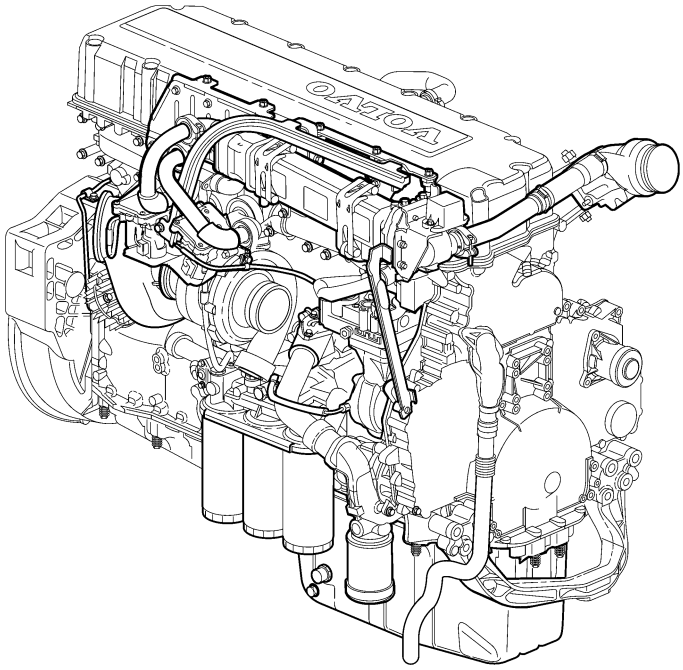
VOLVO
Volvo Trucks North America, Inc.
Greensboro, NC USA

Service Bulletin Trucks

This Service Bulletin replaces SB 200–239, “Specifications, D12D” (07.2004), publication no. PV776–20 0083235.

Specifications



W2004441

Contents:

Note: Illustrations are used for reference only and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

Specifications

Engine

Engine Designation

	Power Output [1]		**Torque** [2]	
D12D 365	272 kW	(365 hp)	1800 Nm	(1328 ft-lb)
D12D 395	295 kW	(395 hp)	2000 Nm	(1476 ft-lb)
D12D 425	317 kW	(425 hp)	2000 Nm	(1476 ft-lb)
D12D 435	325 kW	(435 hp)	2100 Nm	(1549 ft-lb)
D12D 465	347 kW	(465 hp)	2237 Nm	(1650 ft-lb)

[1] Max power output at 30.0 rps (1800 rpm). Net power according to ISO 1585. Smoke requirements met according to ECE reg 24 Federal Register and Swedish Authorities.

[2] Max torque at 20.0 rps (1200 rpm). Net torque according to ISO 1585. Smoke requirements met according to ECE reg 24 Federal Register and Swedish Authorities.

Number of cylinders	6
Cylinder diameter	131 mm (5.16 in.)
Stroke	150 mm (5.91 in.)
Displacement	12.1 L
Firing sequence	1-5-3-6-2-4
Compression ratio	17.3:1
Compression test using VCADS Pro, deviation from peak value 100%	max 20%
Engine speed during compression test, minimum	16.7 r/s (100 rpm)
Low idle	8.3 - 10.8 r/s (550 - 650 rpm)
High idle	38.4 r/s (2300 rpm)
Max. full load revs	35.0 r/s (2100 rpm)
Weight, engine with flywheel, flywheel casing and turbocharger, without starter motor (dry)	1175 kg (2585 lb)
Max length	1350 mm (53.2 in.)
Max width	768 mm (30.2 in.)
Max height	1152 mm (45.4 in.)

Cylinder Head

Type	6 cylinder
Length	1078 mm (42.4 in.)
Width	397 mm (15.6 in.)
Height	135 mm (5.3 in.)
Maximum unevenness (bottom face)	0.1 mm (0.004 in.)

Cylinder Head Bolts

Number/cylinder head	38
Thread size	M16
Length	200 mm (7.87 in.)

Cylinder Block

Length	1052 mm (41.42 in.)
Height, lower block face - crankshaft center	120 mm (4.72 in.)

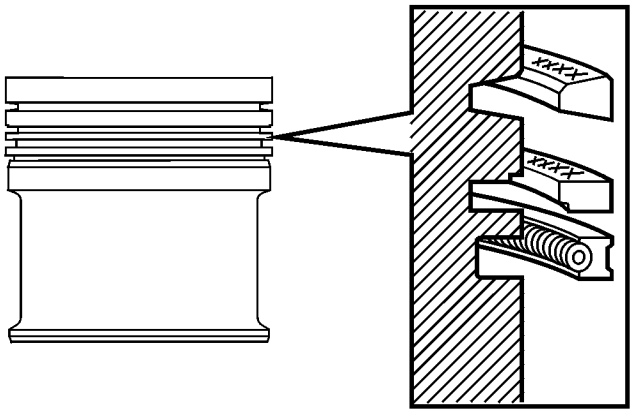
Cylinder Liner

Type	Wet, replaceable
Height, total	273 mm (10.75 in.)
Sealing surface height above block face	0.15 - 0.21 mm (0.006 - 0.008 in.)
Number of sealing rings per cylinder liner	1 + 3

Pistons

Type	steel
Height above cylinder block face	0.15 - 0.65 mm (0.006 - 0.026 in.)
Diameter, combustion chamber	89 mm (3.50 in.)
Depth, combustion chamber	18.6 mm (0.73 in.)
Number of ring grooves	3
Front marking	arrow turned forward
Wrist pin diameter	55 mm (2.17 in.)

Piston Rings



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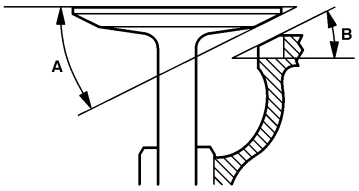
Compression rings		**Specification**	**Wear tolerance**
Number		2	-
Piston ring clearance in grooves:			
	lower compression ring	0.09 - 0.13 mm (0.0035 - 0.0051 in.)	-
Piston ring gap measured in ring opening:			
	upper compression ring	0.4 - 0.65 mm (0.016 - 0.026 in.)	< 1.0 mm (0.039 in.)
	lower compression ring	1.1 - 1.3 mm (0.043 - 0.051 in.)	< 1.6 mm\ (0.063 in.)

Oil scraper ring	**Specification**	**Wear tolerance**
Number	1	-
Width, including spring	4.32 mm (0.170 in.)	-
Piston ring clearance in groove	0.05 - 0.10 mm (0.0019 - 0.0039 in.)	-
Piston ring gap measured in ring opening	0.35 - 0.65 mm (0.0137 - 0.0260 in.)	< 1.0 mm (0.039 in.)

Valve Mechanism

Valves

Valve disc, diameter:		
	Intake	40 mm (1.6 in.)
	Exhaust	40 mm (1.6 in.)
Valve stem, diameter:		
	Intake	8 mm (0.315 in.)
	Exhaust	8 mm (0.315 in.)

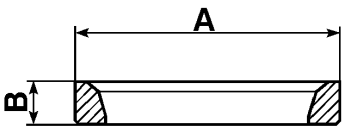
Valve seat angle (A):			
	Intake	29.5°	 T2019432
	Exhaust	44.5°	
Seat angle in cylinder head (B):			
	Intake	30°	
	Exhaust	45°	

		Specification	**Wear tolerance**
Clearance between valve head and cylinder head face:			
	Intake	0.9 - 1.4 mm (0.035 - 0.055 in.)	< 1.5 mm (0.059 in.)
	Exhaust	1.2 - 1.7 mm (0.047 - 0.067 in.)	< 1.8 mm (0.071 in.)

Note: Valves must be replaced when replacing valve seats.

Valve clearance, cold engine, setting value:			
	Intake	0.2 mm	(0.008 in.)
	Exhaust	0.5 mm	(0.019 in.)
	Exhaust, VEB	1.6 mm	(0.063 in.)
Valve clearance, cold engine, control values:			
	Intake	0.15 - 0.25 mm	(0.006 - 0.009 in.)
	Exhaust	0.45 - 0.55 mm	(0.018 - 0.022 in.)
	Exhaust, VEB	1.55 - 1.65 mm	(0.061 - 0.065 in.)

Valve Seats



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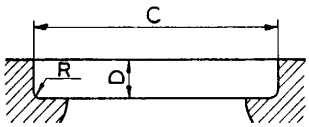
Outer diameter **(A)**			
Standard:			
	Intake	43.1 mm	(1.697 in.)
	Exhaust	43.1 mm	(1.697 in.)
Oversize:			
	Intake	43.3 mm	(1.705 in.)
	Exhaust	43.3 mm	(1.705 in.)
Height **(B)**:			
	Intake	7.3 mm	(0.287 in.)
	Exhaust	8.0 mm	(0.314 in.)

