

2A. Engine -1999

General

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For engine specifications 2000- see 2B

Compression ratio, octane rating, power, torque

Engine type:	Compression ratio:	Petrol unleaded Octane rating: Diesel Cetane rating:	Power kW/rpm:	Torque maximum Nm/rpm:	hp/rpm:
B4164S	10.3:1	95	77/5500	143/4200	105/5500
B4184S	10.5:1	95	85/5500	165/4100	114/5500
B4204S	10.5:1	95	103/6000	183/4500	136/6000
B4194T AT	8.5:1	98 ¹	147/5200	300/2400-3600	200/5200
B4194T MT	8.5:1	98 ¹	147/5500	300/2400-3600	200/5500
B4204T	9.0:1	95	118/5100	230/1800- 4800	160/5100
B4184SM	12.5:1	95 ¹	92/5500	174/3750	125/5500
D4192T	20.5:1	Cetane rating: 51	66/4250	176/2250	89/4250
D4192T2	19.5:1	Cetane rating: 51	70/4000	190/1800-3100	95/4000

¹ Min 91.

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Other engine data

Engine type:	B4164S	B4184S	B4184SM	B4204S B4204T	B4194T	D4192TX
Number of cylinders	4	4	4	4	4	4
Cylinder displacement litres	1,587	1,731	1,834	1,948	1,855	1,870
Cylinder diameter mm	81	83	81	83	81	80
Cylinder stroke mm	77	80	89	90	90	93
Firing order	1-3-4-2 Applies to all.					
Applies to all diesel engines	For diesel engines: Cylinder 1 nearest the flywheel					

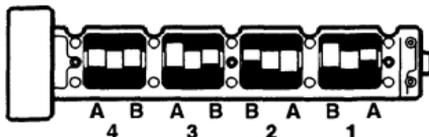
Compression

Measured with the engine at operating temperature and timed to the starter motor:	B4184SM	B4164S B4184S B4204S	B4194T B4204T	D4192T	D4192T2
Compression MPa	1.3-1.6	1.3-1.5	1.1-1.3	1.6-2.4	1.4-2.2
Maximum difference between cylinders MPa	0.1	0.2	0.2	0.2	0.2

Diesel engine, valve system

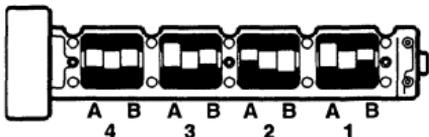
D4192TX, cold engine:		When checking	When adjusting
Exhaust valves	A mm	0.35-0.45	0.40
Intake valves	B mm	0.15-0.25	0.20
Thickness of tappet shims	mm	2.70-3.70 increases in steps of 0.05	
Shim height latest engine version	mm	Increases in steps of 0.05	

D4192t



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

D4192t2

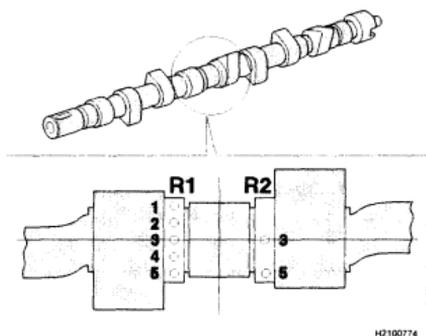


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Diesel engine

Cylinder head gasket:			O	OO	OOO
Markings, hole pattern					
Cylinder head gasket thickness	mm	D4192T	1.5	1.4	1.6
.....	mm	D4192T2	1.45	1.35	1.55
Must be used with the piston height above the cylinder block	mm	D4192T	0.073-0.206	<0.073	>0.206
.....	mm	D4192T2	0.653-0.786	<0.653	>0.786



Diesel engine

Diesel engine D4192TX:		D4192T	D4192T2
Identification (hole pattern) (R2)		3-5	1-2-4-5
Maximum lift height: Intake camshaft	mm	8.5	8.5
Maximum lift height: Exhaust camshaft	mm	10.34	10.3
Maximum difference between camshaft height	mm	0.1	0.1
Values with a theoretical valve clearance of: ..	mm	0.7	0.7
The intake valve opens before TDC	degrees°	0°	-3°
The intake valve closes after TDC	degrees°	18°	-
The intake valve closes after BDC	degrees°	-	21°
Values with a theoretical valve clearance of: ..	mm	0.7	0.7
The exhaust valve opens before BDC	degrees°	41°	43°
The exhaust valve closes after BDC	degrees°	0°	-
The exhaust valve closes after TDC	degrees°	-	-2°
Runout	mm	0.05-0.14	0.05-0.14
Radial clearance	mm	0.05-0.15	0.05-0.15

Crankshaft data

Crankshaft:	Petrol engines Except B4184SM	D4192TX	B4184SM
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 lug out of round mm	-	-	0.005

Main bearing journals:	Petrol engine Except B4184SM	D4192TX	B4184SM
Diameter:			
maximum clearance ¹ mm	-	-	0.1
-standard mm	64,984-65,003	54,785-54,805	-
-under size mm	64.75	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 (2162) in VADIS. Standard value 0.02-0.05 mm.

