Section 2 B6304 Engine

Group 20 General

Engine type	Comp. ratio	Rec. octane RON	Output		Max. torque	
			kW at r/s	hp* (bhp) at rpm	Nm at r/s	kpm (ft.lbf) at rpm
B 6304 F	10.7:1	95[1)]	150/100	204/6000 (201/6000)	267/72	27.2/4300 (197/4300)
B 6304 G	10.7:1	95[1)]	150/100	204/6000	267/72	27.2/4300

* Metric horsepower.
[1)] Unleaded fuel **must** be used. Can be run on 91 octane unleaded.

Other general data

No. of cylinders	6
Cylinder bore mm	83.00
Stroke mm	90.00
Displacement dm3 (litres)	2922
Firing order	1 - 5 - 3 - 6 - 2 - 4
Compression MPa (kp/cm2)	1.3 – 1.5 (13 - 15)
max. deviation between cylinders MPa (kp/cm2)	0.2 (2.0)
Weight	180

Group 21 Engine block

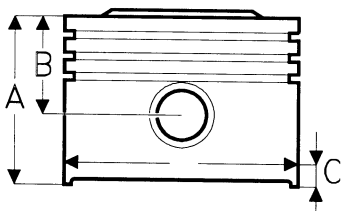
Cylinder head

Height, new	mm	129.00 ± 0.05
Max. machining	mm	0.30
Max. warp		
along	mm	0.50
across	mm	0.20

Cylinder block

Bore

Standard (C-marked)	mm	83.00 - 83.01
(D-marked)	mm	83.01 - 83.02
(E-marked)	mm	83.02 - 83.03
(G-marked)	mm	83.04 - 83.05



Engine type	Dimensions in mm		
	A	B	C
B 6304 F/G	59.9	24.8	16.0

Pistons

Piston diameter (D)
(measured at right angles to gudgeon (piston) pin hole, distance C from lower edge)

• Standard (C-marked)	mm	82.98 - 82.99
(D-marked)	mm	82.99 - 83.00
(E-marked)	mm	83.00 - 83.01
(G-marked)	mm	83.02 - 83.03

Piston clearance	mm	0.010 - 0.030

Piston weight	mm	350 ± 5
• Max weight difference between pistons in same engine	g	10

Piston rings, axial clearance
(measured with ring on piston)

• upper comp. ring	mm	0.050 - 0.085
• lower comp. ring	mm	0.030 - 0.065
• oil scraper ring	mm	0.020 - 0.055

Piston rings, gap
(measured in cylinder)

• upper comp. ring	mm	0.20 - 0.40
• lower comp. ring	mm	0.20 - 0.40
• oil scraper ring	mm	0.25 - 0.50

Gudgeon (piston) pin

• diameter	mm	$23.00\ ^{+0}_{-0.004}$
• fit in connecting rod		Light thumb pressure (close running fit)
• fit in piston		Thumb pressure (push fit)

Valve system	Intake	Exhaust
Valves		
Length ....mm	104.05 ± 0.18	103.30 ± 0.18
Matching surface angle ....°	45.5	45.5
Edge height, new valve ....mm	1.5	1.5
min. after machining ....mm	1.2	1.2
Max. machining valve stem ....mm	0.4	0.4
Valve seats		
Diameter, standard....mm	32.61	28.61
oversize....mm	33.11	29.11
Matching surface angle ....°	45.25	45.25
Reduction angle, upper ....°	20.25	15.25
lower ....°	60.25	60.25
Width ....mm	1.4 - 1.8	1.8 - 2.2
Valve guides		
Diameter, standard....mm	12.00	12.00
oversize 1 ....mm	12.10	12.10
2 ....mm	12.20	12.20
Clearance, valve stem-guide		
(measured with new valve) ...mm	0.06	0.06
min ....mm	0.03	0.06
Heigth above face of cyl. head ....mm	13.0	13.0
Valve springs		
External diameter ....mm	27.90 ± 0.20	27.90 ± 0.20
Internal diameter ....mm	20.10 ± 0.20	20.10 ± 0.20
Valve spring length		
under load ....mm/N	34.00 / 270 ± 15	34.00 / 270 ± 15
" ....mm/N	24.50 / 670 ± 32	24.50 / 670 ± 32

Timing gears

Camshaft

Marking		
Intake		PC I
Exhaust		PC E
Lift height	mm	9.00
Axial clearance	mm	0.05 - 0.20

Camshaft belt

Belt tension, measured with 998 8500	units	3.5 - 4.6

Crankshaft mechanism

Crankshaft

Out-of-true, max.	mm	0.004
Crankshaft, axial clearance	mm	0.08 - 0.19
Main bearing, radial clearance	mm	0.024 - 0.047

