2B. Engine 2000-

General

Engine data: compression ratio, octane rating, power output, torque

Engine type:	Compression ratio:	Petrol: Octane rating unleaded. Diesel: Cetane rating:	Power kW/rpm:	Maximum torque Nm/rpm:	Power hp/rpm:
B4164S2	10.0:1	95	80/5800	145/4000	109/5800
B4184S2	10.3:1	95	90/5800	170/4000	122/5800
B4184S3	10.3:1	95	85/5500	170/4000	116/5500
B4194T2/AT	8.5:1	98[1]	147/5500	300/2400-3600	200/5200
B4194T2/ MT	8.5:1	98[1]	147/5500	300/2400-3600	200/5500
B4204S2	10.3:1	95	100/5800	190/4000	136/5800
B4204T5/AT	8.5:1	98[1]	147/5200	300/2400-3900	200/5200
B4204T5/MT	8.5:1	98[1]	147/5200	300/2400-3900	200/5200
B4204T2	9.0:1	95	118/5100	230/1800-4800	160/5100
B4204T3	9.0:1	95	120/5250	240/1800-4500	163/5250
B4184SM	12.5:1	95[1]	92/5500	174/4000	125/5500
B4184SJ	11.6:1	95[1]	90/5500	174/3750	122/5500
D4192T2	19.0:1	51 minimum 48	70/4000	190/2000-3000	95/4000
D4192T3	19.0:1	51 minimum 48	85/4000	265/1750-2500	115/4000
D4192T4	19.0:1	51 minimum 48	75/4000	215/1750-3250	102/4000
B4184S9 engine data during petrol operation see B4184S2	10.3:1		88/5800	167/4000	120/5800
B4184S10 engine data during petrol operation see B4184S2	10.3:1		85/5500	167/4000	116/5500

[1] Min 91.

Other engine data

Engine type:		B4164S2	B4184S2/S3 B4184S9/S10	B4184SM/SJ	B4194T2
No. of cylinders		4	4	4	4
No. of valves		16	16	16	16
Cylinder displacement	litres	1,587	1,783	1,834	1,855
Cylinder diameter	mm	81	83	81	81
Cylinder stroke	mm	77	82.4	89	90
Firing order		1-3-4-2 Applies to all			

Other engine data, continued

Engine type:		B4204S2	B4204T5	B4204T3/T2	D4192TX [1]
No. of cylinders		4	4	4	4
No. of valves		16	16	16	8
Cylinder displacement	litres	1,948	1,948	1,948	1,870
Cylinder diameter	mm	83	83	83	80
Cylinder stroke	mm	90	90	90	93
Firing order		1-3-4-2 Applies to all			

[1] Diesel engine D4192TX: Cylinder no. 1 on the flywheel side.

Compression

Measured with the engine at operating temperature. Timed to starter motor:	B4184SM	B4184SJ	B4164S2 B4184S2 B4184S3 B4204S2	B4194T2 B4204T2 B4204T3 B4204T4	D4192TX
Compression ... MPa	1.3-1.6	Minimum 1.3	1.3-1.5	1.1-1.3	1.4-2.2
Maximum difference between cylinders ..... MPa	0.1	0.1	0.2	0.2	0.2

Valve system, petrol engines (excl. B4184SM, SJ)

Petrol engine, without hydraulic tappets. Measured with the engine cold:		When checking:	When adjusting:
Inlet valves	mm	0.15-0.45	0.30
Outlet valves	mm	0.35-0.60	0.50

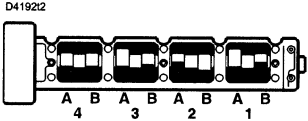
Bi-Fuel cars adjust to the highest permitted play

Valve system, Diesel engines

Diesel engine D4192TX Measured with the engine cold:		When checking:	When adjusting:
Exhaust valves	mm	0.35-0.45	0.40
Intake valves	mm	0.15-0.25	0.20
Tappet lifter height	mm	Increases in steps of 0.05	

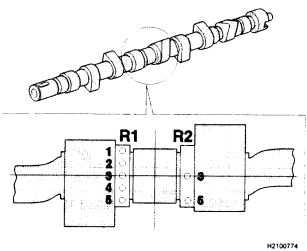
A = Exhaust valve
B = Intake valve
Order 1, 2, 3, 4.

D4192t2



Diesel engine

Cylinder head gasket D4192T, T2:				
Markings (hole template)		O	OO	OOO
Cylinder head gasket thickness	mm	1.45	1.35	1.55
Should be used with the piston height above the cylinder block	mm	0.653-0.786	<0.653	>0.786



Diesel engine

Diesel engine D4192TX:		
Identification (hole template) (R2) -2001		1-2-4-5
Identification (hole template) (R2) 2001-		1-3
Maximum cam lift height:		
Intake camshaft	mm	8.5
Exhaust camshaft	mm	10.3
Maximum difference between camshaft height	mm	0.1
Values for a theoretical valve clearance	mm	0.7
The intake valve opens before TDC		-3°
The intake valve closes after TDC		21°
Values for a theoretical valve clearance	mm	0.7
The exhaust valve opens before BDC		43°
The exhaust valve closes after BDC		-2°
Runout	mm	0.05-0.14
Radial clearance	mm	0.050-0.150

Crankshaft section

Crankshaft:		Petrol engines Except B4184SM/SJ	D4192TX	B4184SM/SJ
Axial clearance, max	mm	0.19	0.07-0.23	0.40
Radial clearance (main bearings)	mm	0.020-0.042	0.031-0.075	-
Taper and pins out of round		-	-	0.005 mm

Main bearing journals:		Petrol engines Except B4184SM/SJ	D4192TX	B4184SM/SJ
Diameter:				
maximum clearance[1]	mm	-	-	0.1
-standard	mm	64,984-65,003	54,785-54,805	-
-under size	mm	64,737-64,750	54,550-54,560	-
Maximum out of round	mm	0.004	0.0025	-
Maximum taper	mm	0.004	0.005	0.005
Axial bearing width	mm	24.96-25.00	-	
Maximum screw length	mm	-	-	71.1[2]

[1] Measure the clearance according to the method in Group 2 (21) in VADIS. Standard value 0.02-0.05 mm.
[2] Longer screws must be replaced.

