

VOLVO

Service Manual

Fault tracing

Repairs

Maintenance

Section 0 (03)

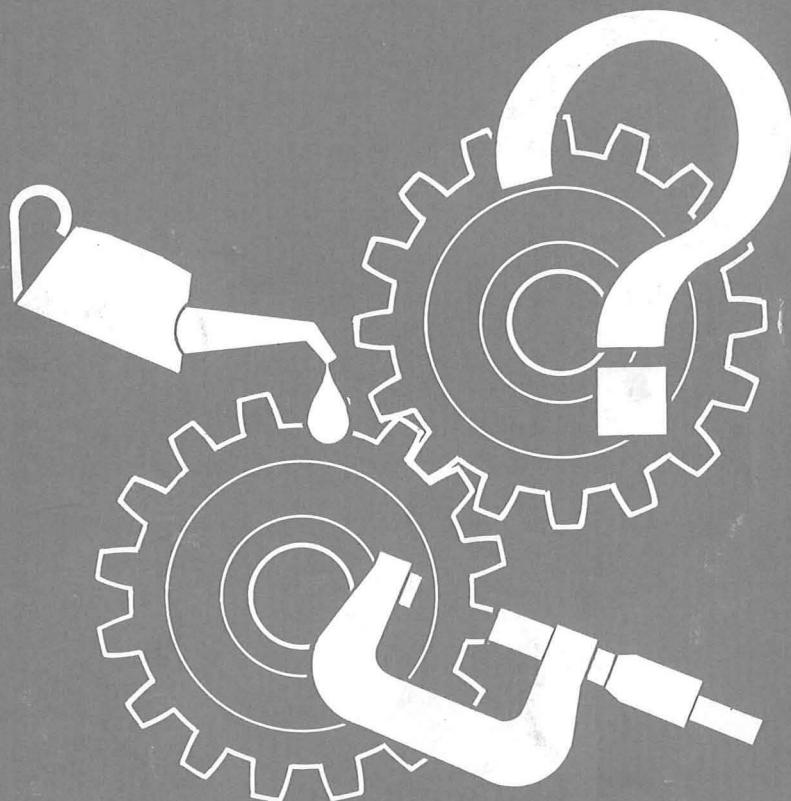
Specifications

700 1982–1991
940/960 1991

TP 30518/10

SAN DIEGO VOLVO

100000



Volvo Cars North America



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a line in the margin.

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

SAN DIEGO VOLVO
#5364

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, 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
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 230 E, 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 230 E, 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

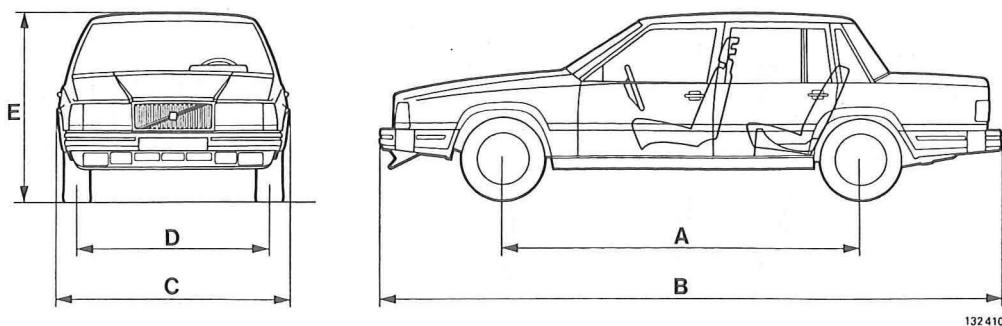
* Sweden: K from chassis number 7509.

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



132410

Dimensions

	740/760	780	944/964	945/965
	mm	in	mm	in
A. Wheelbase	2770	109	2770	109
B. Overall length	4785	188.4	4794	189
C. Overall width.....	1760	69.3	1770	69.7
D. Track, front	1470 ¹⁾	57.9	1470	57.9
rear.....	1460 ²⁾	57.5	1460 ²⁾	57.5
E. Overall height ³⁾	1410	55.5	1400	55.1

¹⁾ – Dec. 1984: wheelbase = 1460 mm.²⁾ 760/960 4-door, 780 1988– Track rear 1520 mm 59.9 in³⁾ Depending on type of tyre.**Weight**

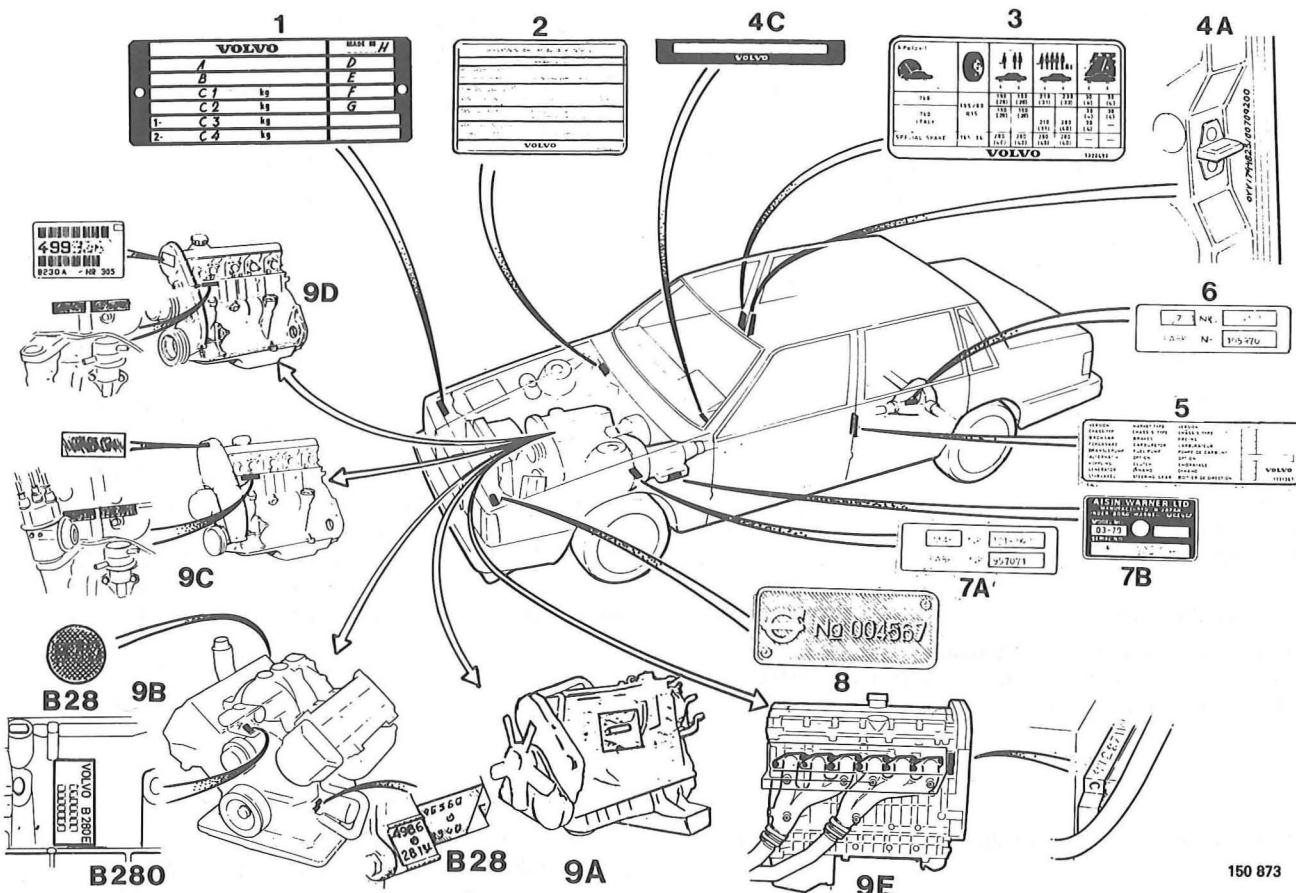
Approximate weight of car without occupants, full fuel tank

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



150 873

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.

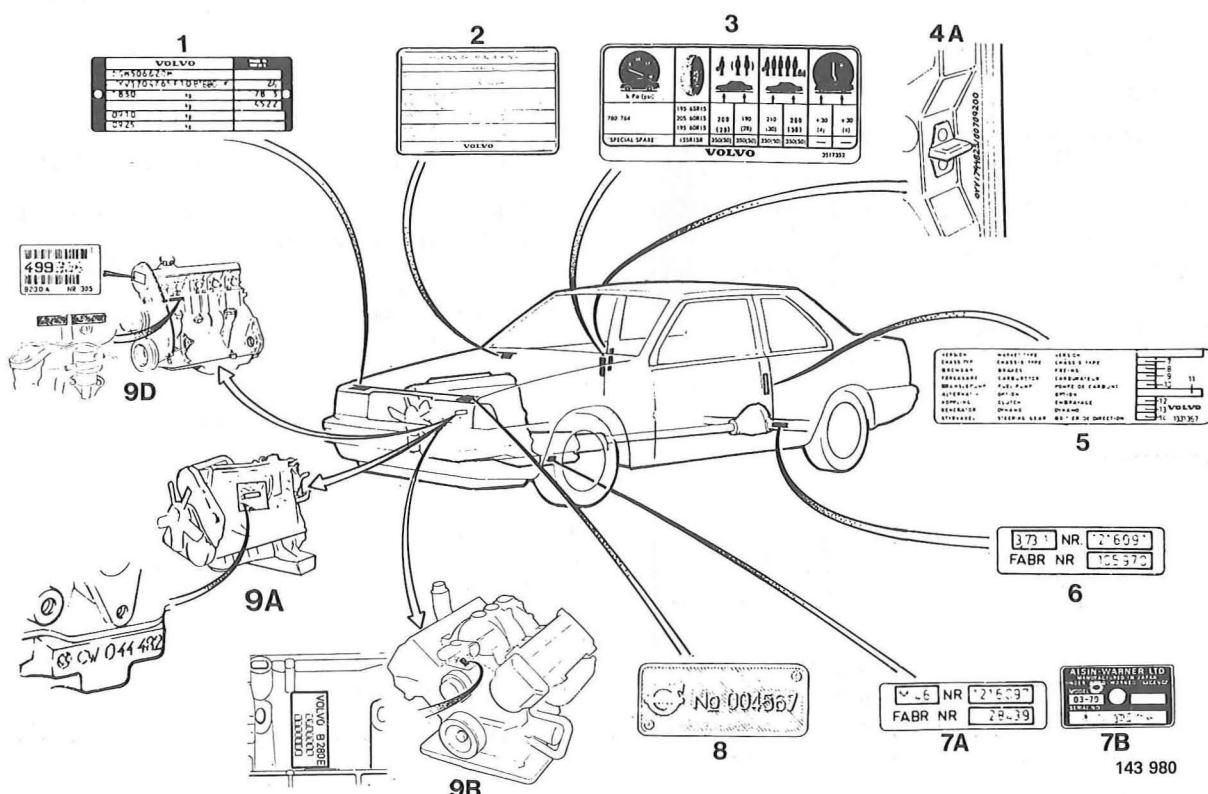
5. Service plate (1982–1989)**740/760**

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****9. Engine type designation, serial number and part number**

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.

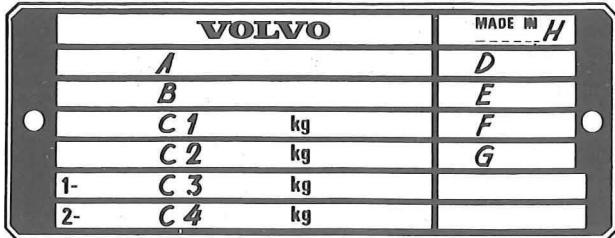
- A. D 24, D 24 T, D 24 TIC
Stamped on cylinder block, beneath vacuum pump.
- B. B 28
Located on plate in front of oil filter. On B 28 E/F engines: a decal on the right rear side of cylinder head shows last three digits of part number.

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.

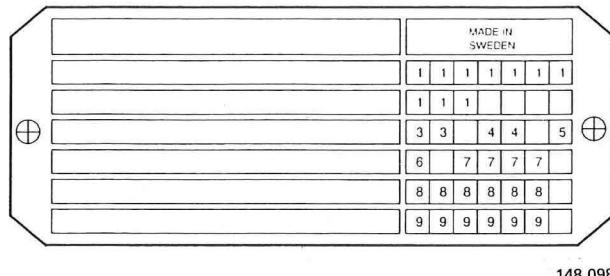
Product plate

1982–1989



147 941

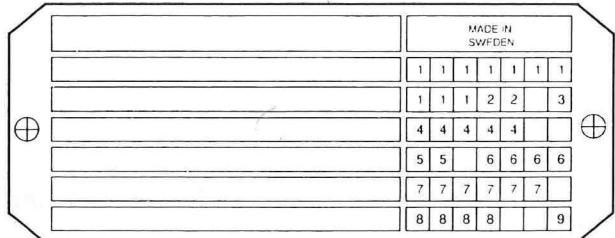
1990 –W 944



148 098

1990 W 945–

1991–



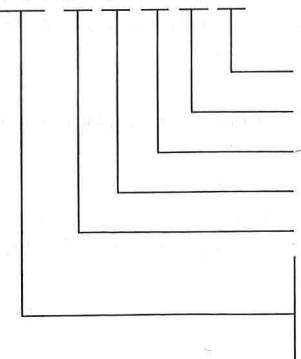
148 099

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

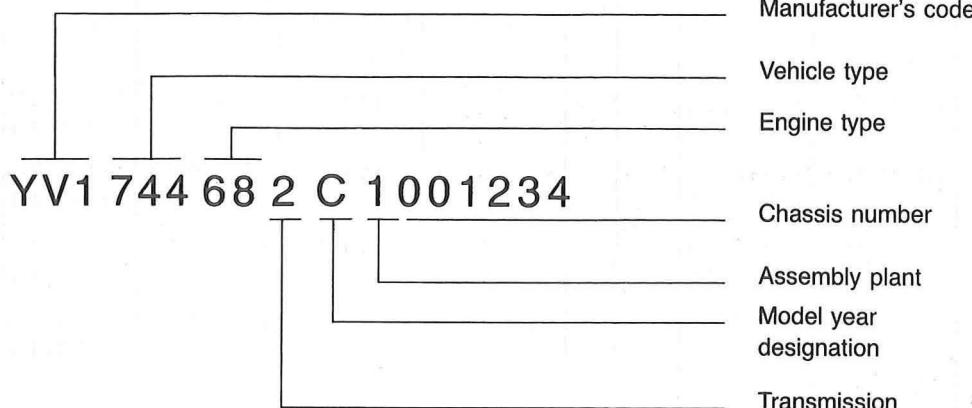
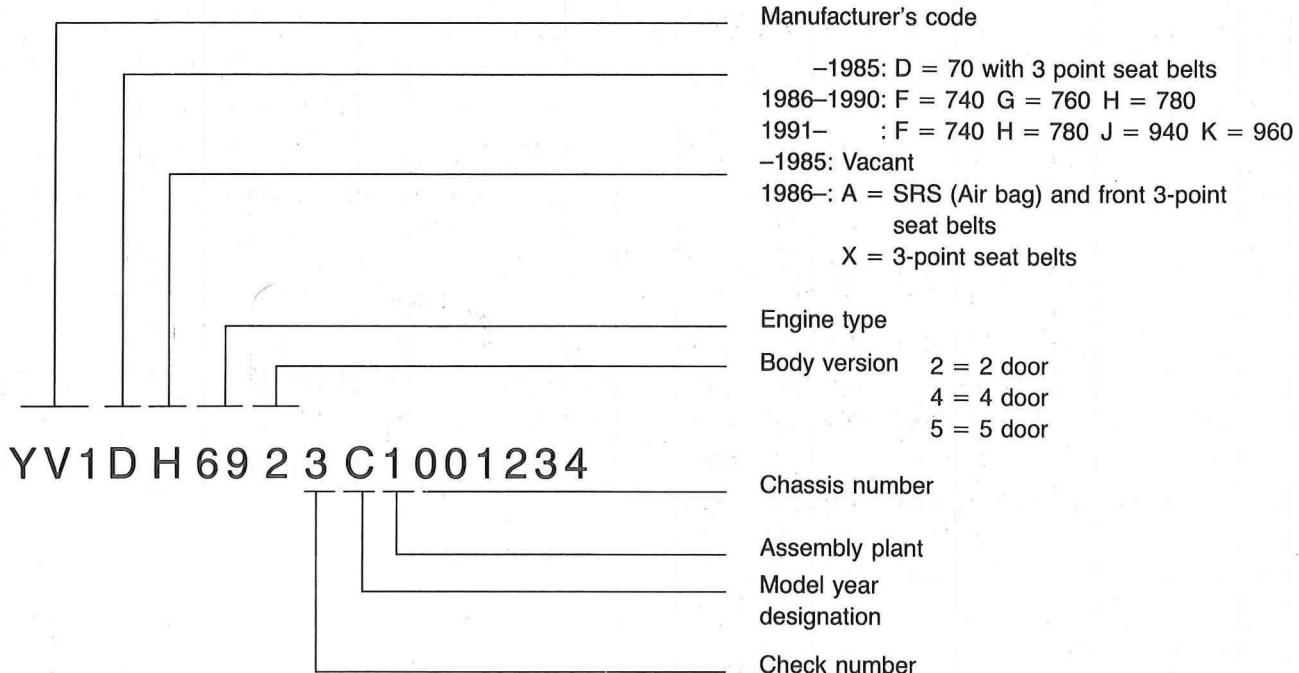
Volvo P/N for each code

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 ab- sorber, 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		

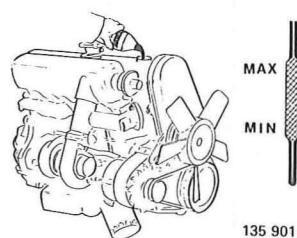
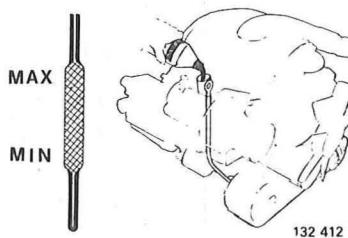
Pos 6	Anti-roll bar, rear	Pos 7	Bump rubber
1	3 516 573-7	4	1 330 853-1
2	3 516 572-9	5	1 359 653-1
3	3 530 751-1	6	1 387 181-9

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



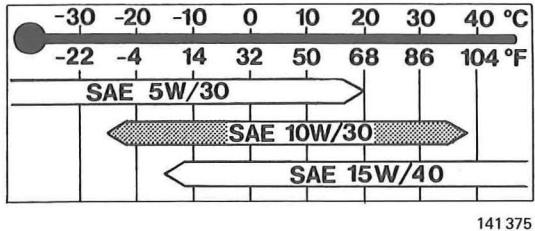
Petrol (gasoline) engines

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)

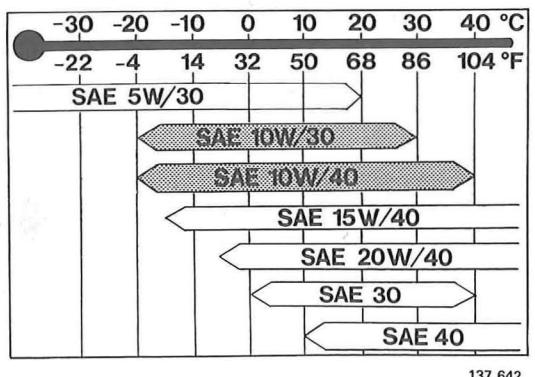


Other markets

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)



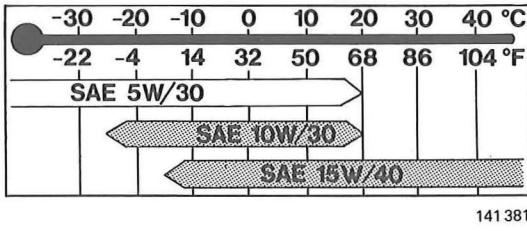
Diesel engines

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)

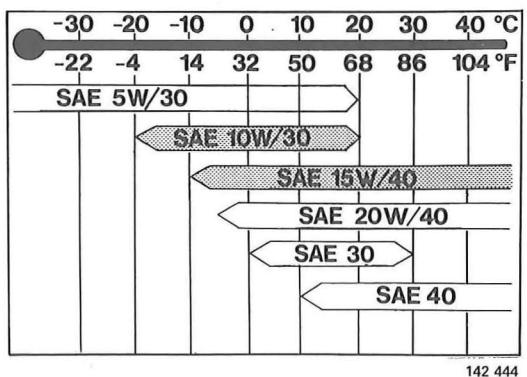


Other markets

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)



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)

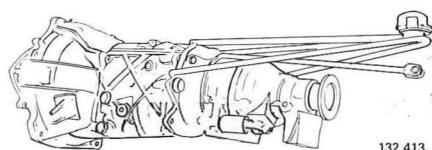
* Turbo: Add extra 0.6 litres if oil cooler is drained.

** 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

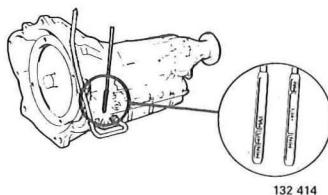
Lubricating oil	ATF type F or G
Oil change quantity, M 46, early type –1990	2.3 litres (2.4 US qts)
late type 1991–	2.6 litres (2.8 US qts)
M 47, early type	1.3 litres (1.4 US qts)
late type	1.6 litres (1.7 US qts)
Tightening torque, oil drain plugs	27–40 Nm (10–29 ft lb)

* 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.

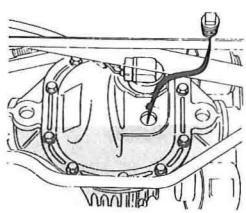
late type	ATF type F or G
Oil change quantity, M 46, early type –1990	2.3 litres (2.4 US qts)
late type 1991–	2.6 litres (2.8 US qts)
M 47, early type	1.3 litres (1.4 US qts)
late type	1.6 litres (1.7 US qts)
Tightening torque, oil drain plugs	27–40 Nm (10–29 ft lb)

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



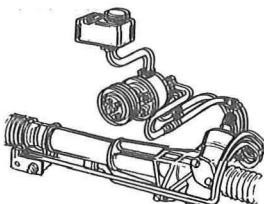
Automatic transmission

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)

Rear axle

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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)
with limited-slip differential (Dana)	Low-friction oil Volvo P/N 1 161 329-6 0.5 litre/US qt
viscosity, above -10°C (+14°F)	API-GL-5(6) or MIL-L-2105 B(C)
below -10°C (+14°F)	with additive Volvo P/N 1 161 129-0 0.5 litre/US qt
Oil change quantity, 1030	SAE 90
1031, -1990	SAE 80
1031, 1991-	1.3 litres (1.4 US qts)
1035	1.6 litres (1.7 US qts)
1041, -1990	1.75 litres (1.85 US qts)
1041, 1991-	1.4 litres (1.5 US qts)
1045	1.45 litres (1.55 US qts)
	1.6 litres (1.7 US qts)
	1.3 litres (1.4 US qts)

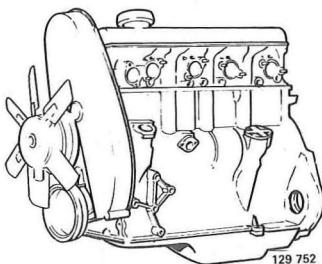
Steering gear

134 143

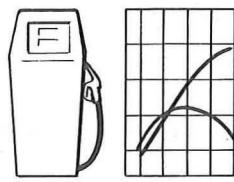
Lubricant.....	Grease, Volvo P/N 1 161 001-1
quantity	approx 100 grams (3.5 ozs)
Power steering fluid	ATF type A, F or G*
quantity, B 28	litres (US qts)
B 19, B 23	1.0 (1.1)
B 200, B 230	0.8 (0.9)
B 280	0.8 (0.9)
B 6304	0.8 (0.9)
D 24, D 24 T -1986	0.8 (0.9)
D 24, D 24 T, D 24 TIC 1987-	0.5 (0.5)

* 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



Group 20 General	15
Group 21 Engine assembly	16
Group 22 Lubricating system.....	20
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Group 20 General

Performance, compression ratios, octane requirements

Engine type	Remarks	Compre-sion ratio	Octane require-ment	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	10.3:1	96	95/88	129/5250	190/50	19.4/3000
	Other markets	10.0:1	98	96/90	131/5400	190/60	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

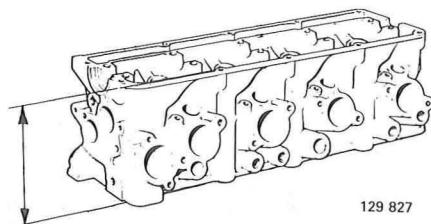
	B 19	B 23
No. of cylinders	4	4
Bore mm (in)	88.9 (3.503)	96 (3.782)
Stroke mm (in)	80 (3.152)	80 (3.152)
Displacement..... dm ³ (litre)	1.99	2.32
Firing order.....	1-3-4-2	1-3-4-2
Compression pressure ¹⁾ MPa (psi)	0.9 (128)	0.9 (128)
Max. deviation between cylinders	MPa (psi)	0.2 (28)
Approx. weight.....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

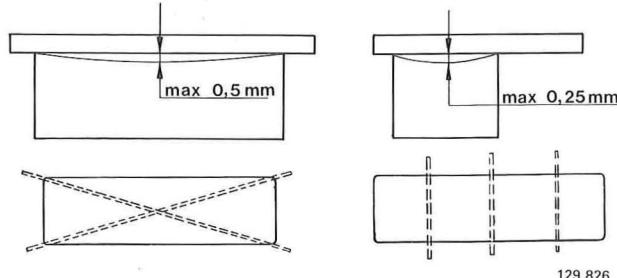
Cylinder head

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



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.



Cylinder block

Bore

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

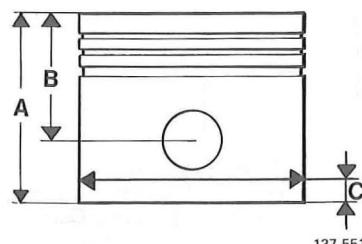
Rebore if wear exceeds 0.1 mm (0.004 in) and oil consumption is very high.

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.



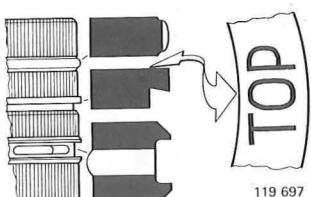
Engine type	Weight in gms ¹ (oz)	Dimension mm (in)		
		A	B	C
B 19 E	515±6 (18.4±0.2)	73.9 (2.912)	46.7 (1.840)	7 (0.276)
B 19 ET	510±6 (18.2±0.2)	71.0 (2.797)	46.0 (1.812)	7 (0.276)
B 23 E	570±7 (20.4±0.3)	76.4 (3.010)	46.4 (1.828)	8 (0.315)
B 23 ET	562±7 (19.8±0.3)	8.4 (2.657)	46.4 (1.828)	12 (0.423)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

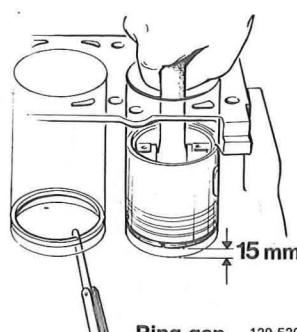
Piston running clearance

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

Clearance in piston groove

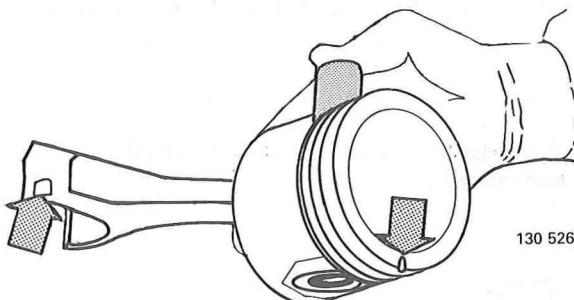
	Upper Comp. rings	Lower Comp. rings	Oil scraper rings
B 19 E, B 19 ET, B 23 E	mm 0.040–0.072 (in) (0.0016–0.0028)	mm 0.040–0.072 (in) (0.0016–0.0028)	mm 0.030–0.062 (in) (0.0012–0.0024)
B 23 ET, B 23 FT	mm 0.060–0.092 (in) (0.0024–0.0036)	mm 0.040–0.072 (in) (0.0016–0.0028)	mm 0.030–0.065 (in) (0.0018–0.0026)

Ring gap (see above)

	mm	mm	mm
B 19 E, B 19 ET, B 23 E	0.35–0.65 (0.0014–0.0026)	0.35–0.55 (0.0014–0.0022)	0.25–0.60 (0.0010–0.0024)
B 23 ET, B 23 FT	mm 0.40–0.65 (in) (0.0158–0.0256)	mm 0.40–0.65 (in) (0.0016–0.0256)	mm 0.30–0.60 (in) (0.0118–0.0236)

Gudgeon (Piston) pins

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



Valves

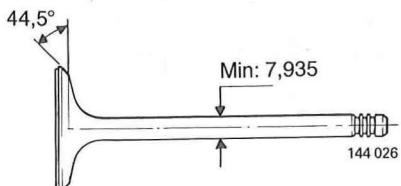
Valve clearance

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

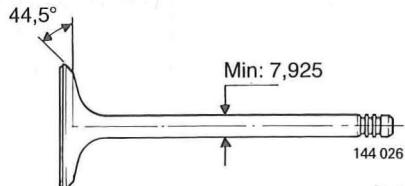
Valves

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

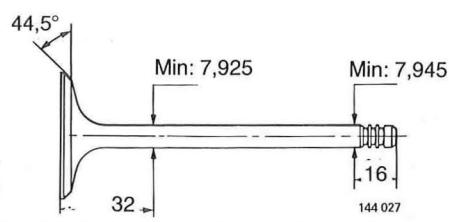
IMPORTANT! Scrapping valves. Exhaust valves in turbo engines are sodium filled and must not be mixed with ordinary scrap iron without first removing the sodium.