² Longer screws must be replaced.

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Crankshaft, main bearing pins:		B4184SM	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 lugs:		Petrol engine Except B4184SM	D4192TX	B4184SM
Diameter:				
-maximum clearance ¹	mm	-	-	0.1
-standard	mm	49,984-50.00	48.00-48.02	
-under size	mm	49.75	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
Clearance between connecting rod / crankshaft, maximum	mm	-	-	0.4

¹ Measure the clearance according to the method in Group 2 (21) in VADIS. Standard value 0.02-0.04 mm.

Connecting rod bearing journals on the crankshaft:		B4184SM	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	D4192T	B4184SM
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	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	Intermedi- ate section	Block	Intermedi- ate section	Block	Intermedi- ate section
A Small	Yellow	Yellow	yellow	Blue	Blue	Blue
	Medium	Medium	Medium	Thick	Thick	Thick
B Medium	Red	Yellow	Yellow	Yellow	Yellow	Blue
	Thin	Medium	Medium	Medium	Medium	Thick
C Large	Red	Red	Red	Yellow	Yellow	Yellow
	Thin	Thin	Thin	Medium	Medium	Medium

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Cylinder head

Mechanical data for the cylinder head:	Petrol engine Except B4184SM	D4192T	D4192T2	B4184SM
Height, new mm	128.95-129.05	159.3-159.7	161-163	131-132.1
Maximum machining mm	0.30	-	-	0.2 ¹
Maximum out-of-true:				
front-rear mm	0.50	0.05	0.05	0.2
cross wise mm	0.20	0.05	0.05	0.2
Swirl chamber, height difference mm	-	0.01-0.04	-	-
Diameter:				
Over size 1 mm	-	37.5	-	-
Over size 2 mm	-	37.5	-	-

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

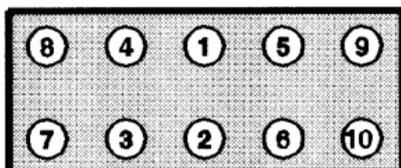
Tightening the cylinder head screws

Step:	Petrol engines: Except B4184SM	D4192TX: Torx 55: 951-2060 Replace all the cylinder head screws.	B4184SM:	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. Install and finger-tighten the screws.
2	Tighten to 60 Nm	Angle tighten a further 50°±4°* . Allow the cylinder head gasket to set for at least 3 minutes.	Slacken off all the screws completely. Then tighten all the screws in the order specified. Tighten to 20 Nm .	
		Slacken off screws 1 and 2. Tighten to 25 Nm . Then angle-tighten a further 213°±7°* .		Carry out this operation on screws: 3-4 5-6 7-8 9-10.
3	Angle-tighten 130°	D4192T (not D4192T2) Run the engine to normal operating temperature and until the engine cooling fan starts to operate. Allow the engine to cool to workshop temperature (approximately 2.5 hours). Angle tighten a further 120°±7°* .	Tighten all the screws a further 90°* in the order specified. Then tighten a further 90°* in order.	

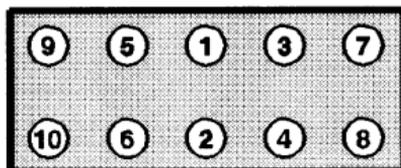
*Tighten in a single motion using special tool: **951-2050**.

Important: The maximum lengths of the screws may be: 158 mm for petrol engines. For B4184SM the maximum permitted length is 96.6 mm. Replace the screws if they are longer.