Crankshaft Main bearing journals:		B4184SM B4184SJ	Colour codes
Over size codes:			
Code 1	mm	49,994-50,000	
Code 2	mm	49,988-49,994	
Code 3	mm	49,982-49,988	
Standard codes:			
Code 1	mm	54,000-54,006	Brown, Black, Green
Code 2	mm	54,006-54,012	Black, Green, Yellow
Code 3	mm	54,012-54,018	Green, Yellow, Pink

Crankshaft bearing journals on the crankshaft:		Petrol engine Except B4184SM/SJ	D4192TX	B4184SM B4184SJ
Diameter:				
-maximum clearance[1]	mm	-	-	0.1
-standard	mm	49,984-50.00	48.00-48.02	-
-under size	mm	49,737-49,750	47.75-47.77	-
Pin width	mm	25.90-26.10	20.25-20.95	-
Maximum taper	mm	0.004	0.0025	-
Maximum out of round	mm	0.004	0.005	0.005
Pressure play between the connecting rod and crankshaft, maximum	mm	-	-	0.4

[1] Measure the clearance according to the method in Group 2 (21) in VADIS. Standard value 0.02-0.05 mm.

Connecting rod bearing journals on the crankshaft:		B4184SM/SJ	Colour codes
Over size codes:			
Code 1	mm	44,995-45,000	Brown
Code 2	mm	44,985-44,995	Black
Code 3	mm	44,980-44,985	Green
Standard inner diameter	mm	48,000-48,015	

Connecting rods:		Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
Diameter	mm	53.00-53,013	-	48,000-48,015
Maximum deviation out of round	mm	0.006	-	-
Axial clearance on the crankshaft	mm	0.17-0.47	0.22 - 0.40	0.2
Diameter, piston bolt eye:				
Normally aspirated engine:	mm	21,005-21,011	-	-
Turbocharged engines: B4204T5	mm	23,005-23,011	26.00-26.0013	-

Classification of the main bearings for petrol engines.
Stamped on the cylinder block and crankshaft. Does not apply to B4184SM

Cylinder block/ Crankshaft	A Small diameter		B medium diameter		C Large diameter	
	Block:	Interme-diate sec-tion:	Block:	Interme-diate sec-tion:	Block:	Interme-diate sec-tion:
A Small	Yellow Medium	Yellow Medium	Yellow Medium	Blue Thick	Blue Thick	Blue Thick
B Medium	Red Thin	Yellow Medium	Yellow Medium	Yellow Medium	Yellow Medium	Blue Thick
C Large	Red Thin	Red Thin	Red Thin	Yellow Medium	Yellow Medium	Yellow Medium

Cylinder head

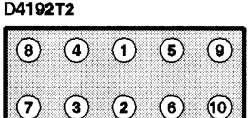
Mechanical data:		Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
Height, new	mm	128.95-129.05	161 - 163	131-132.1
Maximum machining	mm	0.30	-	0.2[1]
Maximum out-of-true:				
front-rear	mm	0.50	0.05	0.2
cross wise	mm	0.20	0.05	0.2

[1] Total remachining of both the cylinder head and the cylinder block.

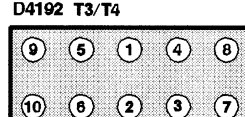
Tightening the cylinder head screws

Step	Petrol engine Except B4184SM/SJ	D4192TX Replace screws with Torx: 55 951-2060	B4184SM/SJ	General
1	Tighten to **20 Nm**	Tighten to **30 Nm**	Tighten to **74 Nm**	Lubricate the screw threads and the mating surfaces of the screw heads. Finger tighten.
2	Tighten to **60 Nm**	T2: Angle-tighten **50°±4°** * T3/T4: Angle-tighten **100°±4°** *	Slacken off all the screws completely. Then tighten all the screws in the order specified. Tighten to **20 Nm**.	
		Allow the cylinder head gasket to settle for at least 3 minutes		
		Slacken off the screws 1 and 2. Tighten to **25 Nm** Angle-tighten **213°±7°** * Then tighten: 3-4, 5-6, 7-8, 9-10.		
3	Angle-tighten **130°**	No post-tightening. Running the engine to normal operating temperature	Tighten all the screws a further **90°*** in the order specified. Post-tighten* in order. Tighten to**90°**.	
*Tighten in a single motion. Use special tool: **951-2050**				
Important: The length of the screw may be a maximum of 158 mm for petrol engines, except B4184SM/SJ. Replace the screws if they are longer. For B4184SM/SJ the maximum permitted screw length is 96.6 mm.				

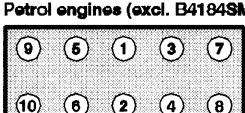
D4192T2



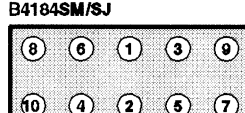
D4192 T3/T4



Petrol engines (excl. B4184SM/SJ)



B4184SM/SJ



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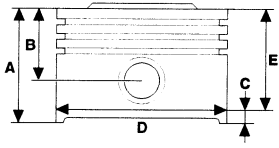
Cylinder block, petrol engine

Diameter:		B4184SX B4194T2 B4204S2 B4204TX	B4164S2	B4184SM B4184SJ
Standard: -C marked	mm	83.00-83.01	81.00-81.01	81.00-81.03
Standard: -D marked	mm	83.01-83.02	81.01-81.02	-
Standard: -E marked	mm	83.02-83.03	81.02-81.03	-
Standard: -G marked oversize ..	mm	83.04-83.05	81.04-81.05	-
Oversize: Reconditioning				
-1	mm	83.20-83.21	81.20-81.21	-
-2	mm	83.40-83,.41	81.40-81.41	-
Maximum machining	mm	-	-	0.2[1]
Cylinder block flatness tolerance, maximum	mm	-	-	0.1

[1] Total remachining of both the cylinder head and the cylinder block.

