667[3]	Green
B 230 FT	AW 71		45.0 (2 700)[2]	1 208 334	Pink
			45.0 (2 700)[2]	1 208 661	Yellow
		USA/CDN/Japan/ Australia 1990	42.0 (2 500)[2]	1 208 642	
		Others 1990	42,0 (2 500)[2]	1 208 643	
B 280 E	AW 71	Scandinavia	35 (2 100)	1 208 533[3]	Green
	AW 71	Others	35 (2 100)	1 208 534	Orange
B 280 F	AW 71		35 (2 100)	1 208 532	Purple
	AW 71		35 (2 100)	1 208 533[3]	Green

[1] At sea level. Stall speed drops 2 r/s (120 rpm) for each 1000 m increase in altitude.
[2] Start–stop.
[3] With kick-down inhibitor.

	AW 70/71	AW 72	
Reduction ratios, 1 st gear	2.45:1	2.83:1	× Converter ratios
2nd gear	1.45:1	1.49:1	
3rd gear	1:1	1:1	
Overdrive	0.69:1	0.73:1	
Reverse	2.21:1	2.70:1	
Torque converter: reduction ratio	1–2:1 approx		
Lubricant, fluid capacity	see page 13		

Throttle cable setting

Distance between adjusting sleeve and cable stop
at idling ..... mm 0.25–1.0
(in) (0.001–0.040)
kick-down ..... mm 50.4–52.6 (1.99–2.1)



Solenoid valve

Resistan ..... 13 Ω

Clearances

Oil pump: pump body – outer gear wheel	mm (in)	0.07–0.15	(0.003–0.006)
arc segment – large gear wheel	mm (in)	0.11–0.14	(0.0043–0.0055)
axial clearance	mm (in)	0.02–0.05	(0.0008–0.0019)
Brake BO: clearance between clutch pressure plate and lock ring	mm (in)	0.35–1.60	(0.0138–0.0629)
Clutch C2, brakes B1 and B2 clearance between clutch assembly pressure plate and lock ring	mm (in)	0.3–1.2	(0.0118–0.0472)
Input shaft, clutch CO, axial clearance	mm (in)	0.3–0.9	(0.0118–0.0354)
Output shaft, axial clearance	mm (in)	0.3–0.9	(0.0118–0.0354)

Brake and clutch rings

Minimum permissible thickness	mm (in)	2.1 mm	(0.083)

Line pressure

Engine	Transmission	Pressure, D MPa (psi)	Pressure, R MPa (psi)
B 19/200 E/F B 23 E B 230 K –1986	AW 70 AW 71 AW 71	0.35–0.44 (50–63) –"– –"–	0.50–0.64 (71–91) –"– –"–
B 200 K, B 230 F B 23/230 FT B 230 A, B 230 FB B 230 K 1987– B 28 A, E, F	AW 70 AW 71 AW 71 AW 71 AW 71	0.46–0.54 (65–77) –"– –"– –"– –"–	0.70–0.82 (106–117) –"– –"– –"– –"–
B 234 F/G	AW 72	0.44–0.52 (63–74)	0.64–0.76 (91–109)
B 280	AW 71	0.51 (73)	0.77 (110)

Stall speed pressure

Engine	Transmission	Pressure, D MPa (psi)	Pressure, R MPa (psi)
B 19/200 E B 23 E B 230 K –1986	AW 70 AW 71 AW 71	1.00–1.20 (142–205) –"– –"–	1.37–1.70 (195–242) –"– –"–
B 200 K, B 230 F B 23/230 FT B 230 A, B 230 FB B 230 K 1987– B 28 A, E, F	AW 70 AW 71 AW 71 AW 71 AW 71	1.00–1.20 (142–205) –"– –"– –"– –"–	1.50–1.90 (213–270) –"– –"– –"– –"–
B 234 F/G	AW 72	1.12–1.32 (159–188)	1.55–1.95 (220–277)
B 280	AW 71	1.15 (164)	1.74 (247)

Governor pressure

Rear axle reduction ratio							
3.54:1		3.73:1		3.91:1		4.10:1	
Speed	Pressure	Speed	Pressure	Speed	Pressure	Speed	Pressure
35 km/h (22 mph)	0.11–0.17 MPa (15.6–24.2 psi)	30 km/h (19 mph)	0.09–0.15 MPa (12.8–21.3 psi)	29 km/h (18 mph)	0.09–0.15 MPa (12.8–21.3)	27 km/h (17 mph) 25 km/h* (16 mph)	0.09–0.15 MPa (12.8–21.3 psi)
55 km/h (34 mph)	0.17–0.23 MPa (24.2–32.7)	55 km/h (34 mph)	0.16–0.22 MPa (22.8–31.3 psi)	53 km/h (33 mph)	0.16–0.22 MPa (22.8–31.3 psi)	50 km/h (31 mph) 45 km/h* (28 mph)	0.16–0.22 MPa (22.8–31.3 psi)
110 km/h (69 mph)	0.38–0.50 MPa (54.1–71.1 psi)	108 km/h (67 mph)	0.41–0.53 MPa (58.3–8.4 psi)	103 km/h (64 mph)	0.41–0.53 MPa (58.3–8.4 psi)	98 km/h (61 mph) 95 km/h* (59 mph)	0.41–0.53 MPa (58.3–8.4 psi)

* Only for AW 72.