Valve Seat Location



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Diameter **(C)** standard:			
	Intake	43.0 mm	(1.693 in.)
	Exhaust	43.0 mm	(1.693 in.)
Diameter **(C)** oversize:			
	Intake	43.2 mm	(1.701 in.)
	Exhaust	43.2 mm	(1.701 in.)
Depth **(D)** :			
	Intake	11.2 mm	(0.441 in.)
	Exhaust	11.2 mm	(0.441 in.)
Seat bottom radius **(R)**:			
	Intake, maximum	0.8 mm	(0.032 in.)
	Exhaust, maximum	0.8 mm	(0.032 in.)

Valve Guides

		Specification	Wear tolerance
Length:			
	Intake	83.4 mm (3.283 in.)	-
	Exhaust	83.4 mm (3.283 in.)	-
Inner diameter:			
	Intake	8 mm (0.315 in.)	-
	Exhaust	8 mm (0.315 in.)	-
Height above the cylinder head spring plate:			
	Intake	26.5 ± 0.4 mm (1.043 ± 0.016 in.)	-
	Exhaust	26.5 ± 0.4 mm (1.043 ± 0.016 in.)	-
Clearance, valve stem - guide: [1]			
	Intake		< 0.2 mm (0.008 in.)
	Exhaust		< 0.2 mm (0.008 in.)

[1] Measurements are calculated for the method described in Service Information, group 21.

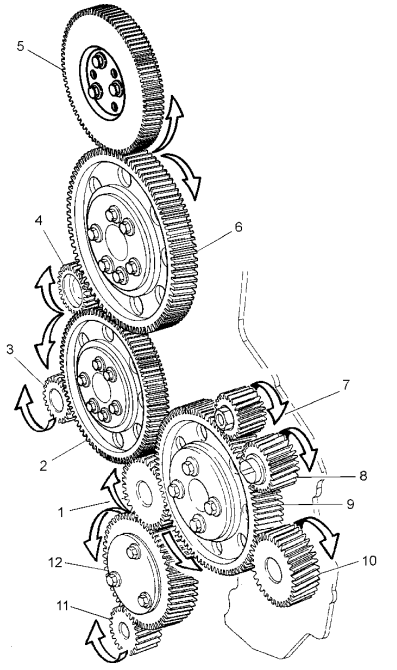
Valve Springs

Intake (left-hand coil)		
Length (unloaded)		73 - 74 mm (2.87 - 2.91 in.)
590 Nm (435 ft-lb) load		58 mm (2.28 in.)
1150 Nm (850 ft-lb) load		45 mm (1.77 in.)
Butt length max		40 mm (1.57 in.)
Exhaust		
Outer valve spring (left-hand coil):		
	Length (unloaded)	73 - 74 mm (2.87 - 2.91 in.)
	590 Nm (435 ft-lb) load	58 mm (2.28 in.)
	1150 (850 ft-lb) Nm load	45 mm (1.77 in.)
	Butt length max	40 mm (1.57 in.)
Inner valve spring (right-hand coil):		
	Length (unloaded)	70 - 71 mm (2.76 - 2.80 in.)
	330 Nm (244 ft-lb) load	54 mm (2.13 in.)
	630 Nm (465 ft-lb) load	41 mm (1.61 in.)
	Butt length max	37 mm (1.46 in.)

Rocker Arms

Bearing play, maximum	< 0.1 mm (0.0039 in.)
Rocker arm roller, play, maximum	< 0.1 mm (0.0039 in.)

Timing Gears and Camshaft



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Timing Gears

Backlash		0.05 - 0.17 mm (0.002 - 0.007 in.)
Shaft journal for intermediate gear, diameter		99.99 ± 0.01 mm (3.937 ± 0.0004 in.)
Bushing for intermediate gear, diameter		100.04 ± 0.01 mm (3.939 ± 0.0004 in.)
Diametrical clearance for intermediate gear		max 0.07 mm (0.003 in.)
Axial clearance for intermediate gear		max 0.17 mm (0.007 in.)
Number of teeth:		
1	Drive gear, crankshaft	38
2	Intermediate gear, coolant pump	83
3	Drive gear, coolant pump	27
4	Drive gear, air compressor	29
5	Drive gear, camshaft	76
6	Intermediate gear (adjustable)	97
7	Drive gear, power steering pump	23
8	Drive gear, (pulley and fuel pump)	27
9	Intermediate gear	71
10	Drive gear, hydraulic pump	39
11	Drive gear, lubrication oil pump	23
12	Intermediate gear, lubrication oil pump	44

Camshaft

Checking camshaft settings, cold engine and valve clearance, cylinder 1 = 0.

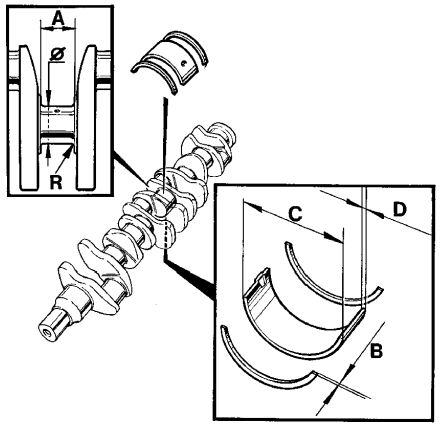
The intake valve for cylinder 1 for flywheel position 6° after TDC must be open 1.6 ± 0.3 mm.
When checking, the crankshaft must be turned in the correct direction (clockwise viewed from front) to eliminate any backlash.

		Specification	Wear tolerance
Drive		Gear	-
Number of bearings		7	-
Diameter bearing journals, standard		69.97-70.00 mm (2.754 - 2.760 in.)	-
Note: Use only check values, not for machining. Diameter bearing journals, undersize: -			
	0.25	69.72 - 69.78 mm (2.746 - 2.747 in.)	-
	0.50	69.47 - 69.53 mm (2.735 - 2.737 in.)	-
	0.75	69.22 - 69.28 mm (2.725 - 2.728 in.)	-
Max axial play			0.35 mm (0.014 in.)
Max permitted out-of-roundness (with new bearings)			0.05 mm (0.0019 in.)
Bearing, permitted wear diametrical			0.05 mm (0.0019 in.)
Valve lift:			
	Intake	13.1 mm (0.52 in.)	-
	Exhaust (VEB)	13.1 mm (0.52 in.)	-
	Exhaust (EPG)	12.0 mm (0.47 in.)	-
	Decompression and charge profiles (VEB)	1.1 mm (0.043 in.)	-
Permitted wear for the complete cam profile			< 0.1 mm (0.0039 in.)
Unit injector, stroke		17 mm (0.67 in.)	-

Camshaft Bearings

Camshaft bearing thickness, standard		1.92 mm	(0.075 in.)
Oversize:			
	0.25	2.04 mm	(0.079 in.)
	0.50	2.17 mm	(0.087 in.)
	0.75	2.29 mm	(0.091 in.)

Crank Mechanism



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Crankshaft

Length	1203 mm (47.36 in.)
Crankshaft axial clearance [1]	0.10 - 0.40 mm (0.0039 - 0.0158 in.)
Main bearing radial clearance [1]	0.046-0117mm (0.0018-0.0046 in.)
Out-of-round, main bearing and connecting rod bearing pins, maximum	0.08 mm (0.0031 in.)
Taper on main bearing and connecting rod bearing pins, maximum	0.05 mm (0.0020 in.)
Run-out of the center bearing, maximum	0.15 mm (0.0059 in.)

[1] Measurements assume lubricated component.

Main Bearing Journals

(Use only for check values, not for machining.)		
Diameter **(ø)** standard		108.0 mm (4.25 in.)
Undersize:		
	0.25 mm (0.01 in.)	107.73 - 107.75 mm (4.2413 - 4.2421 in.)
	0.50 mm (0.02 in.)	107.48 - 107.50 mm (4.2315 - 4.2323 in.)
	0.75 mm (0.03 in.)	107.23 - 107.25 mm (4.2216 - 4.2224 in.)
	1.00 mm (0.04 in.)	106.98 - 107.0 mm (4.2118 - 4.2125 in.)
	1.25 mm (0.05 in.)	106.73 - 106.75 mm (4.2020 - 4.2028 in.)
	Surface finish, main bearing journal	R_a 0.25
	Surface finish, radius	R_a 0.4
Width, thrust bearing journals (A), standard		47.0 mm (1.850 in.)
Oversize:		
	0.2 mm (0.008 in.), axial bearing 0.1 mm (0.004 in.)	47.175 - 47.225 mm (1.8573 - 1.8593 in.)
	0.4 mm (0.016 in.), axial bearing 0.2 mm (0.008 in.)	47.375 - 47.425 mm (1.8652 - 1.8671 in.)
	0.6 mm (0.024 in.), axial bearing 0.3 mm (0.012 in.)	47.575 - 47.625 mm (1.8730 - 1.8750 in.)
Fillet radius (R)		3.75 - 4.00 mm (0.148 - 0.157 in.)

