

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

Group 20 General

Performance, compression ratio

Engine type	Comp. ratio	Output		Max. torque	
		kW at r/s	hp* (bhp) at rpm	Nm at r/s	kpm(ft.lb) at rpm
D 24	23:1	60/78	82/4700	145/33	14.8/2000
D 24 T	23:1	80/80	109/4800	205/42	20.9/2500
D 24 T (EGR)	23:1	79/80	108/4800	190/40	19.4/2400
D 24 TIC	23:1	90/80	122/4800	235/40	24.0/2400
D 24 TIC (EGR)	23:1	90/77	122/4600 (121/4600)	240/42	24.5/2500 (177/2500)

* Metric horsepower.

Other general data

No. of cylinders	6
Cylinder bore	mm 76.5
Stroke	mm 86.4
Displacement	dm ³ (litres) 2.383
Firing order	1 - 5 - 3 - 6 - 2 - 4
Compression, new	MPa 3.2
min.....	MPa 2.4
max. deviation between cylinders	MPa 0.8
Weight, without turbocharger (TC).....	kg 200
with turbocharger (TC).....	kg 210

Group 21 Engine block

Cylinder head

Max. warp, alongmm 0.5
 acrossmm 0.2

Note! Do not surface-grind cylinder head.
 It should be replaced if there is excessive warp.

Gasket, cylinder head			
Three alternative gaskets are used depending on the piston height above the cylinder block.			
Piston height above cylinder block surface in mm.		Gasket, no. of notches (thickness in mm)	
D 24, D 24 T, D 24 TIC	D 24 TIC (EGR) 1993-	D 24, D 24 T, D 24 TIC	D 24 TIC (EGR) 1993-
0.67 - 0.80	0.662 - 0.870	1 (1.4)	1 (1.50)
0.81 - 0.90	0.871 - 0.900	2 (1.5)	2 (1.55)
0.91 - 1.02	0.901 - 1.019	3 (1.6)	3 (1.60)

Cylinder block			
Dimension	Marking (honing group)	Piston diameter (mm)	Cylinder diameter (mm)
Standard		76.48	76.51
Oversize 1 (0.25 mm)	676	76.73	76.76
Oversize 2 (0.50 mm)	701	76.98	77.01
Oversize 3 (1.00 mm)	751	77.48	77.51
Max. wear (compared with nominal diameter).....mm	0.04		

Pistons	
Piston diameter measured at right angle to gudgeon (piston) pin hole, 15 mm from lower edge. See the table on previous page.	
Piston clearance	
newmm	0.03 - 0.05
max.mm	0.13
Max. wear (compared with nominal diameter)mm	0.04
Piston weight	
• Max. weight deviation between pistons in same engineg	12
Piston rings, axial clearance (measured with ring on piston)	
• upper comp. ring, newmm	0.11 - 0.14
max.mm	0.20
• lower comp. ring, newmm	0.07 - 0.10
max.mm	0.20
• oil scraper ring, newmm	0.03 - 0.07
max.mm	0.15
Piston rings, gap (measured in cylinder)	
• upper comp. ring, newmm	0.30 - 0.50
max.mm	1.00
• lower comp. ring, newmm	0.3 0- 0.50
max.mm	1.00
• oil scraper ring, newmm	0.25 - 0.50
max.mm	1.00

Gudgeon (piston) pin,

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

Valve system							
Valve clearance (mm)*							
Intake				Exhaust			
Check		Adjustment		Check		Adjustment	
hot	cold	hot	cold	hot	cold	hot	cold
0.20 - 0.30	0.15 - 0.25	0.25	0.20	0.40 - 0.50	0.35 - 0.45	0.45	0.40

Adjustment washers available in sizes from 3.00 to 4.25 in intervals of 0.05 mm.

* D 24 TIC with EGR has hydraulic tappets.

Valves	Intake	Exhaust
• diameter, discmm	36.00	31.00
stemmm	7.97	7.95
• Height, disc edge, min. after machining.....mm	0.5	*
• matching surface angle.....°	44.5	45.0
* The exhaust valves are stellite coated and must not be machine-ground.		
Valve seats		
Diameter, standard.....mm	37.090 - 37.105	33.090 - 33.105
oversize 1.....mm	37.290 - 37.305	33.290 - 33.305
Matching surface angle°	45.0	45.0
Reduction angle, upper°	15	15
Widthmm	2.0	2.4
Threadmm	0.074 - 0.105	0.074 - 0.105

Valve springs							
Inner valve spring				Outer valve spring			
Length in mm		Load in N		Length in mm		Load in N	
1	2	1	2	1	2	1	2
33.9	32.9	0	0	40.2	37.4	0	0
28.6	26.4	67 - 77	87 - 103	32.6	30.4	167 - 185	193 - 217
18.3	17.4	209 - 231	223 - 247	22.3	21.4	433 - 479	495 - 535
1: D 24, D 24 T, D 24 T (EGR), D 24 TIC 2: D 24 TIC (EGR)1993-							

Valve guides	Intake valve	Exhaust valve
Interior diametermm	8.000 - 8.015	8.000 - 8.015
Height above upper face of cylinder headmm	40.1 - 40.5	40.1 - 40.5
Clearance, valve stem-guide (measured with new valve)		
newmm	0.3	0.3
max.mm	1.3	1.3