Shift speeds km/h (mph)

Engine	Type	Rear axle ratio	1–2	2–3	3–4	4–3	3–2	2–1
B 19 E	AW 70	3.91:1	62 (39)	103 (64)	109 (68)	38 (24)	97 (61)	49 (31)
B 23 E	AW 71	3.73:1	63 (39)	105 (66)	135 (84)	39 (24)	99 (62)	50 (31)
B 23 FT	AW 71	3.73:1	63 (39)	105 (66)	111 (69)	39 (24)	99 (62)	50 (31)
B 28 A	AW 71	3.54:1	73 (46)	123 (77)	123 (77)	28 (24)	115 (72)	58 (36)
B 28 E	AW 71	3.54:1	67 (42)	112 (70)	119 (74)	29 (24)	106 (66)	53 (33)
B 28 F	AW 71	3.54:1	67 (42)	112 (70)	119 (74)	29 (24)	106 (66)	53 (33)
B 200 F	AW 70	4.10:1	57 (36)	101 (63)	110 (69)	37 (23)	94 (59)	46 (29)
B 200 E	AW 70	3.91:1	67 (42)	113 (71)	114 (71)	40 (25)	107 (67)	55 (34)
B 200 K	AW 70	3.91:1	67 (42)	113 (71)	114 (71)	40 (25)	107 (67)	55 (34)
B 230 A	AW 71	3.73:1	71 (44)	119 (74)	118 (74)	27 (17)	111 (69)	56 (35)
B 230 K –1986	AW 71	3.91:1	66 (41)	111 (69)	112 (70)	35 (22)	105 (66)	55 (34)
B 230 K 1987–	AW 71	3.91:1	55 (34)	98 (61)	107 (67)	35 (22)	91 (57)	44 (28)
B 230 F[2]	AW 70	4.10:1	63 (39)	106 (66)	108 (67)	37 (23)	100 (62)	52 (32)
B 230 F 1989–[3]	AW 70	4.10:1	57 (36)	99 (62)	110 (69)	36 (23)	93 (58)	45 (28)
B 230 FT	AW 71	3.73:1	63 (39)	105 (66)	111 (69)	39 (24)	99 (62)	50 (31)
B 230 FT/GT 1990	AW 71	3.73:1	65 (41)	112 (70)	130 (81)	27 (17)	106 (66)	54 (34)
B 234 F	AW 72	4.10:1	56 (35)	102 (64)	116 (73)	33 (21)	93 (58)	41 (26)
B 280 E	AW 71	3.91:1	60 (38)	105 (66)	116 (73)	44 (28)	99 (62)	49 (31)
B 280 F	AW 71	3.73:1	63 (39)	110 (69)	121 (76)	46 (29)	104 (65)	51 (32)
Throttle valve opening %			100[1]	100[1]	75	0	100[1]	100[1]

[1] Kick-down.
[2] USA/Canada estate cars – 1988, 1989–: other markets.
[3] USA/Canada/Japan/Australia 1989–.

Mechanical lock-up

	B 230 K	B 230 F	B 230 F* 1989– B 230 FB B 234 F	B 230 FT**
Engages at ..... km/h (mph)	85 (53)	78 (49)	86 (54)	95 (59)
Disengages at ..... km/h (mph)	83 (52)	76 (47)	84 (53)	90 (56)

*Applies to 1 208 652. 1 208 604 77 (48), 73 (46).
**Applies to 1 208 643.

Tightening torques

AW 70, AW 71, AW 72	Nm	ft lb
Converter casing – engine, M 10	35–50	(25–36)
M 12	55–90	(40–65)
Drive plate to torque converter	41–50	(30–36)
Centre support to gear case:		
tighten alternately in steps to 7 Nm (5 ft lb)	24–28	(17–20)
Pump cover to pump body	6–9	(4–6)
Pump assembly to gear case	22–28	(16–20)
Plate above parking pawl	6–9	(4–6)
Converter casing gear case		
4 × M 10	27–42	(20–30)
2 × M 12	48–68	(35–49)
Rear extension housing to gear case	27–47	(20–34)
Valve bodies, for cam M 6	6–9	(4–6)
other bolts, M 5	5–6	(3.5–4)
Oil strainer to lower valve body	5–6	(3.5–4)
Cover plate to gear case, M 6	6–9	(4–6)
Valve body to gear case	8–12	(6–9)
Oil pan to gear case	4–5	(3–3.5)
Coupling flange to output shaft*	40–50	(30–36)
Blind plug for pressure test	5–9	(3.5–6)
Nut, oil cooler to gear case	20–30	(14–22)
Speedometer drive	4–6	(3–4)
Nut, oil dipstick tube	65–70	(47–51)
Solenoid valve	10–16	(7–12)
Drain plug to oil pan	18–23	(13–17)

* Use locking fluid P/N 1 161 053-2 (1 161 054-0).

Automatic transmission AW 30–43 LE

Engine	Type	Notes	Normal stall speed[1] r/s (r/min)	Volvo P/N	Decal colour
B 6304 F	AW 30–43		35 (2 100)	1 208 657	Black

[1] At sea level. Stall speed drops 2 r/s (120 r/min) for each 1 000 m (3 300 feet) increase in altitude.

Reduction ratios, 1st gear	2.80:1
2nd gear	1.53:1
3rd gear	1:1
4th gear	0.75:1
Reverse	2.39:1
Torque converter, K-factor	177
diameter	254 mm (10 in)
reduction ratio	1:1–2.1:1
Lubricant, fluid capacity	approx 7.7 litre (8.1 US qt)
type	ATF-fluid Dexron II D

Line Pressure

Engine	Transmission	Idling, position D Pressure MPa (psi)	Idling, position R Pressure MPa (psi)
B 6304 F	AW 30–43	0.41–0.45 (58–64)	0.61–0.67 (87–95)

Line Pressure at stall speed

Engine	Transmission	Idling, position D Pressure MPa (psi)	Idling, position R Pressure MPa (psi)
B 6304 F	AW 30–43	1.24–1.34 (176–191)	1.44–1.74 (205–248)

Gear shift speeds, km/h (mph)

Mode selector in position ECONOMY (E). Shift selector in position D. Throttle opening in %

Engine	Type	Final drive ratio	1–2 (100+KD)	2–3 (100+KD)	3–4 (75)	3–4 (100+KD)	4–3 (100+KD)	3–2 (100+KD)	2–1 (100+KD)
B 6304 F	AW 30–43	3.73:1	58	114	157	180	175	105	45

Mode selector in position SPORT (S). Shift selector in position D. Throttle opening in %

Engine	Type	Final drive ratio	1–2 (100+KD)	2–3 (100+KD)	3–4 (75)	3–4 (100+KD)	4–3 (100+KD)	3–2 (100+KD)	2–1 (100+KD)
B 6304 F	AW 30–43	3.73:1	58	114	177	180	175	105	45

Mode selector in position WINTER (W). Shift selector in position D. Throttle opening in %

Engine	Type	Final drive ratio	1–2* (100+KD)	2–3* (100+KD)	3–4 (0–100)	3–4 (100+KD)	4–3 (0–100)	3–2* (100+KD)	2–1* (100+KD)
B 6304 F	AW 30–43	3.73:1	50	100	50	170	40	70	20

* 1st and 2nd gear only used on kick-down.