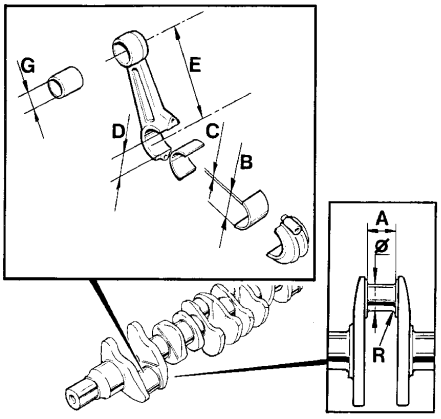
Main Bearing Shells

Outer diameter (C)		113.05 mm (4.445 in.)
Thickness (D), standard		2.29 mm (0.098 in.)
Oversize:		
	0.25 mm (0.01 in.)	2.6 — 2.7 mm (0.102 — 0.106 in.)
	0.50 mm (0.02 in.)	2.7 — 2.8 mm (0.106 — 1.110 in.)
	0.75 mm (0.03 in.)	2.8 — 2.9 mm (0.110 — 0.114 in.)
	1.00 mm (0.04 in.)	22.9 — 3.0 mm (0.114 — 0.118 in.)
	1.25 mm (0.05 in.)	3.1 — 3.2 mm (0.122 — 0.126 in.)

Thrust Washers (Axial Bearings)

Width **(B)** standard		3.1 — 3.2 mm (0.122 — 0.126 in.)
Oversize:		
	0.1 mm	3.2 — 3.3 mm (0.126 — 0.130 in.)
	0.2 mm	3.3 — 3.4 mm (0.130 — 0.134 in.)
	0.3 mm	3.4 — 3.5 mm (0.134 — 0.138 in.)

Connecting Rods



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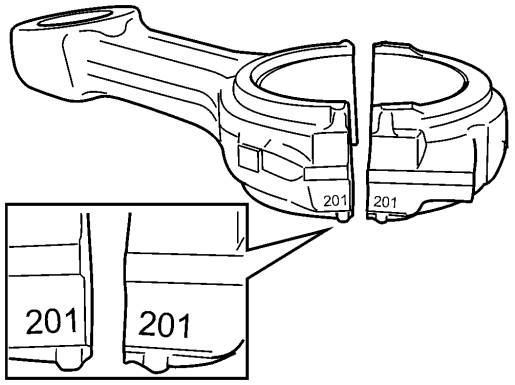

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"FRONT" on the shaft is turned forward. Connecting rod and cap are marked as a pair with a three-figure serial number.

Length center - center **(E)**	260 mm (10.236 in.)
Connecting rod bushing internal diameter **(G)**	55 mm (2.165 in.)
Axial clearance, connecting rod - crankshaft, maximum [1]:	0.25 mm (0.0059 in.)
Connecting rod bearing, radial clearance, maximum [1]:	0.10 mm (0.0039 in.)
Out-of-true, max deviation on measuring length of 100 mm (330 ft)	0.06 mm (0.0024 in.)
Torsion, max deviation on measuring length of 100 mm (330 ft)	0.15 mm (0.0059 in.)

[1] Measurements are with lubrication.

Connecting Rod Bearing Pins

(Only for check values, not machining) Diameter (ø) standard		92.0 mm (3.62 in.)
Undersize:		
	0.25 mm (0.01 in.)	91.73 - 91.75 mm (3.611 - 3.612 in.)
	0.50 mm (0.02 in.)	91.48 - 91.50 mm (3.601 - 3.602 in.)
	0.75 mm (0.03 in.)	91.23 - 91.25 mm (3.592 - 3.593 in.)
	1.00 mm (0.04 in.)	90.98 - 91.00 mm (3.582 - 3.583 in.)
	1.25 mm (0.05 in.)	90.73 - 90.75 mm (3.572 - 3.573 in.)
Surface finish, connecting rod bearing journal		Ra 0.25
Surface finish, radius		Ra 0.4
Width (A)		56.9 - 57.0 mm (2.240 - 2.244 in.)
Fillet radius (R)		3.75 - 4.00 mm (0.148 - 0.157 in.)

Connecting Rod Bearing Shells

Outer diameter (B)	96.85 mm (3.813 in.)
Thickness (C), standard	2.39 — 2.40 mm (0.0941 — 0.094 in.)
Oversize:	
0.25 mm (0.01 in.)	2.51 — 2.52 mm (0.0988 — 0.0992 in.)
0.50 mm (0.02 in.)	2.64 — 2.65 mm (0.1039 — 0.1043 in.)
0.75 mm (0.03 in.)	2.76 — 2.77 mm (0.1087 — 0.1090 in.)
1.00 mm (0.04 in.)	2.89 — 2.90 mm (0.1138 — 0.1141 in.)
1.25 mm (0.05 in.)	3.01 — 3.02 mm (0.1185 — 0.1188 in.)
Diameter, bearing shell bearing seat (D)	96.84 — 96.85 mm (3.8126 — 3.8129 in.)

Flywheel

Axial run-out (manual gearbox) measurement radius 150 mm (5.91 in.), maximum	0.20 mm (0.008 in.)
Number of teeth on starter motor gear ring	153
Sensor groove in flywheel	3 x 18

Flywheel Housing, Installed

Permitted axial runout for mating surface against clutch housing, maximum	0.20 mm (0.008 in.)
Permitted axial runout for location against clutch housing, maximum	0.25 mm (0.010 in.)

Lubrication and Oil System

Oil

For proper volumes and oil and filter change intervals for VOLVO components, refer to Service Information, group 175.

Oil Pressure

Operating speed (above 1100 rpm)	300-550 kPa (45 - 80 psi)
Idle speed, minimum	150 kPa (22 psi)

Oil Pressure, rocker arm shaft

Non-activated VEB	100 kPa (15 psi)
Activated VEB	min. 200 kPa (min. 30 psi)

Oil Temperature

Warm engine (running); coolant temperature 75 - 95 °C (167 - 203 °F)	65 - 105 °C* (149 - 221 °F)*
*Up to 125 °C (257 °F) at high engine load	

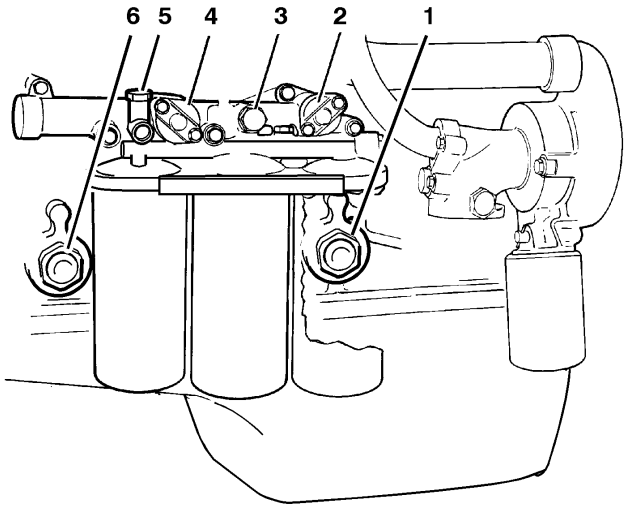
Oil Pump

Type	Gear driven
Number of teeth:	
drive gear	23
intermediate gear	44
Diameter:	
hub, intermediate gear	69.99 ± 0.01 mm (2.7555 ± 0.0004 in.)
bushing, intermediate gear	70.04 ± 0.02 mm (2.7575 ± 0.0008 in.)
Axial clearance:	
drive gear, pump	0.11 mm (0.0043 in.)
intermediate gear	0.10 mm (0.0039 in.)
Backlash	0.05 - 0.17 mm (0.0020 - 0.0067 in.)
Distance, drive gear — oil housing bracket	1.0 - 2.4 mm (0.0394 - 0.9449 in.)

Oil Filter

	Number
Full-flow filter (is tightened 1/2 - 3/4 turn after contact)	2
Fine filter (is tightened 3/4 - 1 turn after contact)	1

Oil Valves



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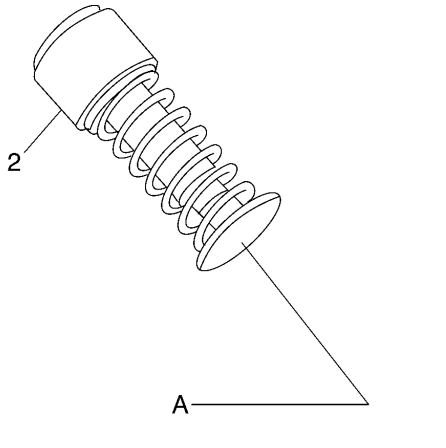

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1. Safety valve		
	Marking	Yellow
2. Control valve, oil cooler (bypass valve)		
	(A) Marking	124
3, 5. Overflow valve, oil filter		
	Spring, free length	69 mm (2.72 in.)
	With a load of 13 - 15 Nm	40 mm (1.57 in.)
4. Piston cooling valve		
	Marking	Orange
6. Reduction valve		
	Marking	Blue

Fuel System

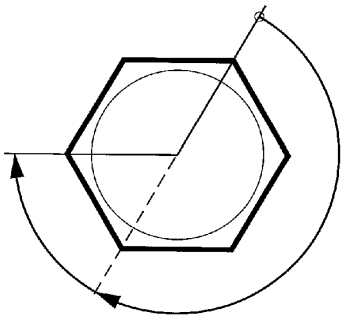
Fuel Pump

Fuel pressure at:		
	600 rpm	> 100 kPa (15 psi)
	1400 rpm	> 300 kPa (45 psi)
	full load	> 300 kPa (45 psi)

Overflow Valve

Opening pressure	360 - 420 kPa (53.6 - 62.5 psi)

Unit Injectors



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Tighten the adjustment screw to zero clearance
against the camshaft,
then turn an additional 3-4 flats (180 – 240°).