Cylinder block, diesel engines

Diameter:		D4192TX
Standard: -class A	mm	80,006 - 80,024
Standard: -class B	mm	80,256 - 80,274



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Locating measurement points on the piston, as illustrated

Type Engine:	B 4164S2	B 4184S2	B 4204S2	B 4194T2 B 4204T5	B 4204T2	B 4204T3	B 4184SJ	D 4192TX
A mm	55.3	48.9	50.0	59.9	59.9	50.4	50.1	-
B mm	29.8	26.93	28.0	35.9	35.9	28.4	30.1	-
C mm	8	15	15	42	16	38	8.0	39
E mm	-	-	-	42	42	-	-	-

Piston diameters: D, as illustrated

Piston diameter D:		B4164S2 B4194T2 B4184SJ	B4204TX B4184SX B4204S2	D4192TX
Standard: -C marked	mm	80.98-80.99	82.98-82.99	A: 79,971-79,985
Standard: -D marked[1]	mm	80.99-81.00	82.99-83.00	B: 80,221-80,235
Standard: -E marked	mm	81.00-81,010	83.00-83,010	-
Standard: -G marked oversize	mm	81,017-81,032	83,017-83,032	-
Oversize:				
-1 Recondition	mm	81,177-81,132	83,177-83,132	-
-2 Recondition	mm	81,377-81,392	83,377-83,392	-
Piston running clearance, new piston	mm	0.03-0.010	-0.03-0.01	0.021-0.055

[1] Measure distance C from the lower edge of the piston at the correct angle against the piston bolt.

Piston weight. Includes: piston, piston bolt, piston rings and locking rings

Piston weight:		B4164S2	B4184S2	B4184SJ	B4204SX	D4192TX
Piston weight	g	421	405	301	409	340-350
Maximum permitted weight difference for pistons installed in the same engine	g	10	10	3	10	10

Piston weight. Includes: piston, piston bolt, piston rings and locking rings, continued

Piston weight:		B4204T5	B4204T3	B4204T2	B4194T2
Piston weight	g	513	424	485	488
Maximum permitted weight difference for pistons installed in the same engine	g	10	10	10	10

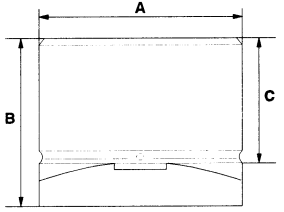
Piston rings, axial clearance: Measured with the piston ring on the piston		Petrol engine Except B4184SM/SJ	D4192T/T2	D4192T3/T4	B4184SM/SJ
Upper compression ring	mm	0.03-0.05	0.03-0.065	0.03-0.065	0.03-0.07 (0.1)[1]
Lower compression ring	mm	0.03-0.05	0.03-0.065	0.05-0.095	0.02-0.06 (0.1)[1]
Oil scraper ring	mm	0.04-0.14	0.03-0.065	0.03-0.065	-

[1] ()=limit

Piston rings, ring gap: Measured in the cylinder		Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
Upper compression ring	mm	0.15-0.30	0.30-0.40	0.25-0.40 (0.8)[1]
Lower compression ring	mm	0.60-0.80	0.25-0.40	0.40-0.55 (0.8)[1]
Oil scraper ring	mm	0.20-0.27	0.25-0.50	0.10-0.35 (1.0)[1]

[1] ()=limit

Piston bolt: Dimensions	B4164S2 B4184SX B4204S2	B4204T3	B4204T5 B4204T2 B4194T2	D4192TX	B4184SM B4184SJ
Tolerance in the piston mm	0.004-0.010	0.004-0.010	0.004-0.010	0.006-0.012	-
Length mm	57.0	60.0	61.0	47,164-47,416	-
Diameter mm	20,996-21.00	20,996-21.00	22,996-23.00	28.00	19.00
Alignment in the piston	Thumb pressure (pressure installation)				4.5-14.7 N



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Tappets

Tappets: Diesel engines = Fixed		D4192TX	B4184SM B4184SJ
A: Diameter	mm	35	-
B: Height	mm	28.5-27.5	-
Clearance in the cylinder head	mm	0.025-0.075	-
Measurement points, see the service information in VADIS			
Length changes during 4-20seconds	mm	-	1

Valve spring

Valve spring data:	Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
Outer diameter ..... mm	22.6-27.1	29.5	-
Inner diameter ..... mm	-	21.5	-
Length:			
-unloaded ..... mm	45.1	45.8	43.8[1]
-loaded to 34.0 ..... mm	200 N	-	-
-loaded to 25 ..... mm	445 N	-	-
-loaded to 36.8 ..... mm	-	-	196 N
-loaded to 37.5 ..... mm	-	270 N	
-loaded to 26.4 ..... mm	-	-	-
-loaded to 27.5 ..... mm	-	614 N	-
Perpendicular ..... maximum	-	-	4°

[1] Minimum length.

Valve guides

Valve guides:		Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
Intake, diameter:				
-standard	mm	12.0	12.0	-
Clearance between valve and valve guide	mm	0.03-0.06	1.3 max[1]	0.10 inlet
Height above the upper surface of the cylinder head	mm	12.8-13.2	-	19
Exhaust, diameter:				
-standard	mm	12.0	12.0	-
Clearance between valve and valve guide	mm	0.03-0.05	1.3 max[1]	0.15
Height above the valve guide to the cylinder head	mm	-	81.05	-
Height above the upper surface of the cylinder head	mm	12.8 - 13.2	-	19
Inner diameter, intake and exhaust	mm	5,955-5.97	7.00-7.02	6.0
Oversize valve guides, intake and exhaust				
Holes in the cylinder head:				
1	mm	12.3-12.5	-	11.05-11.07[2]
2	mm	-	-	11.25-11.27
3	mm	-	-	11.50-11.52

1 Measured with the valve tight to the valve guide.
2 No tracking.

Intake valve seats:		B4XX4SX Except B4184SM/SJ	D4192TX	B4184SM/SJ	B4204TX B4194T2
Diameter:					
-standard	mm	33.61	36.9	-	32.6
-oversize	mm	34.11	-	-	33.11
Holes in the cylinder head:					
1	mm	-	-	34.30-34.33	-
2	mm	-	-	34.60-34.63	-
Mating surface width	mm	1.4-1.8	1.6 - 2.0	-	1.4-1.8
Alignment surface angle		45°	45°	45°	45°
Reduction angle:					
-upper		15°	-	-	15°
-lower		60°	-	-	60°
Seat recession in the cylinder head					
Diameter:					
-standard	mm	32.50-32,525	-	-	32.50-32,525
-oversize	mm	33.00-33,025	-	-	33.00-33,025
Grip	mm	0.069-0.11	-	-	0.069-0.11