Mechanical lock-up (LOCK-UP), km/h (mph). Shift selector in position D. Throttle opening in %

			ECONOMY (E)						SPORT (S)						WINTER (W)	
Engine	Type	Final drive ratio	2 (100+KD) in	2 (100+KD) out	3 (100+KD) in	3 (100+KD) out	4 (100+KD) in	4 (100+KD) out	2 (100+KD) in	2 (100+KD) out	3 (100+KD) in	3 (100+KD) out	4 (100+KD) in	4 (100+KD) out	3 (15–98) in	3 (15–98) out
B 6304 F	AW 30–43	3.73:1	85	77	130	123	180	175	85	77	130	123	180	175	50	40

Components

Control unit
– Volvo part number 3515646

Shift position sensor
– Volvo part number 3515639
– Aisin Warner number 99 03 740 153

Mode selector
– Volvo part number 3515640

Solenoids:
Shift solenoid 1 (S1) and 2 (S2)
– Volvo part number 3515643
– Aisin Warner number 99 03 740 040
Resistance at +25°C (77°F) ..... 13±2 Ω

Lock-up solenoid (SL)
– Volvo part number 3515644
– Aisin Warner number 99 03 740 041
Resistance at +25°C (77°F) ..... 13±2 Ω

Line pressure solenoid (STH)
– Volvo part number 3515645
– Aisin Warner number 99 03 457 389
Resistance at +25°C (77°F) ..... 13±2 Ω

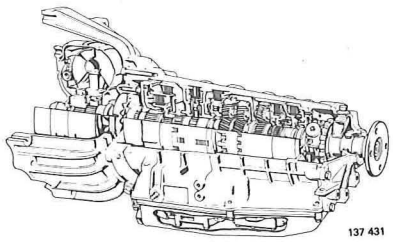
Speed sensor
– Volvo part number 3515641
– Aisin Warner number 99 03 740 151

Oil temperatur sensor
– Volvo part number 3515642
– Aisin Warner number 99 03 740 154
Resistance at
+160°C (320°F) ..... 20.7±2.9 Ω
–0°C (32°F) ..... 2067±396 Ω
<0°C (<32°F) ..... >2067 Ω

Tightening torques

	Nm	(ft lb)
Converter casing – engine, starter motor (2 pcs)	40.0	30
others	48.0	35
Drive plate – torque converter	30.0	22
Coupling flange to output shaft	50.0	36
Plug, oil pan	20.0	14

Automatic transmission ZF


137 431



139 759

Type and designation	ZF 4HP 22	
	D 24, D 24 T/TIC	**Other engines**
Reduction ratios, 1st gear	2.73:1	2.48:1
2nd gear	1.56:1	1.48:1
3rd gear	1:1	1:1
4th gear (overdrive)	0.73:1	0.73:1
Reverse	2.09:1	2.09:1
		× converter-ratio
	D 24	**Other engines**
Torque converter, type	218 K	195 K
reduction ratio	1– approx 2.57	1– approx 2.3
size	260 mm	
Lubricant	ATF oil type Dexron II D*	
Oil fill quantity	7.5 litres incl oil cooler and tubes (2.5 litres = 2.6 US qts approx in torque converter)	

Part number, stall speed

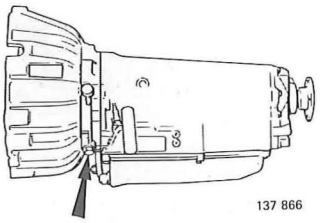
Engine	Volvo P/N[0]	Stall speed[1] r/s (rpm)
B 23 E, B 230 E	1 208 375 1 208 502 1 208 391 1 208 662	36.0 (2 150)
B 230 ET	1 208 376 1 208 503 1 208 480 1 208 609	33.3–41.0 (2 000–2 450)[2]
B 230 F Europe 1987–	1 208 518 1 208 601 1 208 680	35.0 (2 100)
B 230 F Others (not estates 1987)	1 208 301 1 208 501	35.0 (2 100)
B 230 FB	1 208 686	33.0 (2 000)
B 230 FT Europe 1987–88	1 208 517 1 208 610	33.3–41.0 (2 000–2 450)[2]
D 24	1 208 407 1 208 594 1 208 505	36.0 (2 150)
D 24 T Europe	1 208 317 1 208 506 1 208 664 1 208 389 1 208 595	31.7–39.0 (1 900–2 350)[2]
D 24 T USA/Canada Austria 1987–	1 208 365 1 208 507 1 208 665 1 208 390 1 208 596	30.0–33.3 (1 800–2 000)[2]
D 24 TIC	1 208 397 1 208 663	31.7–40.8 (1 900–2 450)[2]

[0] ZF and Volvo part numbers stamped on type designation plate.
Last three digits of Volvo number also stamped on rear of gearbox.
[1] At sea level. Stall speed drops 2 r/s (120 rpm) for each 1000-metre (3300 feet) increase in altitude.
[2] Start–stall.