Preload setting, 3 - 4 flats (see illustration)	0.75 ± 0.1 mm (0.0295 ± 0.0039 in.)

Cylinder Balancing

Cylinder balancing, VCADS		
	Compensation, maximum	± 80%

Intake and Exhaust System

Turbocharger

Axial clearance turbine rotor shaft, maximum	0.1 mm (0.0039 in.)

Minimum Charge Air Pressure at 100% Engine Load — Response Values

		Minimum @ 100% engine load	Pins EA22 (signal) & EA11 (sensor ground)[1]	Response Values[2]
D12D365:				
	1200 rpm	125 kPa (18.1 psi)	2.57 V	3.5 - 4.5 sec
	1400 rpm	176 kPa (25.5 psi)	3.12 V	3.5 - 4.5 sec
	1600 rpm	183 kPa (26.5 psi)	3.21 V	3.5 - 4.5 sec
	1800 rpm	187 kPa (27.1 psi)	3.25 V	3.5 - 4.5 sec
D12D395:				
	1200 rpm	140 kPa (20.3 psi)	2.73 V	4.5 - 5.5 sec
	1400 rpm	180 kPa (26.1 psi)	3.18 V	3.5 - 4.5 sec
	1600 rpm	187 kPa (27.1 psi)	3.26 V	3.5 - 4.5 sec
	1800 rpm	193 kPa (28 psi)	3.32 V	3.5 - 4.5 sec
D12D425:				
	1200 rpm	145 kPa (21 psi)	2.88 V	4.5 - 5.5 sec
	1400 rpm	185 kPa (26.8 psi)	3.23 V	3.5 - 4.5 sec
	1600 rpm	193 kPa (28 psi)	3.32 V	3.5 - 4.5 sec
	1800 rpm	199 kPa (28.9 psi)	3.39 V	3.5 - 4.5 sec
D12D435:				
	1200 rpm	153 kPa (22.2 psi)	2.88 V	4.5 - 5.5 sec
	1400 rpm	190 kPa (27.5 psi)	3.29 V	4 - 5 sec
	1600 rpm	205 Kpa (29.7 psi)	3.46 V	3.5 - 4.5 sec
	1800 rpm	206 kpa (29.9 psi)	3.47 V	3.5 - 4.5 sec
D12D465:				
	1200 rpm	175 kPa (25.3 psi)	3.12 V	4 - 5 sec
	1400 rpm	206 kPa (29.9 psi)	3.47 V	3.5 - 4.5 sec
	1600 rpm	224 Kpa (32.5 psi)	3.67 V	3.5 - 4.5 sec
	1800 rpm	226 Kpa (32.8 psi)	3.69 V	3.5 - 4.5 sec

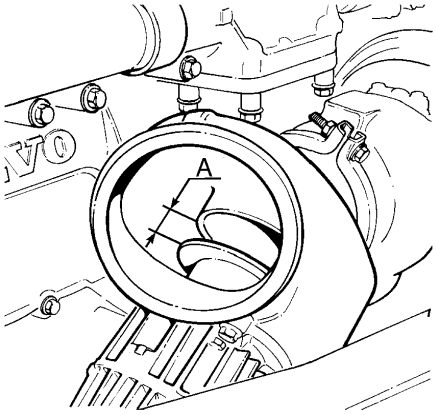
Charge Air Temperature Sensor

Cold engine (off)	Ambient temperature
Warm engine (running, vehicle standing still); coolant temperature 75 - 95 °C (167 - 203 °F)	10 - 30 °C (50 - 86 °F) above ambient temperature

[1]Test run with normal diesel fuel (type 2) and below 1500 m (4500 ft.) altitude.

[2]Response times from 0 kPa (0 psi) charge air pressure to 90% of max charge air pressure.

Exhaust Pressure Governor (EPG)



T2013094

EPG travel (A), minimum	29 mm (1.14 in.)

Heat Retention Function

Air pressure for exhaust pressure governor (EPG)		155 ± 8 kPa (23 ± 2 psi)
Heat retention activated:		
	Coolant temperature (minimum)	< 70 — 80 °C/ —4 ° (158 – 176 °F /— 2 °)
	Engine load	< approx. 50% [1]
	Accelerator pedal	at rest (released)
Heat retention deactivated:		
	Coolant temperature	> 70 °C (158 °F) [2]
	Engine load	> approx. 50%
	Accelerator pedal	off idle (depressed)

[1] Engine load could be more or less depending on engine speed. Check should be made with engine at idle speed.

[2] This value can be programmed from 70 °C (158 °F) to 80 °C (176 °F). Parameter AZN, MID 128 (Engine ECU).

EPG Activation for Idle EGR

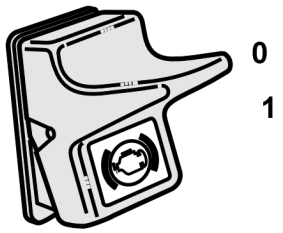
Air pressure for exhaust pressure governor (EPG)	approx. 100 kPa (14.5 psi)

Activation:		
	Coolant temperature	> 65 °C (> 149 °F)
	Clutch pedal	at rest (released)
	Accelerator pedal	at rest (released)
	Engine speed	idle
	Ambient temperature	> 4 °C (> 25 °F)
	EGR temperature	> 98 °C (> 208 °F) [1]

[1] Idle EGR is active when all conditions listed are met. After the first 3 minutes of idle time, the EMS reads the EGR temperature. If below 98 °C (208 °F), idle EGR is not active. If above value, it remains active.

Engine Brake

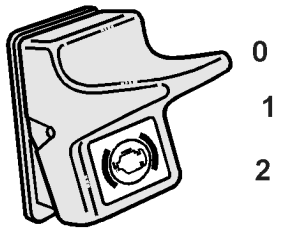
EPG Inlet Pressure



T0008637

Exhaust brake only	Braking force in % [1] Pressure of EPG in kPa (psi)	
	100% (high)	Cruise mode
Engine brake, switch position 1	750 kPa (109 psi)	50 - 750 kPa (7 - 109 psi)

[1] 2–way switch can give 100% (high) EPG only



T0008058

VEB	Brake force in % [1] Pressure of EPG in kPa (psi)			EPG	VCB
	50% (low)	100% (high)	Cruise mode [2]		
VEB Switch position 1	750 kPa (109 psi)	–	50 — 750 kPa (7 — 109 psi)	On	Off
VEB switch position 2	750 kPa (109 psi)	750 kPa (109 psi)	50 — 750 kPa (7 — 109 psi)	On	On

[1] 3–way switch can give 50% (low) or 100% (high) EPG and VCB

[2] Cruise control overspeed protection. Engine brake activation. Parameter AF in VECU MID 144

EPG		
Activated:		
	engine speed	> 900 rpm
	vehicle speed	> 5 km/h (3 mph)
Deactivated:		
	engine speed	< 800 rpm
	vehicle speed	< 5 km/h (3 mph)

VCB		
Activated:		
	engine speed [1]	> 1100 rpm
	vehicle speed	> 5 km/h (3 mph)
	engine oil temperature	> 55 °C (131 °F) [2]
	engine oil temperature	> 60 °C (140 °F) [3]
	charge air pressure	< 50 kPa (7 psi)
Deactivated:		
	engine speed[1]	< 1000 rpm
	vehicle speed	< 5 km/h (3 mph)
	engine oil temperature	< 55 °C (131 °F)
	charge air pressure	> 70 kPa (10 psi)

[1] The value is increased to 1400 rpm for the first five activations. Applies at engine oil temperatures 55 - 82 °C (131 - 180 °F).
[2] Oil temperature sensor combined with oil pressure sensor
[3] Oil temperature sensor combined with oil level sensor in oil pan

Exhaust Backpressure

Standard muffler, maximum	15 kPa (2.18 psi)	or 4.4 in. Hg
Tuned muffler (D12D-465), maximum [1]	20 kPa (2.9 psi)	or 6 in. Hg

[1] Oct. 02 - Jan. 04

Cooling System

For cooling system volumes and coolant requirements, refer to Service Information, group 18: “Coolant Requirements, Volvo Engines.”