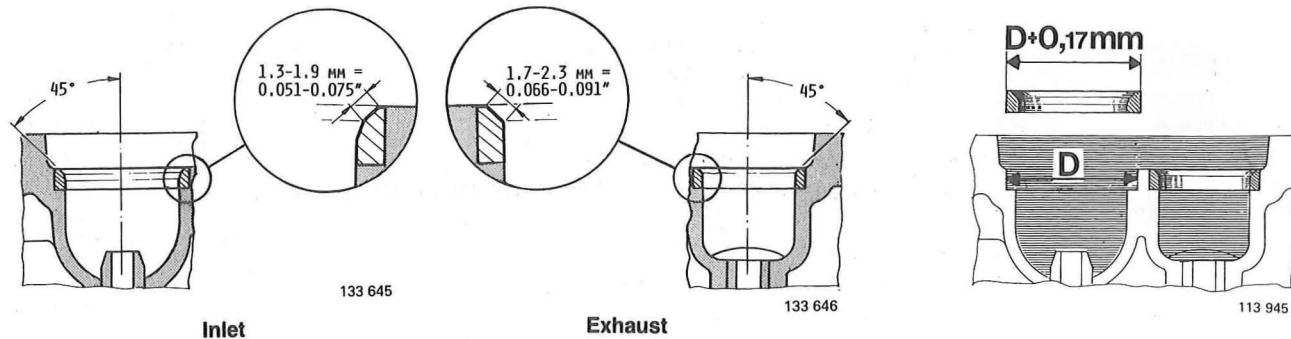
Inlet valve



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



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

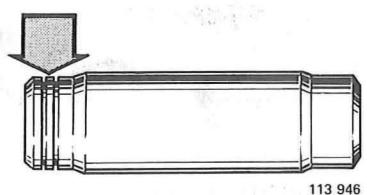
Valve seat

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

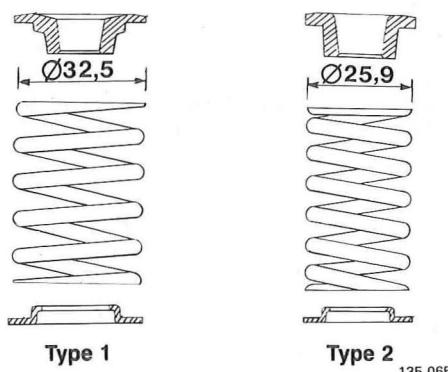
	Inlet valve	Exhaust valve
Inner diameter	mm 8.000–8.022 (in) (0.3152–0.3161)	8.000–8.022 (0.3152–0.3161)
Height above upper face of cylinder head	mm 15.4–15.6 (in) (0.6068–0.6146)	17.9–18.1 (0.7053–0.7131)
Clearance, valve stem-guide (measured with new valve), new	mm 0.030–0.060 (in) (0.0012–0.0021)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

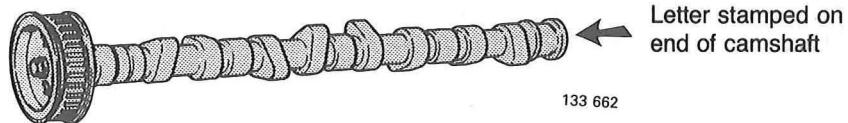
NOTE! The force used when pressing in valve guides must be at least 9000 N (1980 lb). If the pressing force used is lower then the recess for the guide must be reamed out to the nearest oversize and a guide of the corresponding size pressed in.

Valve springs mm (in)

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-of-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)	Out-of-round
Max weight deviation between connecting rods in same engine	10 gms	

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.

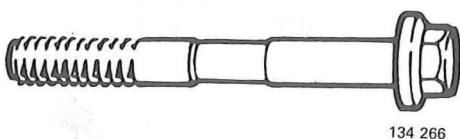
	Nm	ft lb
Main bearings	110	80
Connecting rod bearings, old bolts	63	46
new bolts	70	51
Flywheel (use new bolts).....	70	51
Spark plugs (unoiled).....	25±5	18±3.5
Camshaft sprocket	50	36
Intermediate shaft sprocket.....	50	36
Camshaft bearing caps	20	15
Crankshaft center bolt	165	120

Cylinder head, tighten in stages:

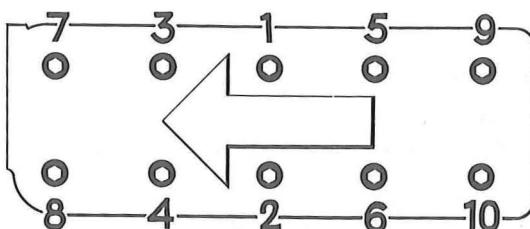
1 = 20 Nm (14 ft lb)

2 = 60 Nm (43 ft lb)

3 = Angle-tighten 90° in one motion



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.



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Tightening sequence for cylinder head bolts

Group 22 Lubricating system

General

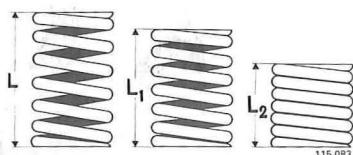
Oil capacity and quality, see page 12.

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



Lengths
39.2 mm (1.5445 in)
26.25 mm (1.0343) in
21.0 mm (0.8274 in)

Load
0
46–54 N (10.1–11.9 lb)
62–78 N (13.6–17.2 lb)

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 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



135 528

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

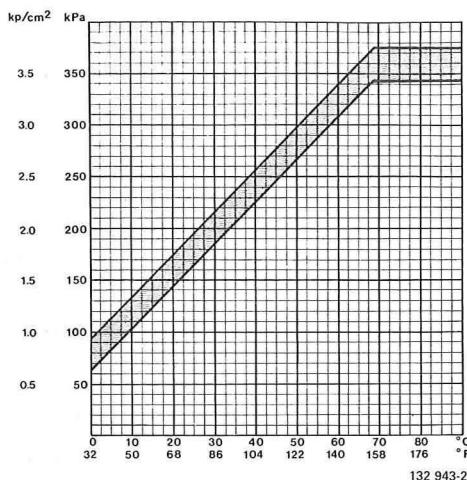
CI system (B 19 E, B 19 ET, B 23 E)**Pressures**

		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)

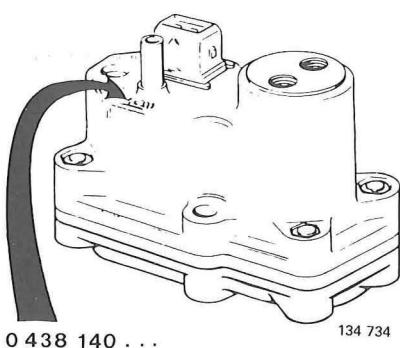
Control pressure

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)

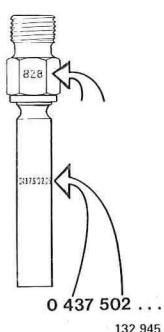


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Control pressure regulator

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

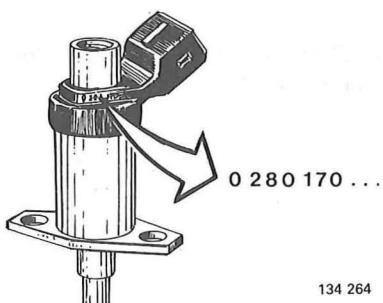
Injectors

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



Start injector Bosch No
Volvo P/N
Injected quantity

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.

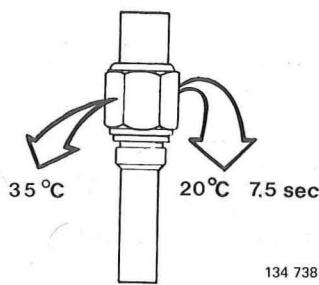
B 19 E, B 23 E

...413
1 276 498-1
85 cm³/min

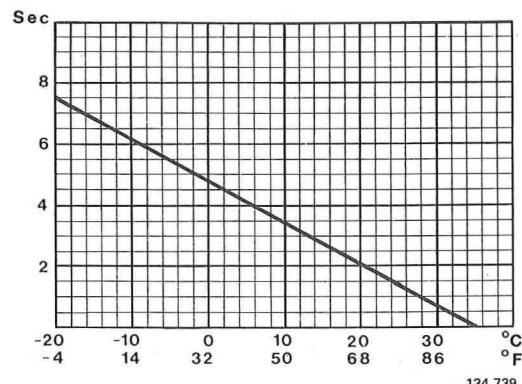
B 19 ET

...415
1 269 585-4
135 cm³/min

Thermal time switch



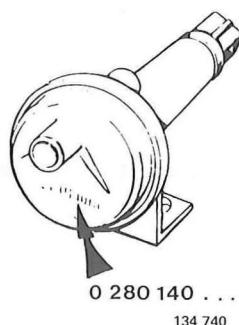
Cut-out temperature and engagement time are stamped on side of switch.



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

Bosch number ... 114
Volvo P/N 1 346 477-1

Manual

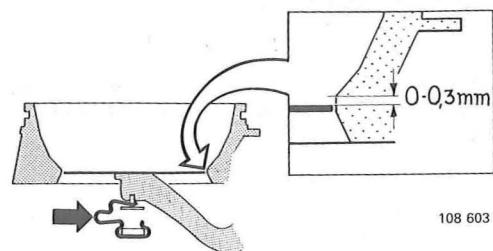
...106
1 346 476-3

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.

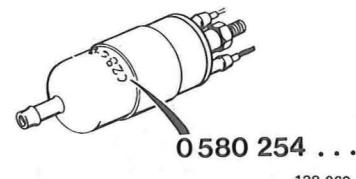
Air-flow sensor

Metering disc rest position



108 603

Fuel pump

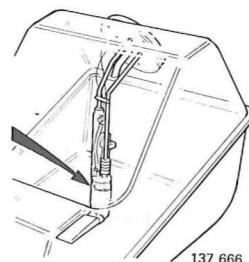


Bo
Vo

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

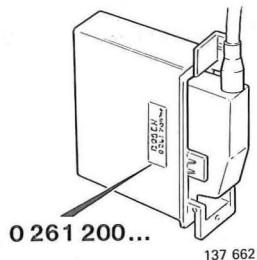
Current consumption at line pressure of 500 kPa (71 psi)
+20°C and 12 V

Tank pump



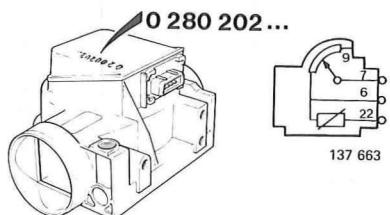
Motronic (B 23 ET)

Control unit



Bosch number012
 Volvo P/N 1 317 025-3

Air flow meter

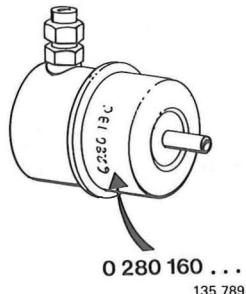


Bosch number035
 Volvo P/N 1 306 967-9

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

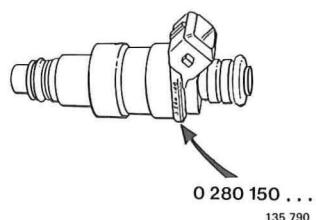
Line pressure, pressure regulator



Bosch number213
 Volvo P/N 1 306 965-3

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

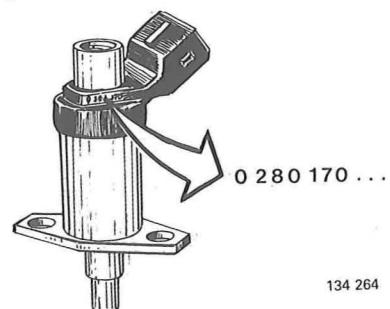
Injector



Bosch number355
 Volvo P/N 1 306 966-1

Injected quantity at a line pressure of
 300 kPa (42 psi) 300 cm³/min

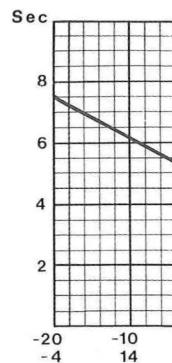
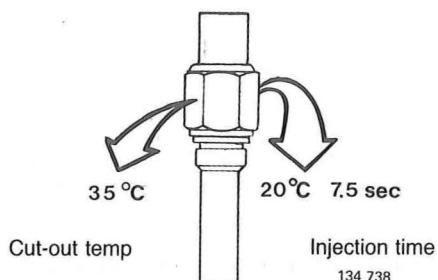
Start injector



134 264

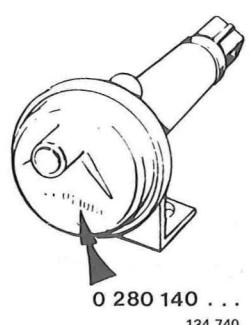
Bosch number
Volvo P/N.....
Injected quantity.....
Injection time control

Thermal time switch



Injection time
Tolerance, time.....
temperature

Auxiliary air valve



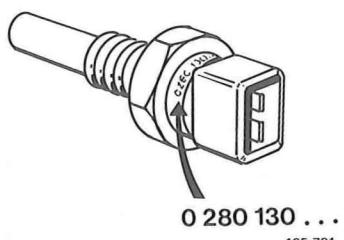
134 740

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

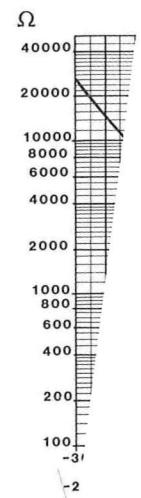
Resistance.....
Fully open at
Fully closed at....

The auxiliary air v
be fully closed af
bient temperature

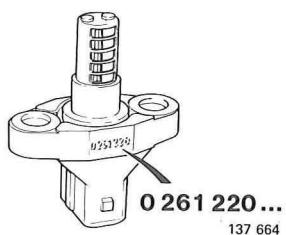
Coolant temperature sensor



135 791



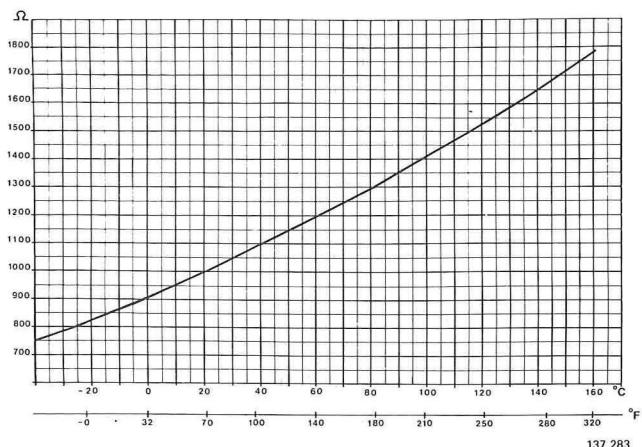
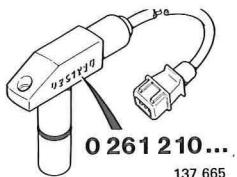
Bosch number..... .026
Volvo P/N 1 332 396-9
Resistance at:
-10°C (-14°F)..... 8 260–10 560 Ω
+20°C (68°F)..... 2 280–2 720 Ω
+80°C (175°F)..... 290–364 Ω

Temperature sensor, charge air

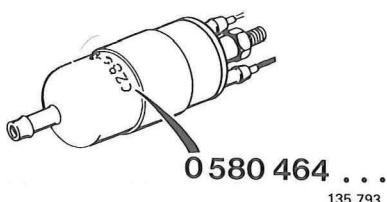
Bosch number001
 Volvo P/N 1 317 273-9

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 number003
 Volvo P/N 1 317 030-3

Fuel pump

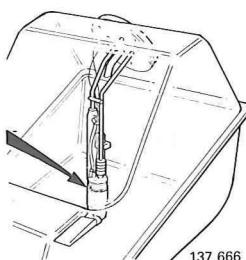
Bosch number025
 Volvo P/N 1 336 679-4

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).

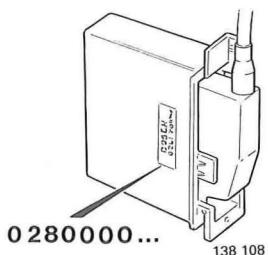
+20°C (68°F) & 12 V max 6.5 A

Tank pump

Current consumption 1–2 A

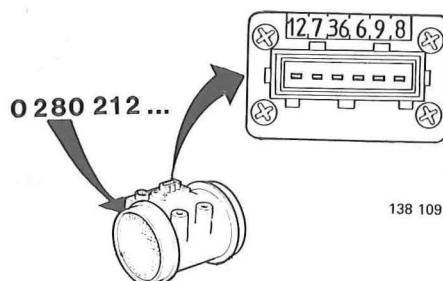
LH-Jetronic (B 23 FT)

Control unit



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

Air mass meter

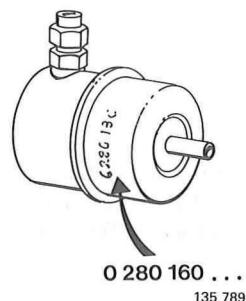


Bosch number 002
Volvo P/N 1 326 065-8

Resistance:

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

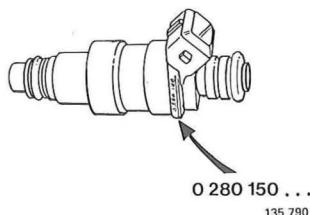
Line pressure, pressure regulator



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

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

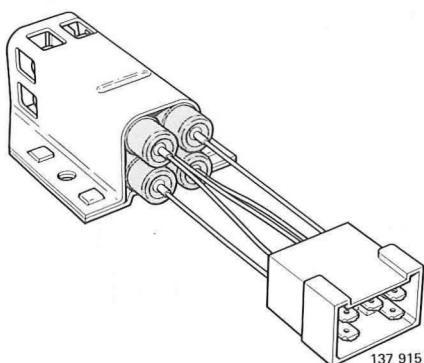
Injectors



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

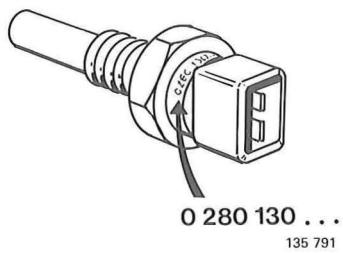
Injected quantity at a line pressure of 300 kPa (42 psi) 300 cm³/min

Injector ballast resistor pack



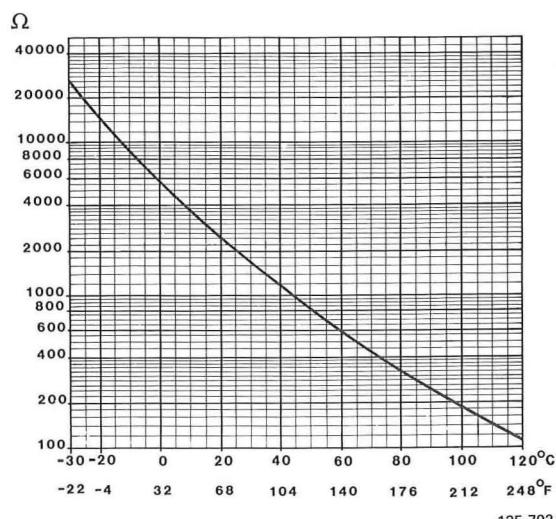
Bosch number 0 280 159 001
 Volvo P/N 1 336 810-5
 Four resistors (1 per injector)
 Resistance 5.5–6.5 Ω

Coolant temperature sensor



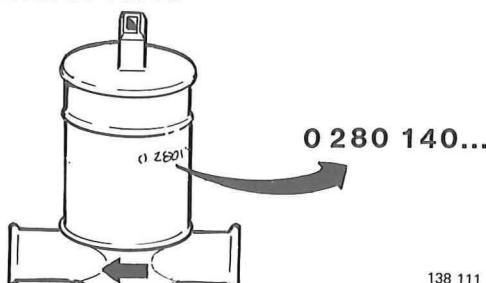
Bosch number 026
 Volvo P/N 1 332 396-9

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



135 792

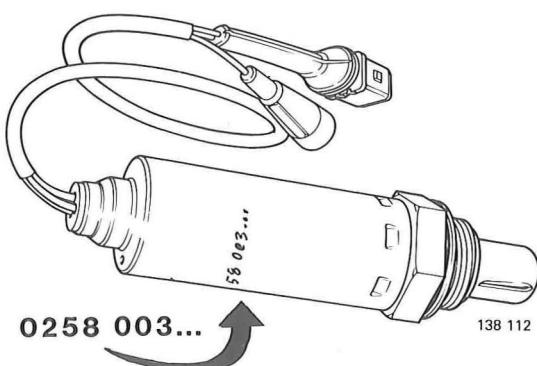
Air control valve



138 111

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



138 112

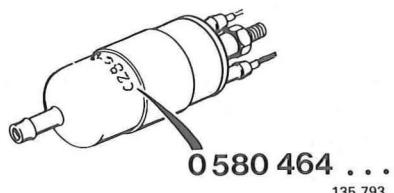
Bosch number 006
 Volvo P/N 1 346 738-6

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

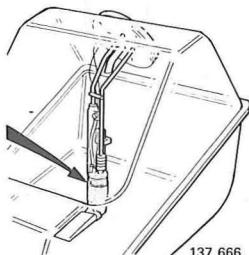
Pump capacity at a line pressure of 300 kPa (42 psi),

+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



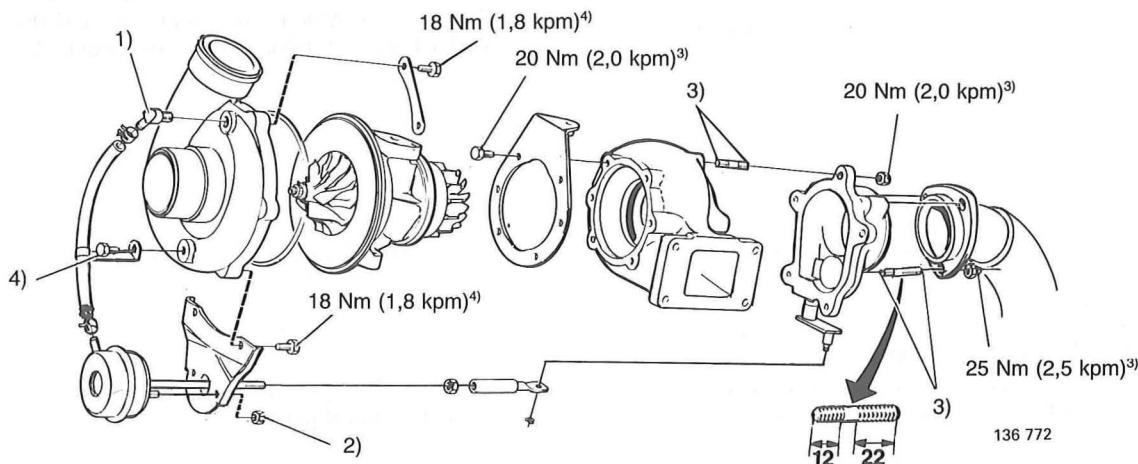
Current consumption 1–2 A

Group 25 Intake and Exhaust systems

Turbocharged engines

Engine type.....	B 19 ET	B 23 ET	B 23 FT
Charge pressure , at full load r/min checking kPa (psi) adjusting kPa (psi)	3500 60–70 (8.5–10.0) 64–70 (9.1–10.0)	3500 45–53 (6.4–7.5) 50 (7.1)	3000 46–54 (615–717) 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

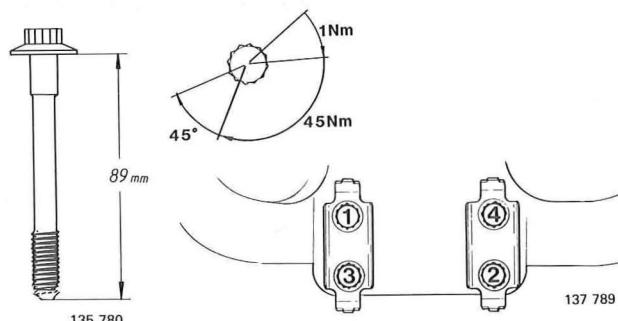


- 1) Apply sealer (P/N 1 161 053-2).
- 2) Use new nuts.
- 3) Use sealer (P/N 1 161 035-9).
- 4) Use new bolts. (Old bolts can if absolutely necessary be reused if they are smeared with sealer P/N 1 161 053-2).

Mounting bolts, turbocharger – exhaust manifold

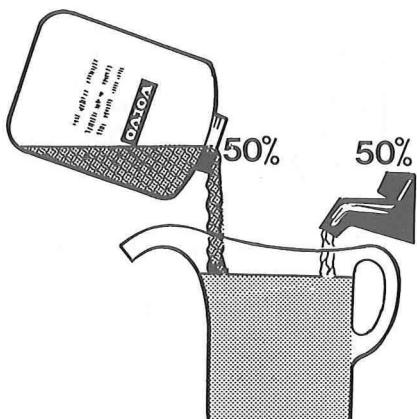
- Measure length of bolt. Bolts can be reused if shorter than **89 mm**.
- Apply assembly paste P/N 1 161 078-9 to mating surfaces and threads
- Fit **new** locking plates
- Tighten bolts in three stages according to below

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 1161 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)

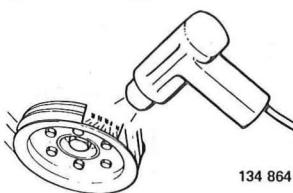
Thermostat

	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

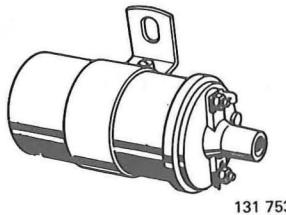
Ignition setting (B.T.D.C.)		
Engine type	12.5 r/s 750 r/min	41.7 r/s 2500 r/min
B 19 E*	10°	28–33°
B 19 ET*	15°	23–26°
B 23 E*	10°	28–33°
B 23 ET	10 ^{o1)}	—
B 23 FT	12 ^{o2)}	—

* 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

0.6–0.9 Ω

0.5 Ω

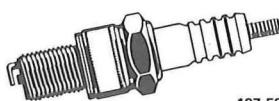
6.5–8.5 kΩ

6.0 kΩ

Resistance of primary coil (terminals 1 and 15)

Resistance of secondary coil (terminal 1 to HT terminal)

Spark plugs, glow plugs



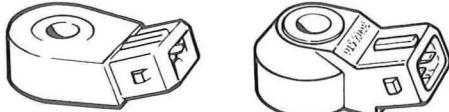
137 530

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 146 804

II

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).

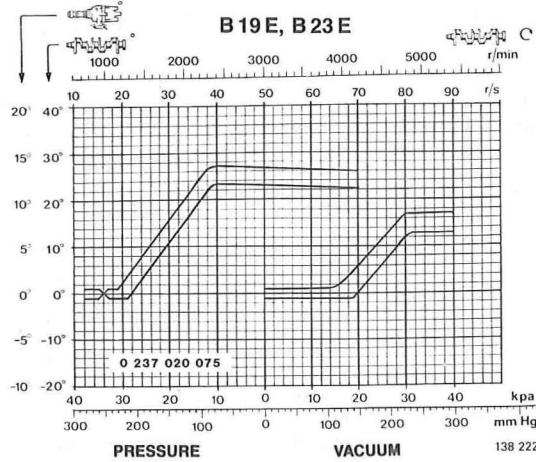
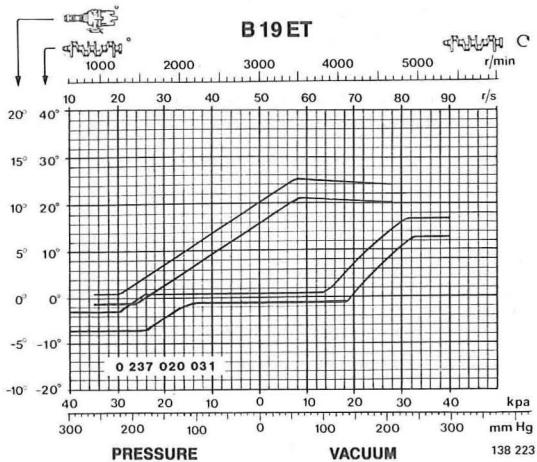
	B 19 E, B 23 E	B 19 ET
Bosch number	0 237 020 075	0 237 020 031
Volvo P/N	1 336 689	1 336 694
Direction of rotation	Clockwise	Clockwise

Centrifugal governor

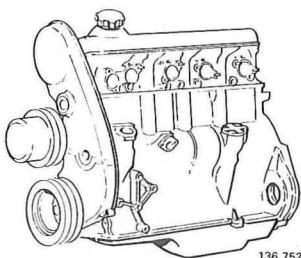
Advance, total, degrees (distributor)	12.5 ± 1.5	12.5 ± 1.5
Advance begins at distrib. rev/sec	6.7–9.2 (400–550)	6.7–11.7 (400–700)
(distrib. rev/min)	20–26 (1 200–1 560)	12.8–16 (770–960)
Data: 5° at distrib. rev/sec	20–26 (1 200–1 560)	12.8–16 (770–960)
(distrib. rev/min)	33.3–39 (2 000–2 340)	17.5–22.3 (1 050–1 340)
10° at distrib. rev/sec	33.3–39 (2 000–2 340)	17.5–22.3 (1 050–1 340)
(distrib. rev/min)	26.7 (1 600)	40 (2 400)
Advance max at distrib. rev/sec	26.7 (1 600)	40 (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

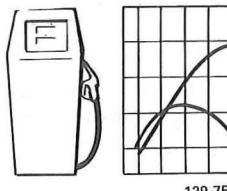
Section 2 B 200, B 230 Engines



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
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Group 20 General

Performance, compression ratio, octane requirements



129 750

Engine type	Remarks	Compre- sion ratio	Octane require- ment 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	98	76/90	103/5400	165/45	16.8/2700
		10.0	98	78/90	106/5400	170/45	17.3/2700
		8.5	93	74/90	100/5400	165/45	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	95 ²⁾	80/98	110/5900	155/48	15.8/2900
		10.0	95 ²⁾	82/95	111/5700	158/57	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	98	84/87	114/5200	192/42	19.6/2500
		9.0	93 ¹⁾	80/87	109/5200	185/42	18.9/2500
		10.5	95 ¹⁾	86/87	117/5200	194/42	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	95 ²⁾	85/90	114 ^{3)/} 5400	183/42 ⁵⁾	135 ^{4)/} 2500 ⁶⁾
		9.8	95 ²⁾	85/90	116/5400	183/42 ⁵⁾	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	95 ²⁾	119/88	160 ^{3)/} 5300	253/48	187 ^{4)/} 2900
		8.7	95 ²⁾	115/80	156/4800	242/55	24.7/3300
		8.7	95 ²⁾	121/80	162 ^{3)/} 4800	264/57	195 ^{4)/} 3450
		8.7	95 ²⁾	121/80	165/4800	264/57	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	95 ^{2,8)}	114/95	155/5700	203/75	20.7/4450
		10.0	95 ²⁾	117/97	159/5800	210/74	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 230
	B 204	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 (lb) (308–330)	140–150 (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 (in) (3.5027–3.5031)	96.00–96.01 (3.7824–3.7828)
D	mm 88.91–88.92 (in) (3.5031–3.5034)	96.01–96.02 (3.7828–3.7832)
E	mm 88.92–88.93 (in) (3.5034–3.5038)	96.02–96.03 (3.7832–3.7836)
G	mm 88.94–88.95 (in) (3.5042–3.5047)	96.04–96.05 (3.7840–3.7844)
Oversize 1	mm 89.29–89.30 (in) (3.5180–3.5184)	96.30–96.31 (3.7942–3.7946)
2	mm 89.67–89.68 (in) (3.5303)	96.60–96.61 (3.8060–3.8064)

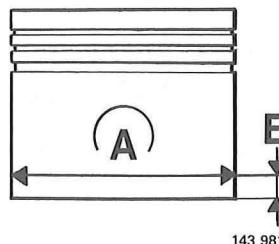
Rebore if wear exceeds 0.1 mm (0.004 in) and oil consumption is very high.