Throttle cable setting

Distance between adjusting sleeve and cable stop

at idling	0.25–1.0 mm	0.001–0.040 in
kick-down	51 $^{+1.6}_{-0.6}$ mm	2 $^{+0.063}_{-0.024}$ in



Line pressure (at idle)

(Measure at plug indicated by arrow)	MPa	psi
Idling, D	0.6–0.76	(85–108)
Idling, R	1.1–1.4	(156–199)

Line pressure at stall speed, ZF

Engine	Position D		Position R	
	MPa	psi	MPa	psi
B 23 E	0.83–1.03	118–147	1.51–1.72	215–245
B 230 E	0.83–1.03	118–147	1.51–1.72	215–245
B 230 F/FB	0.95–1.15	135–164	1.61–1.81	229–257
B 230 ET	0.95–1.15	135–164	1.61–1.81	229–257
D 24	0.86–1.06	122–151	1.57–1.76	223–250
D 24 T	0.81–1.01	115–144	1.48–1.67	211–238
Austria 1987–				
USA/Canada				
Others	0.99–1.10	141–156	1.61–1.82	229–259
D 24 TIC	0.96–1.06	137–236	1.57–1.76	223–250

Gear shift speeds km/h (mph)

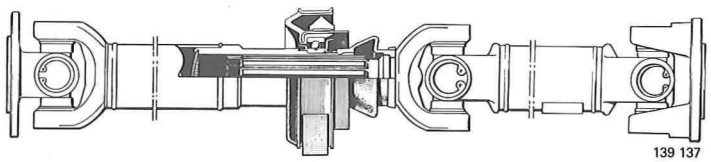
Engine	Ratio	1–2	2–3	3–4	4–3	3–2	2–1	Mechanical lock-up	
								Engages**	Disengages**
B 23 E	3.73:1	62 (39)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	96 (60)	94 (59)
B 230 E	3.73:1	62 (39)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	85 (53)	83 (52)
B 230 F	3.91:1	59 (37)	102 (64)	122 (76)	41 (26)	93 (58)	50 (31)	78 (49)	76 (48)
USA/Canada									
B 230 F	3.91:1	59 (37)	102 (64)	122 (76)	41 (26)	93 (58)	50 (31)	85 (53)	83 (52)
Europe 1987–									
B 230 FB	3.91:1	64 (40)	107 (67)	131 (82)	38 (24)	102 (64)	54 (34)	85 (53)	83 (52)
B 230 ET	3.91:1	59 (37)	102 (64)	122 (76)	41 (26)	93 (58)	50 (31)	92 (58)	90 (56)
	3.73:1	62 (69)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	97 (61)	95 (59)
B 230 FT	3.73:1	62 (39)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	97 (60)	95 (59)
Europe 1987–									
D 24	3.91:1	46 (29)	83 (52)	98 (61)	34 (21)	79 (49)	39 (24)	76 (48)	74 (46)
D 24 T	3.91:1	46 (29)	83 (52)	98 (61)	34 (21)	79 (49)	39 (24)	73 (46)	71 (44)
Austria 1987–									
USA/Canada									
Others	3.73:1	48 (30)	87 (54)	103 (64)	35 (22)	82 (51)	41 (26)	87 (54)	85 (53)
D 24 TIC	3.73:1	48 (30)	87 (54)	103 (64)	35 (22)	82 (51)	41 (26)	87 (54)	85 (53)
Throttle valve opening %		100*	100*	85	0	100*	100*		

* Kick-down
** Late type.

Tightening torques

	Nm	ft lb
Drive plate–torque converter M 8	17–27	12–20
M 10×1.25	41–50	30–36
Torque converter – engine, M 10	35–50	25–36
M 12	55–90	40–65
Valve body – transmission gearcase	7–9	5–6.5
Plate above parking detent	9–11	6.5–8.0
Rear case – gearcase	20–26	14–19
Strainer – valve body – gearcase	7–9	5–6.5
Governor – balance – pawl	9–11	6.5–8.0
Oil pump – separator plate	9–11	6.5–8.0
B 4 cylinder – gearcase	9–11	6.5–8.0
Plug – separator plate, M 14	34–46	25–33
M 20	43–57	31–41
Torque converter casing – separator plate – gearcase	40–52	29–38
Oil pan – gearcase	7–9	5–6.5
Drive plate – output shaft	85–115	61–83
Blind plug, oil pan	13–17	9–12
Oil filler tube – oil pan	85–115	61–83

Group 45 Propeller shaft

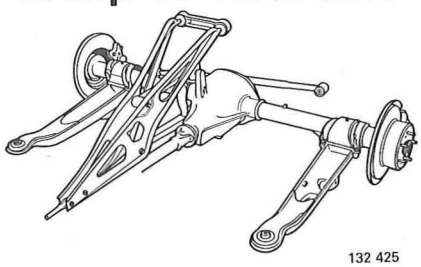


139 137

Tightening torque, flange bolts,	
steel joint M 8	30 Nm (22 ft lbs) + angle-tighten 60°*
M 10	50 Nm (36 ft lbs)
rubber joint	80 Nm (58 ft lbs)

*Use service kit 9 122 130-9, socket 999 5381-2

Group 46 Rear axle



132 425

Rear axle, 740, 760*, 780 –1987, 940, 965

Reduction ratio	3.31:1, 3.54:1, 3.73:1, 3.91:1, 4.10:1	
Axial throw, crown wheel	Max 0.08 mm	Max. 0.003 in
Backlash	0.12–0.18 mm	0.004–0.007 in
Preload torque, pinion bearings, new	2.5–3.5 Nm	1.8–2.5 lbs
used	1.8–3.4 Nm	1.3–2.5 lbs
Preload, differential bearings	0.05–0.08 mm	0.0019–0.0032 in
Clearance, speedometer sensor – pulse wheel	0.5–1.2 mm	0.020–0.047 in
Radial runout outer diameter, pulse wheel	Max. 0.3 mm	Max. 0.0118 in
Lubricant	See page 9	

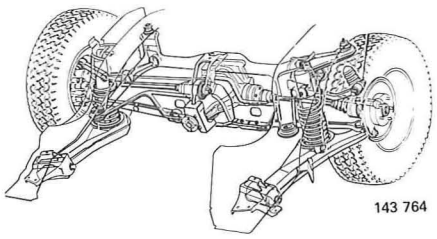
*1988– only 5-doors.