Exhaust valve seats:			Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
Diameter:	-standard	mm	28.61	33.6	-
Diameter:	-over size	mm	29.11	-	-
Diameter:	1:	mm	-	-	30.80-30.83
Diameter:	2:	mm	-	-	31.10-31.13
Alignment surface width		mm	1.8-2.2	1.6-2.0	-
Alignment surface angle			45°	45°	45°
Reduction angle:	-upper		15°	-	-
Reduction angle:	-lower		60°	-	-
Seats recession:					
Diameter:	-standard	mm	28.50-28,521	-	-
Diameter:	-oversize	mm	29.00-29,021	-	-
Grip		mm	0.075-0.11	-	-

Intake valves:		Petrol engine Normally aspirated. Except B4184SM/SJ	B4204TX B4194T2	D4192TX	B4184SM B4184SJ
Diameter: crown	mm	31.85-32.15	30.85-31.15	35.2	-
Diameter: stem	mm	6,955-6.97	6,955-6.97	7.01-7.02	-
Total length	mm	103.98-104.52	103.98-104.52	-	-
-maximum machining of the stem	mm	0.4	0.4	-	0.4
Edge height	mm	0.7±0.2	0.7±0.2	-	-
-minimum after machining	mm	0.1	0.1	-	0.5
Alignment surface angle		44.5°	44.5°	45°	45.5°
Maximum tolerance valve guide / stem	mm	-	-	-	0.10
Contact with the valve seat	mm	-	-	-	0.9-1.3

Exhaust valves: Stellite coated Must not be machined		Petrol engine Normally aspirated Except B4184SM/SJ	D4192TX	B4204TX B4194T2	B4184SM B4184SJ
Diameter:					
-crown	mm	26.85-27.15	32.5	26.85-27.15	-
-stem	mm	6,955-6.97	7.01-7.02	6,945-6.96	-
Total length	mm	103.03-103.57	-	103.03-103.57	-
-maximum machining of the stem	mm	0.4	-	0.4	0.4
Edge height	mm	0.7±0.2	-	0.7±0.2	0.7
Alignment surface angle		44.5°	45°	44.5°	45.5°
Maximum tolerance valve guide / stem	mm	-	-	-	0.15
Contact with the valve seat	mm	-	-	-	0.9-1.3

Valve guides and camshaft, B4184SM/SJ only

B4184SM/SJ Camshaft total height. Maximum lift height:		Intake	Exhaust
Standard	mm	35.49	34.91
Minimum	mm	34.99	34.41
Valve setting: Intake		Opens before TDC 15° Closes after TDC 56°	
Valve setting: Exhaust		Opens before TDC 55° Closes after TDC 15°	

Timing belt, belt tension

Engine type:	checking value:	Adjusting new belt:	Tools:
D4192T2[1] D4192T3,T4[1]	33 - 61 Hz 47 - 85 Hz	Step 1: D4192T2=68 ± 5 Hz D4192T3/4=95 ± 3 Hz Step 2: D4192T2=61 ± 5 Hz D4192T3/4=90 ± 3 Hz	**951-2797**
Petrol engine Except B4184SM/SJ	2.5 - 4.0 Nm	Automatic belt tensioner adjusted manually, no fixed value.	
B4184SM/SJ[2]		Pre-tension: 2.6 Nm	**999-5709**
B4184SM/SJ: Automatic belt tensioner: Height in mm . . . . . . Height in mm		 Tensioner activated = 3.8-4.5 Tensioner not activated = 11	

[1] When a timing belt is reused, the timing belt tension must be checked before the injection pump is removed. Replace the timing belt if the value is not within the checking value. Set the old value when the timing belt is reinstalled.

[2] When the timing belt is to be reused, mark the direction of rotation before removal.

Installing crankshaft. Applies to petrol engines. Except B4184SM/SJ
Install the crankshaft.
Do not turn the crankshaft until the intermediate section has been tightened.
Install the intermediate section.
Tighten the screws in the order illustrated in the following five steps.
Complete each step before starting the next.

Step:	Screwed joint:	Torque:
1.	Tighten all M10 screws to NOTE: Do not tighten the M8 and M7 screws before steps 3 and 4.	20 Nm
2.	Tighten all M10 screws to	45 Nm
3.	Tighten all M8 screws to	24 Nm
4.	Tighten all M7 screws to	17 Nm
5.	Finally tighten the M10 screws to	90°
	Maximum length for M10 screws	118 mm

Tightening torques

The tightening torques given apply to lubricated screws and nuts.
Degreased components must be lubricated.

Mechanical component:	Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
	Nm	Nm	Nm
Conecting rod / caps	-	65	25 Tighten +90°[1]
Conecting rod big end	30 Tighten +90°	50	20 Tighten +90°
Flywheel screws, D4192T/T2: use new screws	-	55	98
Flywheel screws Stage 1 D4192T3/T4:	-	20	-
Stage 2	-	Tighten +70°	-
Flywheel screws Stage 1 Petrol engines MT	45	-	-
Stage 2	Tighten +65°	-	-
Flywheel screws Stage 1 Petrol engines AT	45	-	-
Stage 2	Tighten +50°	-	-
Screw, camshaft gear	20	60	88
Nuts / screws, crankshaft pulley	180	-	181

Mechanical component:	Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
	Nm	Nm	Nm
Screw, crankshaft pulley (Diesel): Stage 1	-	20	-
Stage 2	-	Tighten +115°±15°	-
Screw, crankshaft pulley (petrol): Stage 1	25	-	-
Stage 2	M8x25 Tighten +60° M8x30 Tighten +30°	-	-
Rocker cover nuts	-	D4192T2=5 D4192T3/T4=12	3.5
Timing belt tightening nut	-	50	44
Intermediate pulley bolt	25	50	36
Tensioner screws in the cylinder block	20	D4192T2=15 D4192T3/T4=10	13
Valve guide cover	12	-	-
'98-	-	7	11
Thermostat housing	17	10	24
Camshaft cover	17	-	-
Camshaft bearing cap:-M6	-	-	11
-M8	-	20	24
Water pump housing and cover	17	13	24
Cylinder block, protective plug (TDC check)	-	20	-
Water pump pulley	-	20	-
Screws, lengthwise section to bodywork	69	69	69
Screws, engine mountings front/rear [2]	55	55	59
Engine cover	-	10	4

[1] Important: Screw length.
[2] Tighten the rear screw first. Then tighten the front screw.