Main bearing journals

Diameter	mm	65.00
Out-of-round, max	mm	0.004

Connecting rod bearing journals

Diameter	mm	50.00
Out-of-round, max	mm	0.004

Connecting rods

Axial clearance at crankshaft	mm	0.15 - 0.45

Tightening torque

	Nm	ft. lb
Cylinder head (stage 1)	20	15
(stage 2)	60	44
(stage 3) angle-tighten	130°	130°
Bolts should be tightened in sequence from the centre outwards		
Middle section M10 (stage 1)	20	15
M10 (stage 2)	45	33
M 8 (stage 3)	24	18
M 7 (stage 4)	17	13
M10 (stage 5) angle-tighten	90°	90°
Bolts should be tightened in sequence from the centre outwards		
Connecting rod bearing caps (stage 1)	20	15
(stage 2) angle-tighten	90°	90°
Vibration damper (centre nut)	300	222
Flange bolt, vibration damper (stage 1)	35	26
(stage 2) angle-tighten	60°	60°
Carrier plate (stage 1)	45	33
(stage 2) angle-tighten	50°	50°
Camshaft gear	20	15
Tensioning pulley, camshaft belt	39	29
Damper unit, "	24	18
Idler pulley, "	24	18
Fuel distributor manifold (stage 1)	10	7
(stage 2)	75°	75°
Coolant pump	17	13
Stud, manifold (in cylinder head)	20	15
(on front pipe)	35	26

	Nm	ft. lb
Oil sump	17	13
Plug, oil sump	38	28
Oil suction pipe	17	13
Oil cooler, connection to block	17	13
Oil trap	15	11
Nipple, oil filter	40	30
Oil pressure switch	25	18
Engine speed (RPM) sensor	8	6
Knock sensor (KS)	20	15
Temp. sensor, rear edge of cyl. head	20	15
Temp. sensor, thermostat	10	7
Plug, resetting tool	38	28
Spark plugs	25	18

Group 22 Lubrication system

General

Oil capacity and quality, see page 14.

Oil pressure with warm engine and new oil filter:

at 12.5 r/s (750 r/min), min	MPa	0.1
at 50 r/s (3000 rpm)	MPa	0.3
max	MPa	0.5

Oil pump

Length, reduction valve spring

unloaded	mm	82.13
loaded with 52 ± 4 N	mm	56.10
loaded with 85 ± 8 N	mm	39.90

Group 23 MFI Fuel system

Motronic 1.8

CO-content, idling speed

B 6304 F *, nominal value for CO-content	%	0.4 - 0.8
B 6304 G, nominal value for CO-content	%	0.5 - 2.0
adjustment value for CO-content	%	1.0
Idling speed	r/s(rpm)	12.5 (750)

* CO-content and idling speed cannot be adjusted, only checked.

Heated oxygen sensor (HO2S) connected, measured upstream of three-way catalytic converter (TWC).

Automatic: Gear lever must be in P during the check, and handbrake applied.

Components		
Control modules	**Volvo**	**Bosch**
B 6304 F, – 1991	35 17 623	0 261 200 **362**
B 6304 F, 1991 – 1992	35 47 841	0 261 200 **528**
B 6304 F, 1992	91 35 010	
B 6304 F, 1993	68 42 234	0 261 200 **517**
B 6304 F, (EGR, EL) – 1992	35 31 061	0 261 200 **507**
B 6304 F, (EGR, EL) 1993	68 42 498	0 261 200 **996**
B 6304 F, 1994	91 46 325	0 261 203 **324**
B 6304 F, (EGR, EL) 1994	91 35 688	0 261 200 **996**
B 6304 G, – 1992	35 47 443	0 261 200 **516**
B 6304 G, 1993 –	68 42 235	0 261 200 **997**
Mass air flow (MAF) sensor	**Volvo**	**Bosch**
B 6304 F	35 17 569-4	0 280 213 **012**
B 6304 G	35 17 763-3	0 280 213 **020**
Resistance between connectors 2 and 3 Ω	2.5 - 4.0	
Pressure regulator	**Volvo**	**Bosch**
B 6304 F/G, early type – 1991	35 17 064-6	0 280 160 **294**
recent type 1991 –	35 47 653-0	0 280 160 **731**
System pressure kPa(kp/cm2)	300 (3.0)	

Injectors	**Volvo**	**Bosch**
B 6304 F/G, – 1992,		
B 6304 F(EGR) 1993 –	35 17 572-8	0 280 150 **762**
Injection volume cm^3/min	185	
at system pressure kPa(kp/cm^2)	300 (3.0)	
B 6304 F/G, 1993 –	35 07 708-0	0 280 155 **702**
Injection volume cm^3/min	150	
at system pressure kPa(kp/cm^2)	300 (3.0)	

Idle air control (IAC) valve	**Volvo**	**Bosch**
B 6304 F/G	35 17 886-2	0 280 140 **527**
Resistance between connectors 1 and 3 Ω	10 - 14	
	10 - 14	