Tightening torques

	Nm	ft lb
Pinion drive flange, pinion with spacer	200–250	147–185
pinion with compression sleeve*	180–280	130–207
Differential bearing caps	45–60	33–44
Crown wheel**	90–110	66–81
Wheel nuts	85	63
Lock nut – speedometer sensor	25–40	18–29

* Do not exceed specified torque
** Use new bolts.

Final drive 760/780 4-door 1988–, 960

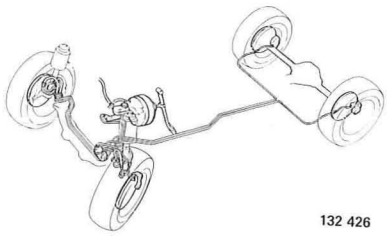


Reduction ratio	3.54:1, 3.73:1, 3.91:1
Axial throw, crown wheel	Max 0.08 mm (0.0032 in)
Backlash	0.1–0.16 mm (0.04–0.006 in)
Pinion bearing preload, new	1.2–2.8 Nm (0.87–2.0 ft lb)
old	1.0–2.5 Nm (0.72–1.8 ft lb)
Differential bearing, preload	1+1 notches on each side
Clearance, speedometer – impulse wheel	0.35–0.75 mm (0.014–0.030 in)
Radial throw, outer diameter, impulse wheel	Max. 0.2 mm (0.008 in)
Lubricant	See page 9

Tightening torques

	Nm	ft lb
Coupling flange – pinion (nut)	180–280	(133–207)
Crown wheel – differential housing bolt + 60 deg. angle-tightening.	35	(26)
Wheel nuts	85	(63)
Impulse sender – rear casing (bolt)	8–12	(6–9)
Rear casing – final drive (bolt)	20–28	(14–20)
Side bracket – final drive (bolt)	40–56	(29–40)
Lock washer – adjustment nut (bolt)	40–56	(29–40)
Balance weight – final drive (bolt)	20–28	(14–20)
Oil drain plug	27–40	(20–29)
Oil filler plug	27–40	(20–29)
Drive shaft bolts (+90° angle tightening)	30	(22)
Drive shaft nuts, (+60° angle tightening)	140	(103)

Section 5 Brakes



132 426

Brake fluid

Grade	DOT 4

Front wheel brakes

		Alt I non-ventilated	Alt II ventilated	Alt III ventilated	Alt IV ventilated ('Jumbo')
Brake disc, outer diameter,	mm (in)	280 (11.0)	287 (11.3)	262 (10.3)	280 (11.0)
thickness new	mm (in)	14 (0.55)	22 (0.87)	22 (0.87)	26 (1.02)
change at	mm (in)	11.0 (0.43)	20.0 (0.79)	20.0 (0.79)	23.0 (0.91)
run-out –1987	mm (in)	max 0.08 (0.003)			
1988–	mm (in)	max 0.06 (0.0024)			
Brake pad thickness, new	mm (in)	11.5 (0.453)		('Jumbo' 12.0 (0.472)	
min	mm (in)	3 (0.12)			

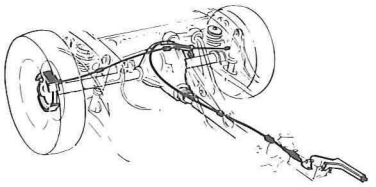
Rear wheel brakes

		Standard	Multi-link
Brake disc, outer diameter	mm (in)	281 (11.06)	265 (11.04)
thickness, new	mm (in)	9.6 (0.378)	10 (0.393)
change at	mm (in)	min 8.4 (0.330)	8 (0.314)
runout	mm (in)	max 0.10 (0.0039)	0.08 (0.003)
Brake pad thickness, new	mm (in)	10 (0.393)	8 (0.314)
min	mm (in)	2 (0.078)	2 (0.078)

Tightening torques

		Nm	ft lbs
Attaching, bolts, front brake calipers		100	(74)
rear brake calipers		58	(43)
caliper bracket		48	(35)
front dust shield	(approx.)	24	(18)
rear dust shield	(approx.)	40	(29)
brake caliper, slide pin		34	(25)
Wheel nuts		85	(63)
Attaching nuts, master cylinder	(approx.)	30	(22)
Bleeder screws, front	(approx.)	5	(4)
rear	(approx.)	4.5	(3.3)
Brake pipe unions		14	(10)
Brake hoses to nipple		17	(12)
Nipple to caliper		17	(12)

Parking brake



123 427

Brake drums, radial runout	max 0.15 mm	max 0.0059 in
out of round	max 0.2 mm	max 0.0078 in
Full braking effect after adjusting at	3–5 notches	
when checking	max 11 notches	

Section 6 Front end and steering

Group 60 Wheel alignment

(Empty vehicle)

Front wheel alignment

Caster ..... 4.5–5.5°
Camber* ..... –0.2 – +0.8°

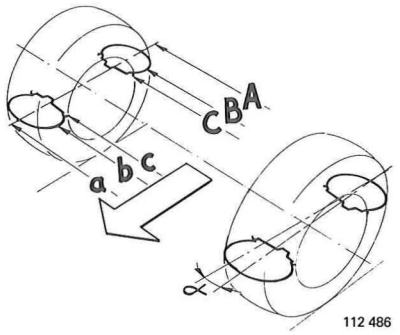
* Difference between left and right-hand locks must not exceed 0.7°.

Toe-in

All variants*

Angle (2 α)	A – a	B – b	C – c
18'±8'	3.2±1.3 mm 0.12±0.05 in	2.3±1.2 mm 0.09±0.05 in	2.1±0.9 mm 0.08±0.04 in

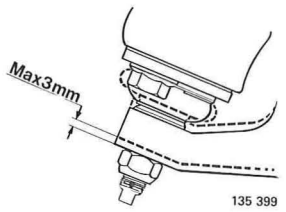
* In order to simplify workshop routines, the same values apply to all 740/940/960 models from 1982. Older values may still be found in some manuals and are not incorrect, though now supplanted by these newer values.