Pistons**Piston diameter (A)**

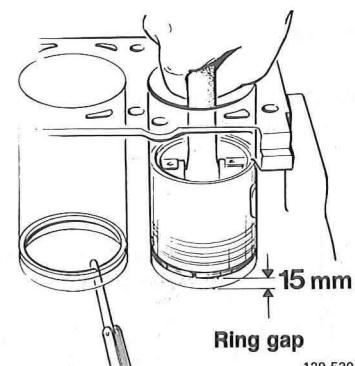
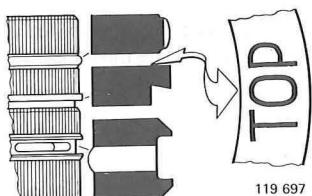
	B 200	B 230
Standard (C).....	mm 88.88–88.89	95.98–95.99
(D).....	mm 88.89–88.90	95.99–96.00
(E).....	mm 88.90–88.91	96.00–96.01
(G).....	mm 88.92–88.93	96.02–96.03
Oversize 1	mm 89.27–89.28	96.28–96.29
2	mm 89.65–89.66	96.58–96.59

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

**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

Side clearance measured with ring on piston B200 mm
(in)

B204 mm
(in)

B230/234 mm
(in)

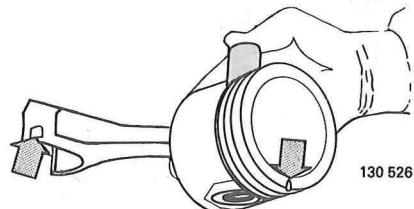
Ring gap (checked in 88.9, 96.0 mm bore) B200/204 mm
(in)

B230/234 mm
(in)

	Upper Comp. rings	Lower Comp. rings	Oil scraper rings
	0.060–0.092 (0.0024–0.0036)	0.030–0.062 (0.0012–0.0024)	0.020–0.055 (0.0008–0.0022)
B204	0.040–0.072 (0.0016–0.0028)	0.030–0.062 (0.012–0.0024)	0.020–0.050 (0.008–0.0019)
B230/234	0.060–0.092 (0.0024–0.0036)	0.040–0.072 (0.0016–0.0028)	0.030–0.065 (0.0012–0.0026)
	0.30–0.50 (0.0118–0.0236)	0.30–0.55 (0.0118–0.0217)	0.20–0.50 (0.0098–0.0197)
	0.30–0.55 (0.0118–0.0217)	0.30–0.55 (0.0118–0.0217)	0.30–0.65 (0.0118–0.0256)

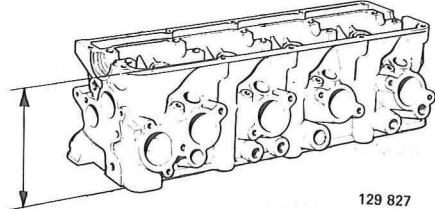
Gudgeon (Piston) pins

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

**Cylinder head****B204/234 B200/230**

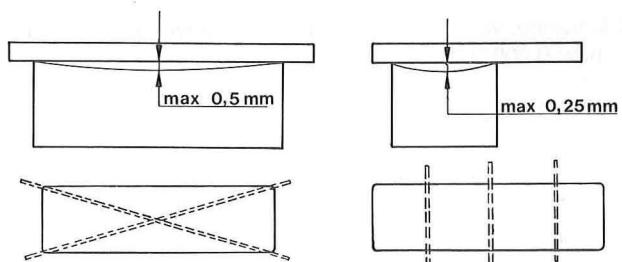
Height, new	mm 103.5 (in) (4.078)	146.1 (5.756)
after machining	mm 102.7* (in) (4.078)	145.6 (5.737)

* Max machining 0.3 mm



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**B200/230**

Inlet and exhaust valves

cold engine mm 0.30–0.40
(in) (0.012–0.016)

warm engine mm 0.35–0.45
(in) (0.014–0.018)

0.35–0.40
(0.014–0.016)

0.40–0.45
(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, B204/234

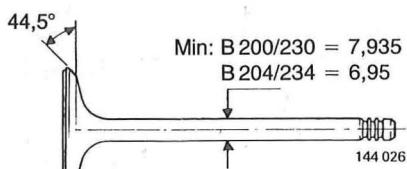
Valve stem height 49.4 ± 0.04 mm
(measured with gauge 5222) 1.946 ± 0.002 in

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

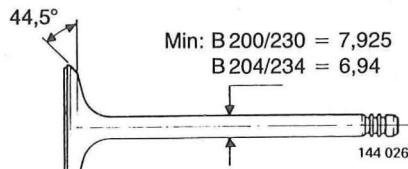
Valves

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

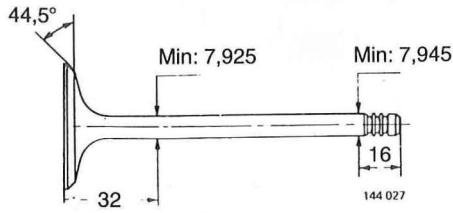
IMPORTANT: Scrapping exhaust valves. The exhaust valves on turbo engines are sodium filled and must not be mixed with ordinary scrap iron before first removing the sodium.



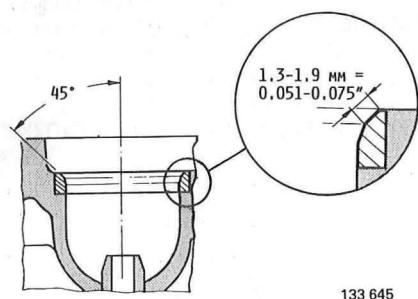
Inlet valve



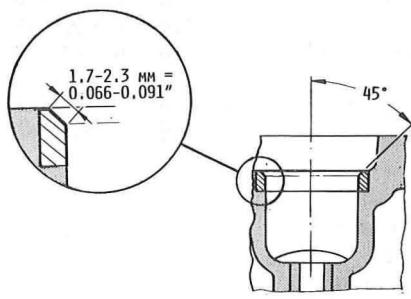
Exhaust valve (Not Turbo)



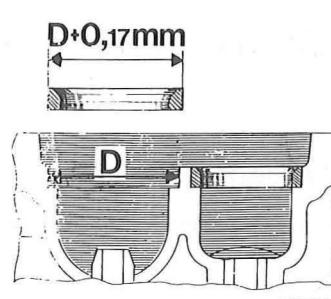
Exhaust valve turbo engines

Valve seats

Inlet



Exhaust

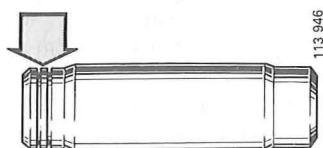


113 945

Valve guides

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

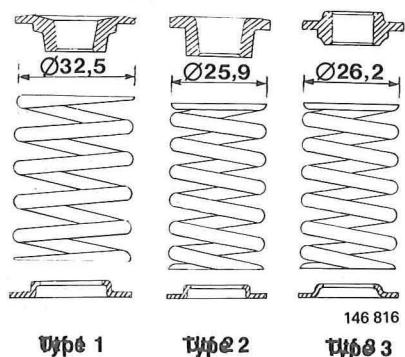
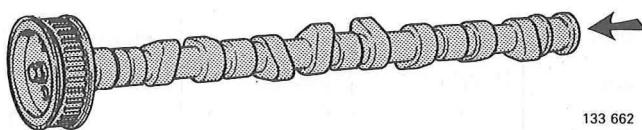
Adjusting shim

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

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

Valve springs

Different types of valve springs are in use as follows.

**Timing gears****Camshaft**

Profile letter stamped on end of camshaft

133 662

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 10.5 exhaust	0.7 (0.0276)	6° A.T.D.C. 44° B.B.D.C.
B 204 E	u ₁ (inlet) u (exhaust)	9.38 (0.3696)	0.7 (0.0276)	5.1° B.T.D.C
B 204 FT/GT	F I (inlet) F A (exhaust)	6.81 (0.0268) 7.45 (0.0294)	0.7 (0.0276)	37.1° B.B.D.C. 12.9° A.T.D.C. 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 1987-	X	10.65 (0.4196)	0.7 (0.0276)	10° B.T.D.C.
B 230 E	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C.
B 230 ET	V	11.37 (0.4480)	0.7 (0.0276)	11° B.T.D.C.
B 230 F	A	10.5 (0.4137)	0.7 (0.0276)	13° B.T.D.C.
B 230 FB	M	9.5 (0.374) inlet 10.5 (0.4137) exhaust	0.7 (0.0276)	6° A.T.D.C. 44° B.L.D.C.
B 230 FT	VX3	11.37 (0.4480) inlet 10.65 (0.4196) exhaust	0.7 (0.0276)	7.7° B.T.D.C. 50.1° B.L.D.C.
B 234 F	T	9.9 (0.3901)	0.7 (0.0276)	4° B.T.D.C.
	u ₁ - (inlet) u - (exhaust)	9.38 (0.3696)	0.7 (0.0276)	5.1° B.T.D.C.
		9.38 (0.3696)	0.7 (0.0276)	37.1° B.B.D.C.

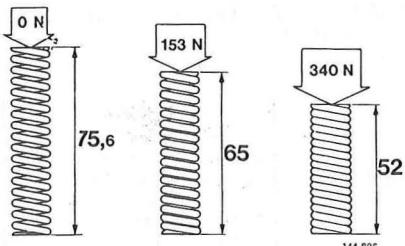
* B.T.D.C. = before top dead centre, A.T.D.C. = after top dead centre, B.L.D.C. = before lower dead centre

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

Coolant temp.	Camshaft belt			Balance shaft belt	
	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

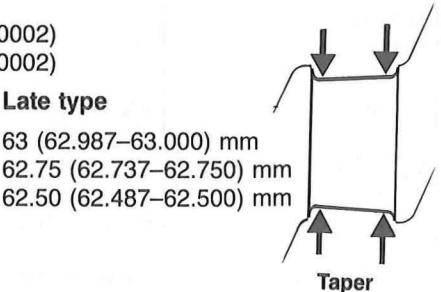
Crankshaft assembly**Crankshaft**

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)

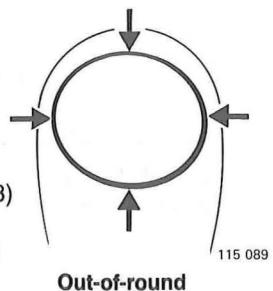
Main bearing journals

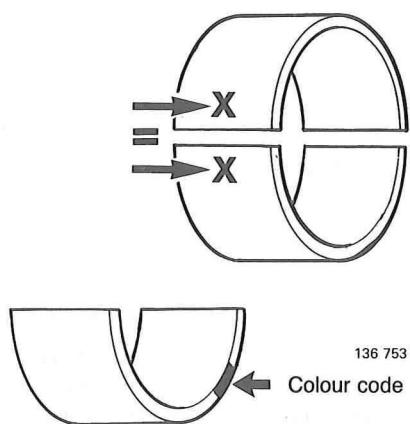
Out-of-round, max	mm (in)	0.006 (0.0002)
Taper, max.....	mm (in)	0.006 (0.0002)

	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

**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)	
undersize 1..... mm (in)	48.984–49.005 (1.9300–1.9308)	
2..... mm (in)	48.75 (1.9207)	
	8.734–48.755 (1.9208–1.9209)	
	48.50 (1.9109)	
	48.484–48.505 (1.9103–1.9111)	





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:



Bolts should be replaced if centre section shows signs of extension.

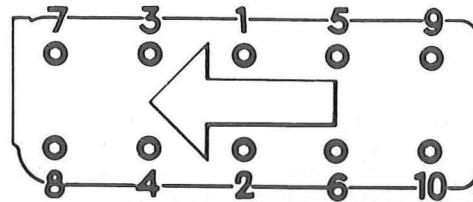
Do not reuse bolts more than 5 times. If in doubt fit new bolts.

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

Group 22 Lubricating system

General data

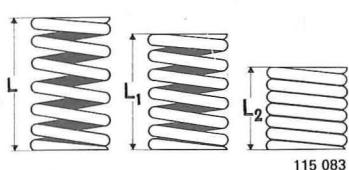
Oil capacity and quality, see page 12.

Oil pressure at 33 r/s (2000 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 (in) (0.0008–0.0047)	0.05–0.10 (0.0020–0.0040)
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:

**B 200/230**

Length	Load
39.2 mm (1.5445 in)	0
26.25 mm (1.0343 in)	46–54 N (10.12 lb)
21.0 mm (0.8274 in)	62–78 N (14–17 lb)

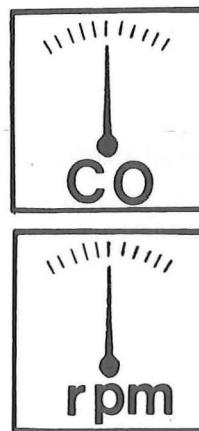
B 204/234

Length	Load
47.6 mm (18.8 in)	0
32.0 mm (1.3 in)	(40–48 N (9–11 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		Manual	Automatic
			Setting	Checking		
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.

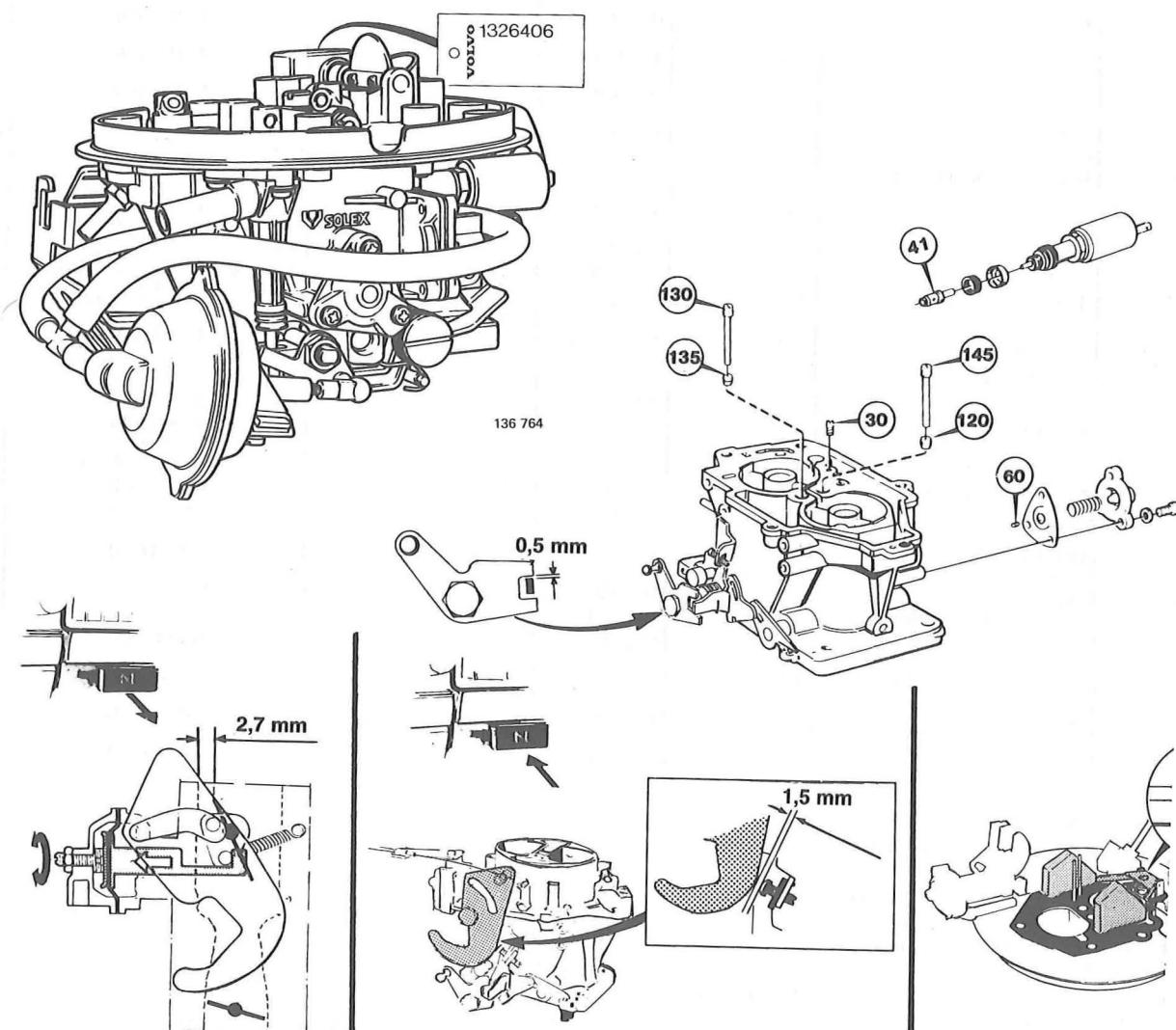
⁵⁾ 1990, connected Lambdasond.

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**

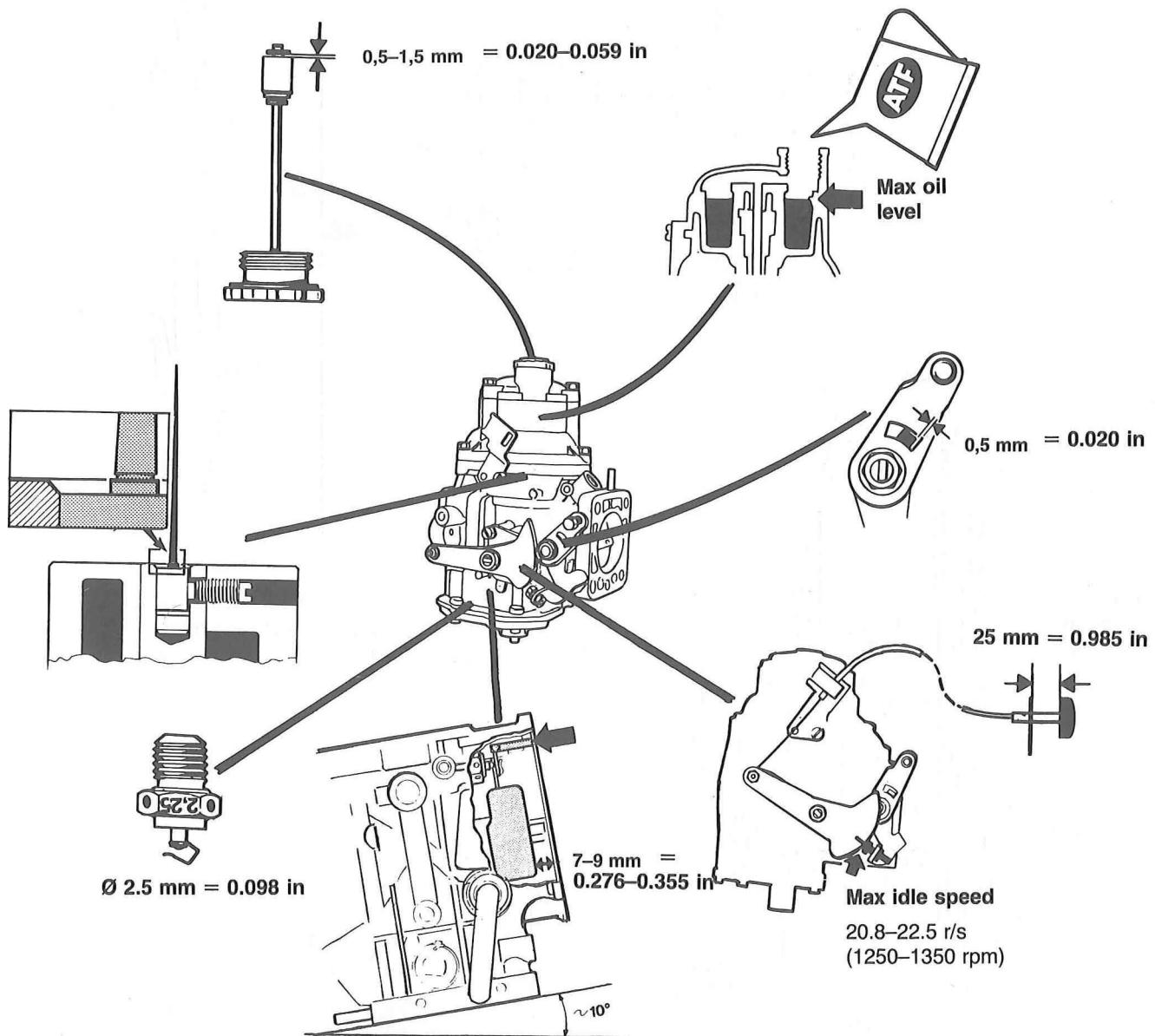
- Choke fully out
- Vacuum servo rod fully in (ie at bottom)

Adjusting max engine speed

- Choke fully in

ENGINE B 230 A**Pierburg (DVG) 175 CDUS Carburettor**

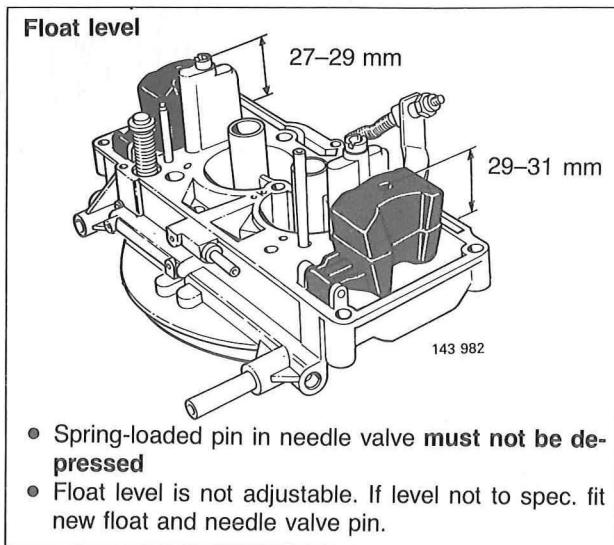
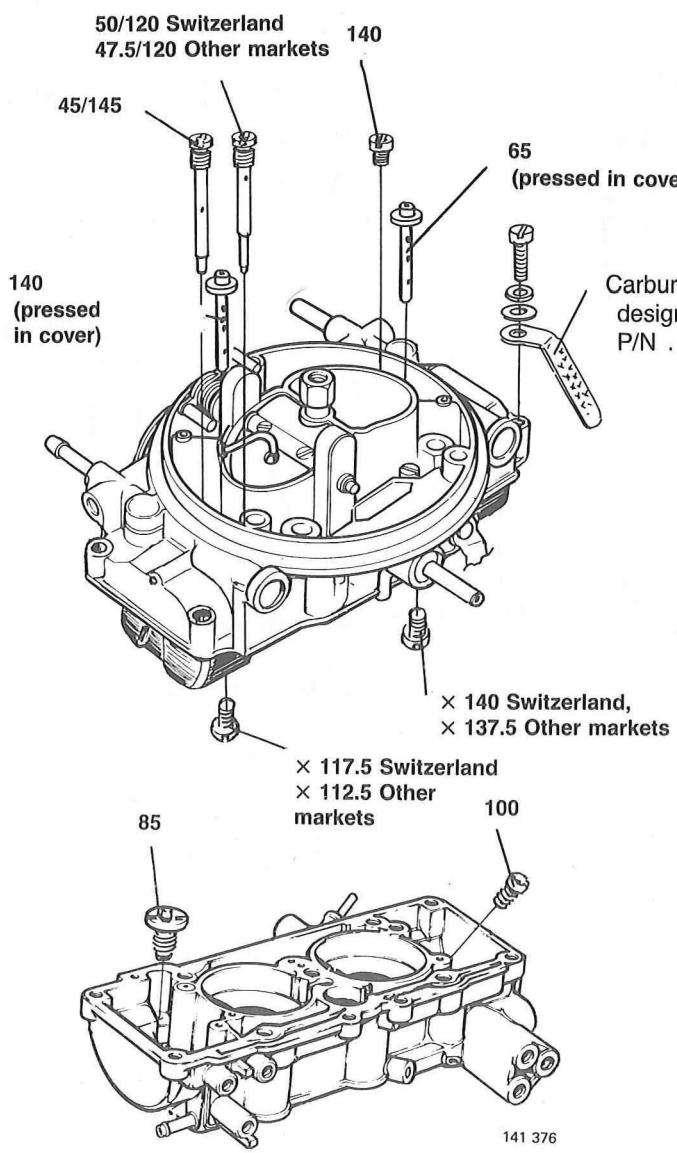
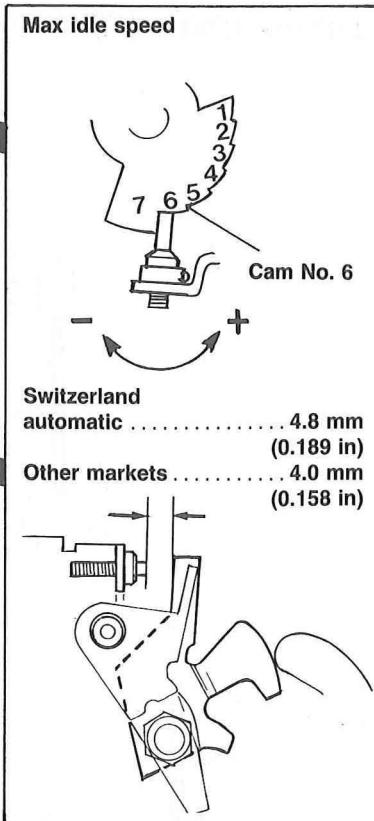
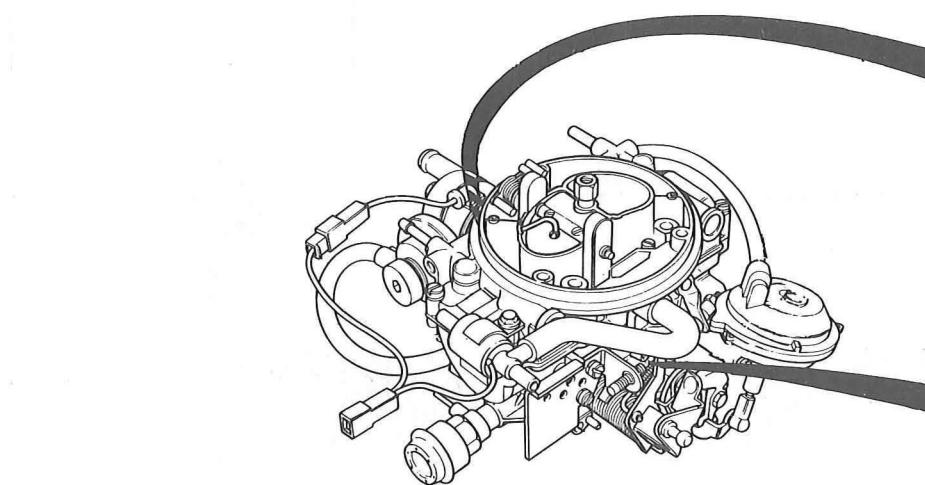
Metering needle
designation
NC

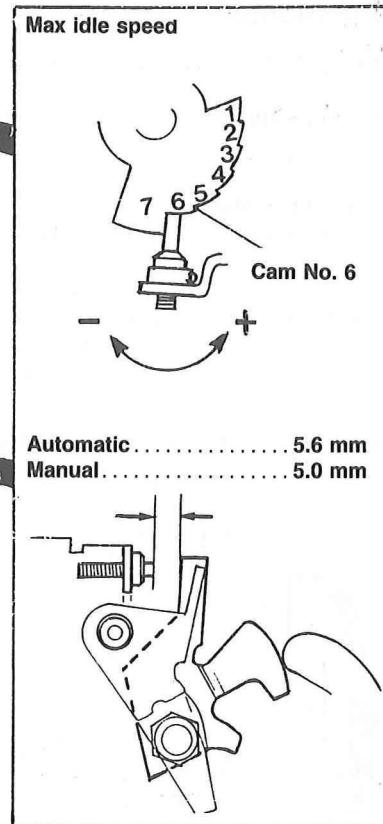
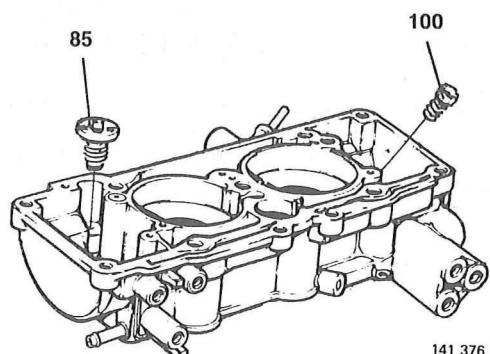
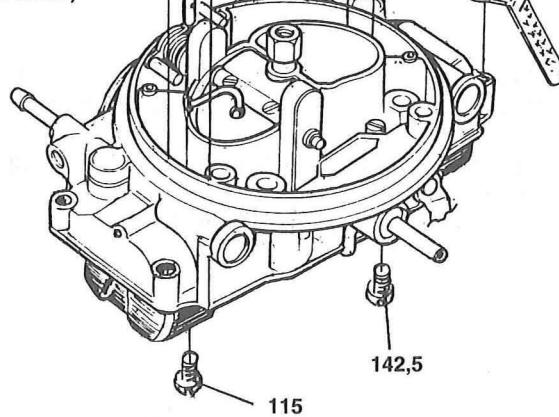
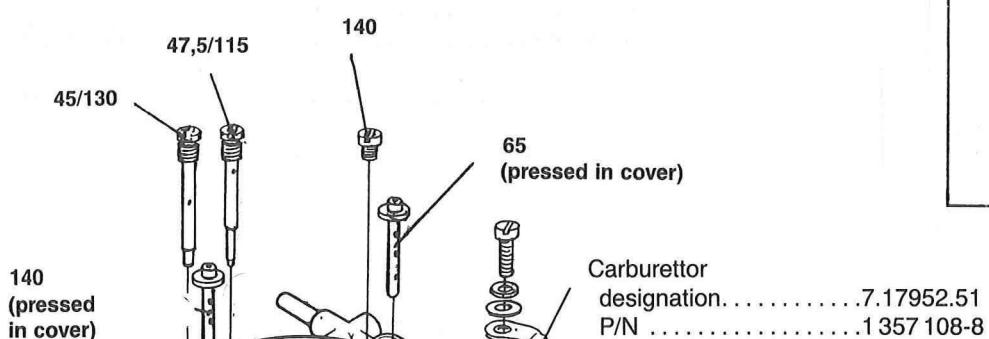
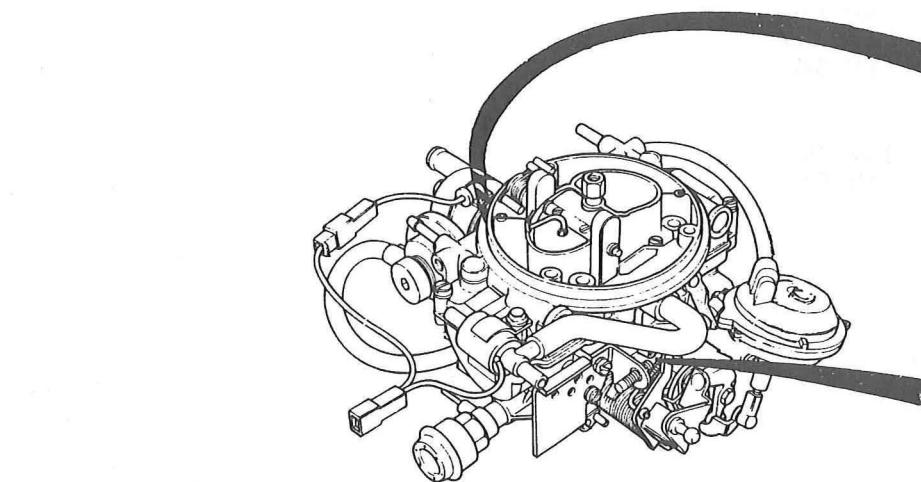


136 755

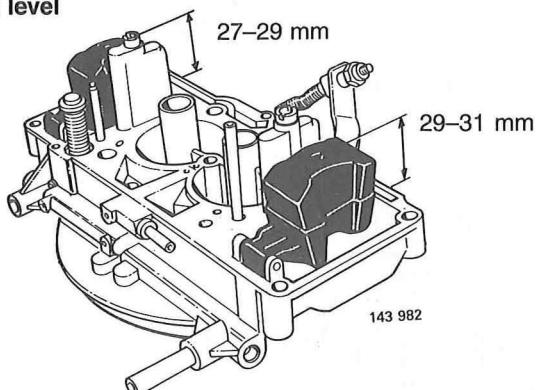
ENGINE B 230 K 1985–1986

Pierburg 2B5 carburettor



ENGINE B 230 K 1987-**Pierburg 2 B 7 carburettor**

136 782

Float level

- 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.