Throttle position (TP) sensor	**Volvo**	**Bosch**
B 6304 F/G	13 36 385-8	0 280 122 **001**
Resistance, shut throttle kΩ	1.0	
open throttle kΩ	2.6	

RPM sensor	**Volvo**	**VDO/SIEMENS**
B 6304 F/G, – 1992	13 89 254-2	K 340.804/051/001
B 6304 F/G, 1991 – 1992	35 07 941-7	K 340.804/051/002
B 6304 F/G, 1993 –	35 47 699-3	S 102 460 001

Camshaft position (CMP) sensor	**Volvo**	**Bosch**
B 6304 F/G	13 83 966-7	0 232 101 **009**

Knock sensor (KS)	**Volvo**	**Bosch**
B 6304 F/G	13 67 644-0	0 261 231 **046**

Engine coolant temperature (ECT) sensor	**Volvo**	**SWF**
B 6304 F/G, – 1993	13 62 643-7	601.605
1993 –	68 49 350-1	
Resistance at 0°C (32°F) Ω	7 300	
+ 20°C (68°F) Ω	2 800	
+ 40°C (104°F) Ω	1 200	
+ 80°C (176°F) Ω	300	
+100°C (212°F) Ω	150	

Heated oxygen sensor (HO2S)	**Volvo**	**Bosch**
B 6304 F/G	35 31 251-1	0 280 003 **119**
Resistance of preheating resistor:		
cold probe (+ 20°C (68°F)) Ω	3	
hot probe (above + 350°C (668°F)) Ω	13	
Tightening torque Nm (ft lb)	55 (40)	
Lubricant, Volvo P/N 11 61 035-9, should be applied all along the probe's threaded section.		

Fuel pump	**Volvo**	**Bosch**
B 6304 F/G, – 1993	13 89 449-8	0 580 464 **039**
1993 –	91 42 044-8	0 580 464 **068**
Pump capacity at system pressure 300 kPa and + 20°C (68°F)		
– 12V litres/hour	130	
– 11V litres/hour	108	
– 10V litres/hour	86	
Current consumption at system pressure 300 kPa, + 20°C (68°F) and 12V:		
maximum amp	6.5	

Prepump	**Volvo**	**VDO/AC**
B 6304 F/G, – 1992	35 01 928-0	92151034
B 6304 F/G, 1993 –	35 17 845-8	644 3270
Current consumption amp	3 - 4	

Fuel filter	**Volvo**	**Bosch**
B 6304 F/G, – 91	13 89 450	0 450 905 **601**
B 6304 F/G, 92 –	68 42 033	0 450 905 **200**
Filters particles down to mm	0.002	
Tightening torque Nm(ft lb)	20 - 35 (15 - 26)	

Main relay	**Volvo**
B 6304 F/G	35 44 322-5

Relay, fuel pump B 6304 F/G	**Volvo** 13 62 914-2
Relay, engine cooling fan (FC) B 6304 F/G	**Volvo** 35 23 872-4

Group 26 Cooling system

General

Use Genuine Volvo green coolant mixed 50/50 with clean water. This mixture helps prevent corrosion and damage by freezing.

- Never top up with only water. Use Genuine Volvo coolant mixed 50/50 with clean water.
- The coolant does not normally need to be changed. In the case of major repairs requiring the draining of coolant, fresh coolant must be used since the drained coolant will have been subjected to oxidation and will contain dirt particles.
- Clean the cooling system when changing the coolant.

Engine type	Approx volume litres	Expansion tank. Pressure valve opens at		Thermostat °C (°F)		
		Pos. pressure kPa	Neg. pressure kPa	Marking	Starts opening	Fully open
B 6304 F/G	10.7	150	7	87	87 (189)	102 (216)

Group 28 Ignition system

Type	Motronic 1.8
Firing order	1 - 5 - 3 - 6 - 2 - 4
Ignition setting at 12.5 r/s (750 r/min) °	5

Components

Power amplifier	**Volvo**	**Bosch**
B 6304 F/G	13 67 776-0	0 227 100 **203**
Ignition coil	**Volvo**	**NipponDenso**
B 6304 F/G, – 1994	35 31 300-6	029 700-7260
1994 –	91 35 689-9	
Resistance of primary coil (between terminals 1 and 15) Ω	0.5	
Spark plugs	**Volvo***	**Volvo****
B 6304 F/G, normal driving	35 17 980	271 636-3
for high-speed driving (not USA,CDN).	35 17 629	271 427-7
Make / designation, normal/high-speed	Bosch	FR 7 DC/FR 6 DC
Make / designation normal/high-speed	Champion	RC 9 YC/RC 7 YC
Electrode gap mm	0.7 - 0.8	
Tightening torque, not oiled Nm(ft lb)	25 (18)	
* P/N ** kit no.		
Relay, ignition	**Volvo**	
B 6304 F/G	35 44 322-5	
Knock sensor (KS)	**Volvo**	**Bosch**
B 6304 F/G	13 67 644-0	0 261 231 **046**