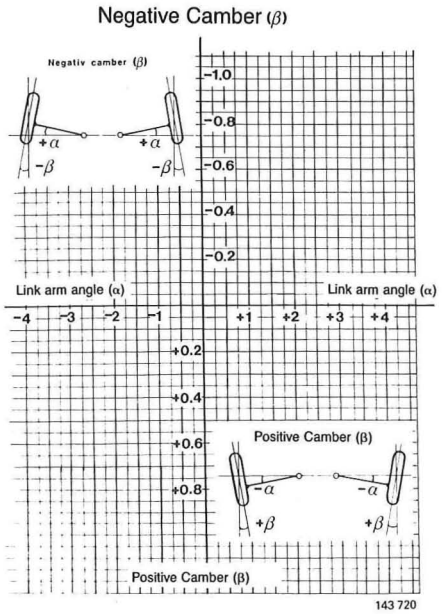
All measurements to be carried out on an empty vehicle. Dimensions are noted at hub height in the form of an angular measurement α or as the difference in mm between the front and rear edges of the wheels at points A, B or C (the tire tread, shoulder and wheel rim edge respectively).

Ball joints

Max axial play with normally loaded front end, 3 mm (0.12 in)
Max radial play, 0.5 mm (0.02 in).



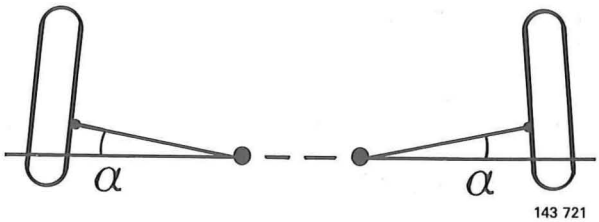
Wheel alignment, rear wheels (Multi-link)

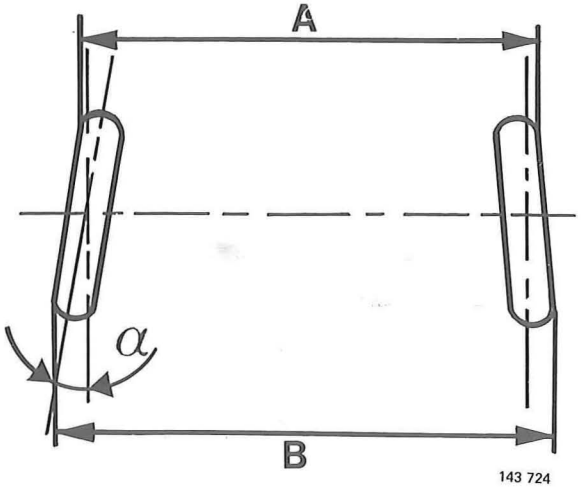


Camber

Diagram shows correct Camber (β) in relation to position of lower links (α).

Example: angle of lower link is +2°, correct Camber is 0.05° (negative Camber). Tolerance = ±0.25°.





Toe-in
Measured as angle

Toe-in (α) angle = 2'±3' per wheel.

Specification

Toe-in measurement (B-A) should be is 0.5±0.8 mm, measured at C, see left.

Note: Camber must always be adjusted before Toe-in.

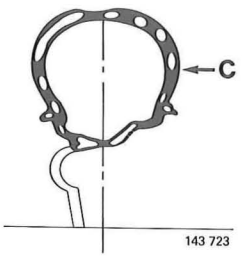
Toe-in tolerance

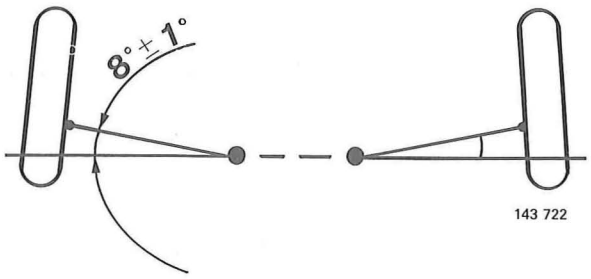
Measure Toe-in of unladen vehicle, according to above.

Apply sufficient load to obtain a lower link angle of 8°±1°.

Repeat Toe-in measurement and compare results.

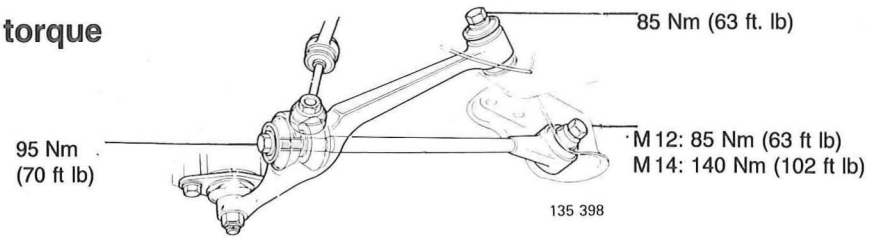
Max. difference = 3′ per wheel.