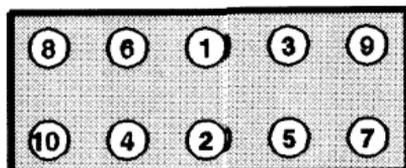
D4192



Petrol engines (excl. B4184SM)



B4184SM



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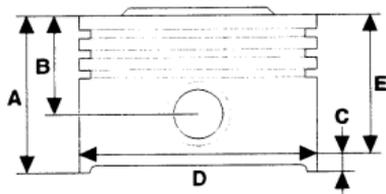
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Cylinder block, petrol engines

Diameter:		B4184S B4204S B4204T	B4164S B4194T	B4184SM
Standard:				
-C marked	mm	83.00-83.01	81.00-81.01	81.00-81.03
-D marked	mm	83.01-83.02	81.01-81.02	-
-E marked	mm	83.02-83.03	81.02-81.03	-
-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, 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
-class B	mm	80,256 - 80,274



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Piston sizes

Type / Engine:	B4164S	B4184S	B4204S	B4194T B4204T	D4192TX
A	mm 66.4	64.9	59.9	59.9	-
B	mm 42.4	40.9	35.9	35.9	-
C	mm 16	16	16	16	39
E	mm -	-	-	42	-

Piston diameter D:	B4164S B4194T	B4184S B4204S B4204T AT	D4192TX	B4204T MAN
Standard:				
-C marked	mm 80.98-80.99	82.98-82.99	A: 79,971- 79,985	83.00-83.03
-D marked ¹	mm 80.99-81.0	82.99-83.0	B: 80,221- 80,235	83.01-83.04
-E marked	mm 81.00-81.01	83.00-83.01	-	83.02-83.05
-G marked oversize	mm 81,017- 81.32	83,017-83,032	-	83,037- 83,072
Oversize: Reconditioning				
-1	mm 81,177- 81,132	83,177-83,132	-	83,197- 83,232
-2	mm 81,377- 81,392	83,377-83,392	-	83,397- 83,432
Piston running clearance, new piston	mm 0.03-0.01	-0.03-0.01	0.021-0.055	0.02-0.04

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

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Piston weight, includes: piston, piston bolt, rings and locking rings

Piston weight:	B4164S B4184S	B4204S	B4194T B4204T	D4192TX
Piston weight g	382-392	348-358	305-315	486-472
Maximum permitted weight difference: Applies to pistons installed in the same engine.	g 10	10	10	14

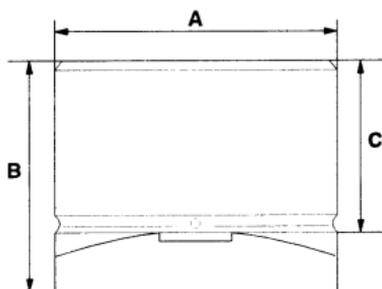
Piston rings axial clearance:	Petrol engine Except B4184SM	D4192TX	B4184SM
Measured with the piston ring on the piston.			
Upper compression ring .. mm	0.05-0.085	0.030-0.065	0.03-0.07 (0.1) ¹
Lower compression ring .. mm	0.03-0.065	0.030-0.065	0.02-0.06 (0.1) ¹
Oil scraper ring mm	0.02-0.055	0.030-0.065	-

¹ (=)limit.

Piston rings ring gap:	Petrol engine Except B4184SM	D4192TX	B4184SM
Measured in the cylinder:			
Upper compression ring .. mm	0.20-0.40	0.30-0.40	0.25-0.40 (0.8) ¹
Lower compression ring .. mm	0.20-0.40	0.25-0.40	0.40-0.55 (0.8) ¹
Oil scraper ring mm	0.25-0.50	0.25-0.50	0.10-0.35 (1.0) ¹

¹ (=)limit.

Piston bolt:		B4164S B4184S B4204S B4191T	B4204T	D4192T	D4192T2	B4184SM
Tolerance in the piston	mm	0.004-0.010	0.004-0.010	0.006-0.012	0.006-0.012	-
Length	mm	61.0	66	-	47,164-47,416	-
Diameter	mm	22,996-23.00	22,996-23.00	26.00	28.00	19.00
Alignment in the piston		Thumb pressure (pressure installation) N				4.5-14.7



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Tappets

Tappets: Diesel engines = fixed		Petrol engine Except B4184SM	Diesel D4192TX	B4184SM
A Diameter	mm	31,959-31,975	35	-
B Height	mm	25.50 - 26.50	28.5 - 27.5	-
C Distance, without load, minimum	mm	18.40	-	-
C Distance, standard size, approximately	mm	17.50	-	-
C Distance, compressed	mm	16.25-16.60	-	-
Clearance in the cylinder head	mm	-	0.025-0.075	-
Measurement points, see the service information in VADIS.				
Length changes: for 4-20seconds	mm	-	-	1

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Valve spring

Valve springs:		Petrol engine Except B4184SM	D4192T	D4192T2	B4184SM
Colour coding Diesel		-	Grey	-	-
Outer diameter	mm	27.70-28.10	-	-	-
Inner diameter	mm	20.08-20.12	-	21.5	-
Length:					
-unloaded	mm	42.4	43.9	45.8	43.8 ¹
-loaded to 36.8 mm	N	-	250	-	196
-loaded to 26.4 mm	N	-	612	-	-
-loaded to 27.5 mm	N	-	-	614	-
Perpendicular . . . maximum degrees		-	-	-	4°

¹ Minimum length.