Timing gears	
Toothed belts	
Belt tension (measured with gauge 999 5197)	
nominal value	12 - 13
adjustment value.....	12.5
Camshaft	
Max. lift height, intake, D 24 TIC (EGR) 1993 –	8.6
Others	8.5
exhaust	9.0
Radial clearance, new	0.05 - 0.10
Axial clearance, max.	0.15

Group 22 Lubrication system

General	
Oil volume and quality, see page 14.	
Oil pressure at + 80° C (176° F) oil temperature	
engine speed r/s (rpm)	oil pressure, min. MPa (kp/cm ²)
33.3 (2000)	200 (2.0)

Oil pump	
Reduction valve opens at	kPa 600 - 700
Reduction valve spring length at different loads	mm/N 53.5/ 0
.....	mm/N 36.0/ 152 - 162
.....	mm/N 28.0/ 229
Oil pressure sensor	
Limit, warning lamp switches off at	kPa 15 - 45

Group 23 Fuel system

Injection timing, idling speed			
Engine type	Injection timing, mm Adjustment (check)	Idling, r/s (rpm)	
		Low	High
D 24	0.70 (0.65 - 0.73)	12.5 (750)	90 (5400)
D 24 T	0.75 (0.72 - 0.80)	13.8 (830)	90 (5400)
D 24 TIC	0.90 (0.87 - 0.95)	13.8 (830)	90 (5400)
D 24 TIC (EGR)	0.95 (0.92 - 1.00)	13.8 (830)	90 (5400)

Injection pump		
TypeDistribution pump		
Make and designationBosch VE6/10 F 2400 + designation below		
Engine type	Designation	
	Manual	Automatic
D 24	L 32-2	L 32-3
D 24 T (USA,CDN,A)	L 194	L 194-1
D 24 T (excl. USA,CDN,A)	L 116	L 116-1
D 24 TIC	TIC 2	TIC 2-1
D 24 TIC (EGR)	L 116-7	L 116-8

Injectors					Carrier
Engine	Injector – compl.		Nozzle (Bosch)		Make and type
	Designation	Volvo P/N	Designation	Volvo P/N	Bosch
D 24	068 130 201 K	12 57 144	DNO SD 193	12 57 146	KCA 30 S 44
	068 130 201 E	13 28 336	DNO SD 293	13 28 298	KCA 30 S 44
	068 130 201 J	13 28 073	DNO SD 1930	13 28 096	KCA 30 S 44
D 24 T (USA,CDN,A)	068 130 201 H	13 28 209	DNO SD 1930	13 28 096	KCA 30 S 36/4
D 24 T (excl. USA,CDN,A)	068 130 201 B	13 28 208	DNO SD 293	13 28 298	KCA 30 S 36/4
D 24 TIC	068 130 201 B	13 28 208	DNO SD 293	1 328 298	KCA 30 S 36/4

Injector opening pressure	D 24	D 24 T, D 24 TIC
Nominal valueMPa(kp/cm ²)	12.0 - 14.0 (120 - 140)	14.5 - 16.3 (145 - 163)
Adjustment valueMPa(kp/cm ²)	13.0 - 13.8 (130 - 138)	15.5 - 16.3 (155 - 163)
Tightening torques	Nm	ft lb
Injectors, in cylinder head.....	70	52
upper and lower section	70	52
Injection pump.....	45	33

Group 25 Intake and exhaust systems

Turbocharger (TC)	
Charge pressure	
D 24 T, at 3000 rpm (full load)	kPa(kp/cm ²) 70 - 77 (0.70 - 0.77)
Safety valve (on intake manifold), opening pressure approx.	kPa(kp/cm ²) 80 - 85 (0.80 - 0.85)
D 24 TIC, at 2400 rpm (full load)	kPa(kp/cm ²) 85 - 95 (0.85 - 0.95)
Over-pressure protector, opening pressure approx.	kPa(kp/cm ²) 110 - 130 (1.10 - 1.30)
Tightening torques	
Use lubricant (P/N 11 61 035-9) on the fasteners below.	
Attachment bolts, front exhaust pipe - turbocharger (TC),	
D 24 T.....	Nm(ft lb) 25 (18)
D 24 TIC.....	Nm(ft lb) 20 (15)
Attachment bolts, turbine housing	
compressor housing	Nm(ft lb) 20 (15)
rear housing (with bypass valve)	18 (13)
D 24 T.....	Nm(ft lb) 20 (15)
D 24 TIC.....	Nm(ft lb) 25 (18)
Attachment nuts	
turbocharger (TC) compressor – manifold	Nm(ft lb) 60 (45)
D 24 TIC: Lock-nut, pull-rod, wastegate.....	Nm(ft lb) 6 (4)
D 24 TIC: Attachment nuts, wastegate	Nm(ft lb) 6 (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) mm			
		Pos. pressure kPa	Neg. pressure kPa	Mar- king	Starts ope- ning	Fully open	Opening dim., min.
D 24	9.5	150	10	87	87 (188)	102 (216)	8
D 24 T	11.0	"	"	"	"	"	"
D 24 TIC	11.0	"	"	"	"	"	"

Drive belts

Generator/radiator fan	HC 47 cog x 1150
Power steering pump	HC 38 cog x 1013
Compressor (A/C), – 1992	HC 50 cog x 913
1993 –	HC 50 cog x 900

Tightening torque

Radiator fan	Nm(ft lb) 9 (6.6)
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