Group 61 Front wheel suspension

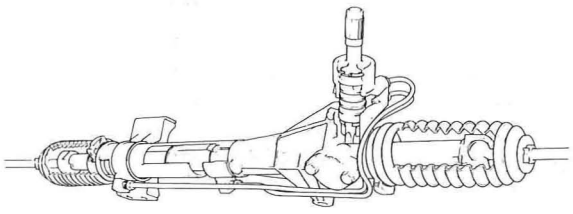
Tightening torque



	Nm	ft lb
Control arm to ball joint, nut	60	44
Ball joint to spring strut +1/4 turn	30	22
Steering rod to steering arm (approx.)	60	44
Upper bearing – body (approx.)	40	29
Upper bearing – shock absorber, –1984 (approx.)	150	111
1985– (approx.)	70	50
Front crossmember to body (approx.)	95	70
Wheel nuts	85	63
Front wheel hub – stub axle +45° angle-tightening nut (1988– models)	100	74

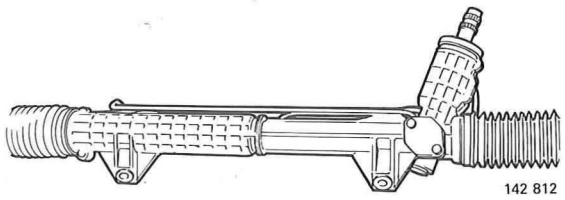
Group 64 Steering

Steering gear


132 429

Cam gear

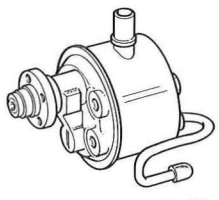
Numbers of turns, lock to lock	3.5	
Steering ratio	16.9:1	
Clearance between pre-tensioning piston and cover	0.05–0.12 mm	0.0019–0.0047 in
Frictional torque, measured on input shaft	0.6–1.7 Nm	5.3 in. lb.
Checking servo balance:		
pump pressure when measuring steering wheel torque	1.2 MPa	171 psi
torque on steering wheel	3.5–4.5 Nm	31–40 in. lb.
max deviation between right and left locks	1 Nm	9 in. lb.
Lubrication, type	Grease, Volvo P/N 1 161 001-1	
quantity	100 grams	
Hydraulic fluid	See page 14	


142 812

ZF

Numbers of turns, lock to lock	3.5	
Steering ratio	16.9:1	
Clearance between pre-tensioning piston and cover	0.025–0.05 mm	0.0010–0.0020
Frictional torque, measured on input shaft	0.6–2.1 Nm	0.4–1.5 ft lb
Checking servo balance:		
pump pressure when measuring steering wheel torque	1.2 MPa	171 psi
torque on steering wheel	3.4–4.5 Nm	31–40 in lb.
max deviation between right and left locks	1 Nm	0.7 ft lb
Lubrication, type	Grease Volvo P/N 1 161 001-1	
quantity	100 grams	
Hydraulic fluid	See page 14	

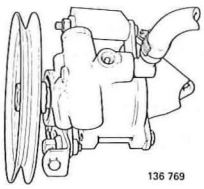
Servo pump


132 430

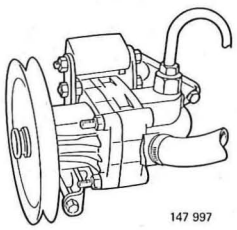
A


136 000

B


136 769

C


147 997

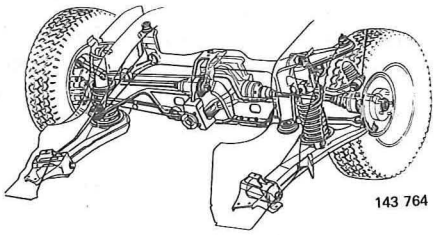
D

Max pressure, early type (A, B,C)	7.6–8.3 MPa	1081–1180 psi
late type of "C"	9.3–10.0 MPa	1323–1422 psi
type "D"	10.0–11.0 MPa	1422–1564 psi
960, B 6304 F	9.3–10.0 MPa	1323–1422 psi

Tightening torques

	Nm	ft lb
Steering column 760 1988–	24	17
Steering wheel nut	34	25
Steering column, universal joints	24	17
Steering gear – crossmember	44	32
Steering rod – outer ball joints (approx.)	70	52
Steering arm – outer ball joints (approx.)	60	44

Group 65 Rear wheel suspension



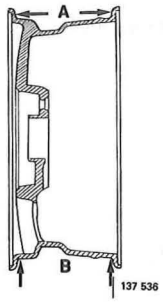
Tightening torques (Multi-link)

	Nm	ft lb
Link to lower wheel bearing housing, nut +90° angle tighten	50	37
Link to lower rear axle crossmember, nut +90° angle tighten	50	37
Stud to body	70	51
Support arm mount to body, nut +90° angle tighten	70	51
Support arm to body, bolt	48	35
Support arm to mount, nut +120° angle tighten	125	91
Support arm to wheel bearing housing, bolt +90 angle tighten	60	44
Link to upper wheel bearing housing, nut	115	83
Link to rear axle upper front crossmember, nut +60° angle tighten	70	51
Link to rear axle upper rear crossmember, nut	85	61
Track rod to wheel bearing housing, bolt	85	61
Track rod to rear axle crossmember, nut	70	51
Rear axle crossmember (front) to body, bolt +60° angle tighten	70	51
Rear axle crossmember (rear) to body, bolt +60° angle tighten	70	51
Final drive (front) to rear axle crossmember, bolt	160	116
Final drive (rear) to rear axle crossmember, bolt	160	116
Cable bracket to rear axle crossmember, nut	24	17
Shock absorber to support arm, nut	56	41
Shock absorber to body, bolt	85	61
Wheel stud to shaft +60° angle tighten	140	102
Wheel bearing housing buffer, nut	24	17
Backplate to rear wheel bearing housing, bolt	24	17
Brake caliper to wheel bearing housing, nut	60	43

Section 7 Springs, shock absorbers, wheels

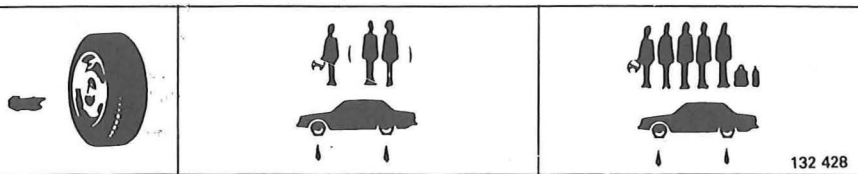
Group 77 Wheels, tires, hubs

Wheels



RIMS	Aluminium	Steel
Lateral runout (A)	Max. 0.8 mm (0.032 in)	1.0 mm (0.039 in)
Radial runout (B)	Max. 0.6 mm (0.024 in)	0.8 mm (0.032 in)