Valve guides

Valve guides:	Petrol engine Except B4184SM	D4192T	D4192T2	B4184SM
Intake, diameter:				
-standard mm	12.0	13.0	12.0	-
-over size 1 mm	12.1	13.9	-	-
-over size 2 mm	12.2	13.36 ¹	-	-
Clearance, valve and valve guide mm	0.03-0.06	1.3 max ²	1.3 max ²	0.10 inlet
Height above the upper surface of the cylinder head mm	12.8 - 13.2	-	-	19
Exhaust, diameter:				
-standard mm	12.0	13.0	12.0	-
-over size 1 mm	12.1	13.09	-	-
-over size 2 mm	12.2	13.36 ^{<1}	-	-
Clearance, valve and valve guide mm	0.03-0.05	1.3 max ²	1.3 max ²	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, inlet and exhaust mm	-	-	7.00-7.02	6.0
Over size valve guides, inlet and exhaust.				
Diameter of holes in the cylinder head:				
1 mm	-	-	-	11.05-11.07 ³
2 mm	-	-	-	11.25-11.27
3 mm	-	-	-	11.50-11.52

¹ 2 groove.² Measured with the valve tight to the valve guide.³ No tracking.

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Intake valve seats:	Petrol engine Except B4184SM	D4192T	D4192T2	B4184SM
Diameter:				
-standard	mm 32.61	37	36.9	-
-oversize	mm 33.11	-	-	-
Holes in the cylinder head:				
1	mm -	-	-	34.30-34.33
2	mm -	-	-	34.60-34.63
Alignment surface width	mm 1.4-1.8	1.6-2.0	1.6-2.0	-
Alignment surface angle	45°	45°	45°	45°
Reduction angle:				-
-upper	15°	-	-	-
-lower	60°	-	-	-
Seat recessing in the cylinder head:				
Diameter:				
-standard	mm 32.50-32,525	-	-	-
-oversize	mm 33.00-33,025	-	-	-
Clearances	mm 0.059-0.11	0.17	-	-

Exhaust valves seats:	Petrol engine Except B4184SM	D4192T	D4192T2	B4184SM
Diameter:				
-standard mm	28.61	32.10	33.6	-
-oversize mm	29.11	-	-	-
Diameter of holes in the cylinder head:				
1 mm	-	-	-	30.80-30.83
2 mm	-	-	-	31.10-31.13
Alignment surface width mm	1.8 - 2.2	1.6 - 2.0	1.6 - 2.0	-
Alignment surface angle	45°	45°	45°	45°
Reduction angle:				
-upper	15°	-	-	-
-lower	60°	-	-	-
Seat recessing in the cylinder head.				
Diameter:				
-standard mm	28.50-28,521	-	-	-
-oversize mm	29.00-29,021	-	-	-
Clearances mm	0.075-0.11	0.17	-	-

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Intake valves:	Turbo Petrol engine Except B4184SM	D4192T	D4192T2	B4184SM
Diameter:				
-crown mm	30.85-31.15	36.22	35.2	-
-stem mm	6,955-6.97	8,005-8,027	7.01-7.02	-
Total length mm	104.05-104.45	-	-	-
-maximum machining the stem	mm 0.4	-	-	0.4
Edge height mm	1.5	-	-	-
-minimum after machining	mm 1.2	-	-	0.5
Alignment surface angle	44.5°	45°	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:	B4164S B4184S B4204S	D4192T	D4192T2	B4194T B4204T	B4184SM
Diameter:					
-crown ... mm	26.85-27.15	31.62	32.5	26.85-27.15	-
-stem mm	6,955-6.97	8,018- 8,040	7.01-7.02	6,945-6.96	-
Total length ... mm	103.1-103.5	-	-	103.0-103.6	-
-maximum machining the stem ... mm	0.4	-	-	0.4	0.4
Edge height ... mm	1.5	-	-	1.5	0.7
Alignment surface angle	44.5°	45°	45°	44.5°	45.5°
Maximum tolerance valve guide / stem	mm -	-	-	-	0.15
Contact with valve seat ... mm	-	-	-	-	0.9-1.3