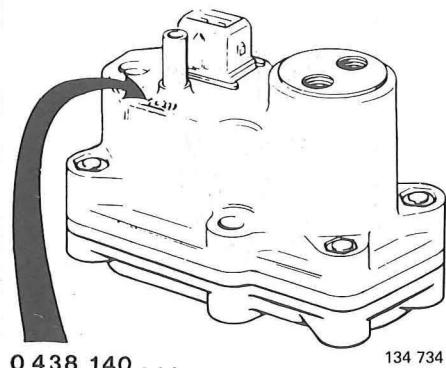
B 200 E, B 230 E: CI System**Pressures**

Line pressure kPa (psi) 450–530
(64–75)

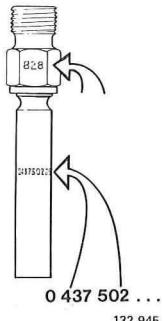
Rest pressure kPa (psi) 150–240
(21–34)

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

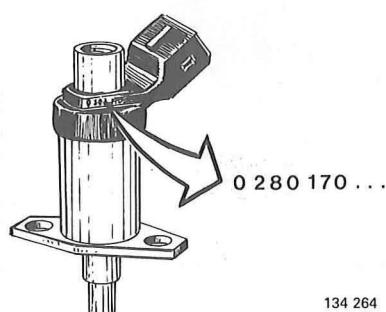
cold engine, see diagram

Control pressure regulator

Bosch No004
Volvo P/N 463 971-2
Resistance 20–30 Ω

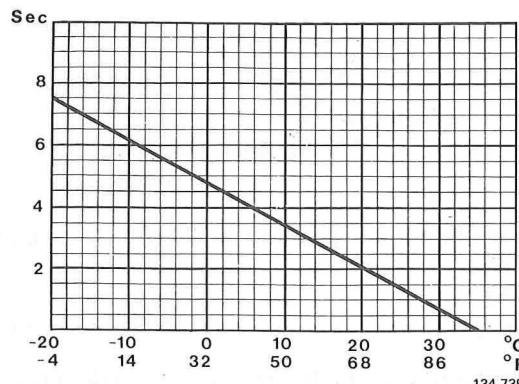
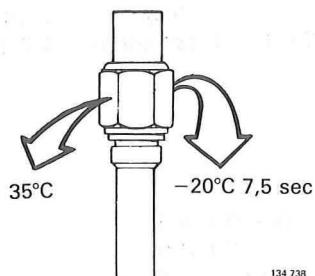
Injectors

Bosch No015
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

	Early type	Late type
Bosch No.	.413	.445
Volvo P/N	1 276 498-1	3 517 065-3
Injected quantity	85 cm³/min	
Injection time	is controlled by a thermal timer (see diagram on next page.)	

Thermal time switch

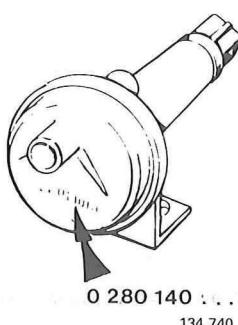


Cut-out temperature and injection time at -20°C (-4°F) is stamped in side of switch.

Injection time at different temperatures

Tolerances: time ± 2 sec
temperature $\pm 4^{\circ}\text{C}$ (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.

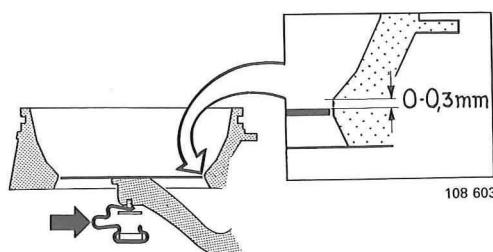
Bosch No	Volvo P/N
B 200 E, manual	106 1 346 476-3
automatic	114 1 346 477-1
B 230 E, manual	112 1 346 478-9
automatic	118 1 357 448-8

Resistance $40\text{--}60 \Omega$
Fully open at -30°C (-22°F)
Fully closed at $+70^{\circ}\text{C}$ (158°F)

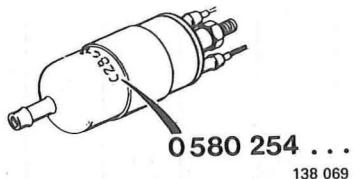
The auxiliary air valve is controlled electrically and should be fully closed after 5 minutes driving at 20°C (68°F) ambient temperature.

Air flow sensor

Metering disc rest position



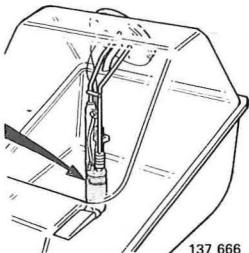
Carry out check at maximum control pressure (in hot engine, fuel pump running).

Fuel pump

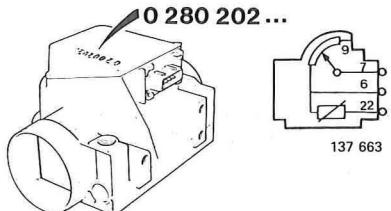
	Type I	Type II	Type III
Bosch No.....	...948	...935	...934
Volvo P/N.....	1 336 677-8	1 389 448-0	1 389 447-2

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

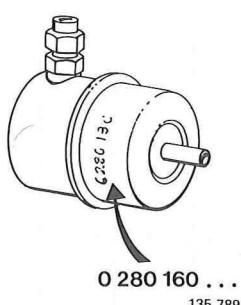
Current consumption 1–4 A

B 200 ET, B 230 ET: MOTRONIC**Air flow meter**

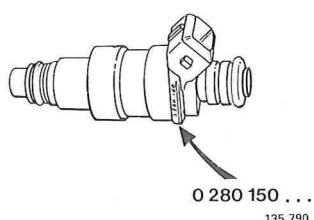
	B 200 ET	B 230 ET
Bosch No.....	067	035
Volvo P/N	1 346 698-2	1 306 967-9

Resistance:

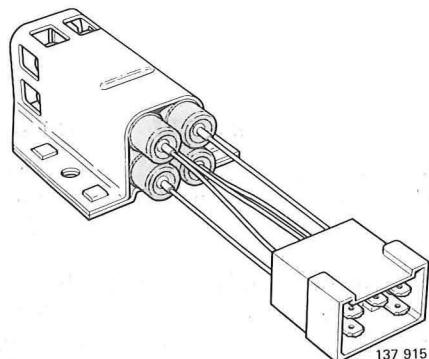
- between terminals 6 and 22 of temperature sensor
at -10°C (14°F) 8 260–10 560 Ω
- +20°C (68°F) 2 280–2 720 Ω
- +50°C (122°F) 760–910 Ω
- between terminals 6 & 9 500–1 100 Ω
- between terminals 6 & 7 8–200 Ω

Line pressure, pressure regulator

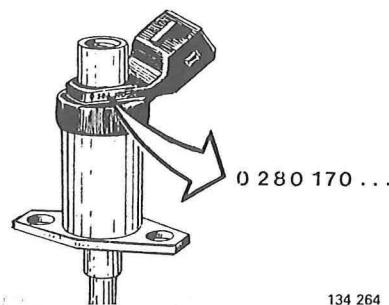
	B 200 ET	B 230 ET
Early type		
Bosch No.....	225	226
Volvo P/N	1 357 705-1	1 357 710-1
Late type		
Bosch No.....	292	294
Volvo P/N	3 517 063-8	3 517 064-6
Line pressure kPa (psi)	250 (36)	300 (42)
Rest pressure kPa (psi)	150–250 (21–36)	200–300 (28–43)
Avstängningstryck		
.....	150–250 kPa (1,5–2,5 kp/cm²)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

Injectors

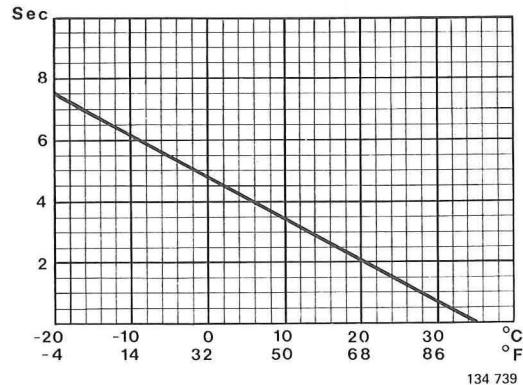
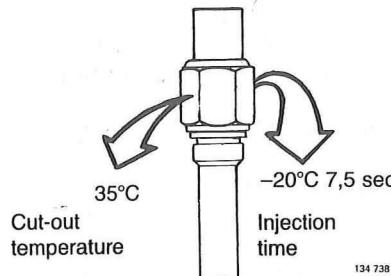
	B 200 ET	B 230 ET
Bosch No.....	802	357
Volvo P/N	1 346 699-0	1 332 337-3
Injected quantity.....	271 cm³/min at a line pressure of ... 250 kPa (36 psi)	300 cm³/min 300 kPa (42 psi)

Injector ballast resistor pack

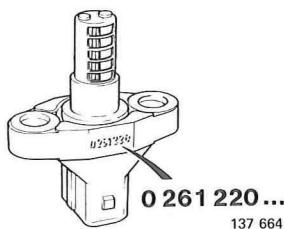
Four resistors (1 per injector)
Resistance 5.5–6.5 Ω

Start injector

	Early type	Late type
Bosch No.	... 400	... 444
Volvo P/N	269 292-9	3 517 066-1
Injected quantity	165 cm ³ /min	
Injection time is controlled by a thermal time switch (see below).		

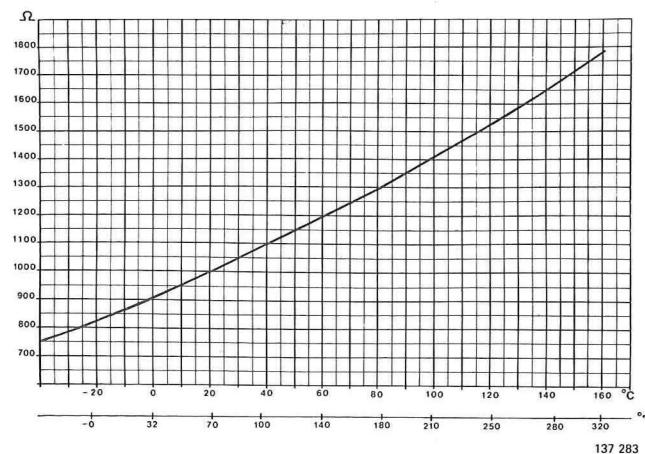
Thermal time switch**Injection time at different temperatures**

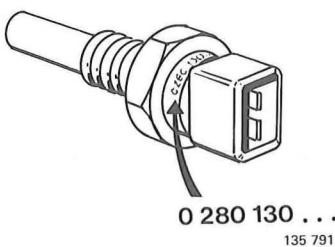
Tolerances: time ± 2 secs
temperature ± 4°C (7.2°F)

Charge air temperature sensor

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

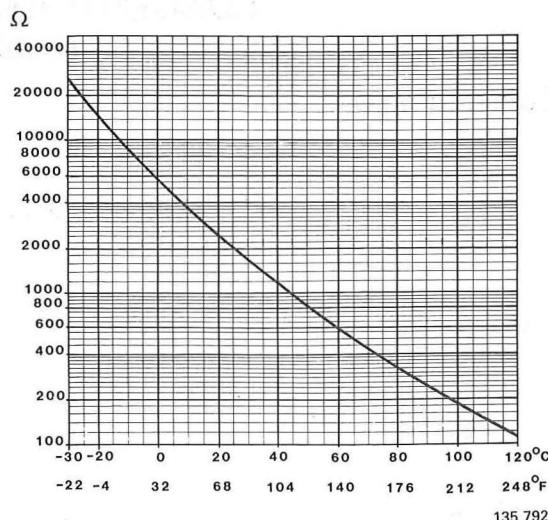
Resistance:
+20°C (68°F) 985–1015 Ω
+40°C (104°F) 1080–1110 Ω
+130°C (266°F) 1550–1620 Ω



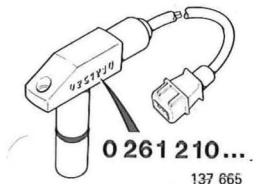
Coolant temperature sensor

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

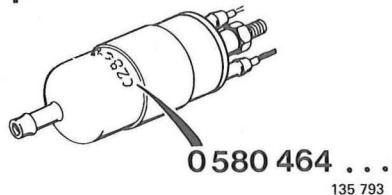
Sensor incorporates 2 resistors: One is connected to Motronic system the other to an idle speed compensation system.

**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)

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

Fuel pump

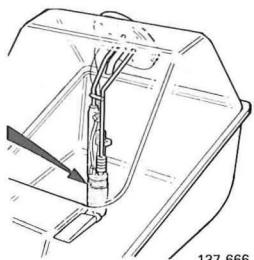
Bosch No 025
 Volvo P/N 1 336 679-4

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),

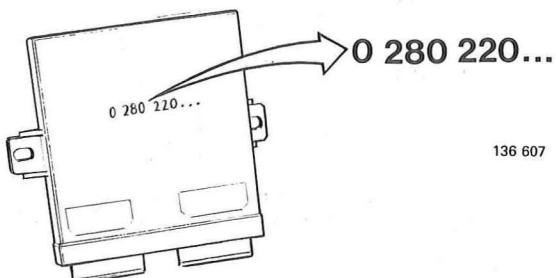
+20°C (68°F) and 12 V	max 6.5 A
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Tank pump

Current consumption 1–4 A

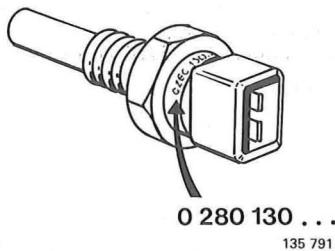
CONSTANT IDLE SPEED SYSTEM (CIS), (B 200 ET, B 230 ET)

Control unit



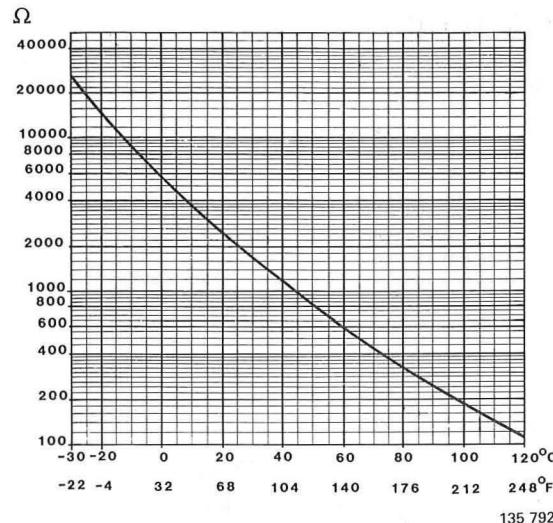
Bosch No 016
Volvo P/N 1346 567-9

Coolant temperature sensor



Bosch No 032
Volvo P/N 1346 030-8

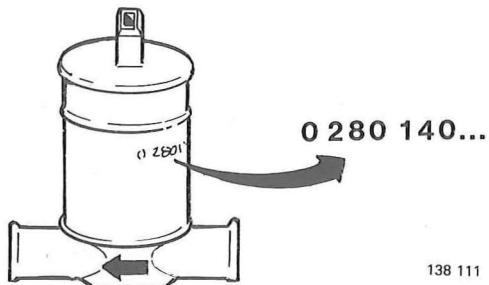
Sensor incorporates 2 resistors: One is connected to Motronic system the other to an idle speed compensation system.



Resistance:

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

Air control valve

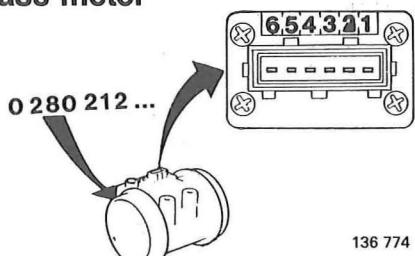


	Early type	Late type
Bosch No.....	.501	.520
Volvo P/N	1 317 957-7	3 517 067-9
Resistance between terminals 3 and 4, 4 and 5.....	approx 20 Ω	

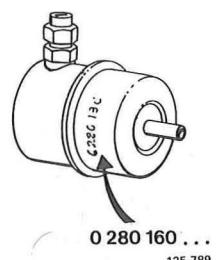
LH-JETRONIC 2.2/2.4 B 200 F, B 230 F, B 230 FT, B 230 GT

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

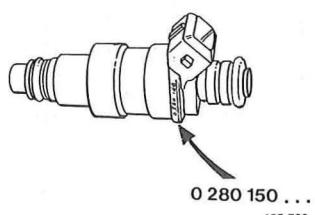
B 230 FT –1989: LH-Jetronic 2.2 (LH 2.2)
B 230 FT/GT 1990–: LH-Jetronic 2.4 (LH 2.4)

Air mass meter

136 774

Pressure regulator

135 789

Injectors

135 790

	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
• between terminals	2.5–4.0 Ω
2 and 6	0–1000 Ω

B 200 F
B 230 F (LH 2.2) **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)
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Rest pressure	150–250 (21–36 psi)	200–300 (28–43 psi)
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B 230 F (LH 2.2)**Early type** **Late type**

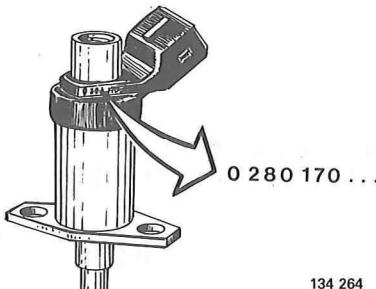
Bosch No.	...209	...734
Volvo P/N	1 326 427-9	1 389 844-0
Injected quantity		
at a line	170 cm ³ /min	170 cm ³ /min
pressure of	250 kPa (36 psi)	250 kPa (36 psi)

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 cm ³ /min
pressure of	300 kPa (43 psi)

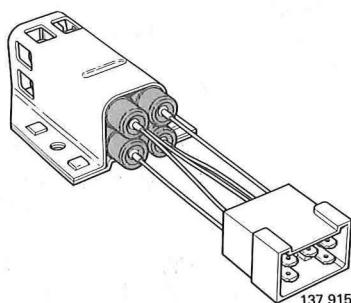
B 230 FT (LH 2.2) **B 230 FT/GT (LH 2.4)**

Bosch No.	...357	...804
Volvo P/N	1 332 337-3	3 517 283-2
Injected quantity		
at a line	300 cm ³ /min	300 cm ³ /min
pressure of	300 kPa (43 psi)	300 kPa (43 psi)

Start injector (LH 2.4)

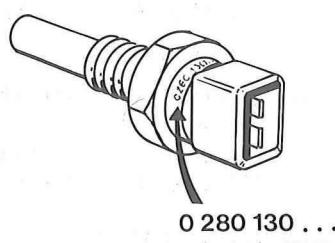
134 264

Bosch No.....	... 446
Volvo P/N.....	3517130-5
Injected quantity	160 cm³/min
Insprutningsmanga	160 cm³/min

Injector ballast resistor pack (B230 FT only)

137 915

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

Coolant temperature sensor

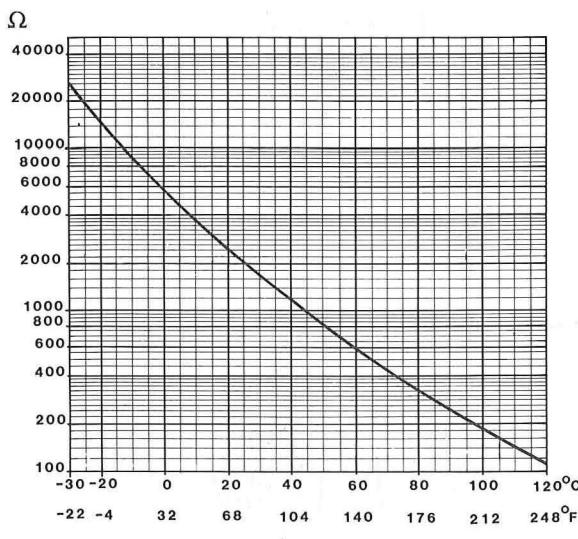
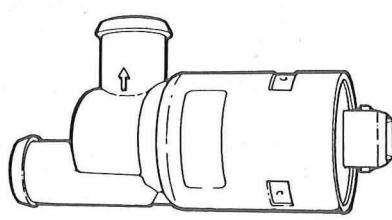
135 791

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

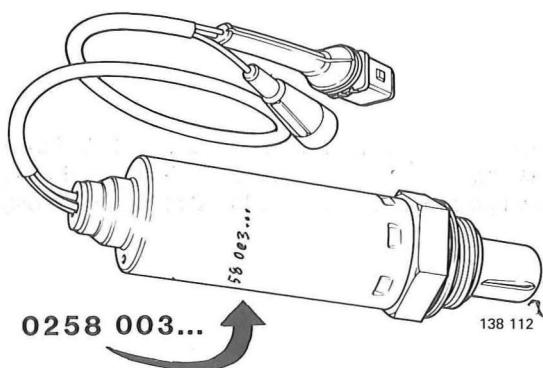
**Air control (idle) valve**

146 771

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

B 230 F	B 200 F
LH 2.2	LH 2.4

Bosch No	009	034
Volvo P/N	1346 962-2	3501 753-2
Replacement part .	(. . . 006)	

B 230 FT	B 230 FT	B 230 GT
LH 2.2	LH 2.4	1990

Bosch No	006	090	085
Volvo P/N	1346 738-6	3531 400-4	3517 778-1

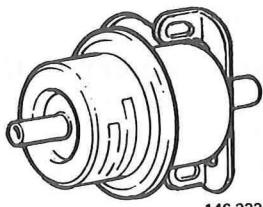
Resistance of preheating resistors:
 cold Lambda ($20^{\circ}\text{C} = 68^{\circ}\text{F}$) 3Ω
 warm Lambda sond (above $350^{\circ}\text{C} = 662^{\circ}\text{F}$) 13Ω

Tightening torque 55 Nm (40 ft lb)*

* Apply Sealer (P/N 1161 035-9) to threaded section of sond.

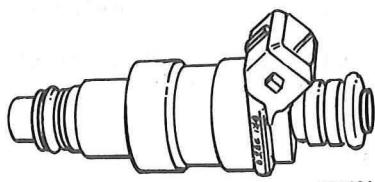
B 230 F: REGINA

(USA only)

Pressure regulator

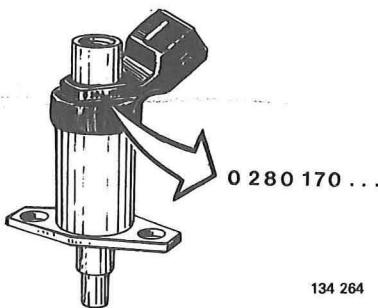
146 333

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

Injectors

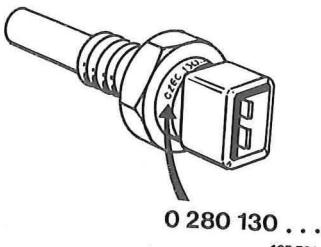
146 334

Volvo P/N..... 1 389 563-6
 Injected quantity..... approx. 170 cm³/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 cm³/min

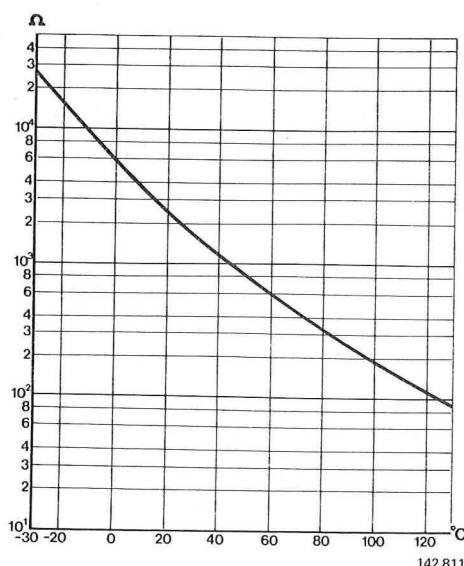
Coolant temperature sensor

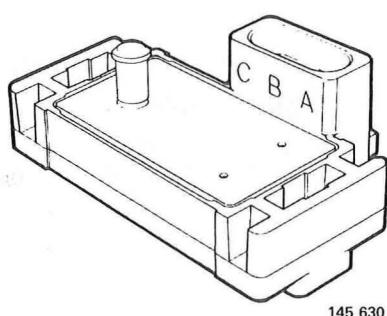
135 791

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

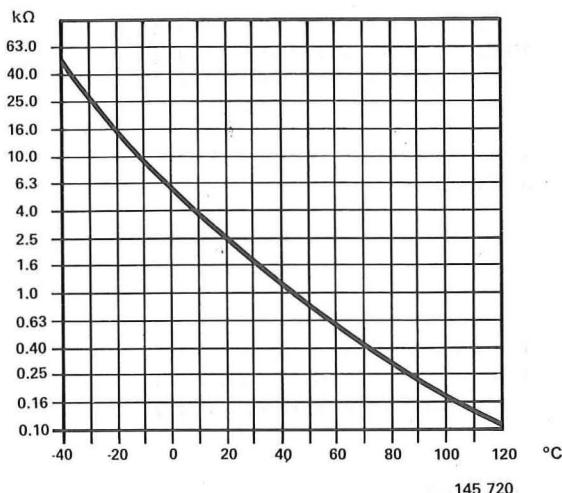
Resistance:

-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





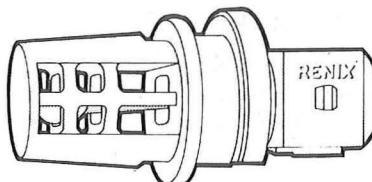
145 630



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

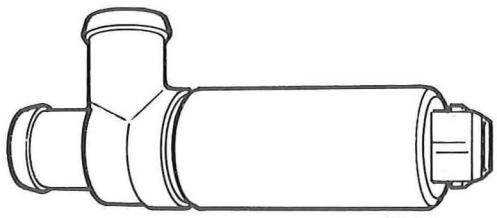
Volvo P/N..... 1 389 556-0

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.

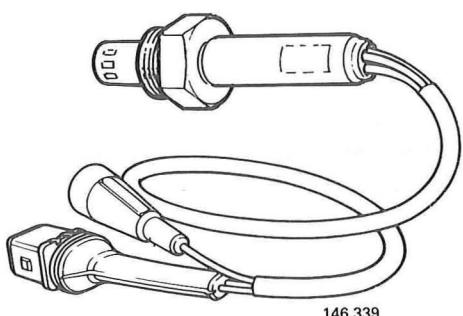
Air control (idle) valve



146 338

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

Lambda-sond



146 339

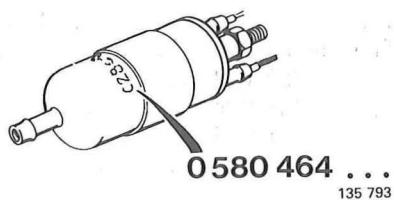
Volvo P/N..... 3 517 394-7

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
Volvo P/N	1306 932-3	1389 449-8
		1336 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)

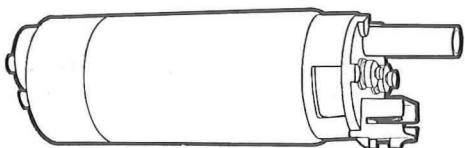
+20°C (68°F) and 12 V	140 litres/hr (37.0 US Galls. per hr)
11 V	120 litres/hr (31.7 US Galls. per hr)
10 V	95 litres/hr (25.1 US Galls. per hr)

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

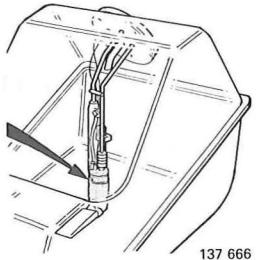
+20°C (68°F) and 12 V	max 5.0 A
-----------------------------	-----------

B 230 F, Regina 1990

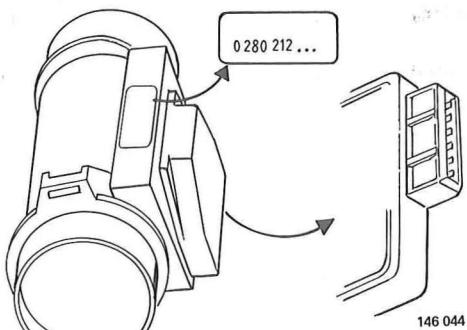
(Pump in tank)



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 –

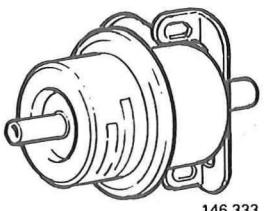
	B 234 F	B 234 F
	Type I*	Type II**
Bosch P/N.....	... 016	.. 010
Volvo P/N	3 517 020-8	3 501 987-6

Resistance:

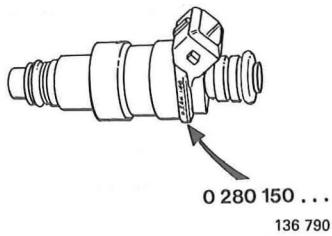
- between terminals
2 and 3 2.5–4.0 Ω 2.5–4.0 Ω

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

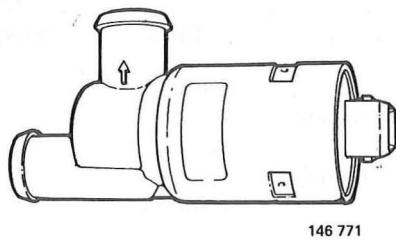
** Type II = 1989: All other manuals.