Tire pressures, cold kPa (psi)*



	1–3 occupants		Full load	
Tire size/model	Front	Rear	Front	Rear
740/760				
4-door	190 (28)	190 (289)	210 (31)	230 (33)
Estate	190 (28)	210 (31)	210 (31)	280 (40)
780 –1987	210 (31)	190 (28)	230 (33)	230 (33)
760/780 1988–	200 (29)	190 (28)	210 (31)	260 (37)
940/960				
4-door	190 (1.9)/940 200 (2.0)/960	190 (1.9)	210 (2.1)	260 (2.6)
Estate	190 (1.9)	210 (2.1)	210 (2.1)	280 (2.8)
Spare wheel "Special Spare"				
155/R 15 18.14	350 (50) 280 (40)	350 (50) 280 (40)	350 (50) 280 (40)	350 (50) 280 (40)

Sustained high speed driving (more than an hour at above 120 km/h = 72 mph): air pressure of cold tires should be increased by 30 kPa (4 psi). **Note: This does not apply to the "Special Spare".**

* For USA/Canada: refer to sticker on front right door.

Tightening torques

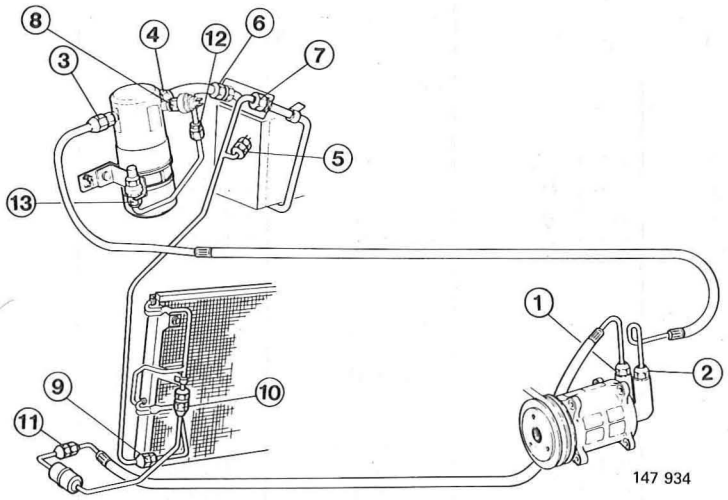
	Nm	ft lb
Trailing arm bracket	45	33
Springs rear, upper mount (approx.)	48	35
Attaching bolts, front brake calipers	100	74
Attaching bolts, rear brake calipers	58	43
Wheels	85	63

Section 8 Body and interior

Air conditioning

Refrigerant, type	Freon 12 (dichlorodifluoromethane)				
quantity	1.2 kg (2.6 lb)				
760 1988	1.1 kg (2.4 lb)				
Compressor, make + designation	Delco R4	Sanden Sankyo SD510	York A210	Kiki YA 15 DKS 15BH/ CH	Sanden SD709
max. rev	115 r/s (7000 r/m)	100 r/s (6000 r/m)	100 r/s (6000 r/m)	115 r/s (7000 r/m)	100 r/s (6000 r/m)
lubricating oil capacity	177 ml	135 ml	300 ml	200 ml	240 ml
safety valve, actuated at	3.1 MPa (441 psi)	3.2 MPa (455 psi)	3.1 MPa (441 psi)	3.2 MPa (455 psi)	3.2 MPa (455 psi)
Lubricating oil	Volvo P/N 1 160 048-3				

Tightening torques



		Nm	ft lb
1	Compressor outlet	27	20
2	Compressor inlet	39	29
3, 4	Receiver/drier	45	33
5	HP pressostat	10	7.5
6	Evaporator (line from receiver/drier)	27	20
7	Evaporator	12	9
8	LP pressostat	3.5	2.5
9	Condenser (line from evaporator)	20	15
10	Connection at condenser	24	18
11	Compressor-silencer connection	18	13.5
12, 13	ETF valve	16	12

Delco R4 Compressor

Compressor, coupling plate	14–34	10–25

Kiki Compressor

Front cover bolts	22	16
Drive plate centre bolt	15	11
Rear cover connection	22	16
Oil drain/filler plug	11	8

York Compressor

Compressor mounting bolts	30	22
Oil drain/filler plug	5	3.5
Pulley/clutch centre bolt	25–30	18–22
Rear bearing housing	20	14
Conrods	20	14
Lower cover	20–30	14–22
Valve plate/upper cover	20–30	14–22

Sankyo Compressor

Oil drain plug	10	7
Pulley/clutch centre bolt	38	27
Valve plate	15	11

Pressure sensor

(Only fitted to vehicles with D 24, D 24 T and tropic type radiator)

Electric cooling fan engaged at pressure	2.0 MPa (284 psi)
disengaged at pressure	1.7 MPa (242 psi)

Performance test

Test conditions

Bonnet	closed
Doors	closed
Engine speed	33 r/s (2000 r/min)

Control settings	**CU + AC**	**ACC**	**ECC**
Fan speed	3		5
Temperature control	COOL	Max cool	Max cool
Mode selector	MAX	Auto Hi	Vent
AC switch			In
Recirculation switch			In


143 985

Recorded operating conditions

Ambient temp (in front of car)	20°C (68°F)	30°C (86°F)	40°C (104°F)
Temp of expelled air, measured at centre panel vents	5–8°C (41–46°F)	5–8°C (41–46°F)	8–12°C (46–54°F)



VOLVO SUPPORTS VOLUNTARY
MECHANIC CERTIFICATION
BY THE N.I.A.S.E.

(U.S.A. only)

SAN DIEGO VOLVO
#5364

Service literature

Your most important special tool

SAN DIEGO VO
#5384

TP 30518/1
2500.11.90
USA