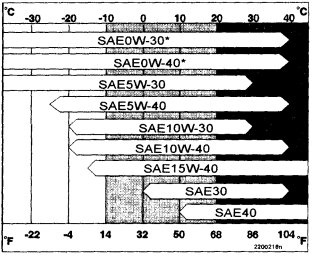
22 Lubrication system

Engines

Oils, classifications

Classification / Designation:			
	ACEA	API	Global DLD
Petrol engines	A1 or A3	SL, SJ	—
Petrol engines with turbocharger (TC) and B4184SM/SJ	A3	SL, SJ	—
Diesel engines	ACEA-B4	API CH-4	DLD-3

Viscosity: Petrol and diesel engines



Viscosity

(assumes constant air temperature.)

In extreme driving conditions resulting in abnormally high oil consumption, for example when driving in mountains with excessive engine braking or high-speed motorway driving, ACEA A3 grade oil is recommended (petrol engines).

* Oils with a viscosity of OW-30 and OW-40 must meet the ACEA A3 requirements (petrol engines).

Oil grade:

Petrol engines: ACEA All Oil grade ACEA A3 can also be used. Note that the same oil can meet the requirements for ACEA Al and ACEA 131, irrespective of whether it is a mineral oil, semi-synthetic or fully synthetic oil.

Only ACEA A3 should be used for all turbo charged petrol engines, B4184SM/SJ and for petrol engines used in extreme conditions.

Diesel engines: ACEA B4 Note that the same oil can meet the requirements for ACEA A3 and ACEA B3, irrespective of whether it is a mineral oil, semi-synthetic or fully synthetic oil.

Do not use oil additives.

Oil capacities

Engine:	Without the oil filter, litres:	With the oil filter, litres:
Petrol engines Except B4184SM/SJ	5.0	5.4
B4184SM/SJ	3.5	3.8
D4192T2	4.7	5.4
D4192T3,T4	4.9	5.6

Lowest oil pressure with new filter and engine at operating temperature:

Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
12.5 r/s MPa 0.10 (750 rpm) ...	16.6 r/s MPa 0.12 (1000 rpm) .	<1500 rpm . MPa 0.1-0.3
66.7 r/s MPa 0.35 (4000 rpm) ..	50 r/s MPa 0.35 (3000 rpm) .	>1500 rpm . MPa 0.3-0.5
Number of teeth 8		
Clearance between the gear wheel and housing	0.1-0.24 mm	
Relief valve opens at MPa 0.5		
Maximum oil pressure .... MPa 0.7		
Clearance between the housing and gear wheel .	0.02-0.09 mm	

Spring, relief valve:		Petrol engine Except B4184SM/SJ	D4192TX
Number of revolutions		26	26
Outer diameter	mm	9.5	9.5
Length, unloaded	mm	82	82
Oil pressure, oil cooler nozzles	MPa	-	0.15

Tightening torques

Mechanical component: The tightening torques given apply to lubricated screws and nuts. Degreased components must be lubricated.		Petrol engine Except B4184SM/SJ	D4192TX	B4184SM/SJ
		Nm	Nm	Nm
Cover, oil pump.		-	12	10
Oil sump, drain plug	Aluminium sump	35	20	39
	Steel sump	-	42	-
Oil pump on the engine		10	-	14
Oil suction pipe		17	-	19
Cover, oil sump (lower)		-	-	7
Threaded socket, oil cooler terminal		17	12	-
Sump:	Aluminium	17[1]	14[1]	7
	Steel	-	13	-
	M8 screw	-	-	24
Oil filter	Diesel + Petrol -'97	See the instructions on the oil filter		
Oil filter	Petrol -'98	25	-	14
Nipple, oil cooler / filter body		40	-	-
Oil nozzles for piston cooling		-	20	-
Oil pressure gauge		25	20	10
Mounting bracket between the engine and the gearbox:				
Gearbox side cover		-	27	-
Engine side		-	50	-
Oil sump to gearbox housing		-	50	49
Reducer plug for oil pressure		-	-	44
Dipstick		10	10	10

[1] Press the sump towards the gearbox (or adjust to the correct dimension).

23 Fuel system

General

Fuel tank

Fuel tank volume S/V40:		litres
Executable volume	petrol, diesel	60
Reserve capacity		7±2
Executable volume	Bi-fuel	41

Fuel sensor

Fuel sensor value	Volume litre	Resistance Ω
Empty tank	0	120 ± 2.5
Full tank	60	6 ± 2.5

Fuel filler cap

Fuel filler cap		Pressure kPa
Pressure relief valve	Low	-4 kPa -12 kPa
Pressure relief valve	High	+14 kPa +30 kPa

Tightening torques

Mechanical component:	Nm
Nut, fuel pump / element	50
Nut, tensioner front	25

Fuel injection, petrol engines

CO content, idling speed, engine at operating speed

Engine:	CO% Value when checking:	Idling speed: r/s (rpm)[1]
B4164S2 B4184SX B4204S2	< 0.2	12.5 (750) MT: 2001- 11.7 (700) AT 2001- 11.7 (700) AT 2000
B4194T2 AT/MT B4204T2 B4204T3 B4204T5	< 0.2	12.5 (750)
B4184SJ/SM	< 0.5	10.3 (620), 95 RON[2], 12.5 (750), 91 RON

1 The idling speed cannot be adjusted.
2 Depending on gearbox temperatur and after 4 minutes at idle speed

Engines with the correct values do not require any further adjustment, provided that the engine runs satisfactorily.
Read off diagnostic trouble codes (DTCs) and check with information in VADIS

Adjustments must be carried out with the air conditioning (A/C) system and engine cooling fan switched off

A pulsed secondary air injection system (PAIR System) should be disconnected and plugged (not B4184SM/SJ).