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)

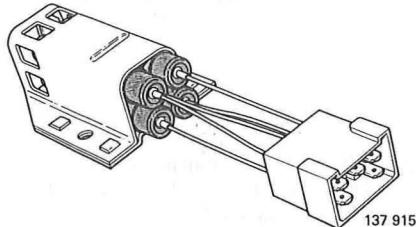
Injector

	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)

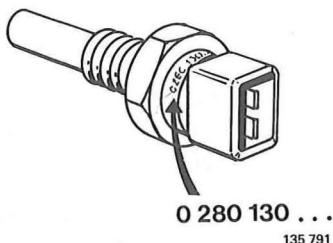
Air control (idle) valve

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

Resistance approx 8 Ω

Injector ballast resistor pack

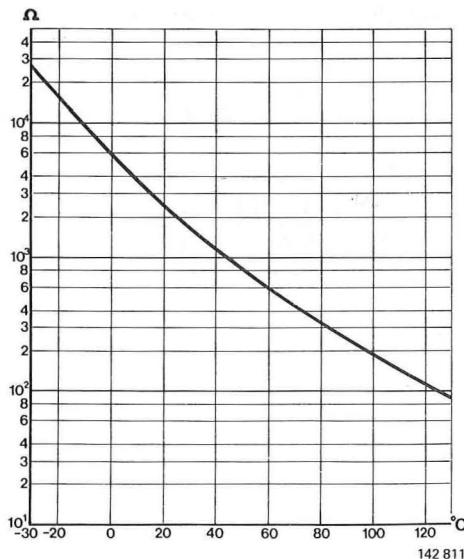
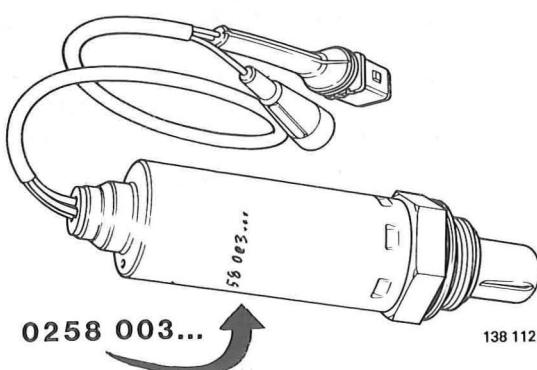
Four resistors (1 per injector)
Resistance 5.5–6.5 Ω

Coolant temperature sensor

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

Resistance:

10°C (41°F)	8.10–10.77 k Ω
20°C (68°F)	2.28–2.72 k Ω
+80°C (176°F).....	290–364 Ω

**Lambda-sond****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

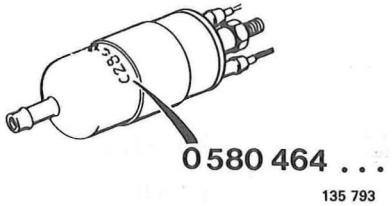
Resistance of preheating resistors:

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

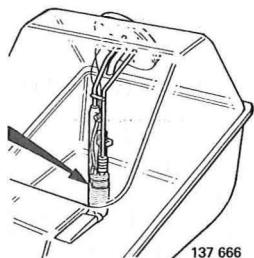


Bosch P/N..... 039
Volvo P/N..... 1 389 449-8

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



Current consumption..... 3-4 A

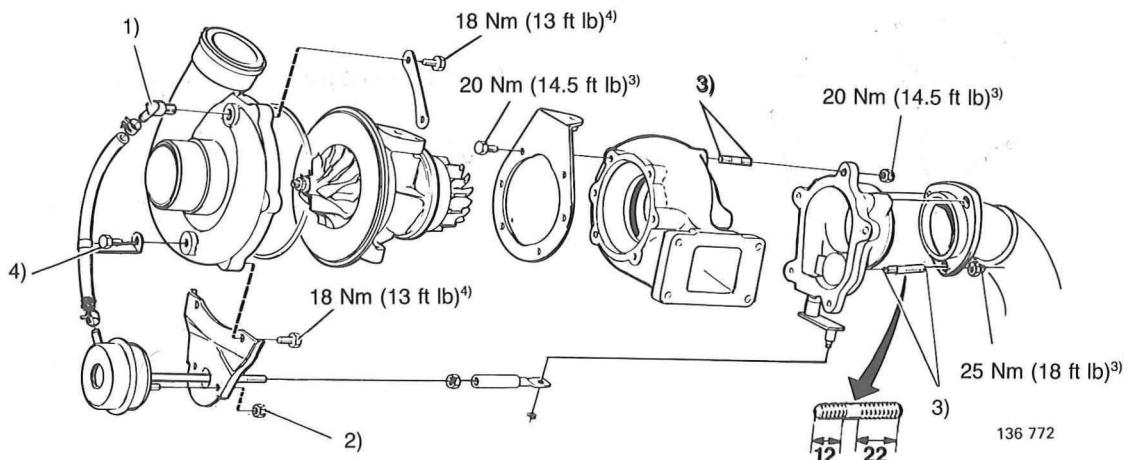
Group 25 Intake and exhaust systems

Turbo engines

-1989

Engine type	B 200/230 ET	B 230 FT
Charge pressure, at full load and r/min checking kPa (psi) setting kPa (psi)	3 500 45–53 (6.4–7.5) 50 (7.1)	3 000 46–54 (6.5–7.7) 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

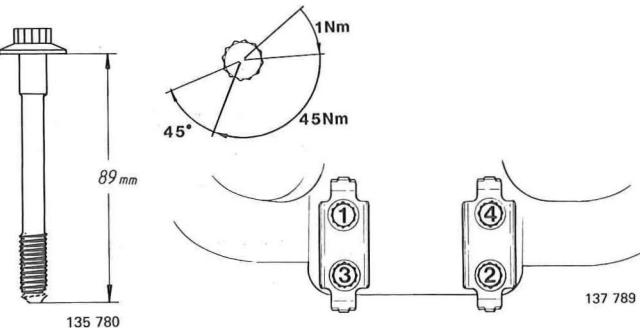


- 1) Apply sealer P/N 1 161 053-2.
- 2) Use new nuts
- 3) Use sealer P/N 1 161 035-9.
- 4) Use new bolts. If absolutely necessary, old bolts can be reused if they are smeared with sealer P/N 1 161 053-2.

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

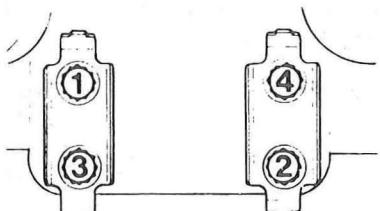


Turbo engines

1990–

Engine type	B 230 FT/GT
Charge pressure, at full load and	t/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)

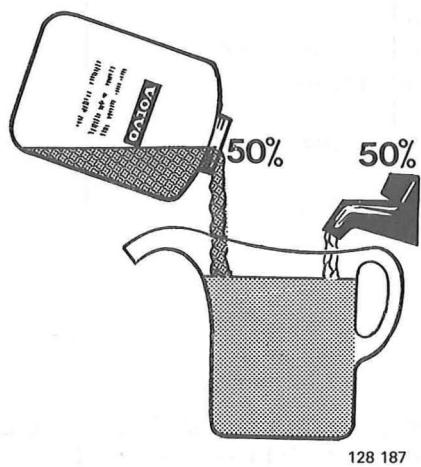
Turbocharger – exhaust manifold* **30 Nm (22 ft lb)**
Use special tool 5411 (at 90° angle to torque wrench)

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

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

Group 26 Cooling system

General



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 1161328-8 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

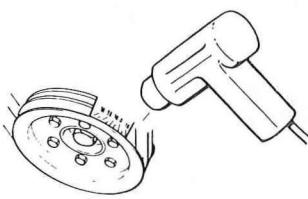
Expansion tank

Pressure valve in filler cap opens at:	kPa	psi
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)

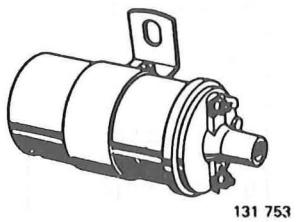
Engine type	Ignition timing b.t.d.c.	Speed r/s (rpm)
B 230 E	12°	14.2–15.8 (850–950)
B 230 ET	10°	14.7–15.3 (880–920)
B 230 F –1988	12°	12.2–12.8 (730–770)**
1989–	12°***	12.1–13.8 (725–825)
B 230 FB	12°	12.9 (775)
B 230 FT/GT	12°	12.2–12.8 (730–770)**
B 234 F/G	15°	13.3–15.0 (800–900)

* Vacuum regulator disconnected.

** Japan –1988: 15 r/s (900 rpm).

*** Ignition system Rex, USA/Canada: 10°.

Ignition coil



B 230 A

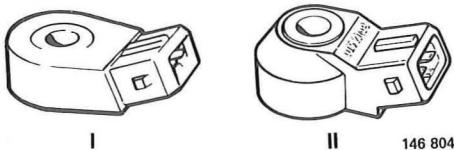
B 200E, B 200 K, B 230 E B 200 ET,
B 230 F, B 230 FB, B 230 K, B 230 ET B 230 F
B 230 FT, B 204 E, B 204 FT/GT, Rex
B 234 F/G

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

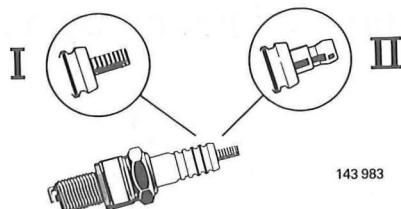


I

II

146 804

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

Spark plugs, glow plugs

143 983

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 B 200 E, B 204 E/FT/GT, B 230 K 1987–, B 230 E, B 234 F/G B 230 F, B 230 FB, B 230 FT/GT B 230 FT Europe	WR7DC** WR6DC** WR7DC WR6DC	1 306 605-5 1 306 604-8 1 346 541-4 1 367 015-3	273 597-5 273 596-7 271 409-5 271 415-2	1 367 528-5 1 367 529-3 1 367 528-5 1 367 529-3	270 746-1 270 747-9 270 746-1 270 747-9

* 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 B 230 E, B 230 F –1988, B 230 FT –1989 B 200 K B 200 F	EZ-K EZ-K Renix EZ 116 K	1 336 087 1 336 087 1 336 132 1 336 132	0 237 502 001 0 237 502 001 0 237 502 002 0 237 502 002
B 230 F 1989–, B 230 FB, B 230 FT/GT 1990 B 200 ET, B 230 ET B 230 A	EZ 116 K (Rex*) Motronic TZ-28 H	1 336 132 1 336 132 1 336 690	0 237 502 002 0 237 502 002 0 237 024 013
B 204 E/FT/GT, B 234 F/G	EZ 116 K	1 367 197	0 237 502 003

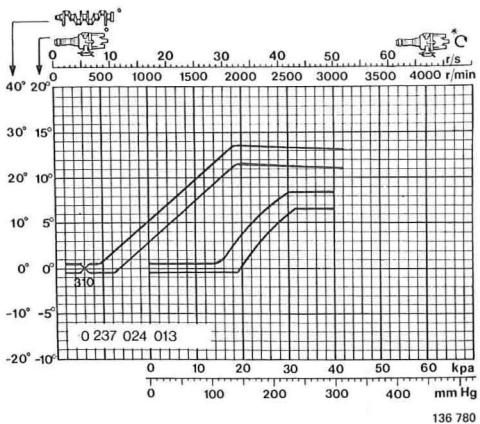
*USA only

Centrifugal governor

Advance, total degrees (distributor) 12,5±1
Advance begins at distrib. rev/sec 7,5–10,5
distrib. rev/min (450–630)
Data: 5° at distrib. rev/sec 16,5–20,5
(distrib. rev/min) (1000–1250)
10° at distrib. rev/sec 25–29
(distrib. rev/min) (1500–1750)
Advance max at distrib. rev/sec 31,7
(distrib. rev/min) (1900)

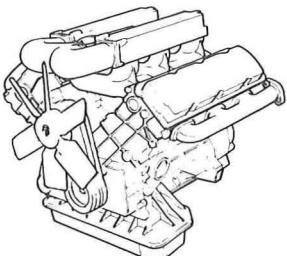
Vacuum governor

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

136 780

Section 2 B 28 Engine

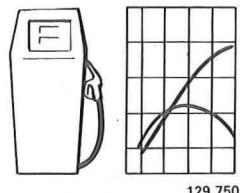


129 756

Group 20 General	69
Group 21 Engine	70
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Group 23 Fuel system	75
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Group 26 Cooling system.....	83
Group 28 Ignition system.....	84

Group 20 General

Performance, compression ratios, octane requirements



129 750

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 octane²⁾ According to research method (RON). Unleaded gasoline
According to formula (R+M/2) = 87 octane³⁾ 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).

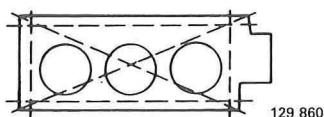
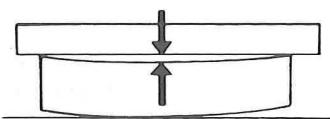
Group 21 Engine block

Cylinder head

Max warp:

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!

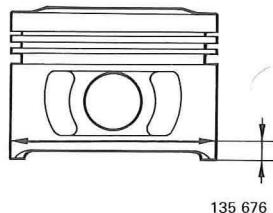


Cylinder liners

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:		
checking (running 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

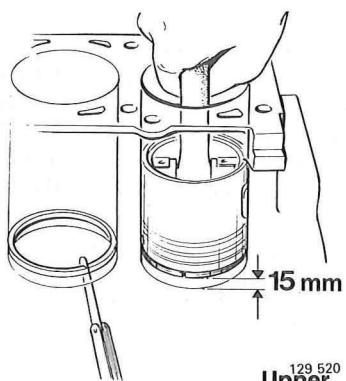
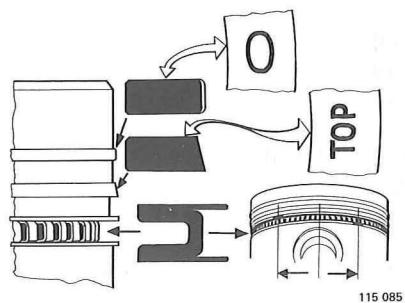
Pistons

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 mm	0.045–0.074	0.025–0.054	0.009–0.233
	in 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 mm	0.40–0.60	0.40–0.60	0.40–1.45
in in	0.0157–0.0236	0.0157–0.0236	0.0157–0.0570

Gudgeon (piston) pins

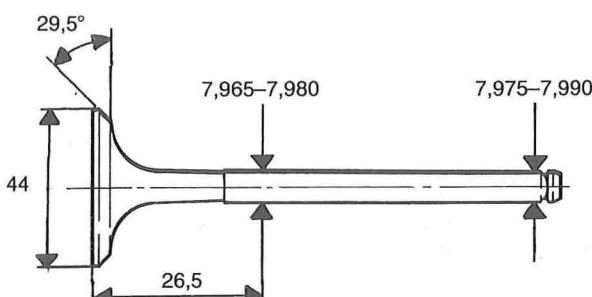
Clearance in connecting rod	0.020–0.041 mm	0.0007–0.0016 in
piston	0.010–0.016 mm	0.0003–0.0006 in

Valve system

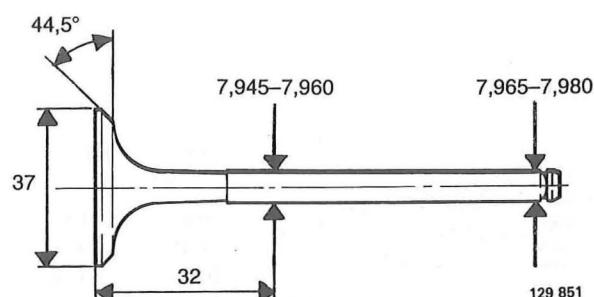
Valve clearance

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)

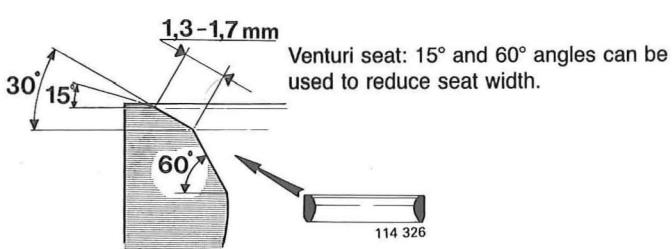


Inlet valve

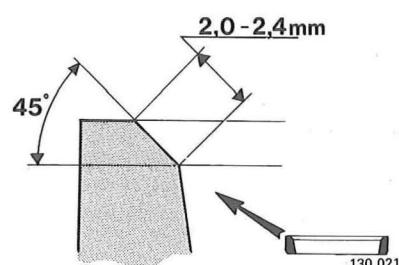


Exhaust valve

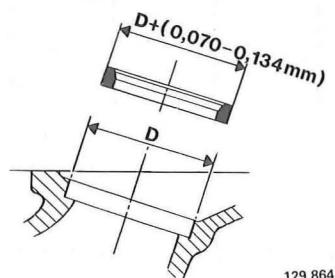
Valve seats



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

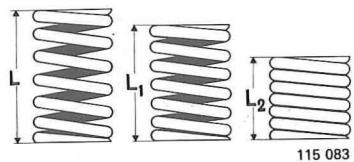
Section 2 B28 Engine



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



Springs marked green
Length

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

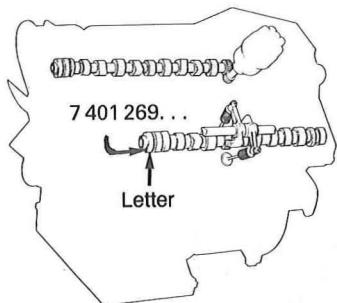
Rocker arm mechanism

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



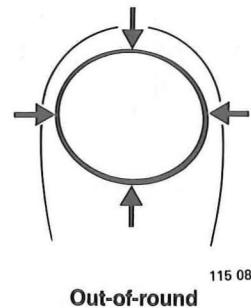
Engine type	B 28 A, E		B 28 F	
	Left	Right	Left	Right
Marking	F	F	G	G
Part number (last three digits), early type 615	... 616	... 486	... 487
late type 977	... 978	... 979	... 980

	B 28 A, E	B 28 F	
Max lobe lifting height, left and right, inlet exhaust	5.96 mm (0.2348 in) 5.96 mm (0.2348 in)	5.44 mm 5.94 mm	(0.2142 in) (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

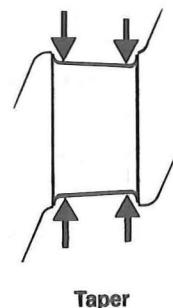
Crankshaft

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



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

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	

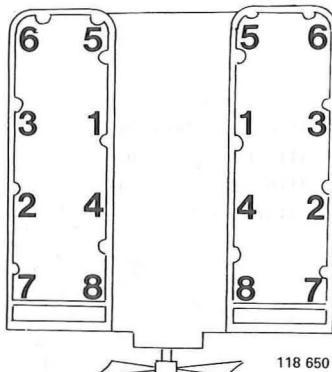
Flywheel

Axial throw, max	0.05 mm	0.0019 in
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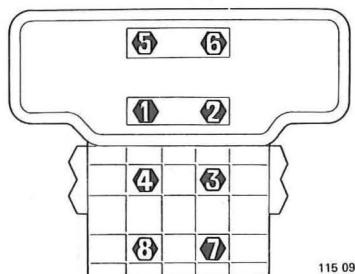
Tightening torque

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



Tightening sequence for main bearings (via lower crankcase)

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

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)

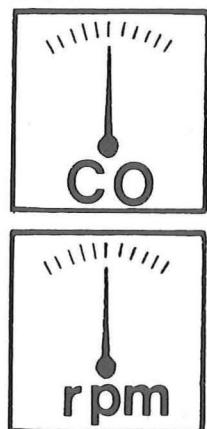
Lubricating oil pump

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

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

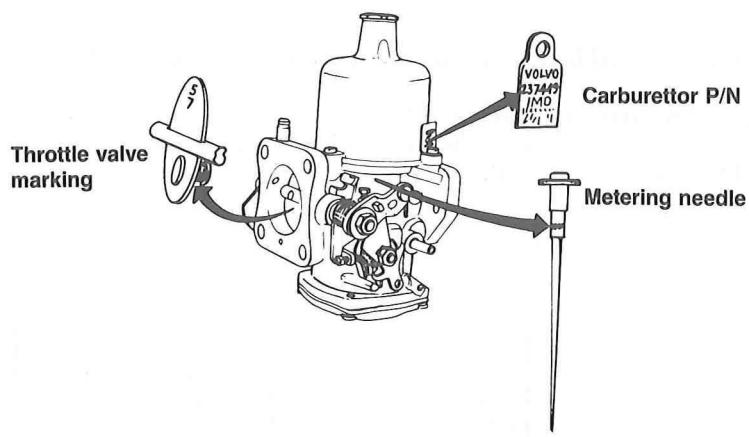


135 528

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)

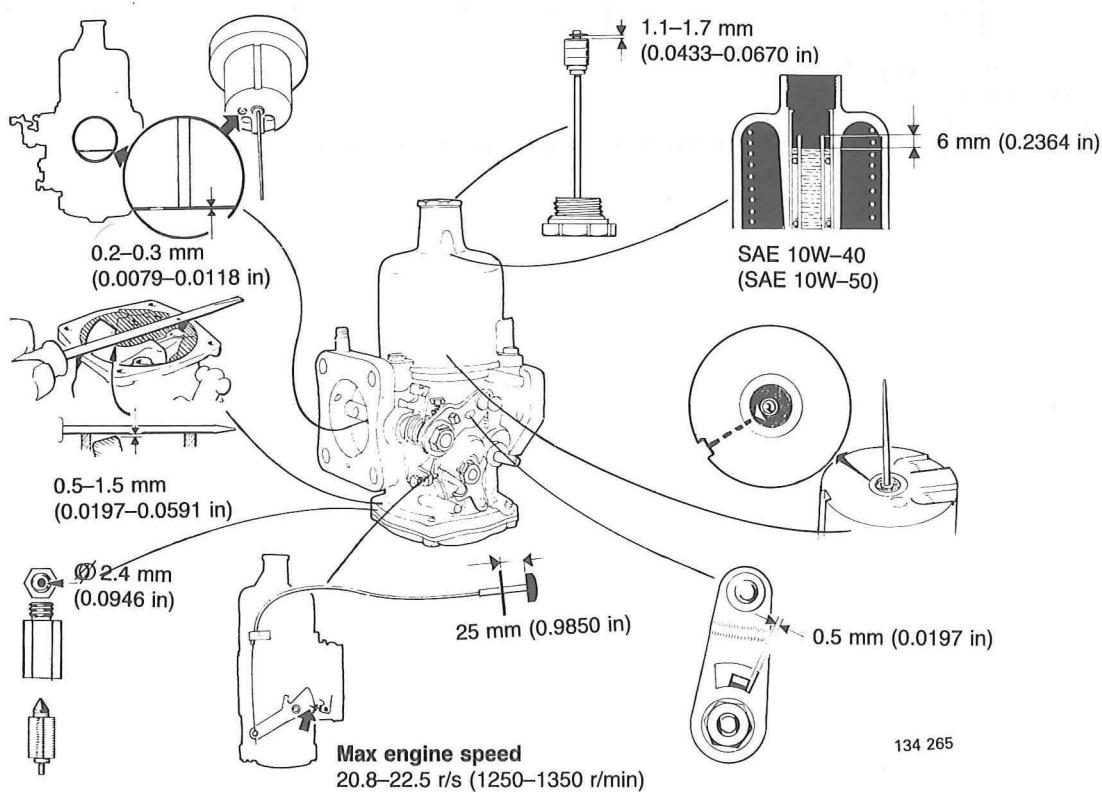
¹⁾ Pulsair system disconnected and plugged.²⁾ Lambda-sond disconnected.³⁾ Lambda-sond connected.⁴⁾ AC switched off. Idle speed increases to 15.0 r/s (900 r/min) when AC is switched on again.

Carburetted engine (B 28 A)



119 943

SU-HIF 6 carburettor



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)

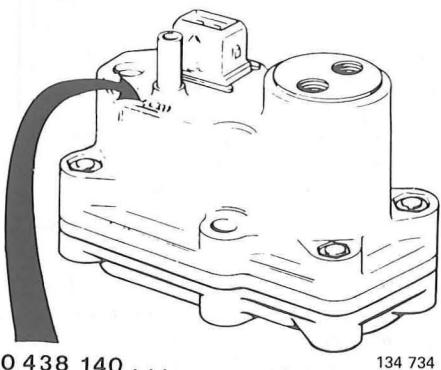
CI-SYSTEM (B 28 E, B 28 F)

Pressures

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

Control pressure, see graphs.

Control pressure regulator



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

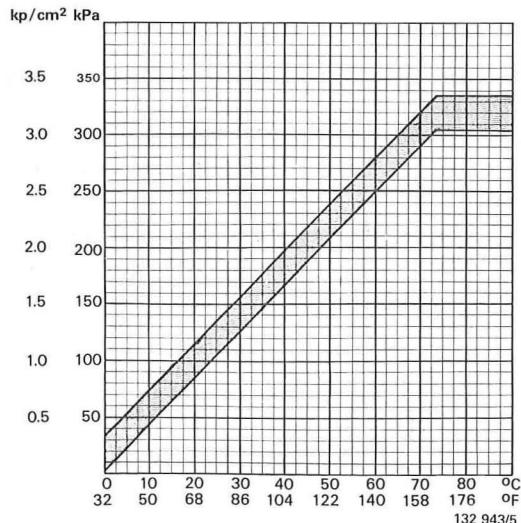
CONTROL PRESSURE REGULATOR . . . 038

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.

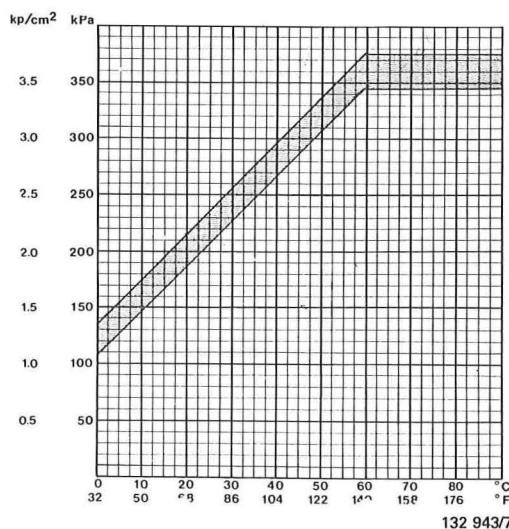
Resistance 20–24 Ω



CONTROL PRESSURE REGULATOR . . . 099

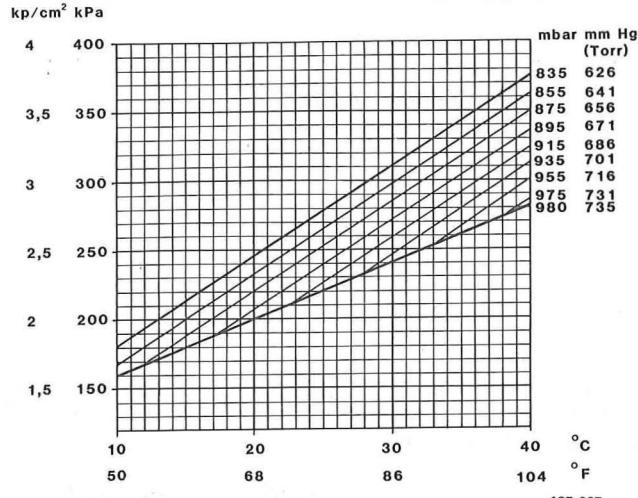
Control pressure, warm engine 345–375 kPa
 (49–53 psi)
 cold engine see diagram

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

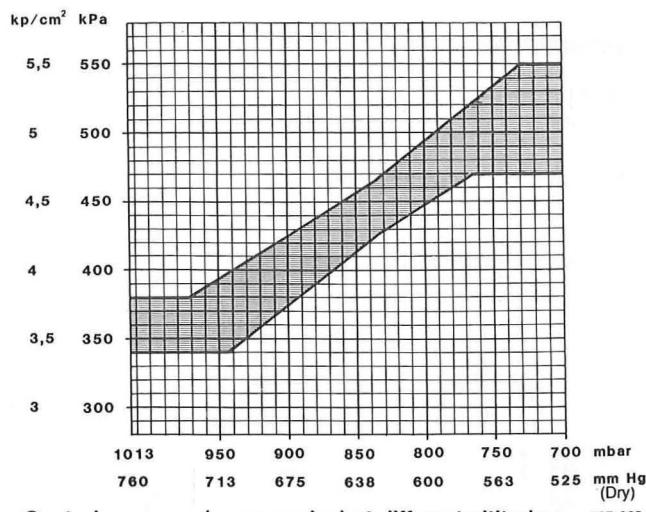


Control pressure regulator . . . 128 (altitude compensated)

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 137 667

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

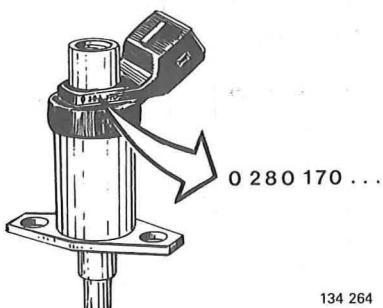
Control pressure (warm engine) at different altitudes 137 668

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

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

Start injector

Bosch No
 Volvo P/N
 Injected quantity

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.

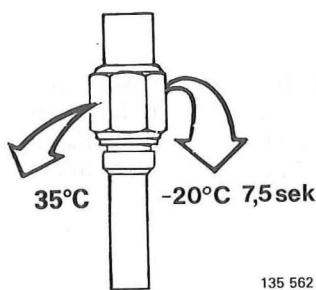
B28 E

... 404
 462 865-7
 115 cm³/min

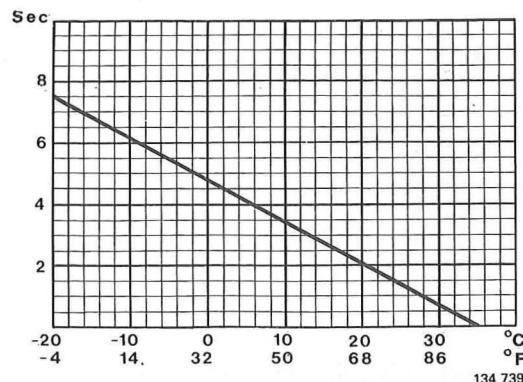
B28 F

... 400
 269 292-9
 165 cm³/min

Thermal time switch



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

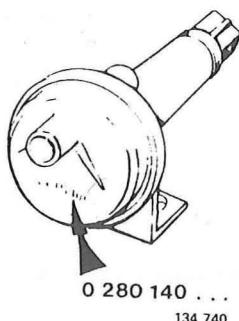


Engagement time at different temperatures

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

Auxiliary air valve, B28 E

(B28 E without constant idle speed system).