Valve guides, petrol engines. Does not apply to B4184SM

Engine type:	Camshaft:		Checking the camshaft setting, cold engine:					
	Profile		Maximum lifting height		Valve opening when checking mm		Camshaft setting	
	Intake	Ex- haust	Intake	Ex- haust	Intake	Ex- haust	Intake	Ex- haust
B4164S2	PMI	PHE	7.95	7.95	0.7	0.7	1.8 ¹	31.8 ²
B4184SX	PMI	PHE	7.95	7.95	0.7	0.7	1.8 ³	31.8 ⁴
B4194T2 B4202T2	945 8087	945 8088	7.40	7.40	0.7	0.7	2.3 ³	26.3 ⁴
B4204S2	PJI	PJE	8.43	8.43	0.7	0.7	1.6 ⁵	36.4 ⁴

¹ Before top dead centre (TDC).

² Before bottom dead centre (BDC).

³ Before top dead centre (TDC).

⁴ Before bottom dead centre (BDC).

⁵ After top dead centre (TDC).

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Valve guides and camshaft, B4184SM only

Maximum lifting height: ¹		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°

¹ Camshaft overall height.**Timing belt, belt tension**

Engine type	Checking value	Adjusting (new belt)	Tools
D4192 T ¹	3 minimum	7.5	999-5506 and 999-5434
D4192TX ¹	33-61 Hz	Step 1: 68 ±5 Hz Step 2: 61 ±5 Hz	951-2797
Petrol engine except B4184SM	2.5 - 4.0	Automatic belt tensioner adjusted manually (no fixed value)	998-8500
B4184SM ²		Pre-tension 2.6 Nm	999-5709
B4184SM Automatic belt tensioner: Altitude:		Tensioner activated = 3.8-4.5 mm Tensioner not activated = 11 mm	

¹ When a timing belt is reused, the timing belt tension is checked before the timing belt is removed. Replace the timing belt if the tension is without the checking value² When the timing belt is to be reused, mark the direction of rotation before removal.

Installing the crankshaft, petrol engines, except B4184SM

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.

1:	Tighten all M10 screws to	20 Nm
	Note: Do not tighten the M8 and M7 screws before steps 3 and 4.	
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	D4192T	D4192T2	B4184SM
	Nm	Nm	Nm	Nm
Main bearings / caps	-	65	65	25 Turn +90° ¹
Connecting rod bolts	30 Tighten +90°	45	50	20 Tighten +90°
Flywheel screws (use new screws)	-	53	55	98
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	50	60	88
Nuts / screws, crankshaft pulley ..	180	95	20	181
Screw, crankshaft: stage 1 .. pulley, petrol, Diesel	25	-	20	-
stage 2 ..	Tighten +60°	-	Tighten +115°	-
Rocker cover nuts	-	5	5	4
Timing belt tightening nut	-	50	50	44

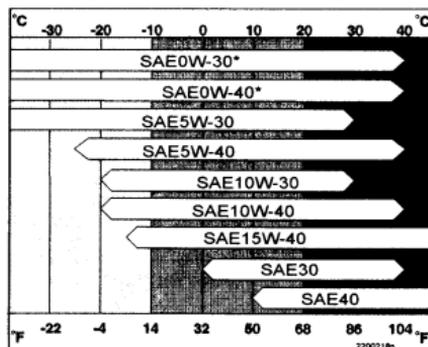
22 Lubrication system

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 0W-30 and 0W-40 must meet the ACEA A3 requirements (petrol engines).

Oil grade:

Petrol engines: ACEA A1 Oil grade ACEA A3 can also be used. Note that the same oil can meet the requirements for ACEA A1 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.

2A. Engine -1999

Engines

Oil capacities

Engine:	Without the oil filter: litres	With the oil filter: litres
Petrol -1997	5.0	5.4
Petrol 1998 - 1999 (Excl B4184SJ) Dip stick with orange handle.	5.0	5.4
B4184SM	3.5	3.8
D4192T	4.4	5.0
D4192T2	4.7	5.4

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

Petrol engine Except B4184SM				D4192T	D4192 T2	B4184SM		
12.5 r/s (750 rpm)	MPa	0.1	16.6 r/s 1000 rpm	MPa	0.2	0.12	<1500 rpm MPa	0.1-0.3
66.7 r/s (4000 rpm)	MPa	0.35	50 r/s 3000 rpm	MPa	0.35	0.35	>1500 rpm MPa	0.3-0.5
Number of teeth		8						
Clearance between the gear wheel and housing .					-	0.1- 0.24		
Relief valve opens at .	MPa	0.5						
Maximum oil pressure .	MPa	0.7						
Clearance between the housing and gear wheel . . .					-	0.02- 0.09		