Pressure valve opens at	75 kPa	(10.9 psi)

Fan

Viscous Fan (Air Sensing Fan)

Speed, engaged (engine speed @ 1800 rpm)	
Fan pulley diameter 167 mm (6.57 in.)	2400 rpm
Fan pulley diameter 191 mm (7.52 in.)	2150 rpm
Fan pulley diameter 214 mm (8.43 in.)	1900 rpm
Speed, not engaged	500 - 1000 rpm
Engagement temperature	75 °C (167 °F) in front of fan

Electronically Controlled Viscous Fan

Activated system	**Condition**	**Fan RPM Requested**
Coolant temperature	Start temperature 90 °C (194 °F)	600 rpm
Coolant temperature	> 93 °C (199F)	Variable fan speed activation
Engine ECU temperature	Activation ECU temperature > 100 °C (212 °F), deactivates < 95 °C (203 °F)	1200 rpm
AC system	Refrigerant pressure > 20 bar (300 psi)	Full engagement (120% of engine speed) example engine speed 1500 rpm x 120% = 1800 approx. fan speed
AC system (a/c compressor magnetic clutch activated)	Engine speed > 1500 rpm, ambient temp > 40 °C (104F), vehicle speed < 45km/h (28 mph)	1200 rpm
	Engine speed > 1200 rpm, ambient temp > 30 °C (86F), vehicle speed < 45km/h (28 mph)	1000 rpm
	Ambient temp > 35 °C (95F), vehicle speed < 10km/h (6 mph)	1200 rpm
	Ambient temp > 20 °C (68F), vehicle speed < 20km/h (12 mph)	600 rpm

On-off Fan

Activation temperature	91 °C (196 °F)
Deactivation temperature	87 °C (189 °F)

Activated System	**Condition**
Coolant temperature	Activation > 91 °C (196 °F), deactivation 87 °C (189 °F)
Engine ECU temperature	ECU temperature > 100 °C (212 °F), deactivates < 95 °C (203 °F)
Intake manifold air temperature (VHD 465 hp only)	> 80 °C(176 °F) for more than 2.5s, deactivates below 70 °C(158 °F) for more than 5s
AC system	Refrigerant pressure > 20 bar (300 psi)

Thermostat

Quantity	1
Opening temperature	82 °C (179 °F)

Engine Control System

Engine Electronic Control Unit (EECU)

Note: The EECU may not be replaced without prior authorization from Volvo; refer to Service Information, Engine ECU, IMPACT or ID DVD: Info type “Diagnostics” group 2841.

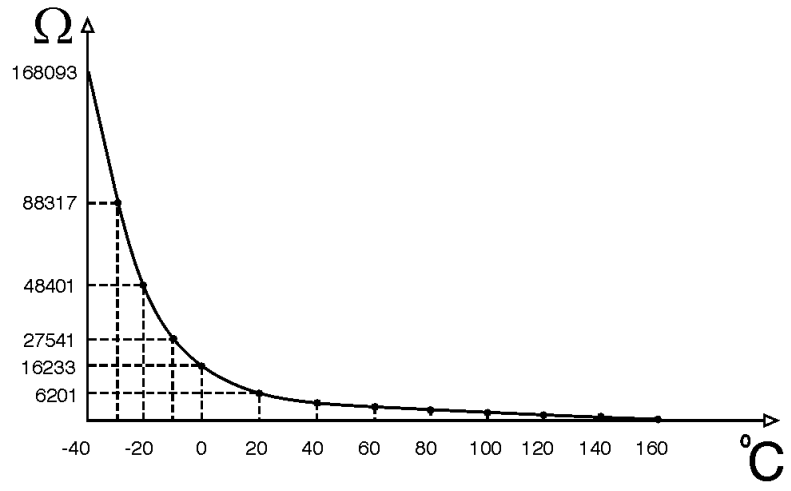
Number of pins	2 x 62

Sensors

Charge air sensor

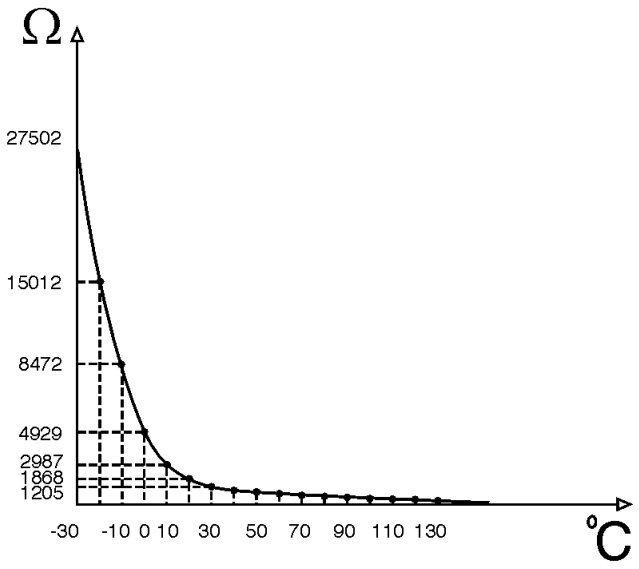
Check value	1.05 — 1.30 V (normal atmospheric pressure)

Intake air temperature sensor



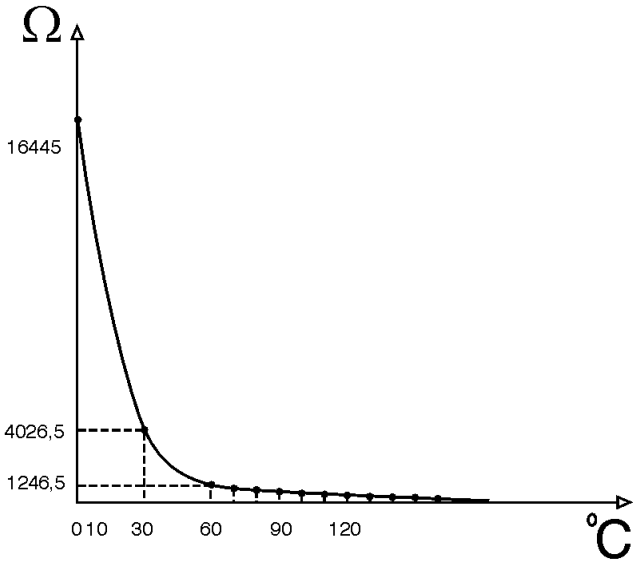
T2019008

Coolant temperature sensor



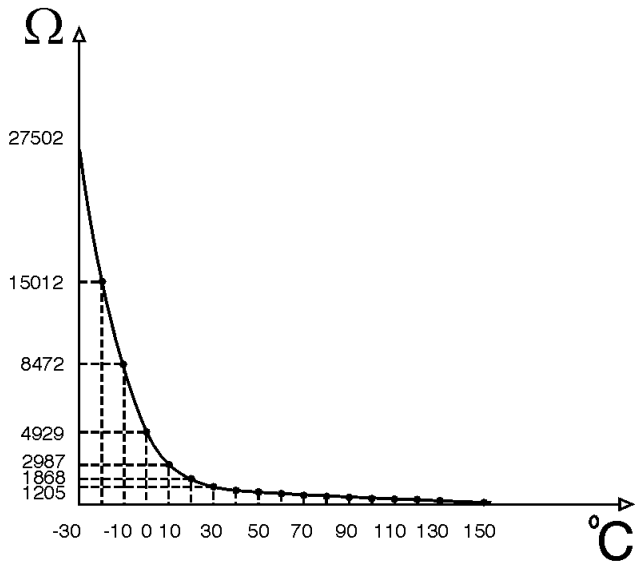
T2019009

Intake temperature sensor



T2019010

Engine oil temperature sensor



T2019011

Camshaft sensor

Distance to camshaft	0.3 - 1.0 mm (0.012 - 0.039 in.)
Resistance measurement	775 - 945 Ω

Flywheel sensor

Distance to flywheel	0.7 - 2.1 mm (0.028 - 0.083 in.)
Resistance measurement	775 - 945 Ω

Crankcase Pressure Sensor

Sensor alarm limit	> 8 kPa (1.2 psi)
Crankcase pressure: normal value (VEB not active) regardless of engine speed, maximum	1.0 kPa (0.13 psi)‘

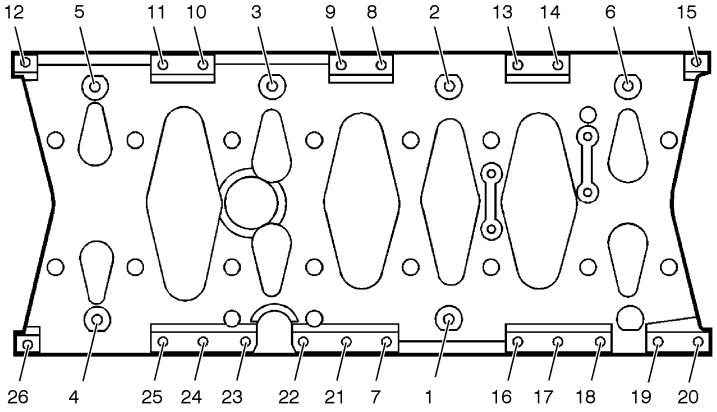
Tightening Torques and Patterns

Group 20

Tightening		**Torque**
M6 standard screw 8.8		10 ± 1.5 Nm (7.4 ± 1ft—lb) (89 ± 13 in-lb)
M8 standard screw 8.8		24 ± 4 Nm (18 ± 3 ft—lb)
M10 standard screw 8.8		48 ± 8 Nm (35 ± 6 ft—lb)
M12 standard screw 8.8		85 ± 15 Nm (63 ± 11 ft—lb)
M14 standard screw 8.8		140 ± 25 Nm (103 ± 18 ft—lb)
M16 standard screw 8.8		190 ± 35 Nm (140 ± 26 ft—lb)
Only torque-tightened screws may be reinstalled.		
Torque and angle tightened / yield point screws:		
	8.8	must not be reinstalled
	10.9	may be reinstalled
	12.9	may be reinstalled
Note: Check the screw that is being reinstalled. A damaged screw (e.g. with tear damage under the head) must be replaced.		