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

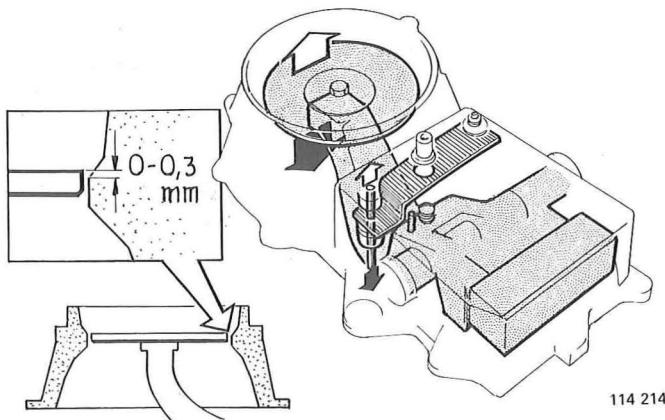
Identification number on side of valve.

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

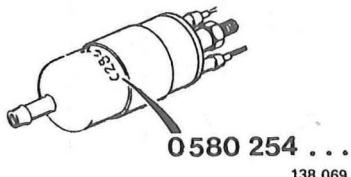
Resistance 40–60 Ω
Fully open at -30°C (-22°F)
Fully closed at +70°C (158°F)

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



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

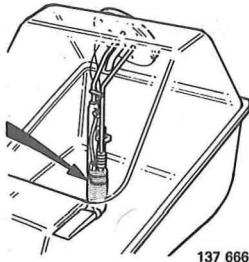
Fuel pump

	Bosch No	Volvo P/N
B 28 E, early type	963	1 306 028-0
late type	948	1 336 677-8
B 28 F	948	1 336 677-8

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

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

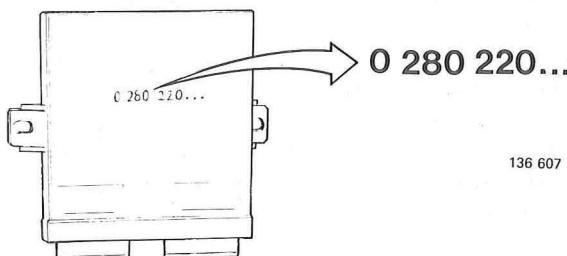
Current consumption max max 9.5 A

Tank pump

Current consumption 1-4 A

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

Control unit

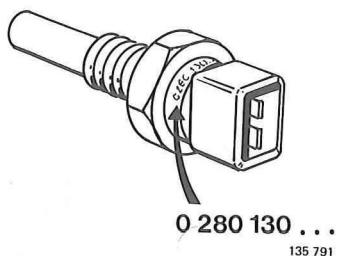


Type of control unit fitted to engine depends on engine type.

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

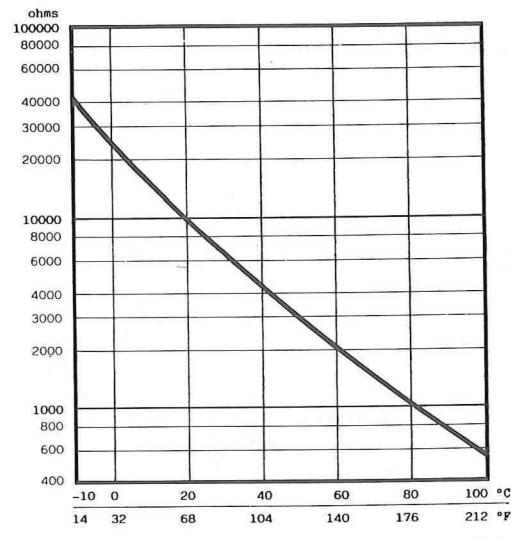
Temperature sensor



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

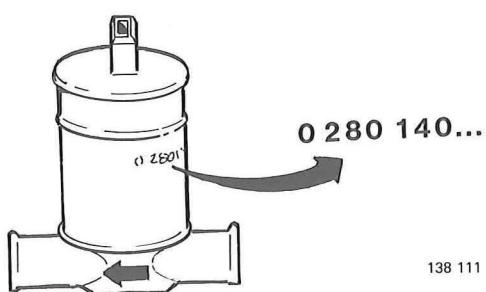
Resistance at:

- 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



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

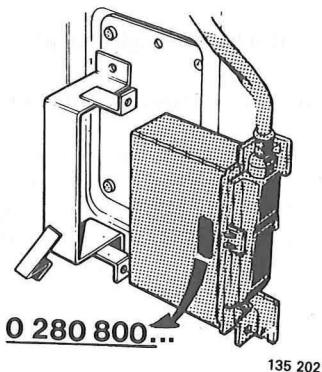
	Bosch No	Volvo P/N
B 28 E	501	1 317 957-7
B 28 F, early type	500	1 276 871-9
late type	501	1 317 957-7

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



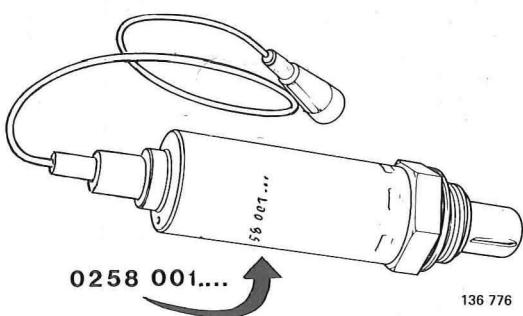
Bosch No 050
 Volvo P/N 1 274 368-8

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



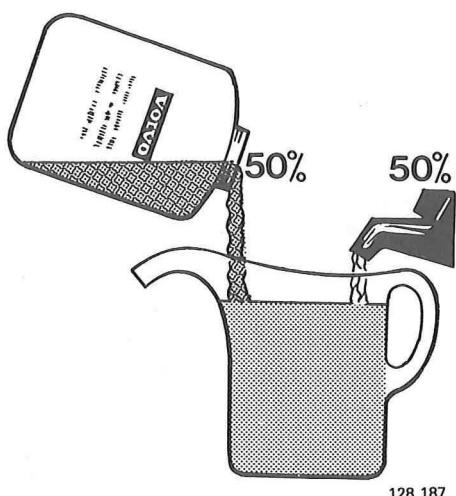
Bosch No 037
 Volvo P/N 1 274 367-0

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



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 1161328-8) prior to filling new coolant.

	litres	US qts
Capacity	10.0	10.5

Expansion tank

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

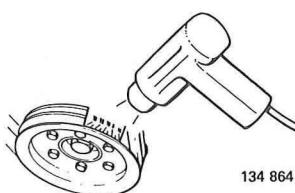
Thermostat

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

Fan belts

Designation, type I.....	HC 38 × 1100
type II.....	HC 38 cog × 1100
type III (not B28 F USA)	HC 38 cog × 1075

Group 28 Ignition system

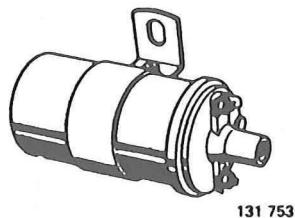


Type..... Breakerless
 Firing order..... 1-6-3-5-2-4

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)

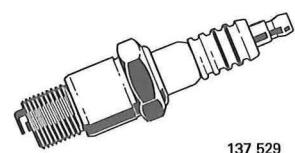
* Vacuum regulator disconnected.

Ignition coil



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



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

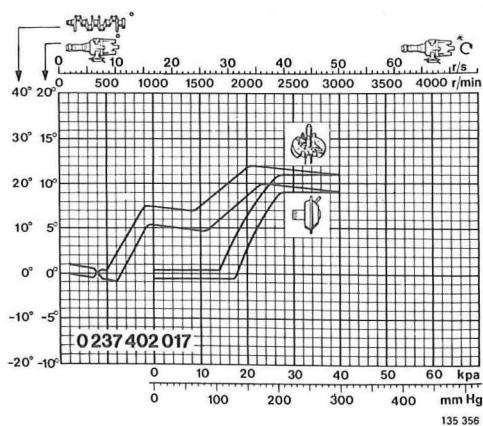
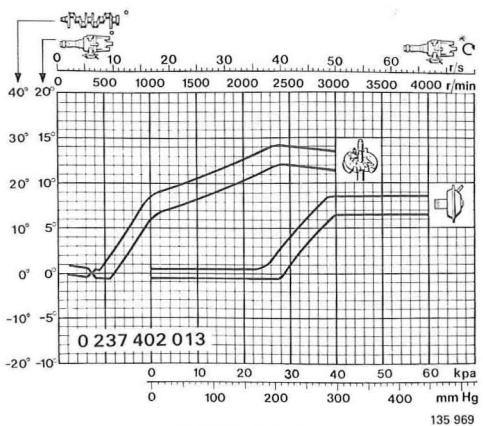
	B 28 A, E	B 28 F
Bosch number	0 237 402 013	0 237 402 017
Volvo P/N	1 269 191	1 269 380
Direction of rotation	Clockwise	Clockwise
Resistance of impulse sender coil, Ω	540–660	540–660
Air gap, rotor – stator, min	0.3 mm	0.3 mm

Centrifugal governor

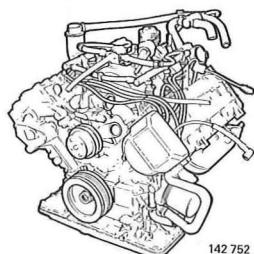
Advance, total, degrees (distributor)	13 ± 1	11 ± 1
Advance begins at distrib. rev/sec	7.5–9.6	8.5–10
distrib. rev/min	(450–575)	(500–600)
Data: 5° at distrib. rev/sec	12.5–15.4	12.4–15.3
(distrib. rev/min)	(750–925)	(740–920)
10° at distrib. rev/sec	23.3–32.5	30–50
(distrib. rev/min)	(1 400–1 950)	(1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

Vacuum governor

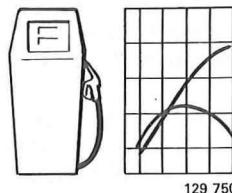
Control direction	Positive	Positive
Control, total degrees (distributor)	7.5 ± 1	10 ± 1
Control commences at mm Hg	160–210	105–135
Data: 2° at mm Hg	200–240	115–145
max control at mm Hg	300	210

Ignition advance

Section 2 B 280 Engine



Group 20 General	86
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Group 23 Fuel system	93
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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 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).

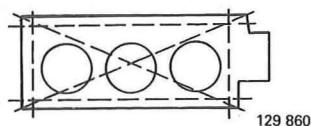
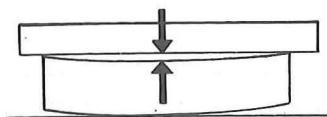
Group 21 Engine block

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)
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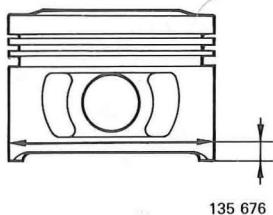
Shims for adjustment of liner height:

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)

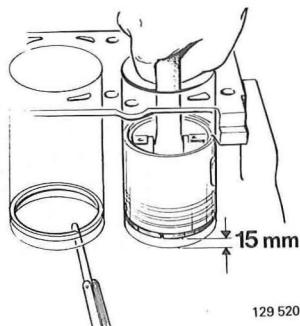
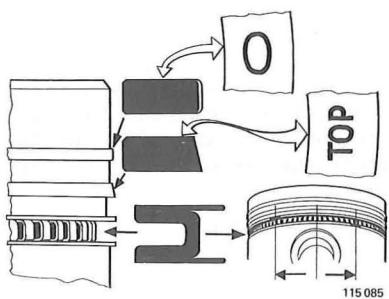
Piston diameter, A-marked pistons	90.920–90.930 mm	(3.5822–3.5826 in)
B-marked pistons	90.930–90.940 mm	(3.5826–3.5830 in)
C-marked pistons	90.940–90.950 mm	(3.5830–3.5834 in)



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

135 676

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	in 0.0017–0.0029	0.025–0.054	0.009–0.233
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Ring gap when checked in 91 mm (3.5826 in) (cylinder, see fig)	mm 0.40–0.60	in 0.0157–0.0236	0.40–0.60	0.40–1.45
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Gudgeon (piston) pins

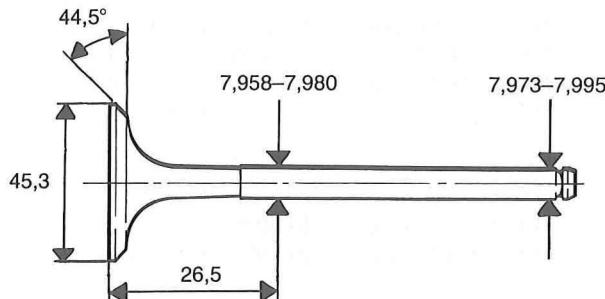
Piston	0.007–0.017 mm	(0.0003–0.0007 in)
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Valve system

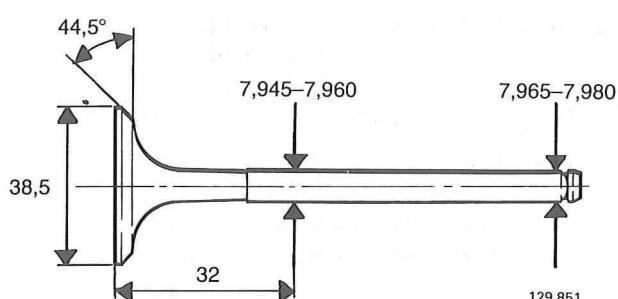
Valve clearance

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)

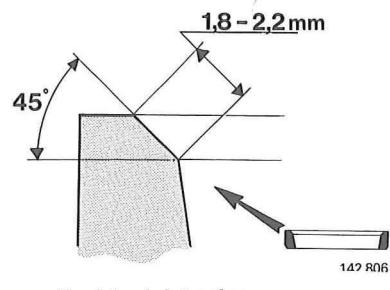


Inlet valves

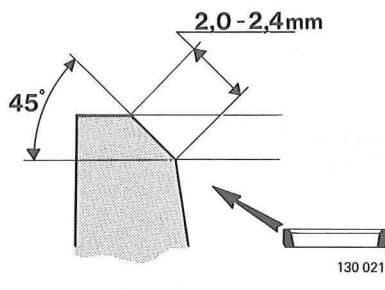


Exhaust valves

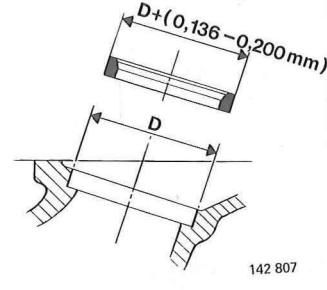
Valve guides



Seat for inlet valve



Seat for exhaust valve

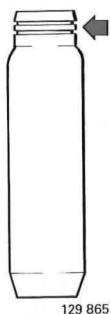


When replacing valve seats: the interference between the valve seat and its bore in the cylinder head shall be 0.136–0.200 mm (0.0054–0.0079 in), i.e. valve seat diameter must be 0.136–0.200 mm greater than the diameter of the bore in the cylinder head.

Valve seats are available in three oversizes.

Valve guides

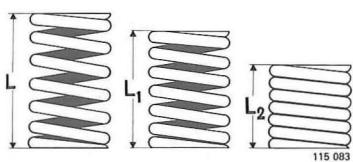
Inner diameter	8.000–8.022 mm	(0.3149–0.3158 in)
Press-in measurement to cylinder head contact surface against block:		
inlet	46–47 mm	(1.8124–1.8518 in)
exhaust	36.9–37.9 mm	(1.4527–1.4921 in)
Clearance in cylinder head	0.053–0.098 mm	(0.0020–0.0037 in)



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



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

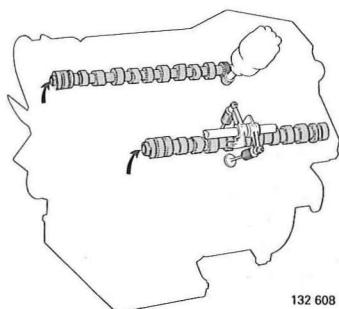
Rocker arm mechanism

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



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 exhaust	6.08 mm (0.2396 in) 5.85 mm (0.2305 in)	5.96 mm (0.2348 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)	

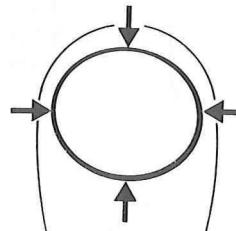
Crank mechanism

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)

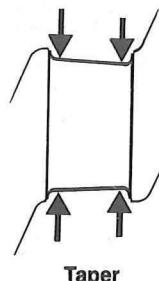
Main bearing journals

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)

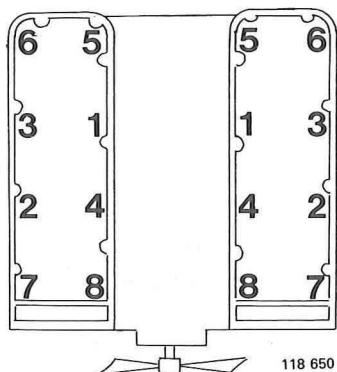
Connecting rods

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	

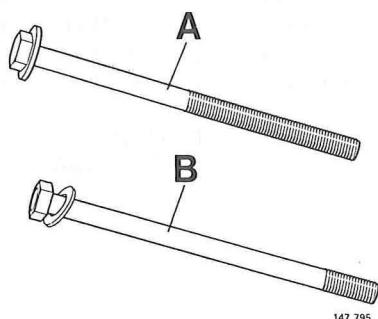
Tightening torque

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)	

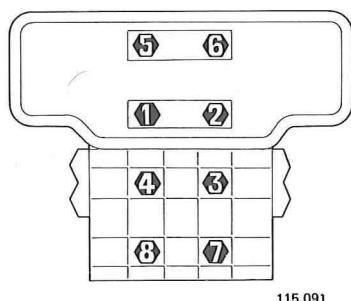
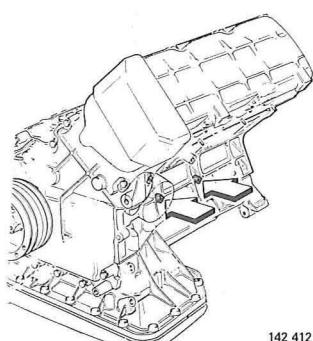


Tightening sequence for cylinder head bolts



A. 1900-

B. Earlier type

Tightening sequence for main bearings
(via lower crankcase)**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°.

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

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

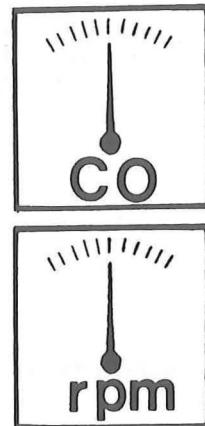
End float.....	0.025–0.084 mm	(0.0010–0.0033 in)
Clearance between tooth tip and pump housing wall (excl. bearing clearance)	0.020–0.095 mm	(0.0008–0.0037 in)
Backlash (excl. bearing clearance)	0.17–0.27 mm	(0.0066–0.0106 in)
Bearing clearance, driveshaft.....	0.015–0.053 mm	(0.0006–0.0021 in)
idler 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

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)

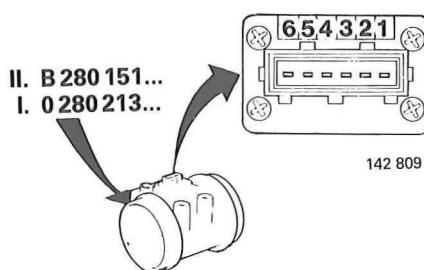


135 528

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

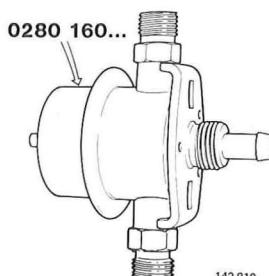


Manufacturer's No type I 006
 II 615
 Volvo P/N 1 336 354-4

Resistance:

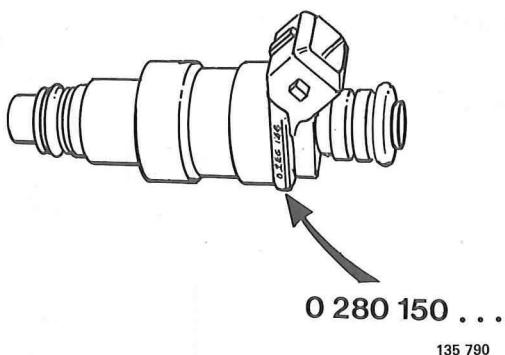
- between terminals 2 and 3 2.5–4.0 Ω
- between terminals 2 and 6 0–1000 Ω

Line pressure, pressure regulator



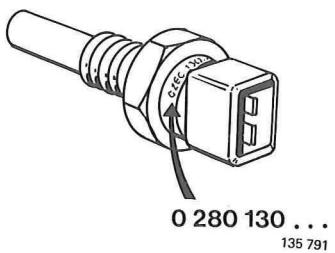
Bosch No 215
 Volvo P/N 1 271 135-4

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

Injectors**Early type Late type**

Bosch No.....	... 725	... 734
Volvo P/N	1 271 100-8	1 389 844-0

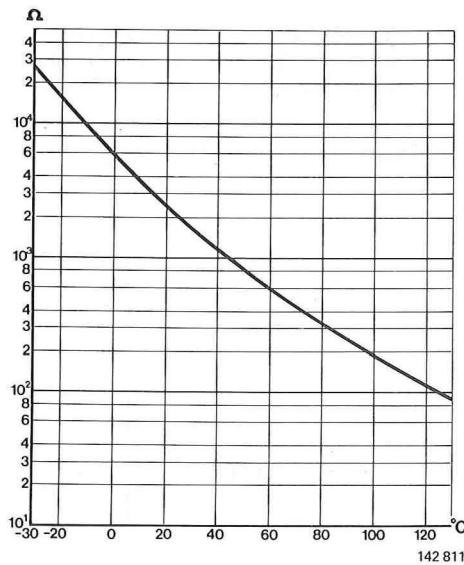
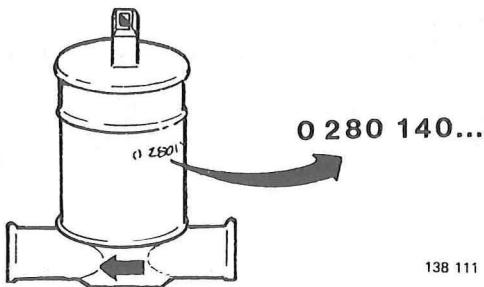
Injected quantity.....	170 cm ³ /min at a line pressure of ...	170 cm ³ /min 250 kPa (36 psi)
		250 kPa (36 psi)

Coolant temperature sensor

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

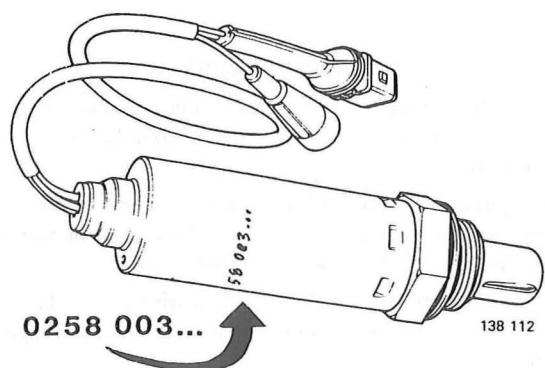
Resistance at:

-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

**Air control valve**

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

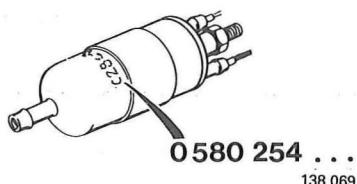
	Early type	Late type
Bosch No.	... 020	... 034
Volvo P/N	1 378 123-2	3 501 753-2

Resistance of preheating resistors:

cold Lambda sond ($20^{\circ}\text{C} = 68^{\circ}\text{F}$) 3Ω
warm Lambda sond (above $350^{\circ}\text{C} = 662^{\circ}\text{F}$) 13Ω

Tightening torque 55 Nm (40 ft lb)*

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

Fuel pump

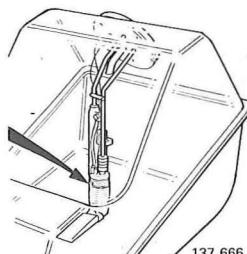
	Type I	Type II
Bosch No.	... 948	... 039
Volvo P/N	1 336 677-8	1 389 449-8

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),

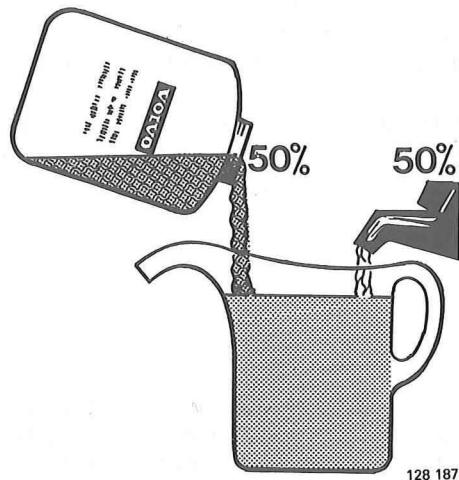
+20°C (68°F) and 12 V	max 5.0 A
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Tank pump

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 1161328-8) 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

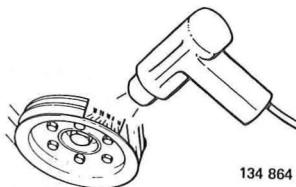
Thermostat

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

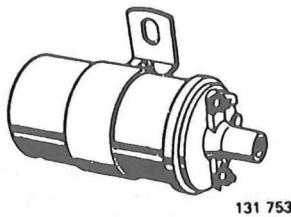
Group 28 Ignition system



Type..... EZ 115 K
Firing order..... 1-6-3-5-2-4

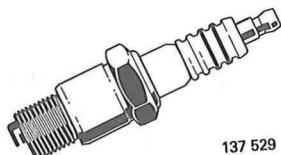
Engine type	Ignition timing b.t.d.c.	Speed r/s (rpm)
B 280 E	10°	12.2–12.8 (730–770)
B 280 F	16°	12.2–12.8 (730–770)

Ignition coil



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

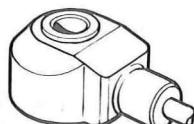
Spark plugs, glow plugs



Engine type	Designation	P/N	Kit number
B 280 E Scandinavia, B 280 F	HR6DC	1 269 915-3	273 599-1
B 280 E Other markets	HR5DC	1 389 896-0	270 590-3

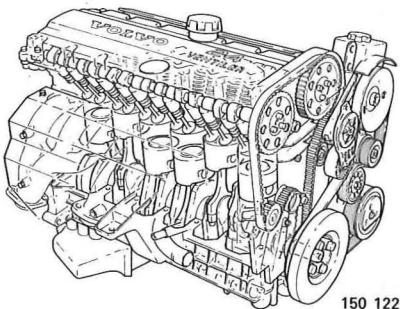
Electrode gap 0.6–0.7 mm (0.0236–0.0276 in)
Tightening torque, (unoiled plugs) 12 Nm (9 ft lb)

Knock sensor



Tightening torque 20 Nm (14.5 ft lb)

Section 2 B 6304 Engine



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Group 20 General

Performance, compression ratios, octane requirements

Engine type	Notes	Compre-sion 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 in	0.05–0.085 0.0020–0.0033	0.03–0.065 0.0012–0.0026	0.02–0.055 0.0008–0.0022
Ring gap (measured in cylinder, bore 83.00 mm).....	mm in	0.2–0.4 0.008–0.016	0.2–0.4 0.008–0.016	0.25–0.5 0.009–0.020

Gudgeon (Piston) pins

Fit in connecting rod.....	in piston	Light thumb pressure (close running fit) 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)
oversize	mm (in)	33.11 (1.304)
Matching surface angle	°	45.25
Reduction angle, upper	°	20.25
lower	°	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)

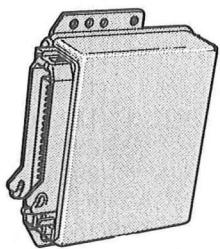
Group 23 Fuel System

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.

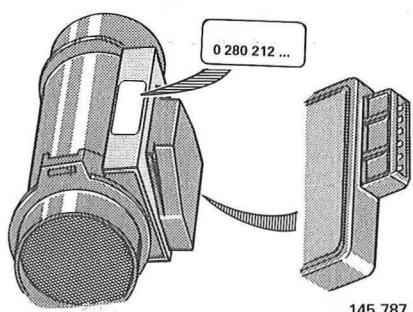
Motronic 1.8



150 362

Control unit

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

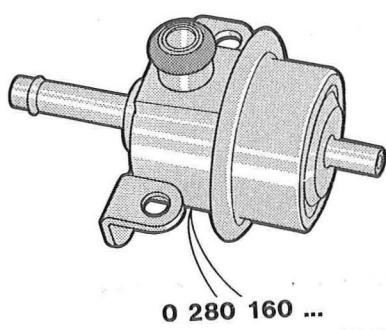


145 787

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



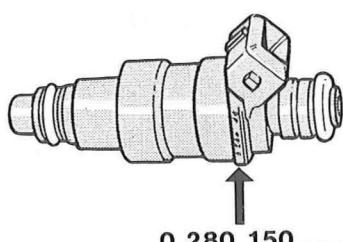
145 789

Pressure regulator

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

Line pressure 300 kPa (43 psi)

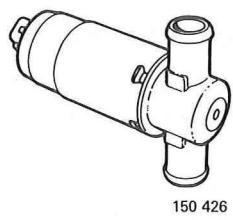
Late type
 Bosch number 0 280 160 731
 Volvo part number 3 547 653



145 677

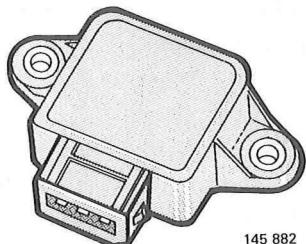
Injector

Bosch number 0 280 150 762
 Volvo part number 3 517 572-8
 Injected quantity 185 cm³/min
 at line pressure 300 kPa (43 psi)



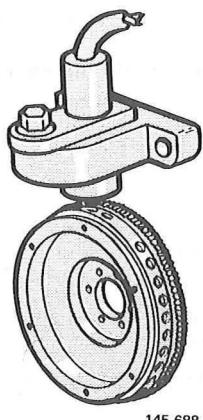
Idling valve

Bosch number..... 0 280 140 527
Volvo part number..... 3 517 886-2
Resistance:
between terminals 1 and 3..... 25 Ω



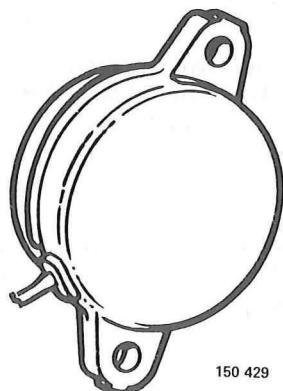
Throttle position sensor

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



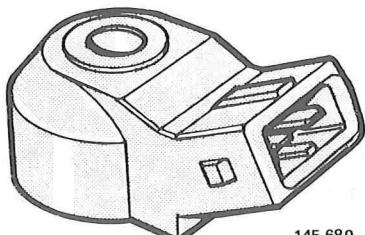
Speed and position sensor

Volvo part number..... 1 389 254-2



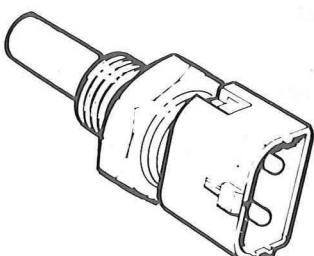
Camshaft sensor

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

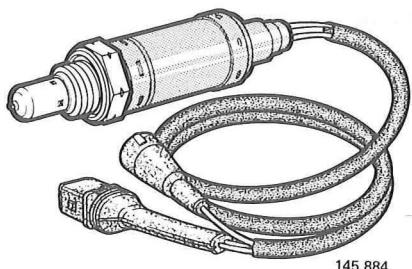


Knock sensor

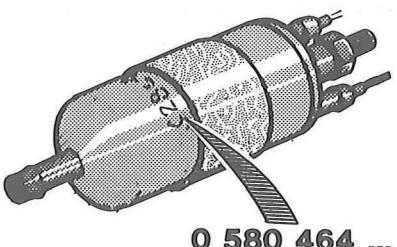
Bosch number..... 0 261 231 006
Volvo part number..... 1 367 644-0



150 425

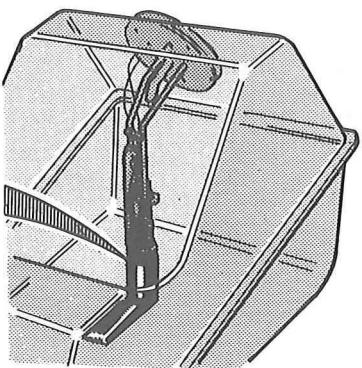


145 884

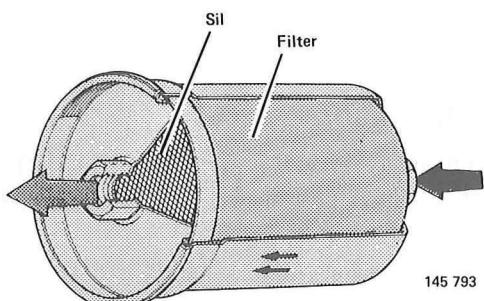


0 580 464 ...