Spring, relief valve:	Petrol engine Except B4184SM	D4192T	D4192T2
Number of revolutions	26	-	26
Outer diameter mm	9.5	-	9.5
Length, unloaded mm	82	79.6	82
Length loaded. 10.2 mm N	-	48.2	-
Loaded length 70.0 mm N	-	41.2	-
Oil pressure, oil cooler nozzles MPa	-	0.15	0.15

2A. Engine -1999

Engines

Tightening torques

Mechanical component:	Petrol engine Except B4184SM	D4192TX	B4184SM
	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 bolt	-	-	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 gearbox: Gearbox side cover	-	27	-
Engine side	-	50	-
Oil sump to gearbox housing	-	50	49
Reducer plug for oil pressure	-	-	44

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

23 Fuel system

General

Fuel tank

Tank volume:		S/V40
Executable volume	litres	60
Reserve volume	litres	7±2

Tightening torques

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

Fuel injection (petrol engines)**B4164S/B4184S/B4204S CO content, idle speed rpm, engine at operating temperature**

Engine:	CO% Value at inspection	Idling speed r/s (rpm) ¹
B4164S B4184S B4204S	< 0.2	12.5 (750)
B4194T -97	< 0.2	12.9 (775)
B4194T 98- B4204T 98-	< 0.2	12.5 (750)
B4184SM	< 0.5	10.3 (620) 95 RON ² 12.5 (750) 91 RON

¹ The idling speed cannot be adjusted.

² Depending on the gearbox temperature 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 the information in VADIS

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

The pulsed secondary air injection system (PAIR System) (if applicable) should be disconnected and plugged (not B4184SM).

2A. Engine -1999

Fuel injection (petrol engines)

Fuel pump:	B4164S B4184S B4204S	B4194T B4204T	B4184SM
Line pressure on the injector side	kPa		-
Pressure regulator, low	kPa	309±6	309±6
Pump capacity at +20°C and a system pressure of 300 KPa:			320±20
12.5 V	l/hour	120	150
12 V	l/hour	100	125
Power consumption at +20°C and a system pressure of 300 kPa:			120
12 V maximum	A	5.5	5.5
Pump pressure			100
at 12.5 V max	kPa	800	800
at 12.5 V min	kPa	480	480
Line pressure regulator, fuel tank	kPa	-	400-500

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

Fuel injection system:	B4164S B4184S B4204S	B4194T B4202T	B4184SM
Manufacturer	Siemens	Siemens	MCC
Type	Fenix 5.1	EMS 2000	Melco 1

Injectors:	B4164S B4184S B4204S	B4194T B4202T	B4184SM
Manufacturer	Siemens	Siemens	Melco
Colour code	Violet / black	Grey / black	-
Resistance 20°C Ω	14-15	14-15	13-16
Injection angle	16°	16°	Mixed
Line pressure kPa	299-301	299-301	5000
Fuel injection volume at 300 kPa .. min: cm ³	238	397	-
Fuel injection volume per 0.3 ms mm ³	-	-	5
Fuel injection volume per 2.5 ms mm ³	7	13	-

Intake air temperature (IAT) sensor:	B4164S B4184 B4204S	B4194T B4202T	B4184SM
Type	Bendix	Siemens	Melco 1
Resistance at 20°C Ω	3500	3515	2300-3000
Resistance at 80° Ω	-	-	300-420

Flywheel sensor:	B4164S B4184 B4204S	B4194T B4202T	
Air aperture mm	32.20-34.20 axial tolerance	-	
Distance from mounting to flywheel mm	-		32.6-33.9
Resistance at 20°C Ω	260-340		260-340

Coolant temperature sensor:	B4164S B4184S B4204S	B4194T B4202T	B4184SM
Injection / ignition	Fenix 5.1	EMS 2000	Melco
Resistance at 20°C Ω	2800	2450	2400-2500
Resistance at 80°C Ω	-	-	300-400

2A. Engine -1999**Fuel injection (petrol engines)**

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

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

Heated oxygen sensor (HO2S):	B4164S B4184S B4204S	B4194T B4202T	B4184SM
Preheating resistance: λ 1.1	-	< 100 MV	-
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