Group 21

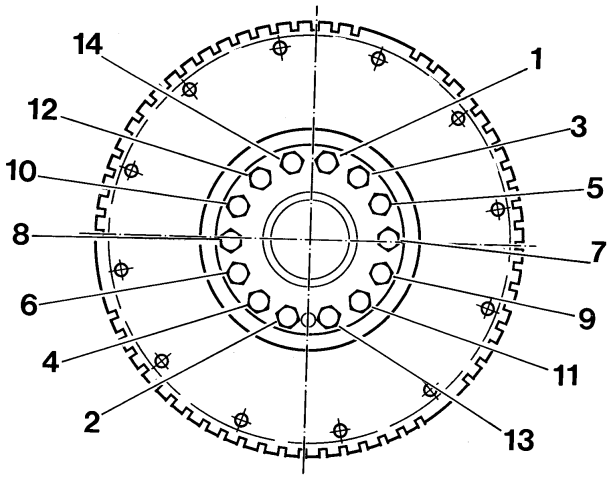
Tightening:	**Torque**	**Angle**
Front engine mounting, cylinder block	175 ± 20 Nm (129 ± 15 ft-lb)	
Front engine mounting, crossmember	85 ± 15 Nm (63 ± 11 ft-lb)	
Rear engine mounting, flywheel casing	245 ± 35 Nm (181 ± 27 ft-lb)	
Rear engine mounting, rubber cushion		
step 1	175 ± 5 Nm (129 ± 4 ft-lb)	
step 2	255 ± 38 Nm (188 ± 28 ft-lb)	
Main bearing cap		
step 1	150 ± 20 Nm (110 ± 15 ft-lb)	
step 2		120 ± 5°
Connecting rod cap		
step 1	275 ± 15 Nm (204 ± 11 ft-lb)	



T2014149

Stiffening frame, tightening sequence

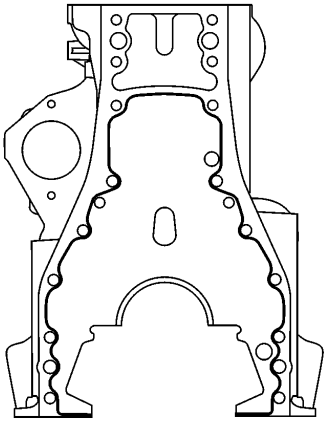
Tightening:	**Torque**	**Angle**
Stiffening frame		
step 1: tighten screws 1-6 in sequence	48 ± 8 Nm (36 ± 6 ft-lb)	
step 2: tighten screws 7-26 in sequence	15 Nm (11 ft-lb)	90 ± 5°
Piston cooling valve, screw*	24 ± 4 Nm (18 ± 3 ft-lb)	
*screws may not be reused.		



T2006973

Flywheel, tightening sequence (ensure that flange is dry and clean).

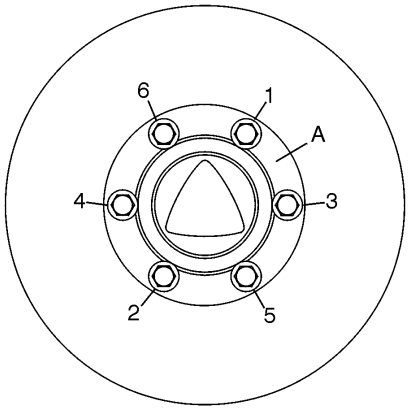
Tightening:	Nm	ft-lb	Angle
Flywheel (tighten screws in numerical order as illustrated):			
step 1	60 ± 5	44 ± 4	
step 2			60 ± 5°



T2019062

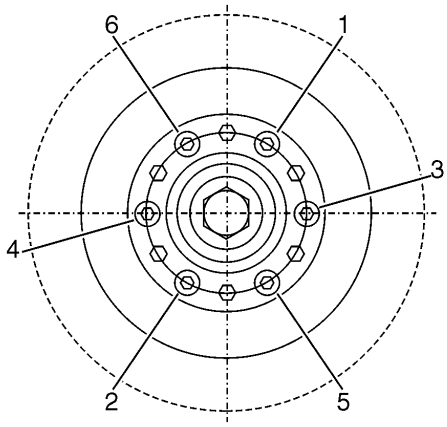
Flywheel housing, tightening sequence.

Tightening:	Torque
Flywheel housing **Note:** Apply a string of silicone as illustrated, thickness 2 mm (0.08 in.), max. 20 minutes before assembly.	140 ± 14 Nm (105 ± 10 ft-lb)



T2014027

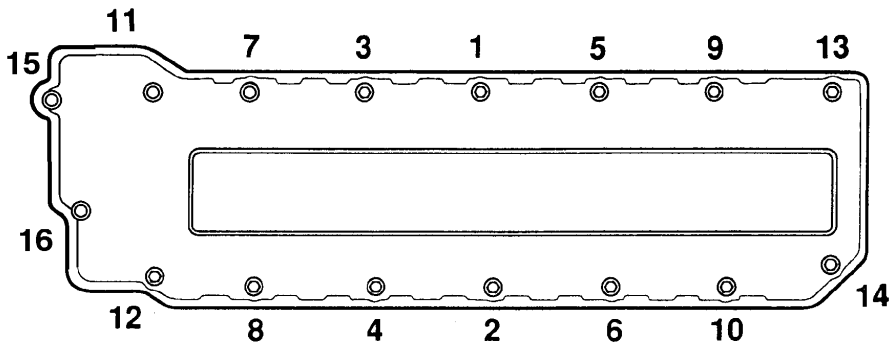
Vibration damper, VN — tightening sequence.



W2004219

Vibration damper, VHD — tightening sequence.

Tightening:	**Torque**	**Angle**
Vibration damper		
step 1*	20 ± 5 Nm (15 ± 4 ft-lb)	
step 2		90 ± 5°
* Following the numerical order, tighten screws according to step 1 before tightening according to step 2.		
NOTE: Screws may NOT be reused if they have been tightened with torque and angle.		

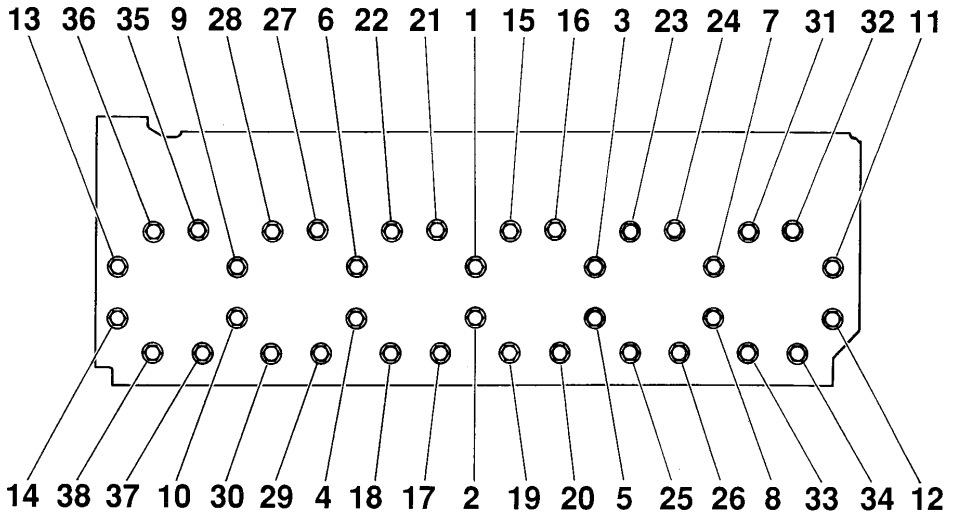


T2012845

Valve cover, tightening sequence

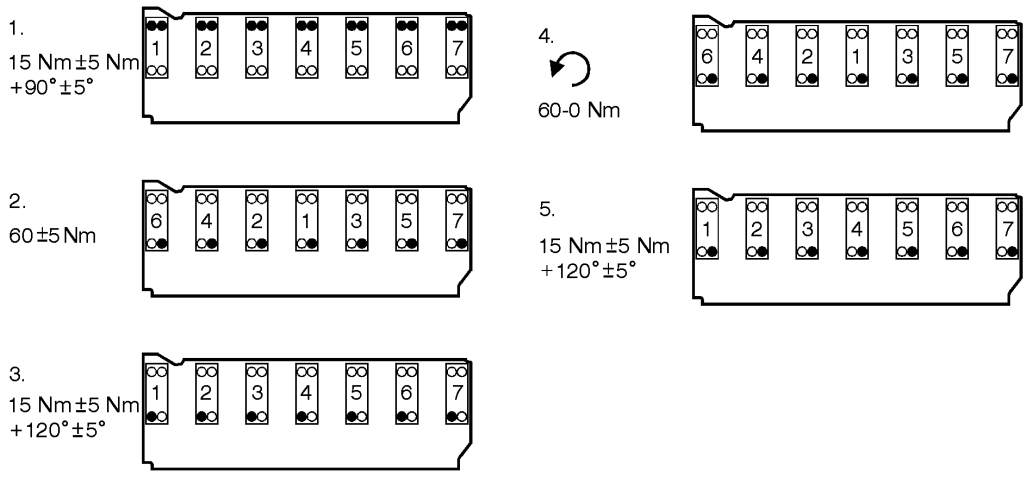
Note: If the valve cover is replaced, a new Engine Certification Label must be printed and affixed to the new valve cover via VCADS Pro “Engine Label Print,” group 2841.