145 791



145 792



145 793

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

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.

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

Tank pump

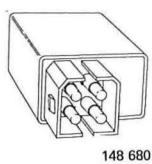
VDO number 92151034
Volvo part number 3 501 928-0

Current consumption 3-4 amp

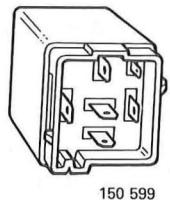
Fuel filter

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

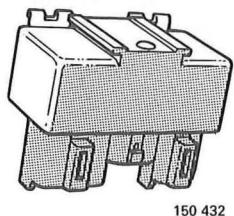
Filters particles down to 0.002 mm (0.00008 in)
Tightening torque 20-35 Nm
(15-26 ft lb)

**Main relay**

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

**Relay, fuel pump**

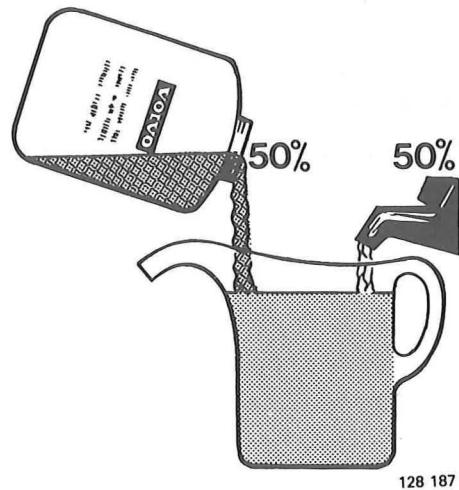
Volvo part number..... 1 362 914-2

**Relay, electric cooling fan**

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

Group 26 Cooling System

General



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 warranted 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:

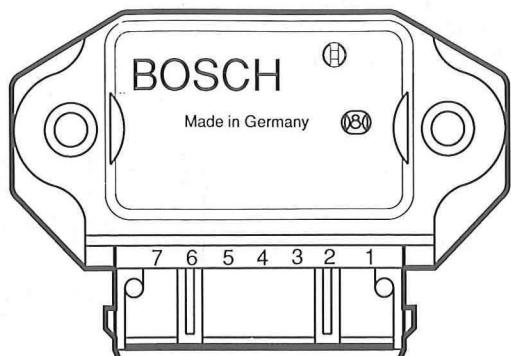
overpressure	150 kPa	(21 psi)
underpressure	7 kPa	(1 psi)

Thermostat

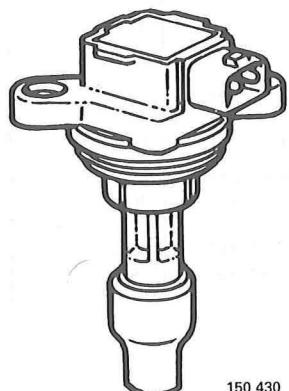
Marking	87	
starts opening at	87°C	(189°F)
fully open at	102°C	(216°F)

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°



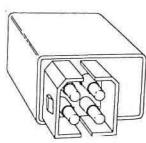
150 365



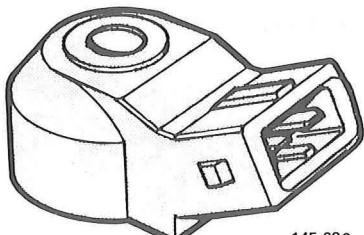
150 430



150 431



148 680



145 689

COMPONENTS

Power stage

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

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

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)

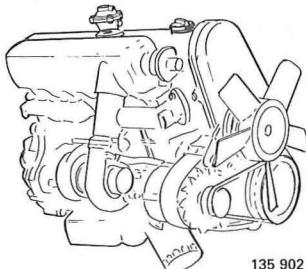
Relay, ignition

Volvo part number..... 3 323 592-4

Knock sensor

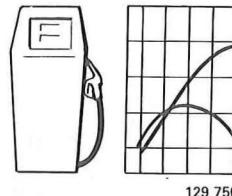
Bosch number..... 0 261 231 006
 Volvo part number..... 1 367 644-0

Section 2 D 24, D 24 T, D 24 TIC Engines



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Group 20 General



Performance, compression ratios

Engine type	Market	Compre- sion ratio	Output, DIN		Max torque, DIN	
			kW at r/s	hp at r/min	Nm at r/s	kpm at r/min
D 24		23:1	60/78	82/4 700	145/33	14.8/2000
D 24 T	USA+Canada, Austria 1987–	23:1	79/80	108/4 800	190/40	19.4/2400
	Other markets	23:1	80/80	106 ¹ /4800 109/4800	205/42	140 ² /2400 20.9/2500
D 24 TIC	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⁾ Horsepower²⁾ 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

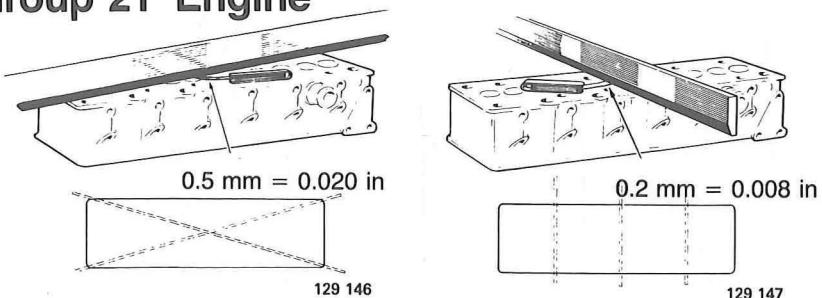
D 24	approx.	200 kg (440 lb.)
D 24 T	approx.	210 kg (463 lb.)

Group 21 Engine

Cylinder head

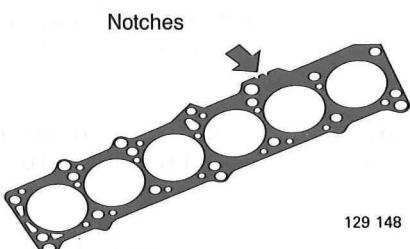
Max. warp.....

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



Cylinder head gasket

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



Height of piston above cylinder block		Gasket number of notches	thickness mm	thickness in
mm	in			
0.67–0.80	0.026–0.031	1*	1.4	0.055
0.81–0.90	0.032–0.035	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 D24T/D24TIC

Cylinder block

Bore

	Marking (honing group)	Piston diameter		Cylinder bore	
		mm	in	mm	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..... (0.25 mm = 0.010 in).....	676	76.73	3.0209	76.76	3.0220
	677	76.74	3.0213	76.77	3.0224
	678	76.75	3.0216	76.78	3.0228
Oversize 2..... (0.50 mm = 0.020 in).....	701	76.98	3.0307	77.01	3.0318
	702	76.99	3.0311	77.02	3.0322
	703	77.00	3.0315	77.03	3.0326
Oversize 3..... (1.00 mm = 0.040 in).....	751	77.48	3.0504	77.51	3.0515
	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

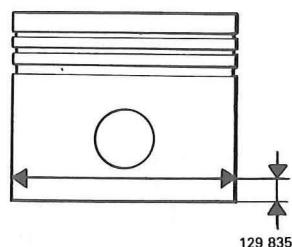
same engine 12 grams

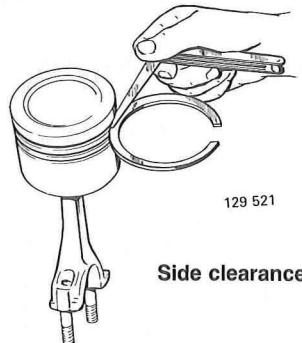
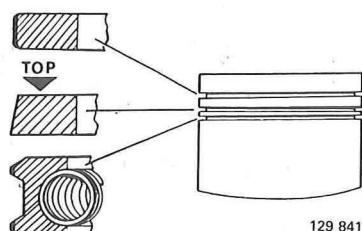
Piston float, new 0.03–0.05 mm 0.0012–0.0019 in
max..... 0.13 mm 0.0051 in

Piston diameter, see cylinder bore table

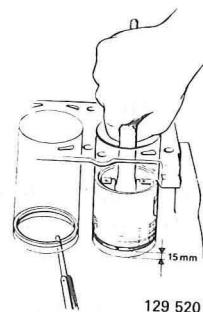
Max wear (compared with specified diameter) 0.04 mm 0.0016 in

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



Pistons rings

Side clearance

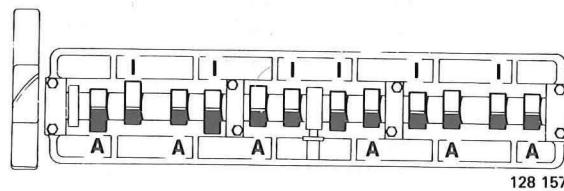


Ring gap

	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**

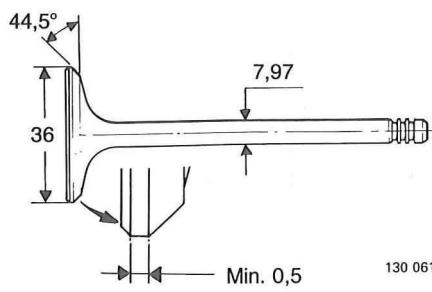
Cold engine = engine at room temperature

I = intake valves

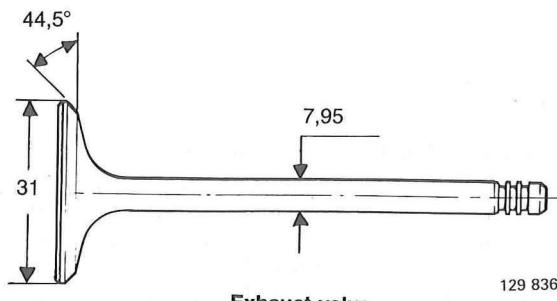
A = exhaust valves

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

	Valve clearances			
	Checking mm	in	Setting mm	
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)			

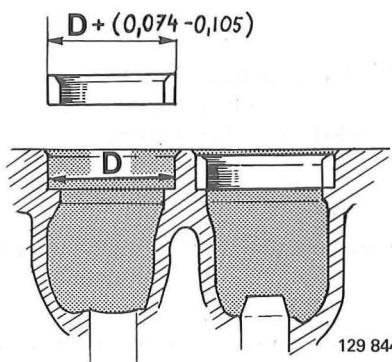
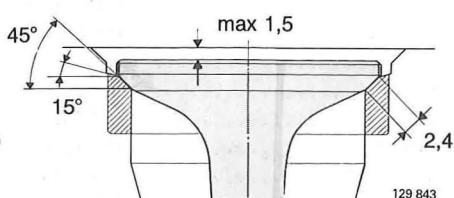
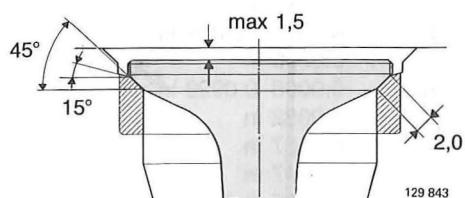
Valves (dimensions in mm)

Intake valve



Exhaust valve

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

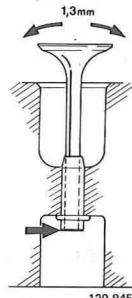
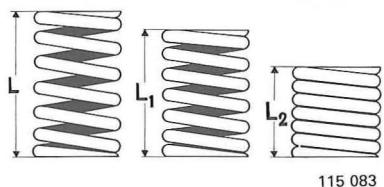
Valve seats (measured in mm)

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**

Length	Load
33.9 mm	0
28.6 mm	67–77 N (15–17.5 lb)
18.3 mm	209–231 N (47–52.2 lb)

Outer valve springs

Length	Load
40.2 mm	0
32.6 mm	167–185 N (38–42 lb)
22.3 mm	433–479 N (98–108.3 lb)

Shims (for valve clearance)

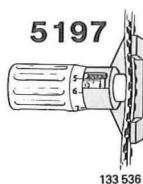
Thickness	3.00–4.25 at intervals of 0.05 mm (0.012–0.167 at intervals of 0.002 in)
-----------------	---

Timing gears**Toothed belts**

Belt tension (measured with tool 5197)

Check value	12–13
Setting	12.5

5197

**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

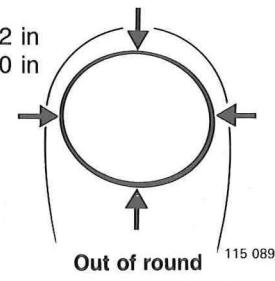
Crankshaft

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

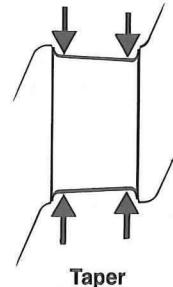
¹⁾Measured with two outer main bearings in V-blocks.

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.

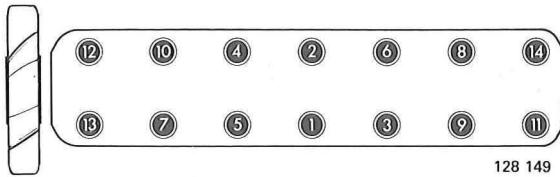
Side clearance on crankshaft, max.....	0.4 mm	0.0157 in
Max. weight deviation between connecting rods in same engine ...	6 grams	

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 |

Crankshaft pulley (vibration damper)

center bolt¹⁾ 350 258

Allen bolts 20 15

Flywheel (use new bolts and locking fluid,

Volvo P/N 277 961-9) 75 55

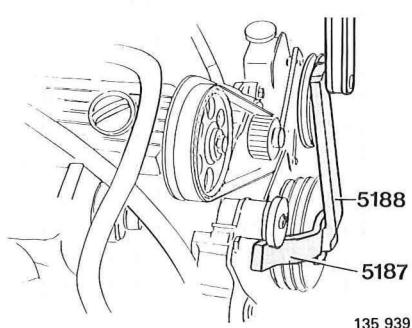
Camshaft gear, front 45 33

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



138 220

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

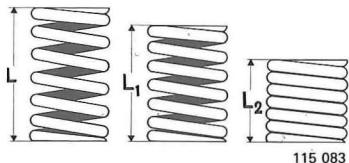
Oil pressure sensor

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) ca 200 (45)	36 (1.42)	152–162 (34–36) 229 (37)
19.8* (0.78)		28 (1.10) 25.9* (1.02)	—

* Fully compressed

Group 23 Fuel system

Injection timing, idle

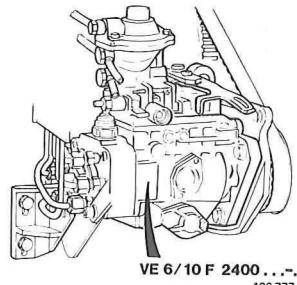
Engine type	Market	Injecting timing,* mm Adjusting (checking)	Engine speed r/s (r/min)	
			Idle	Max
D 24	–1986 1987–	0.70 (0.65–0.73) 0.80 (0.77–0.85)	12.5 (750) 12.5 (750)	90 (5 400)** 90 (5 400)
D 24 T	USA+Canada 1982–1983 1984 Federal+Canada California 1985–	0.80 (0.77–0.85) 0.85 (0.82–0.90) 0.75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

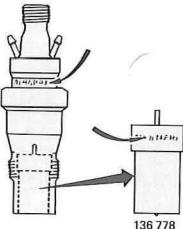
Type Distributor pump
 Model and designation Bosch VE6/10 F 2400 + designation below



Engine type	Market	Man	Aut
D 24		L32-2	L32-3
D 24 T	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
D 24 TIC	740/760 780 –86 780 87–	TIC 2 TIC 1 TIC 3	TIC 2–1 – –

Injectors

Model and designation: (complete) D 24 Bosch KCA 30 SD 27/4 (44)
 D 24 T/TIC Engines Bosch KCA 30 S 36/4



Engine type	Injector — complete		Distributor (Bosch)	
	Designation	Volvo P/N	Designation	Volvo P/N
D 24	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
	068 130 201 H	1 328 209	DNO SD 1930	1 328 096
D 24 T (USA+Can. Austria 1987–)	068 130 201 B	1 328 208	DNO SD 1930	1 328 298
D 24 T (Others)	068 130 201 B	1 328 108	DNO SD 293	1 328 298
D 24 TIC				

Injector opening pressure,
checking MPa (psi)

D 24

D 24 T, D 24 TIC

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

D24 T, at 3 000 r/min (full load)	70–77 kPa	10–11 psi
Pressure sensor	80–85 kPa	11–12 psi
Cut-out point, approx	90–100 kPa	13–14 psi
D24 TIC, at 2 400 r/min (full load)	110–130 kPa	13–18 psi
Overpressure safety valve, opens		

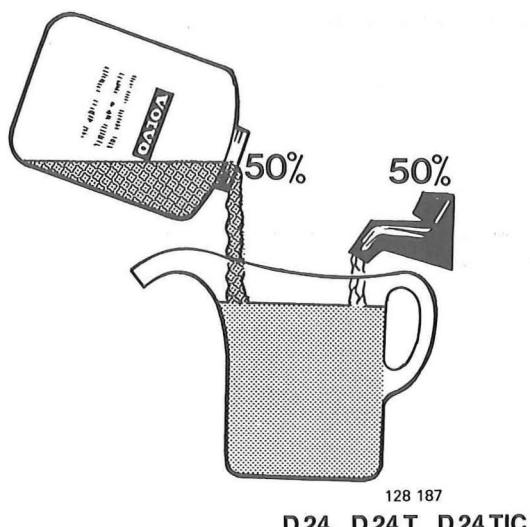
Tightening torques

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

	Nm	ft lb
Mounting nuts, front exhaust manifold-turbo D24 T	25	18
D24 TIC	20	15
Mounting bolts, turbine housing	20	15
compressor housing	18	13
rear housing (with waste gate) D24 T	20	15
D24 TIC	25	18
D24 TIC Lock nut, pull rod – pressure actuator	6	4
D24 TIC Pressure actuator nuts	6	4
Mounting bolts, turbocharger – exhaust manifold	60	45

Group 26 Cooling system

General



Capacity,* with manual gearbox..... litres (US qts) 9.5 11.0 11.5
(9.9) (11.6) (12.2)

with aut. gearbox..... litres (US qts) 9.2 10.0 11.5
(9.7) (10.6) (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 1161328-8) 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

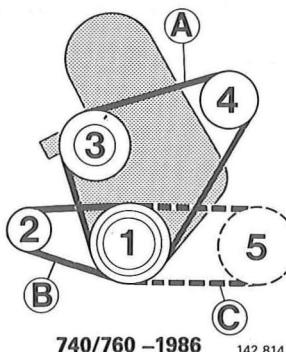
Pressure valve in cap opens at:

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

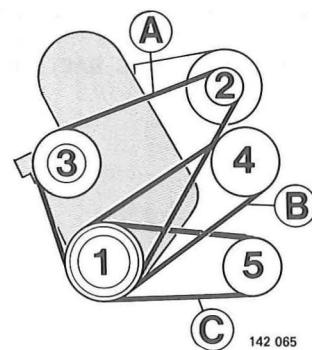
Drive belts



Profile x length:

A HC 38 x 1238	A HC 47 cog x 1150
B HC 38 x 750	B HC 38 cog x 1013
C HC 50 x 913	C HC 50 cog x 913

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



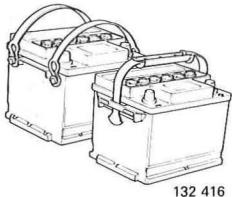
Tightening torque

	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



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

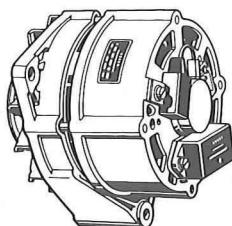
1991– type and market adaption

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 $+27^{\circ}\text{C}$ (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
min (after machining)	26.8 mm
Max permissible runout, slip rings	0.03 mm
rotor body	0.05 mm
Carbon brush spring force	3–4 N
Min length, carbon brushes	5 mm
Tightening torque, attaching screws	4 Nm
pulley nut	40 Nm
	1.102 in
	1.055 in
	0.0012 in
	0.0019 in
	0.6–0.9 lb
	0.2 in
	3 ft lb
	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
min (after machining)	27 mm
Max permissible runout, slip rings	0.03 mm
rotor body	0.05 mm
Carbon brush spring force	3–4 N
Min length, carbon brushes	5 mm
Tightening torque, attaching screws	4 Nm
pulley nut	35–45 Nm
	1.102 in
	1.063 in
	0.0012 in
	0.0019 in
	0.6–0.9 lb
	0.2 in
	3 ft lb
	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	1120 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	1260 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
Max permissible run-out, slip rings	1.063 in
rotor body	0.03 mm
0.05 mm	0.0012 in
Carbon brush spring force	0.0019 in
Min length, carbon brushes	3–4 N
Tightening torque, attaching screws	0.6–0.9 lb
5 mm	0.2 in
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

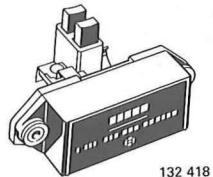
Volvo P/N	3 523 420
Bosch number	0 120 465 006
Max amperage	120 A
Max output	1 680 W
Max speed	300 r/s (18 000 r/min)
Direction of rotation	Clockwise
Diameter, slip rings, new	15 mm (0.59 in)
min (after machining)	14 mm (0.55 in)
Max permissible run-out, slip rings	0.003 mm (0.0001 in)
rotor body	0.005 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

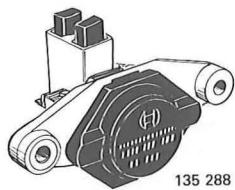
Resistance, rotor winding	2,6 Ω
stator	0,02 Ω
Amperage at 14 V (min value)	60 A vid 30 r/s (1 800 r/min)
	120 A vid 100 r/s (6 000 r/min)

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

State battery charge.....
 Air temperature
 Temperature, warm regulator

In car	On test bench
min $\frac{3}{4}$	fully charged
+25°C (77°F)	+25°C (77°F)
+60–80°C (140–176°F)	+60°C (140°F)

Test values

Alternator speed	100 r/s (6000 rpm)	100 r/s (6000 rpm)
Engine speed	50 r/s (3000 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 \times 0.85)
70 A.....	60 A (rated output \times 0.85)
90 A.....	77 A (rated output \times 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**

State of battery charge

Air temperature

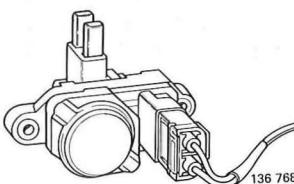
Temperature, warm regulator

In car	On test bench
min $\frac{3}{4}$	fully charged
+25°C (77°F)	+25°C (77°F)
+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	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

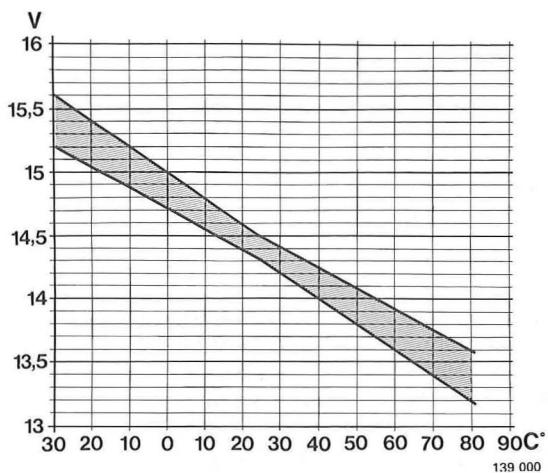
* Load achieved when engine running.



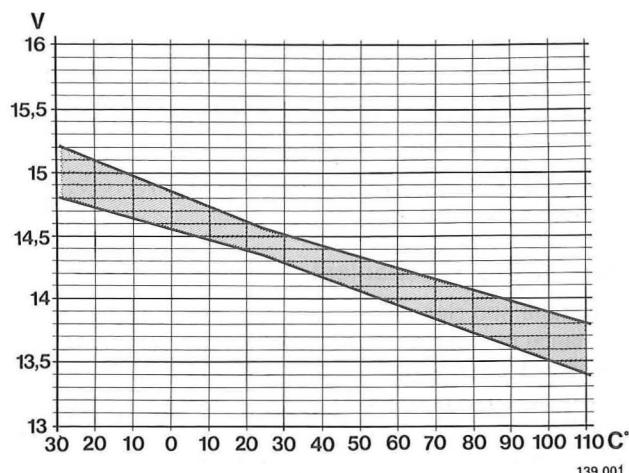
Control tolerance (on test bench)

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

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

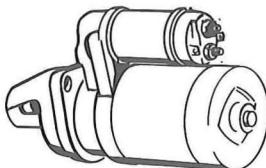


External voltage-temperature
5 A load



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 1257 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 1328 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 1357373)

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 1328391)

Direction of rotation (viewed towards) Clockwise
Output 2.0 kW (2.7 hp)**Test values, mechanical**

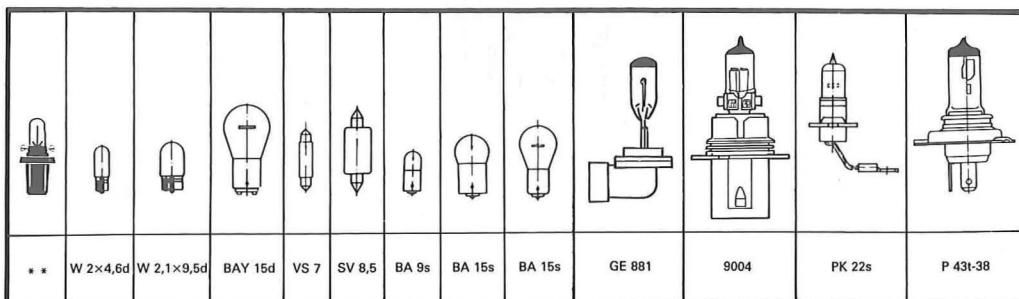
Armature end clearance	0.2–0.5 mm (0.0079–0.0197 in)
Brush spring force	26.5–32.4 N (6.0–7.3 lb)
Pinion modulus	2.12 mm (0.0835 in)
Pinion backlash.....	0.3–1.5 mm(0.0118–0.0591 in)
Commutator, min diameter	35.5 mm (1.40 in)
Carbon brushes, min length	9 mm (0.35 in)

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

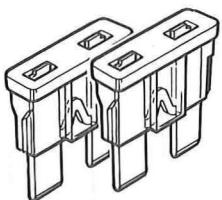


	Rating	Socket	Qty
		USA	
Headlight	60/55 W	P 45t-38 (H4)	2
Headlight USA, CDN, outer	35/35 W	"Sealed Beam"	2
inner	50 W	"Sealed Beam"	2
Headlight 760 1988–/780 USA, CDN.....	50/70 W	"Semi-sealed"	2
Parking/day running lights (certain markets)	21/5 W	BAY 15d	2
Parking lights (other markets)	5 W (4 cp)	BA 15s	2
Parking lights, 780.....	4 W	BA 9s	2
Parking lights, 780 USA/Canada.....	4 W	W 2.1x9.5d	2
Turn signals, front	21 W (32 cp)	BA 15s	2
Turn signals, front USA/Canada	24/2.2 cp	BAY 15d	1157 NA
Turn signals, side (certain markets)	5 W	W 2.1x9.5d	2
Turn signals, rear.....	21 W (32 cp)	BA 15s	1156
Fog/spot lights	55 W	PK 22s (H3)	2
Foglight 760 1988– USA, CDN.....	27 W	–	GE 881
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	–
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 2.1x9.5d	2
Reading light, rear	5 W	W 2.1x9.5d	2
Vanity mirror light.....	3 W	SV 7	2
Glove compartment light.....	2 W	BA 9s	1
Door open warning lights	3 W	W 2.1x9.5d	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 2x4.6d	16
Lighting	3 W	W 2.1x9.5d	3
Control and panel lighting	1.2 W	W 2x4.6d	12

* 780.