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

Air pump: 1996w07 - 1997w01. Automatic: 1996w07 - 1997w27	B4XX4S
Continuous amperage of current	< 28.5 A at 13 V

Solenoid valve for the air pump: 1996w07 - 1997w01. Automatic: 1996w07 - 1997w27	B4XX4S
Coil resistance between 1-2	30 - 36.5 Ω

2A. Engine -1999
Fuel injection (petrol engines)

EGR control servo:	B4184SM
Coil resistance at 20°C Ω	15-20
Air (PAIR) pump relay for auxiliary air: 1996w07 - 1997w01. Automatic: 1996w07 - 1997w27	B4XX4S
Coil resistance at 20°C	80 Ω
By-pass check:	B4184SM
Coil resistance at 20°C	8-11 Ω
Bleed control valve:	B4184SM
Coil resistance at 20°C	35-40 Ω
Oil temperature sensor:	B4184SM
Resistance at:	
20°C	950-2050 Ω
80°C	300-400 Ω

2A. Engine -1999**Fuel injection (petrol engines)****Tightening torques**

Mechanical component:	All engines Except B4184SM	B4184SM
	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 B4184SM)	30	32
Temperature sensor gauge	25	10
Oil pressure sensor	27	10
Throttle body	10	19
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	-	13

Fuel injection, diesel engine
 D4192T D4192T2

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)
D4192T	Data, fuel injection pump		13.7±0.4 (825±25)	72.5±1.7 (4350±100) ¹
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
D4192T	1.4M-1 (%)		4900-5100	800-850

¹ Cannot be adjusted.

Fuel injection system:	D4192T2
Manufacturer	Bosch
Type	MSA 15.5

Fuel injection pump:	D4192T	D4192T2
Manufacturer	Lucas	Bosch
Type	DPI-N	H870309
Adjust idle speed throttle	mm 145	-

Glow plug:	D4192T	D4192T2
Electrical consumption after 8 seconds 1997 A	13 - 15	-
Electrical consumption after 5 seconds 1998- A	16	16

Injectors:		
Manufacturer	Lucas	Bosch
Pressure when opening	125-140	-
..... 1997 bar	130-135	200 1 st step
..... 1998- bar		380 2 nd step
Adjust pressure	130-135	-
Maximum difference between injectors	8	8
bar		
Vent resistance	105	100
±10 Ω		

2A. Engine -1999

Fuel injection, diesel engine

D4192T, D4192T2

Preheating fuel

		D4192T	D4192T2
Capacity	12V	150 Watts	150 Watts
Connect at temperature	°C	< 0°	< 0°
Disconnect at temperature	°C	> 8°	> 8°
Terminal for heating	P.C.V. 12 V at 25°C Ω	5-14	±2.2

Values, resistances

Flywheel sensor	Ω	220	480-1150
Injector sensor for needle lift	±10 Ω	105	100
Adjuster, pre-ignition	Ω	11.5	-
Exhaust Gas Recirculation Valve (EGR Valve)	Ω	0.5-10.5	5-6
Solenoid valve high idling speed	Ω	50	-
Switch fuel injection pump stroke ..	<8m Ω	0	-
	>12m Ω	∞	-
Adjusting throttle position sensor	%	80% ± 1%	0 % idle speed 100 % wide open throttle (WOT)
Coolant heater	Ω	-	0.45
Glow plug	Ω	0.4-0.6	0.31-0.41

Tightening torques

The tightening torques given apply to lubricated screws and nuts.

Degreased components must be lubricated.

Mechanical component:	D4192T	D4192T2
	Nm	Nm
Glow plug nut	5	5
Glow plug	20	15
Nut, gear wheel holder on the injection pumps		
Steel flange	50	50
Aluminium flange	15	15
..... Stage 1	Tighten	Tighten +60°
..... Stage 2	+60°	
Clamp screw, injectors	-	27
Injectors in the cylinder head	70	-
Screws, fuel pump (FP), cylinder block (cylinder head) ..	20	20
Screws, fuel pump mounting / cylinder mounting	24	24
Screws, fuel pump (FP) on engine mounting-torx	29	29
Adjusting fuel pump (FP) gear wheel	90	90
Fuel injection pipes, connecting nuts	25	29
Plug, adjusting fuel pump (FP)	10	20
Plug for the locking pin for the crankshaft	20	20
Coded starter module (CSM) (stop valve)	20	20
Heater in coolant system	-	20
Fuel injection pump cover	-	7
Pre-set solenoid on pump	-	10