Tightening:	**Torque**
Valve cover (tighten screws in order as illustrated)	20 ± 2 Nm (15 ± 1.5 ft-lb)
Stud, valve cover	40 ± 3 Nm (29 ± 2 ft-lb)



Cylinder head, tightening sequence

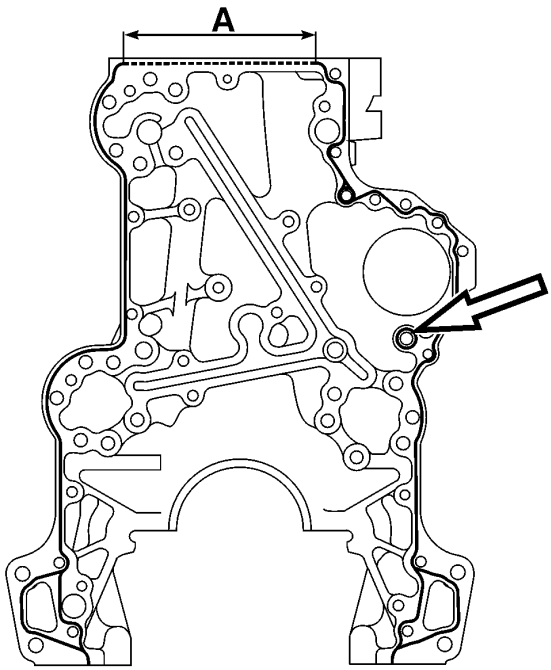
Tightening:		**Torque**	**Angle**
Cylinder head (tighten screws in order as illustrated):			
	step 1	60 ± 10 Nm (44 ± 7 ft-lb)	
	step 2 (check tightening)	60 ± 10 Nm (44 ± 7 ft-lb)	
	step 3		90 ± 5°
	step 4 (turn additional)		90 ± 5°
Cleaning plug, cylinder head		60 ± 10 Nm (44 ± 7 ft-lb)	
Lock nut, valve adjustment screw:			
	Option 1	38 ± 4 Nm (28 ± 3 ft-lb)	
	Option 2		60 ± 5° after contact
Lock nut, valve yoke (EPG)			60 ± 5° after contact
Lock nut, valve yoke (VEB)			60 +10/-0 ° after contact



T2012850

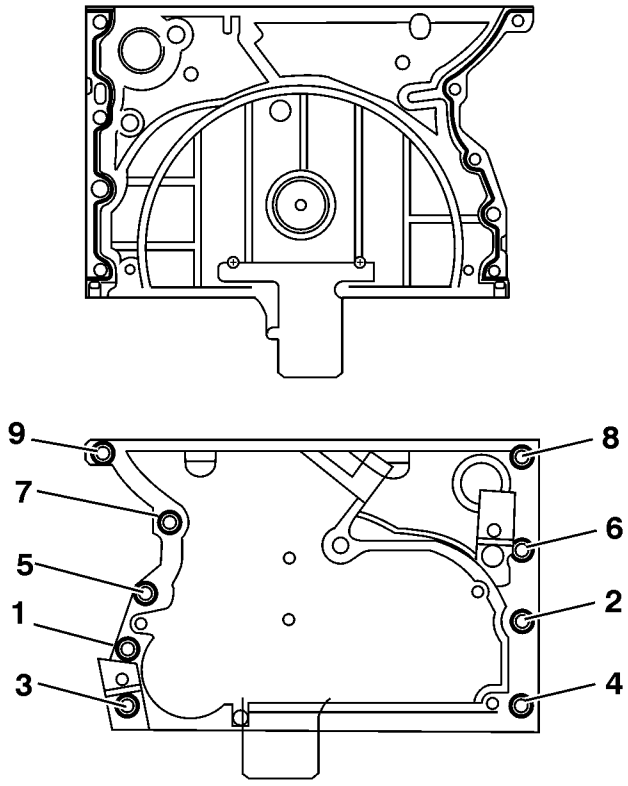
Bearing cap, camshaft/rocker arm shaft, tightening sequence

Tightening:		**Torque**	**Angle**
Bearing cap, camshaft/rocker arm shaft			
	step 1	15 ± 5 Nm (11 ± 4 ft-lb)	90 ± 5°
	step 2*	60 ± 5 Nm (44 ± 4 ft-lb)	
	step 3	15 ± 5 Nm (11 ± 4 ft-lb)	120 ± 5°
	step 4 (loosen the screws)	0	
	step 5	15 ± 5 Nm (11 ± 4 ft-lb)	120 ± 5°
	*screws must be tightened in stages to ensure that the rocker arm shaft comes down without bending.		



Timing gear cover, lower

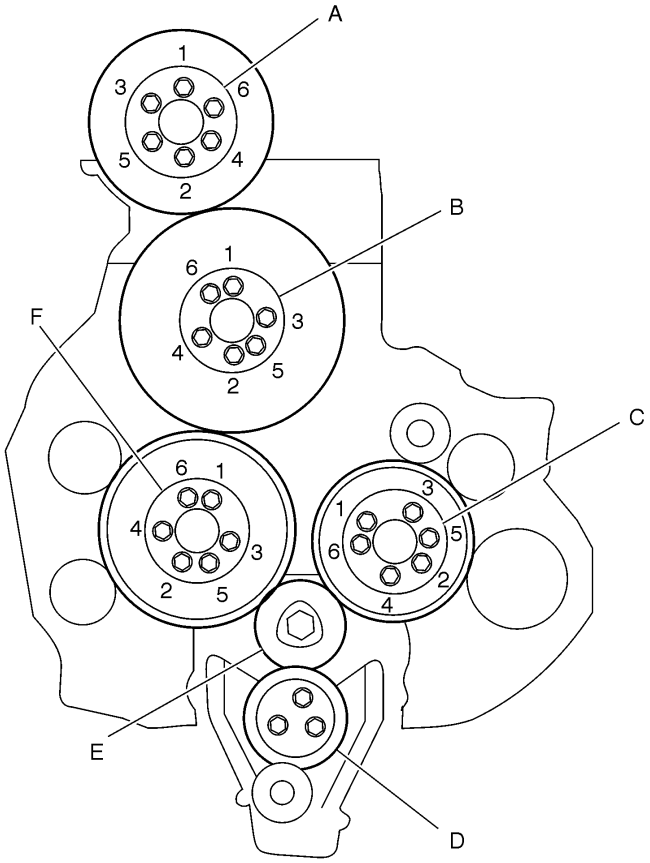
Tightening:	**Torque**
Timing gear cover, lower:	
Step 1: Apply a thin bead* of silicone as illustrated, including around the marked hole no more than 20 minutes before assembly.	
Step 2: Working from center outward, tighten to	34 ± 4 Nm (24 ± 3 ft-lb)
* Solid line = 2 mm bead; dashed line (area A) = 1 mm bead.	



Timing gear cover, upper

Note: When the upper timing gear cover is installed, the top section must be flush with the cylinder head.

Tightening:		**Torque**
Timing gear cover, upper:		
Step 1: Apply a thin bead of silicone* as illustrated, including around the marked holes, no more than 20 minutes before assembly.		
Step 2: Tighten screws in order as illustrated:		
	M8	24 ± 4 Nm (18 ± 3 ft-lb)
	M10	48 ± 8 Nm (36 ± 6 ft-lb)
* Thickness 2 mm.		



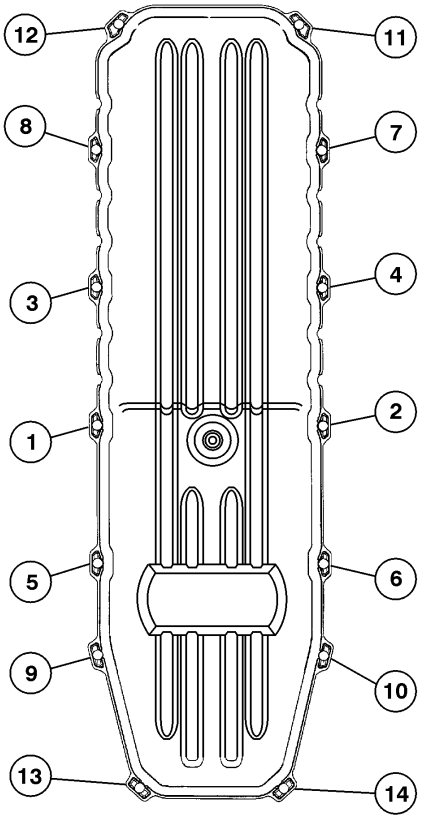
W2004477

Gear train

Timing gears: use the following torques (and angles, when indicated) for the corresponding gear; follow the tightening sequence for each gear as illustrated.