Fuel pump:		B4164S2 B4184SX B4204S2	B4194T2 B4204T2/T3 B4204T5	B4184SM/SJ
Line pressure on injector side	kPa	309±6	309±6	320±20 (low)
Pump capacity at +20°C and a system pressure of 300 kPa:				
-12.5 V	l/hour	120	150	120
-12 V	l/hour	125	125	100
Electrical/power consumption at +20°C and a system pressure of 300 kPa:				
-12 V maximum	A	5.5	5.5	5.5
Pump pressure				
at 12.5 V max	kPa	800	800	800
at 12.5 V min	kPa	480	480	480
Line pressure regulator, on the fuel pump (FP)	kPa	350±10	430±10	-

B4184SM High-pressure fuel pump (FP):		
Type		Mechanical
Pressure	MPa	5

B4184SJ High-pressure fuel pump (FP):		
Type		Mechanical
Pressure	MPa	5

B4184S9,S10 Bi-Fuel
The governor reduces the gas pressure in two steps: step 1 from 8 bar to 1.40-1.45bar, step 2 to 0.96-0.97bar. The pressure of the governor can be adjusted using an Allen key. The pressure can be read off using a difference pressure gauge.

Fuel injection system:	B4164S2 B4184SX B4204S2	B4194T2 B4202T2/T3/T5	B4184SM/SJ
Manufacturer	Siemens	Siemens	MCC
Type	EMS 2000	EMS 2000	Melco 1/2

Injectors:		B4164S2 B4184SX B4204S2	B4202T3/T5	B4194T2 B4204T2 For US/CAN other values apply.	B4184SM/SJ
Manufacturer		Siemens	Siemens	Siemens	MCC
Colour code		Green / black	Dark red	Grey	-
Resistance 20°C	Ω	14.5±0.4	12±0.4	14.5±0.4	13 - 16
Injection angle	±5°	16°	16°	16°	Mixed
Line pressure	kPa	299 - 301	299 - 301	299 - 301	5000
Fuel injection volume at 300 kPa min:	g	174±4	297±4	270±4	-
Fuel injection volume per 0.3 ms	mm^3	-	-	-	5
Fuel injection volume per 2.5 ms	mg	5.4±4	9.17±4	9±4	-

Temperature sensor for intake air:		B4164S2 B4184SX B4204S2	B4194T2 B4202T2	B4184SM/SJ
Type		Siemens	Siemens	Melco
Resistance at 20°C	Ω	3500	3060-4045	2300-3000
Resistance at 80 °	Ω	-	3060-4045	300-420

Flywheel sensor:		B4164S2 B4184SX B4204S2	B4194T2 B4202T2
Air aperture	mm	32.20-34.20 Axial tolerance	-
Distance from mounting to flywheel	mm	32.6-33.9	32.6-33.9
Resistance at 20°C	Ω	260-340	260-340

Engine coolant temperature (ECT) sensor:	B4164S2 B4184SX B4204S2	B4194T2 B4202T2	B4184SM/SJ
Injection / ignition	Fenix 5.1	EMS 2000	Melco
Resistance at 20°C Ω	2450	2450	2400-2500
Resistance at 80°C Ω	-	-	300-400

Idle air control (IAC) valve:	Petrol engine Except B4184SM/SJ	B4184SM/SJ
Resistance at 20°C Ω	8.6 - 10.6	28-32

Throttle position sensor:	Petrol engine Except B4184SM/SJ	B4184SM/SJ
Idle speed indicator:		
Resistance across the terminal pin Ω	960 - 1440	3500-6500

Heated oxygen sensor (HO2S):	B4164S2 B4184SX B4204S2	B4194T2 B4202T2	B4184SM/SJ
Preheating resistance λ 1.1	-	< 100 mV	-
Preheating resistance λ 0.9	-	> 770 mV	-
Voltage, heated oxygen sensor (HO2S) V	2	2	0.6-1.0
Resistance at 20°C Ω	-	-	2.5-5.0
B4184S9,S10 Has a front heated oxygen sensor (HO2S) for gas operation			
Voltage V	0.1-0.9		

MAF sensor:	
Idle speed kg/h	7–12

Mapping sensor:	Petrol engines
Resistance between A-C Ω	< 10 (10% = < 11Ω)

EGR control servo:	B4184SM/SJ
Coil resistance at 20°C Ω	15-20

2B. Engine 2000-
Fuel injection, petrol engines

By-pass check:	B4184SM/SJ
Coil resistance at 20°C ..... Ω	8-11

EVAP canister purge valve:	All engines: Except B4184SM/SJ	B4184SM/SJ
Coil resistance at 20°C	23 Ω ±1.5 Ω	35-40 Ω

Oil temperature sensor:	B4184SM/SJ
Resistance at: 20°C ..... Ω	950-2050
Resistance at: 80°C ..... Ω	300-400

B4194S9,S10 Bi-Fuel: Designation	Terminal	Resistance
Shut-off valve, fuel tank	#1-#2	15Ω
Shut-off valve, engine	#1-#2	15Ω
Fuel shut-off valve	#1-#2	24Ω
Fuel rail stepper motor	#A-#B #C-#D	45Ω 45Ω
Switch gas / petrol	#2-#4 #1-#3	Off / On: ∞ Ω/0Ω Indicator lamp: 48Ω

Tightening torques

Mechanical component:	All engines Except B4184SM/SJ	B4184SM/SJ
	Nm	Nm
High pressure fuel lines	-	13
Delivery lines (low pressure)	-	10
Knock sensor	-	22
Temperature sensor in thermostat housing	10	29
Oil temperature sensor in gearbox	30	32
Temperature sensor gauge	25	10
Oil pressure sensor	27	10
Fuel pressure sensor B4184SJ	-	25
Throttle body (TB)	10	19
Throttle body (TB), strut B4184SJ		25
Idle speed control valve	10	-
Flywheel sensor	20	-
Fuel rail intake manifold	10	13
Heated oxygen sensor (HO2S)	55	55
Temperature sensor in the cylinder head	-	30
Angle sensor for crankshaft	-	8
Return lines	-	9
EGR valve housing	-	21
Injector holders	-	22
Fuel rail	-	12
Throttle position sensor	-	2
Camshaft position sensor	B4184SM=13, B4184SJ=10	

B4184S9, S10 Bi-Fuel Designation	Tightening torques Nm
Fuel shut-off valve (deceleration fuel cut off)	25±6
Shut-off valve, gas tank	80
Level sensor in the gas tank, four screws	6
Safety valve	100
Intake valve	80
Shut-off valve, governor	12±3
Governor bracket	10

Fuel injection diesel engines:
D4192T2, D4192T3, D4192T4

Timing of injection and idle speed for diesel engines

Engine type:	Injection timing		Idling speed r/s (rpm)	
	Adjustment value	Value at inspection	Low	High (loaded)
D4192T2	0.32±0.02	0.35±0.1	14.2±0.4 (850±25)	83.3±1.7 (5000±100)[1]
	Smoke content exhaust emission decal:		Maximum unloaded.	Idle speed tolerance
	0.72M-1 (%)		4550-5050	800-900
D4192T3/T4	Smoke content exhaust emission decal:		Idle speed rpm:	
			Low	High,(loaded)
	1.8M-1 (52%)		750±50	4500±100

[1] Cannot be adjusted.