2A. Engine -1999

25 Intake and exhaust system

25 Intake and exhaust system

Specifications

Turbocharger unit, petrol engine B4194T, B4204T

Turbocharger unit B4194T manual	Mitsubishi (single scroll)
Turbocharger unit B4194T automatic, B4204T automatic / manual	Mitsubishi (twin scroll)

Engine:	B4194THP manual	B4194THP automatic B4204TLP automatic / manual
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
Basic boost 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 mm	B4194THP Manual kPa	B4194THP Automatic kPa	B4204TLP Manual / automatic kPa	kPa
1	37	60	29	+/-4
5	74	97	50	+/-4
>7	>80	>100	>60	

Diesel engine, turbocharger (TC) D4192TX

Turbocharger (TC):	D4192T	D4192T2
Water cooled turbocharger (TC)	Garrett T2	-
Air cooled turbocharger (TC)	Garrett T2	Garrett GT15

Engine:	Check	After adjustment
D4192T: Boost pressure at full load 20°C, 2500-4800 rpm kPa	80-95	82-91
D4192T2: Boost pressure at full load 20°C, 1800-4000 rpm kPa	80-95	82-91

Setting value for the boost pressure control (BPC) valve:	D4192T	D4192T2	D4192T	D4192T2
Length:	Control value kPa	Control value kPa	Adjustment value kPa	Adjustment value kPa
0.4 mm	102-108	-	105-108	-
1 mm	-	109-118	-	112-118
4 mm	118-126	127-141	122-126	130-141

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: 39 79 850.

Cooling system capacity:	Applies to petrol and diesel engines, Except turbocharged and normally aspirated engines	B4194T B4204T	B4184SM
Type	Closed		
Capacity litres	6.3	5.7	6.0
Quantity when refilling litres	4.5 - 5.0	5.0	5.0
Temperature sensor in radiator D4192TX Activation temperature.	85°C	-	-

Expansion tank, all models:	-1996	1997-	B4184SM
The pressure valve in the filler cap opens at:			
- Overpressure kPa	110-130	140-160	75-105
- Negative pressure kPa	< 7	< 7	< 7

Thermostat:	Petrol engine	D4192TX	B4184SM
Begins to open at	90°C	89°C	85°C
Fully open at	105°C	101°C	95°C

2A. Engine -1999

Drive belts

Drive belts

Inspection

Engine type:	Inspection: ¹ Minimum value:	Adjustment "Run-in"belt:	Adjustment New belt:	
D4192T (6 groove belt) Tool: 999 5434 and 999 5436				
Without AC	3.0	2.5	1.5-2.5	
With AC	Automatic belt tensioner Control value between 90.5 and 100 mm.			
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	Belt tensioning is automatic.			
B4184SM deflection ²	Generator (GEN)	10.5 mm	8.5-10 mm	6.0-7.0 mm
	Power steering pump	12.0 mm	10-11 mm	6.0-8.0 mm

¹ If the belt tension drops below its nominal value, it must be adjusted to the "run-in" belt value.

² At tension of 98N.

Tightening torques

Mechanical component:	Petrol engine Except B4184SM	D4192TX	B4184SM
	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

2A. Engine -1999
28 Ignition system

28 Ignition system
 General

Firing order	1-3-4-2
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Ignition timing

Engine:	Ignition system:	Ignition setting at 750 rpm ($\pm 3^\circ$)
B4164S	Fenix 5.1	10°
B4184S	Fenix 5.1	5°
B4204S	Fenix 5.1	8°
B4194T B4204T	Fenix 5.1	0°-15°
B4184SM	Melco 1	16° (with VST 5°)

Ignition coil:		Petrol engine except B4184SM	B4184SM ¹
Coil resistance	Ω	260 - 340	1700 - 2500
Coil inductance	mH	60 -80 kHz	-
Misfire sensor	Ω	-	< 0.1

¹ Measured with voltage: 1.5 V.

Spark plugs

Spark plug data:	Service, kit number	Electrode gap
B4164S, B4184S, B4204S	272 207	
First electrode		1.2 ± 0.1
Second and third electrode		1.2 ± 0.25
B4194T, B4202T	8692070	0.7 ± 0.1
B4184SM	271 239	0.75 ¹
Resistance, B4184SM	1000Ω or more	

¹ Must not be adjusted.

Tightening torques

Mechanical component:	Nm
Spark plugs	25
Knock sensor	20
Ignition coil, B4164S, B4184S, B4204S	3
Ignition coil, B4194T, B42042T	10
Ignition coil, B4184SM	10
Injection driver, B4184SM	5