** Inc. holder, see fig.

Group 37 Fuses



132 421

1982–1983

1982–1983

Fuse num- ber	Circuits protected	Fuse rating	Fuse num- ber	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	12	Cigar lighter	15 A			
2*	Four-way hazard warning lamps	25 A	13	Radio Power door mirrors Power seats				
	Headlight flasher (via fuses 17 and 18) Central locking system		14	Horn	25 A			
3	Extra lights (spot/fog lamps in air dam/ front spoiler).....	15 A		Windshield wash/wipe (intermittent relay) Headlamp wash/wire				
4	Brake lights.....	15 A	15	Heater fan, other speeds.....	30 A			
5	Clock..... Vanity mirror lamp Glove compartment lamp Engine and luggage compartment lamps Interior lamp Power aerial Door warning lamps Radio	15 A		Tank pump E and F-engines via fuse number 1..... (only in circuit when starting and when en- gine is running)	15 A			
15 + feed (ignition II & III) (fuses 6 a 7 via relay)								
6	Electric cooling fan	25 A	Main and dipped beams					
7	Power windows	30 A	16	Rear fog lamps.....	15 A			
8	Direction indicators..... Constant idling (E & F engines) Solenoid valve (carb) Hot start valve (carb) Overdrive relay Relay glow plugs, Diesel	15 A	17	Indicator lamp, main beam	15 A			
9	Electrically heated rear window	30 A	18	Main beam, left..... Relay, spot lights	15 A			
	Power sun roof		19	Dipped beam, left	15 A			
10	Instrumentation	25 A	20	Dipped beam, right	15 A			
	Reversing (back-up) lights Heated front seats Seat belt reminder <i>Spade terminals + 15 in central electrical unit:</i>		Feed from light switch (58)					
	– Relay fuel pump – Relay power windows/electric cooling fan – Oil level sensor Delay valve AC Bulb failure warning Seat belt reminder (USA & Canada)		21	Instrument and control lighting, front..... Tail and parking lights, left Number (license) plate light Light warning buzzer	15 A			
11	Day running lights	25 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			
	Cruise control Heater fan, CU low speed ACC							

*Applies to 1983 models.

1982 models:

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

1984

Fuse number	Circuits protected	Fuse rating
-------------	--------------------	-------------

30 + feed (circuits always live)

- 1 Fuel pumps E-engines + CI system..... 25 A
(via fuel pump relay)
Fuel injection ((B 23 ET))
- 2 Four-way hazard warning lamps 25 A
Headlight flasher (via fuses 17 and 18)
ABS
- 3 Extra lights (spot/fog lamps in air dam/
front spoiler)..... 15 A
Rear fog lamp relay
- 4 Brake lights..... 15 A
- 5 Clock..... 15 A
Vanity mirror lamp
Glove compartment lamp
Engine and luggage compartment lamps
Interior lamp
Power aerial
Door warning lamps
Radio

**15+I-feed via relay (ignition II)
(fuses 6&7 via relay)**

- 6 Electric cooling fan..... 25 A
Fasten seat belt light
Heated seats
- 7 Power windows 30 A
- 8 Day running lights 15 A
Bulb failure sensor
Relay, power windows + cooling fan
- 9 Heated rear window..... 30 A
Power sun roof
Air conditioning

15+R-feed (ignition II & III)

- 10 Instrumentation..... 15 A
Reversing (back-up) lights (25 A)
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)
- 11 Direction indicators..... 15 A
Overdrive relay (25 A)
Constant idle speed system
Glow plug relay
Hot spot relay
Warm start-valve (carb. engines)

1984

Fuse number	Circuits protected	Fuse rating
-------------	--------------------	-------------

X-feed (ignition I & II)

- 12 Cigar lighter 15 A
Radio
Power door mirrors
Power driver's seat
- 13 Horn 25 A
Windshield wash/wipe (intermittent relay)
Headlamp wash/wipe
- 14 Fan motor 30 A
Air conditioning
- 15 Tank pump E and F-engines via fuse num-
ber 1 15 A
(only in circuit when starting and when en-
gine is running)

Main and dipped beams

- 16 Rear fog lamps (UK + S) 15 A
Headlamp cut-out
- 17 Indicator lamp, main beam 15 A
Main beam, left
- 18 Main beam, right 15 A
Relay, spot lights
- 19 Dipped beam, left 15 A
- 20 Dipped beam, right 15 A

Feed from light switch (58)

- 21 Instrument and control lighting, front..... 15 A
Tail and parking lights, left
Number (license) plate light
- 22 Seat belt lock and ashtray light, rear..... 15 A
Panel light, auto selector lever
Lighting, switches on trans tunnel
Tail and parking lights, right
Relay, auxiliary lamps

760 1985–1987
740 1985–1988

Fuse num- ber	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	25 A
	Headlight flash (via number 17 & 18)	
	Central lock	
	ABS	
3	Relay, auxiliary lights..... (spot/fog in front spoiler)	15 A
	Relay, rear fog lights	
4	Brake lights.....	15 A
	Gear shift indicator (USA & CDN)	
5	Clock	15 A
	Vanity mirror light	
	Glove compartment light	
	Engine compartment and boot (trunk) light	
	Courtesy lighting	
	Radio	
	Power aerial	
	Door-open warning lamps	
6	Heated front seats	30 A (15 A)
7	Electric cooling fan	25 A (30 A)
8	Power windows	30 A
9	Direction indicators.....	15 A
	Fasten seat belt light	
	Heated front seats	
	Power windows	
	AC	
	Electric cooling fan	
10	Heated rear window.....	30 A
	Power sun roof	
	Power door mirrors	
11	Tank pump	15 A
	Heated Lambda-sond	

760 1985–1987
740 1985–1988

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

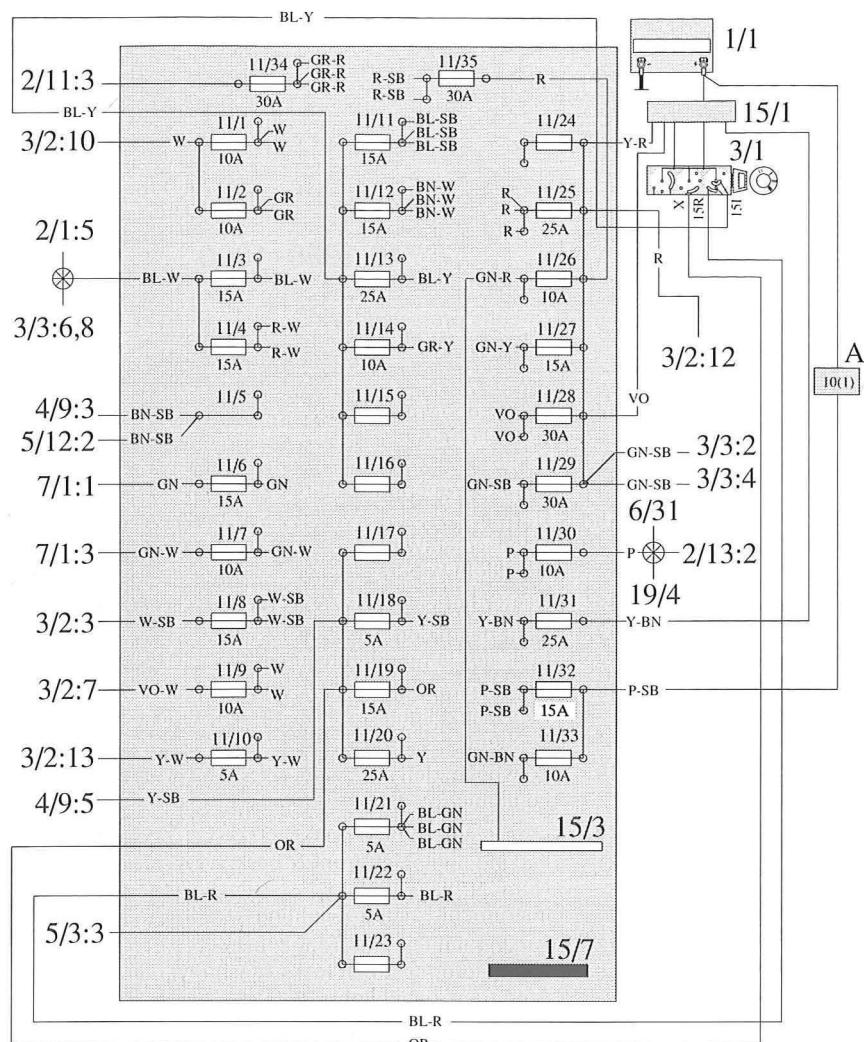
740 1989–1990

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

740 1989–1990

Fuse num- ber	Circuits protected	Fuse rating
14	Power door mirrors	15 A
	Cigar lighter	
	Radio	
	Tailgate wiper, interval relay	
15	Horn	25 A
	Windscreen wipers	
	Headlight wipers	
16	Heater fan	15 A
17	High beam, left	15 A
	Indicator lamp, high beam	
18	High beam, right.....	15 A
	Relay, aux. lights	
	Foglights	
19	Low beam, left.....	15 A
	Foglights	
20	Low beam, right	15 A
21	Parking lights, left front & back.....	15 A
	Number plate lighting	
	Instrument & control lighting	
22	Parking lights, right front & back	15 A
	Lighting for seat belt locks & ashtray, rear	
	Auto.trans panel light	
23	Day running lights (1989).....	15 A
	Heated front seats (1990)	
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	15 A
	RH parking lights, front and rear.	
	Illumination of storage pocket between front seats. Supplementary main beams.	
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

780 1989–1991

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	30 A
	ECC heater fan	
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

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

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	Faster 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

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	X-relay, main beam	Heater fan (not ECC) ECC, control unit ECC, solenoid valves	30 A
17		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

960 1991

Fuse number	Fed by	Circuits protected	Fuse rating
1	Light switch	Left parking lights, Licence plate light Bulb failure warning – 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		Back-up lights Turn indicators Cruise control	15 A
12	Ignition switch 15I	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	Ignition switch X	Reserve	
17		Reserve	
18		Radio (SRS Airbag not fused)	5 A

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	$296 \pm 15 \Omega$
Full	60 L (16 US gals)	$36 \pm 2 \Omega$

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

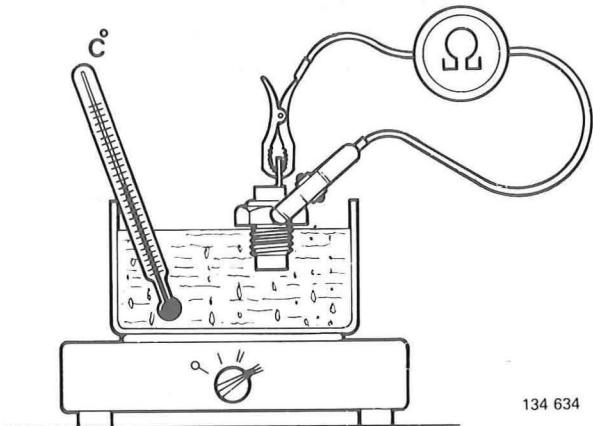
Resistance at different temperatures

(1982–86)

Temperature	Resistance
60°C (140°F)	$217 \pm 35 \Omega$
90°C (194°F)	$87 \pm 15 \Omega$
100°C (212°F)	$67 \pm 11 \Omega$

(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
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Group 41 Clutch



Pressure plate, max out-of-true 0.2 mm (0.008 in)

Clutch fork free travel:

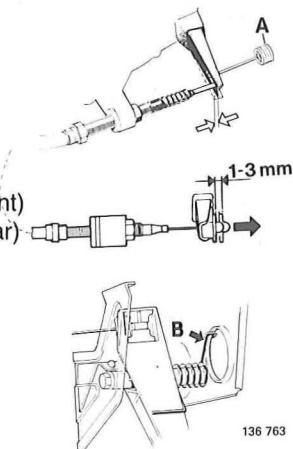
hydraulic not adjustable

clutches with return spring (A) 1-3 mm (0.04-0.12 in) (to front)

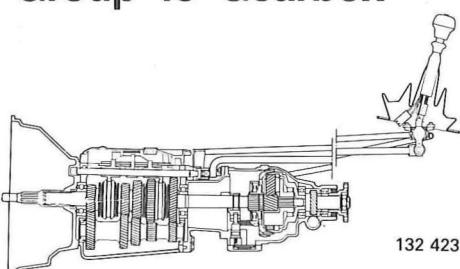
clutches without return spring 1-3 mm (0.04-0.12 in) (to rear)

Clutch pedal travel 160 mm (6.23 in)

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



Group 43 Gearbox



Manual gearbox

Reduction ratios:

	M 46	M 47/M 47 II
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

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)

All..... 2.8–3.1 MPa (400–440 psi)

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)

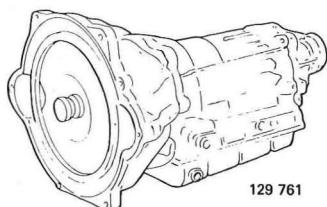
Lubricant

	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 1161 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 BW55

129 761

Make and type.....	Borg Warner type 55
Reduction ratios, 1st gear.....	2.45:1
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
B28 A	38.3 (2 300)	029	Light brown



* 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 mm –0.6 mm	(2 +0.63 in) (-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

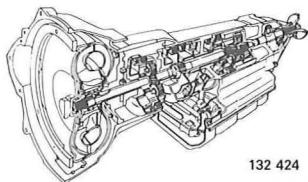
Min permissible thickness	2.1 mm	(0.083 in)
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Tightening torque data

	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
B 23 E	AW 71		35.0 (2 100)	1 208 300
B 23 FT	AW 71		41.7 (2 500) ²⁾	1 208 334
B 28 A	AW 71		35.0 (2 100)	1 208 360
B 28 E	AW 71		35.0 (2 100)	1 208 310
B 28 F	AW 71		33.0 (2 000)	1 208 248
B 200 K	AW 70		38.0 (2 300)	1 208 332
B 200 E	AW 70		35.0 (2 100)	1 208 415
B 200 F	AW 70		37.0 (2 200)	1 208 659
B 230 A	AW 71		35.0 (2 100)	1 208 304
B 230 K	AW 71	-1986	42.0 (2 500)	1 208 371
	AW 71	1987-	42.0 (2 500)	1 208 417
B 230 F	AW 70	USA/CDN 5-door, Japan, Australia 1988	33.0 (2 000)	1 208 563
	AW 70	USA/CDN Japan/ Australia	33.0 (2 000)	1 208 604
	AW 70	Others	33.0 (2 000)	1 208 652
B 230 FB	AW 71		33.0 (2 000)	1 208 682
B 234 F/G	AW 72	USA/CDN Europe	30.0 (1 800) 41.0 (2 450) 30.0 (1 800) 41.0 (2 450)	1 208 637 1 208 666 1 208 638 1 208 667 ³⁾
B 230 FT	AW 71	USA/CDN/Japan/ Australia 1990 Others 1990	45.0 (2 700) ²⁾ 45.0 (2 700) ²⁾ 42.0 (2 500) ²⁾ 42.0 (2 500) ²⁾	1 208 334 1 208 661 1 208 642 1 208 643
B 280 E	AW 71	Scandinavia	35 (2 100)	1 208 533 ³⁾
	AW 71	Others	35 (2 100)	1 208 534
B 280 F	AW 71		35 (2 100)	1 208 532
	AW 71		35 (2 100)	1 208 533 ³⁾

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
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

³⁾ × Converter ratios

Torque converter:

reduction ratio

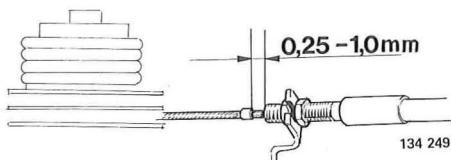
1-2:1 approx

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**

Resistance 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	AW 70	0.35–0.44 (50–63)	0.50–0.64 (71–91)
B 23 E	AW 71	—	—
B 230 K –1986	AW 71	—	—
B 200 K, B 230 F	AW 70	0.46–0.54 (65–77)	0.70–0.82 (106–117)
B 23/230 FT	AW 71	—	—
B 230 A, B 230 FB	AW 71	—	—
B 230 K 1987–	AW 71	—	—
B 28 A, E, F	AW 71	—	—
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	AW 70	1.00–1.20 (142–205)	1.37–1.70 (195–242)
B 23 E	AW 71	—	—
B 230 K –1986	AW 71	—	—
B 200 K, B 230 F	AW 70	1.00–1.20 (142–205)	1.50–1.90 (213–270)
B 23/230 FT	AW 71	—	—
B 230 A, B 230 FB	AW 71	—	—
B 230 K 1987–	AW 71	—	—
B 28 A, E, F	AW 71	—	—
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* B 230 FT**

1989–

B 230 FB

B 234 F

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 out	3 (100+KD) in out	4 (100+KD) in out	2 (100+KD) in out	3 (100+KD) in out	4 (100+KD) in out	3 (15–98) in 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 3 515 646

Shift position sensor

– Volvo part number 3 515 639
 – Aisin Warner number 99 03 740 153

Mode selector

– Volvo part number 3 515 640

Solenoids:

Shift solenoid 1 (S1) and 2 (S2)

– Volvo part number 3 515 643
 – Aisin Warner number 99 03 740 040
 Resistance at +25°C (77°F) 13±2 Ω

Lock-up solenoid (SL)

– Volvo part number 3 515 644
 – Aisin Warner number 99 03 740 041
 Resistance at +25°C (77°F) 13±2 Ω

Line pressure solenoid (STH)

– Volvo part number 3 515 645
 – Aisin Warner number 99 03 457 389
 Resistance at +25°C (77°F) 13±2 Ω

Speed sensor

– Volvo part number 3 515 641
 – Aisin Warner number 99 03 740 151

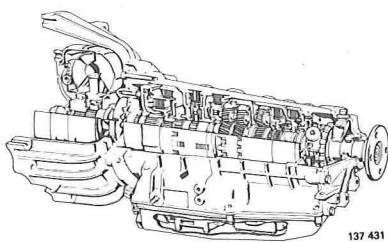
Oil temperatur sensor

– Volvo part number 3 515 642
 – 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) others.....	40.0 48.0	30 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



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

	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 (2150)
B 230 ET	1 208 376 1 208 503 1 208 480 1 208 609	33.3–41.0 (2000–2450) ²
B 230 F Europe 1987–	1 208 518 1 208 601 1 208 680	35.0 (2100)
B 230 F Others (not estates 1987)	1 208 301 1 208 501	35.0 (2100)
B 230 FB	1 208 686	33.0 (2000)
B 230 FT Europe 1987–88	1 208 517 1 208 610	33.3–41.0 (2000–2450) ²
D 24	1 208 407 1 208 594 1 208 505	36.0 (2150)
D 24 T Europe	1 208 317 1 208 506 1 208 664 1 208 389 1 208 595	31.7–39.0 (1900–2350) 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 (1800–2000) ²
D 24 TIC	1 208 397 1 208 663	31.7–40.8 (1900–2450) 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.

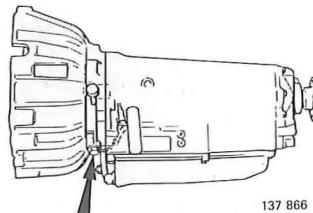
²) Start–stall.

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 $+1.6$ mm –0.6	2 $+0.063$ in –0.024

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)

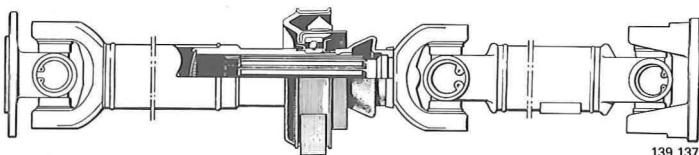
Engine	Ratio	1–2	2–3	3–4	4–3	3–2	2–1	Mechanical lock-up	
								Engages**	Disengages**
B 23 E	3.73:1	62 (39)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	96 (60)	94 (59)
B 230 E	3.73:1	62 (39)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	85 (53)	83 (52)
B 230 F USA/Canada	3.91:1	59 (37)	102 (64)	122 (76)	41 (26)	93 (58)	50 (31)	78 (49)	76 (48)
B 230 F Europe 1987–	3.91:1	59 (37)	102 (64)	122 (76)	41 (26)	93 (58)	50 (31)	85 (53)	83 (52)
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)
B 230 FT Europe 1987–	3.73:1	62 (69)	107 (67)	128 (80)	43 (27)	98 (61)	52 (33)	97 (61)	95 (59)
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

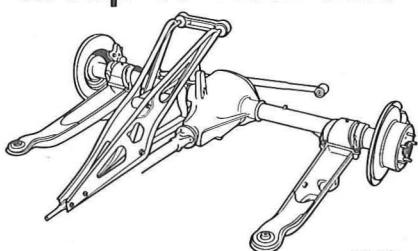
	Nm	ft lb
Drive plate–torque converter M 8.....	17–27	12–20
M 10×1.25	41–50	30–36
Torque converter – engine, M 10.....	35–50	25–36
M 12	55–90	40–65
Valve body – transmission gearcase.....	7–9	5–6.5
Plate above parking detent.....	9–11	6.5–8.0
Rear case – gearcase	20–26	14–19
Strainer – valve body – gearcase	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

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**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

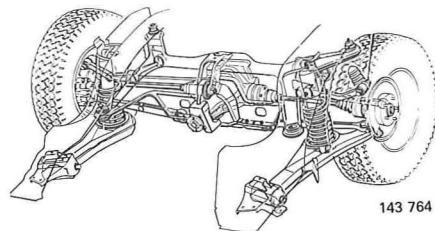
*1988– only 5-doors.

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.

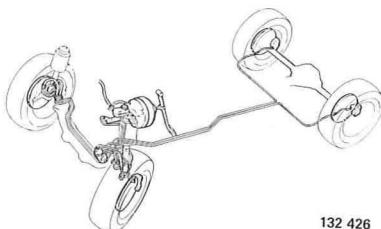
Final drive 760/780 4-door 1988–, 960

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’)
min mm (in)	3 (0.12)			12.0 (0.472)

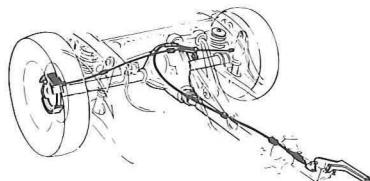
Rear wheel brakes

	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	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	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°

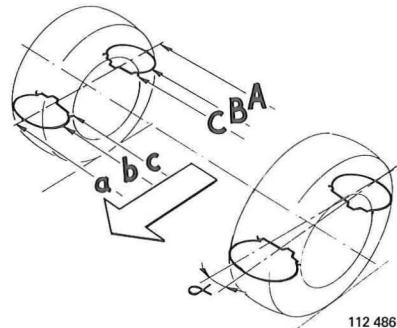
* Difference between left and right-hand locks must not exceed 0.7°.

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.



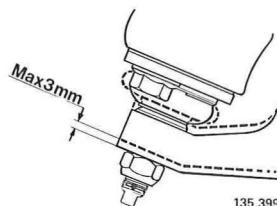
112 486

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)

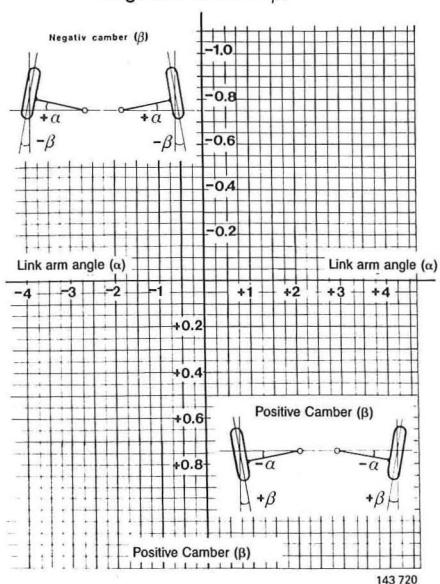
Max radial play, 0.5 mm (0.02 in).



135 399

Wheel alignment, rear wheels (Multi-link)

Negative Camber (β)

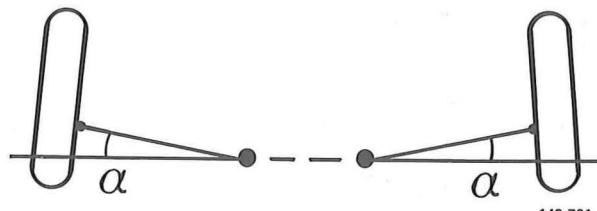


143 720

Camber

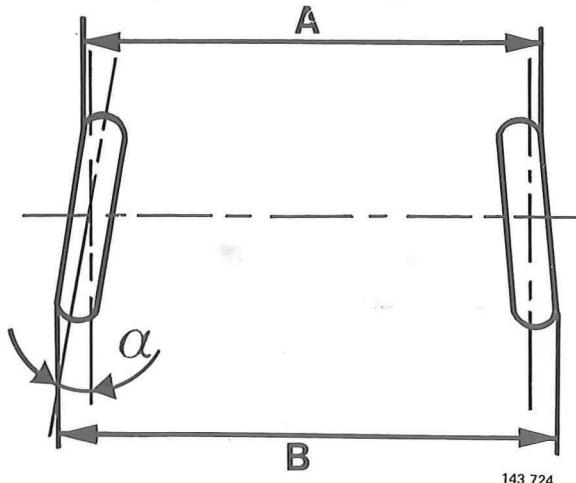
Diagram shows correct Camber (β) in relation to position of lower links (α).

Example: angle of lower link is +2°, correct Camber is 0.05° (negative Camber). Tolerance = $\pm 0.25^\circ$.



143 721

Section 6 Suspension and steering


**Toe-in
Measured as angle**

Toe-in (α) angle = $2' \pm 3'$ per wheel.

Specification

Toe-in measurement (B-A) should be 0.5 ± 0.8 mm, measured at C, see left.

Note: Camber must always be adjusted before Toe-in.

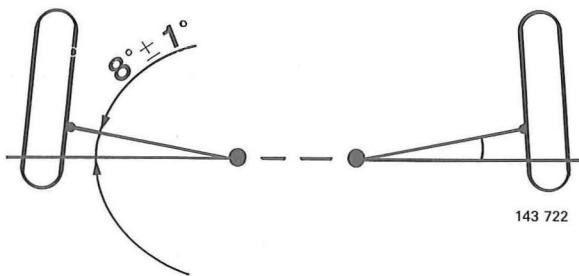
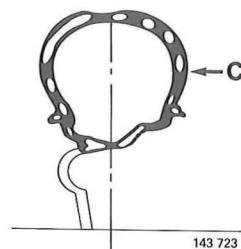
Toe-in tolerance

Measure Toe-in of unladen vehicle, according to above.

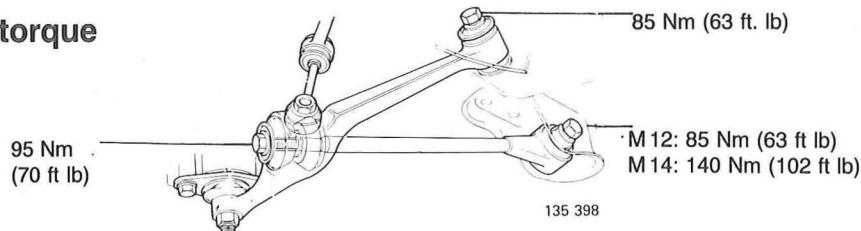
Apply sufficient load to obtain a lower link angle of $8^\circ \pm 1^\circ$.

Repeat Toe-in measurement and compare results.

Max. difference = $3'$ per wheel.



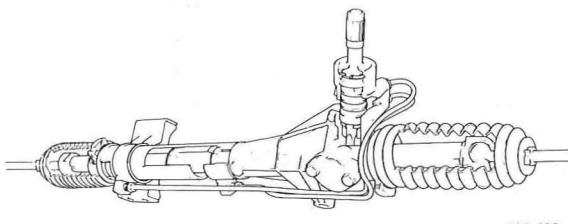
Group 61 Front wheel suspension

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

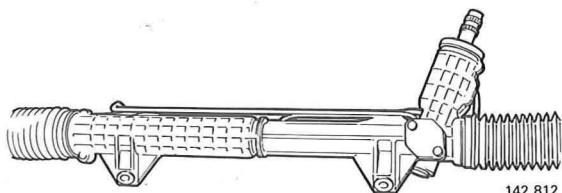
Steering gear



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 1161 001-1	
quantity	100 grams	
Hydraulic fluid	See page 14	

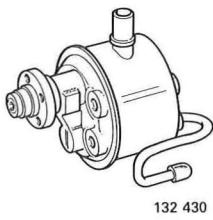


142 812

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 1161 001-1	
quantity	100 grams	
Hydraulic fluid	See page 14	

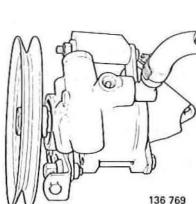
Servo pump



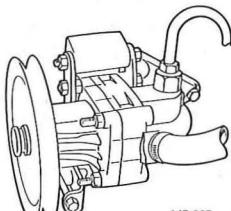
132 430



136 000



136 769

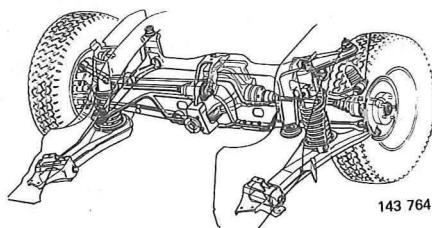


147 997

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

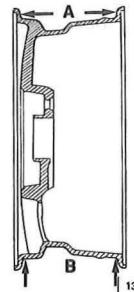
RIMS

	Aluminium
Lateral runout (A)	Max. 0.8 mm (0.032 in)
Radial runout (B).....	Max. 0.6 mm (0.024 in)

Steel
1.0 mm (0.039 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	190 (1.9)	210 (2.1)	260 (2.6)
Estate	200 (2.0)/960	210 (2.1)	210 (2.1)	280 (2.8)
Spare wheel "Special Spare"				
155/R 15	350 (50)	350 (50)	350 (50)	350 (50)
18.14	280 (40)	280 (40)	280 (40)	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

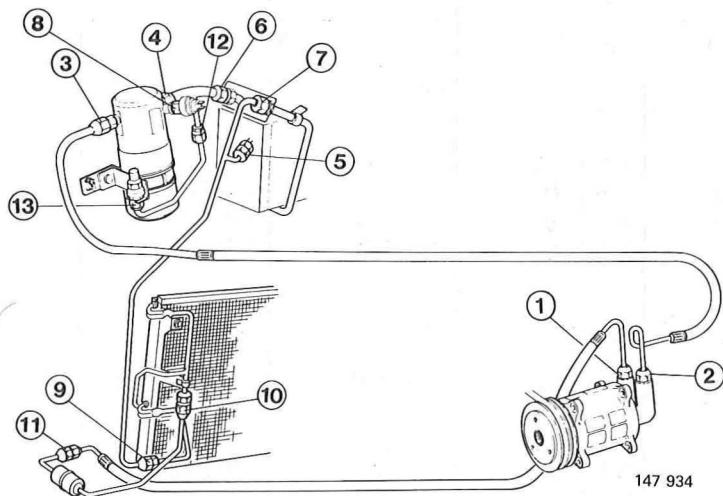
	Nm	ft lb
Trailing arm bracket	45	33
Springs rear, upper mount	(approx.) 48	35
Attaching bolts, front brake calipers	100	74
Attaching bolts, rear brake calipers	58	43
Wheels	85	63

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	Sanden DKS 15BH/ SD709 CH
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
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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

Fan speed	3	CU + AC	ACC	ECC
Temperature control	COOL		Max cool	5
Mode selector	MAX		Auto Hi	Max cool
				Vent



AC switch
 Recirculation switch

In
 In

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)



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