Fuel injection system, diesel engine:	
Manufacturer	Bosch
D4192T2 Type	MSA 15.5
D4192T3/T4 Type	EDC15C Common rail CP32

Fuel injection pump:	D4192T2	D4192T3/T4
Manufacturer	Bosch	Bosch
Type	H870309	CR/CP 153/R65/10-15
Adjust idle speed throttle	mm	-

Fuel injection diesel engines:
D4192T2, D4192T3, D4192T4

Glow plug:			
D4192TX: Electrical consumption after 5 seconds	'98-		16 A
Injectors:			
Manufacturer			Bosch
D4192T2:			
Pressure when opening	98-	bar	200 1° step 380 2° step
Adjust pressure		bar	-
Maximum difference between injectors		bar	8
Vent resistance		Ω	100 ±10

Preheating fuel

Technical data D4192TX:			
Capacity		12V	150 Watts
Engages at a temperature of		°C	< 0°
Disengages at a temperature of		°C	> 8°
Terminal for heating	P.C.V. 12 V at 25°C		±2.2 Ω

Resistances

Resistance / sensor:		D4192T2	D4192T3/T4
Flywheel sensor	Ω	480-1150	720-880
Exhaust Gas Recirculation Valve (EGR Valve)	Ω	5-6	-
Coolant heater	Ω	0.45	0.45
Glow plug	Ω	0.31-0.41	0.6

Tightening torques

The tightening torques given apply to lubricated screws and nuts.
Degreased components must be lubricated.

Mechanical component:	D4192T2	D4192T3/T4
	Nm	Nm
Glow plug nut	5	–
Glow plug	15	15
Nut, gear wheel holder on the injection pump:		–
Steel flange	50	
Aluminium flange Stage 1	15	15
Stage 2	Tighten +60°	Tighten +60°
Clamp screw injectors	27	25
Screws, fuel pump (FP) on engine mounting, cylinder head	20	25
Screws, fuel pump mounting / cylinder mounting	24	27
Screws, fuel pump (FP) on engine mounting, torx	29	32
Adjusting fuel pump (FP) gear wheel	90	–
Fuel injection pipes, connecting nuts	25	25
Plug, adjusting fuel pump (FP)	20	–
Plug for the locking pin for the crankshaft	20	20
Coded starter module (CSM) (stop valve)	20	–
Heater in coolant system	20	20
Fuel injection pump cover	7	–
Pre-set solenoid on pump	10	–

25 Intake and exhaust system

Specifications

Petrol, engines turbocharger unit: B4194T2, B4204T2/T3/T5

Turbocharger unit: B4194T2 MT(manual gearbox)	Mitsubishi. Single scroll
Turbocharger unit: B4194T2 AT(automatic gearbox), B4204T2 AT/MT, B4204T3 AT/MT, B4204T5 AT/MT	Mitsubishi. Twin scroll

Engine: HP: High pressure LP: Low pressure		B4194T2 (HP) MT B4204T5 (LP) AT/MT	B4194T2 (HP) MT B4204T2 (LP) AT/MT B4204T3 (LP) AT/MT
Maximum boost pressure, with boost pressure control valve engaged, at full load and at 20°C, between 1800-5100 rpm	kPa	90-100	40-60
Boost pressure, basic pressure, without boost pressure control valve engaged, at full load and at 20°C, between 1800-5100 rpm	kPa	50-60	20-30

Setting value for the boost pressure control (BPC) valve:			
Length	B4194T2 MT	B4194T2 AT B4204T5 AT/MT	B4204T2/T3 AT/MT
mm	kPa	kPa	kPa
1	37 ±4	60 ±4	29 ±4
5	74 ±4	97 ±4	50 ±4
>7	>80	>100	>60 ±4

Diesel engine, turbocharger unit

Turbocharger (TC):	D4192T2	D4192T3/T4
Air cooled turbocharger (TC)	Garrett GT15	Garrett GT15 With boost pressure control valve and VNT (variable nozzle ring turbine)

Diesel engine

Engine D4192T during test drive	Check	After adjustment
Boost pressure, full load, at 20°C, 1800-4000 rpm ..... kPa	80-95	82-91

For setting values see VADIS

Diesel engine

Setting value for the boost pressure control (BPC) valve:	D4192T2	D4192T2
Level length:	Control value kPa:	Adjustment value kPa:
1 mm	109-118	112-118
4 mm	127-141	130-141

Diesel engine

Setting value for the boost pressure control (BPC) valve:	D4192T3
Control rod movement:	Negative pressure kPa:
0.5 - 3.5 mm	- 20
9.5 - 12.5 mm	- 60
Control rod to stop	> - 60

Diesel engine

Setting value for the boost pressure control (BPC) valve:	D4192T4
Control rod movement:	Negative pressure kPa:
1 - 4 mm	- 16
10 - 12 mm	- 54
Control rod to stop	> - 60

Tightening torques: D4192T3/4 has the first catalytic converter directly connected to the turbocharger (TC)

Mechanical component: The tightening torques apply to lubricated screws and nuts.	B4XX4 SX	B4XX4 TX	D4192 T2	D4192 T3/4	B4184 SM/SJ
	Nm	Nm	Nm	Nm	Nm
Rear silencer, exhaust pipe	60	55	55	-	50
Exhaust pipe, cylinder head ... M8	25	25	25	28	18
M10	-	-	-	-	29
Exhaust manifold, heat shield .. M6	10	15	-	-	-
M8	25	25	-	-	13
Studs, exhaust pipe, turbocharger (TC)	-	20	21	24	-
Intake manifold, cylinder head	19	20	25	25	19
Nuts, turbocharger (TC), curved connector pipe	-	45	90	25	-
Nuts, front exhaust pipe, manifold	25	-	25	-	45
Screws, front exhaust pipe, catalytic converter	35	-	40	-	80
Nuts, turbocharger (TC), exhaust pipe	-	25	26	24	-
Studs, exhaust pipe, front	16	16	15	-	44
Mountings, exhaust system	13	13	13	-	13
Pipe for cooling system	-	25	-	-	-
Turbocharger (TC) oil intake pipe	-	-	20	24	-
Turbocharger (TC) oil outlet pipe	-	-	9	12	-
Relief valve lock nut	-	-	7	7	-
Screw relief valve, turbocharger (TC)	-	-	15	-	-
Nuts down pipe, turbocharger	-	25	-	-	-
Screw mounting front exhaust pipe, mounting	-	-	-	-	50
Screw mounting, front exhaust pipe, manifold, engine	-	-	-	-	19
Nuts / screws exhaust pipe, catalytic converter, rear side	60	60	49	-	50
Mass air flow (MAF) sensor, air cleaner	-	3	10	-	-
Air hose/-pipe intake system	-	5	-	-	-

26 Cooling system

General data

Important: Never top up using water only.

Coolant composition:

Use Volvo Genuine parts green coolant diluted with clean water to a ratio of 50/50.

This mixture prevents corrosion and frost damage.

The coolant does not usually need replacing.

When repairs require the coolant to be drained always refill using new coolant.

The drained coolant has been exposed to oxidation and impurities.

Used coolant should be handled according to the relevant environmental regulations.

Important: Clean the cooling system before filling using new coolant.

Volvo cleaning agent for cooling systems, P/N: 11 61 328.

Cooling system capacity:	Applies to petrol and diesel engines. Except turbocharged engines and B4184SM/SJ	B4194T2 B4204TX	B4184SM/SJ
Type	Closed		
Capacity litres	6.3	5.7	6.0
Volume filling litres	4.5 - 5.0	5.0	5.0

Expansion tank:		All engines Except B4184SM/SJ	B4184SM/SJ
Pressure valve opens at: Over pressure	kPa	140-160	75-105
Pressure valve opens at: Negative pressure	kPa	< 7	< 7

Thermostat:	Petrol engine Except B4184SM/SJ	D4192TX	B4184SM	B4184SJ
Starts to open	90°C	89°C	85°C	82°C
Fully open	105°C	101°C	95°C	95°C

Temperature sensor:	D4192TX
Temperature sensor in radiator: Activation temperature	85°C

Drive belts

Inspection, adjust

Engine type:		Inspection[1] Minimum value	Adjustment "Run in" belt	Adjustment new belt
D4192TX (6 groove belt) Tool: **951 2797**				
Without AC		125 Hz	Maximum 175 Hz	180 ±5 Hz
With AC		Automatic belt tensioner Control value between 90.5 and 100 mm		
Petrol engine except B4184SM/SJ		Automatic belt tensioning.		
B4184SM/SJ Deflection[2]	Generator (GEN)	10.5 mm	8.5-10 mm	6-7 mm
	Power steering pump	12 mm	10-11 mm	6-8 mm

[1] If the belt tension drops below its nominal value, it must be adjusted to the "run-in" belt value.
[2] At belt: 98N.

Tightening torques. The tightening torques given apply to lubricated screws and nuts. Degreased components must be lubricated

Mechanical component:	Petrol engines Except B4184SM/SJ	D4192TX	B4184SM/SJ
	Nm	Nm	Nm
Water pump	17	13	24
Water pump pulley	-	20	-
Screws, thermostat housing	17	10	24
Engine oil cover	15	-	-
Mountings, radiator on the bodywork	25	25	25
Temperature sensor, diesel, in the radiator	-	20	-
Coolant reservoir cap	3	3	3
Adjustment nut, pulley	-	-	25
Core plugs in cylinder block	-	-	39
Bleed screw in thermostat housing	-	-	13
Temperature sensor for instruments	25	-	10

28 Ignition system

General

Firing order	1-3-4-2

Ignition setting, controlled by ECM

Engine:	Ignition system:	Ignition setting at 750 rpm (±3°):
B4164S2	EMS 2000	10°
B4184SX	EMS 2000	5° 1996 – 2000
	EMS 2000	10° 2000-
B4204S2	EMS 2000	8° 1996 – 2000
	EMS 2000	10° 2000-
B4194T2/T5 (HP)	EMS 2000	12°
B4204T2/T3 (LP)	EMS 2000	12° –2001
B4204T3 (LP)	EMS 2000	8° 2002–
B4184SM	MELCO 1	16° With VST 5°
B4184SJ	MELCO 2	16° With VST 5°

Ignition coil

Ignition coil:	Petrol engine Except B4184SM/SJ	B4184 SM/SJ[1]
Coil resistance	Primary winding: 0.55±0.06 Ω Secondary winding: 9.0±0.9 kΩ	1700-2500 Ω
Coil inductance	2.3 ±1.2 mH	-
Misfire sensor	-	< 0.1 Ω

[1] Measured with the voltage at 1.5 V.

Spark plugs

Spark plug data:	Service kit: Volvo P/N:	Electrode gap mm:
petrol, naturally aspirated engines, except B4184SM/SJ	272 207	1.2 ± 0.1
First electrode		1.2 ± 0.1
Second and third electrode		1.2 ± 0.25
Petrol, turbocharged engines	86 92 070	0.7 ± 0.1
B4184SM/SJ	271 239	0.5 - 0.75 [1]
Resistance B4184SM/SJ	1000 Ω or more	

[1] Must not be adjusted.

Tightening torques

Mechanical component:	Nm
Spark plugs	25
Knock sensor	20
Ignition coil, petrol engines, except B4284SM/SJ	10
Ignition coil B4184SM/SJ	10
Injector driving B4184SM/SJ	5
Misfire sensor B4184SM/SJ	6