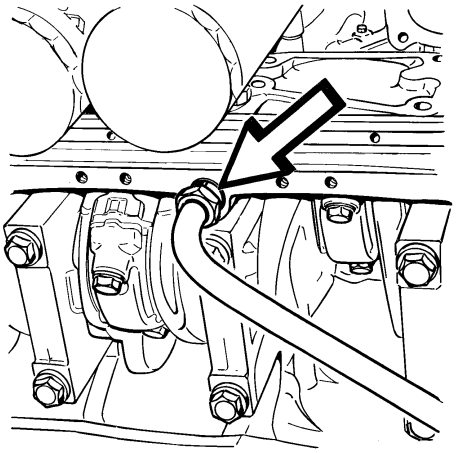
Tightening:		**Torque**	**Angle**
A.	Camshaft gear	35 ± 3 Nm (26 ± 2 ft-lb)	90 ± 5°
B.	Adjustable idler (intermediate) gear	15 ± 3 Nm (11 ± 2 ft-lb)	120 ± 5°
C.	Intermediate gear	15 ± 3 Nm (11 ± 2 ft-lb)	120 ± 5°
D.	Idler/intermediate gear	24 ± 4 Nm (18 ± 3 ft-lb)	
E.	Crankshaft gear (polygon hub)	645 ± 25 Nm (476 ± 18 ft-lb)	
F.	Idler gear	15 ± 3 Nm (11 ± 2 ft-lb)	120 ± 5°

Group 22



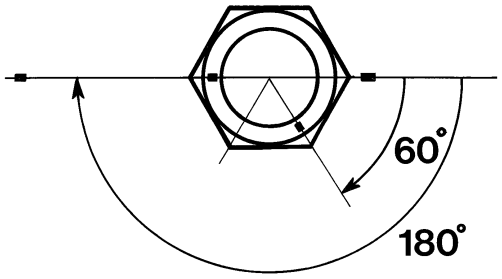
Oil pan, tightening sequence

Tightening:	**Torque**
Oil pan (tighten bolts in order as illustrated)	24 ± 3 Nm (18 ± 2 ft-lb)
Drain plug, oil pan	60 ± 10 Nm (44 ± 7 ft-lb)
Bracket, oil pump/main bearing cap	24 ± 3 Nm (18 ± 2 ft-lb)
Oil strainer, mounting screws in pump	27 ± 3 Nm (20 ± 2 ft-lb)
Oil cooler, mounting screws	27 ± 3 Nm (20 ± 2 ft-lb)



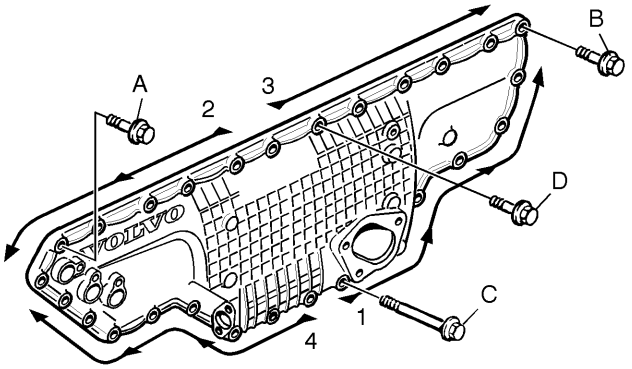
T2006701

Delivery pipe



T2006825

Delivery Pipe		**Torque**	**Angle**
Step 1:			
	Tighten fitting in cylinder block until it bottoms; approximately	10 Nm (88 inch-lb)	
Step 2:			
	New pipe		180°
	Pipe being reinstalled		60°



T2014088

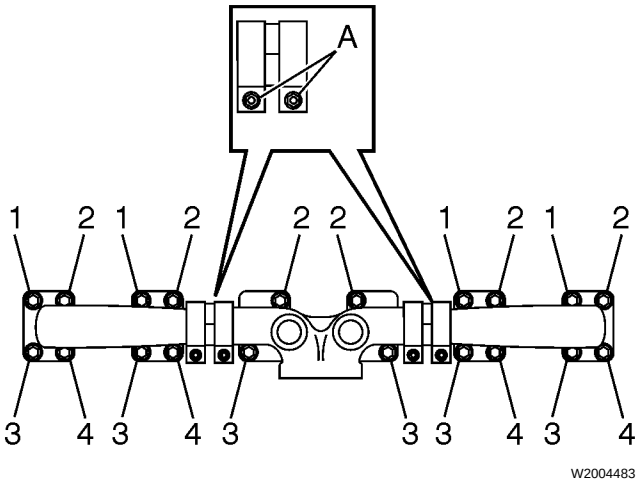
Oil cooler, cover; always use guide pins when installing the cover on the engine.

Tightening:		**Torque**	
Oil cooler, cover			
	Mount screws A and B	24 ± 4 Nm	(18 ± 3 ft-lb)
	Tighten C and D	24 ± 4 Nm	(18 ± 3 ft-lb)
	Tighten cover screws in numerical order from the middle outwards (1–4); see illustration	24 ± 4 Nm	(18 ± 3 ft-lb)
	Check tighten screws A and D	24 ± 4 Nm	(18 ± 3 ft-lb)

Group 23

Tightening:		**Torque**	**Angle**
Retainer, unit injector *(new copper sleeve)*			
First tightening			
	step 1	20 ± 5 Nm (15 ± 4 ft-lb)	
	step 2		180 ± 5°
Loosen the retainer screw before the second tightening.			
Second tightening			
	step 1	20 ± 5 Nm (15 ± 4 ft-lb)	
	step 2		60 ± 5°
Retainer, unit injector *(reused copper sleeve)*			
	step 1	20 ± 5 Nm (15 ± 4 ft-lb)	
	step 2		60 ± 5°
Lock nut for adjustment screw, unit injector:			
	Option 1	52 ± 4 Nm (38 ± 3 ft-lb)	
	Option 2		45 ± 5°
Banjo screw, 10 mm		12 ± 2 (108 ± 22 inch-lb)	
Banjo screw, 14 mm		35 ± 4 (26 ± 3 ft-lb)	
Banjo screw, 16 mm		40 ± 5 (30 ± 4 ft-lb)	

Group 25

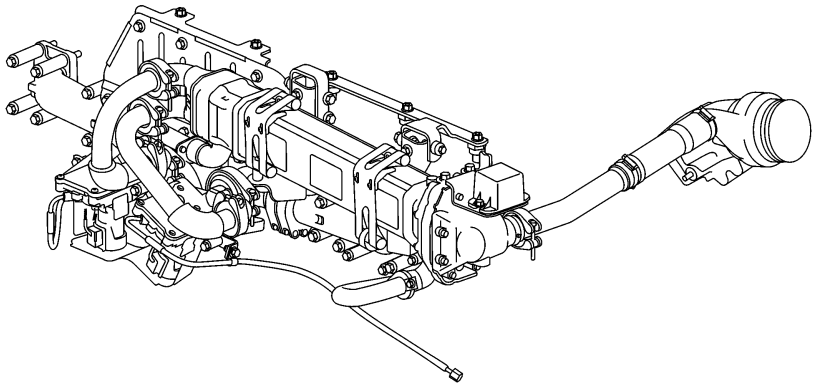


Exhaust manifold

Exhaust manifold (refer to illustration for tightening sequence):		**Torque**	
1.	Tighten bolts 1 to maximum	10 Nm	(88 inch-lb)
2.	Tighten bolts 2 to maximum	10 Nm	(88 inch-lb)
3.	Tighten bolts 3 to	52 ± 4 Nm	(38 ± 3 ft-lb)
4.	Tighten bolts 2 to	52 ± 4 Nm	(38 ± 3 ft-lb)
5.	Tighten bolts 4 to	52 ± 4 Nm	(38 ± 3 ft-lb)
6.	Tighten bolts 1 to	52 ± 4 Nm	(38 ± 3 ft-lb)

Tightening	**Torque**
Clamp, exhaust manifold (“A” in illustration)	10 ± 1 Nm (71 ± 8 inch-lb)
Exhaust pressure governor (EPG) turbine housing	24 ± 2 Nm (18 ± 1.5 ft-lb)
Control valve (VEB)	20 ± 3 Nm (15 ± 2 ft-lb)
Nut electrical connector, VEB-valve	1.5 ± 0.5 Nm (13 ± 4 inch-lb)
V-clamp, turbocharger housing	8.5 Nm (75 inch-lb)

EGR System



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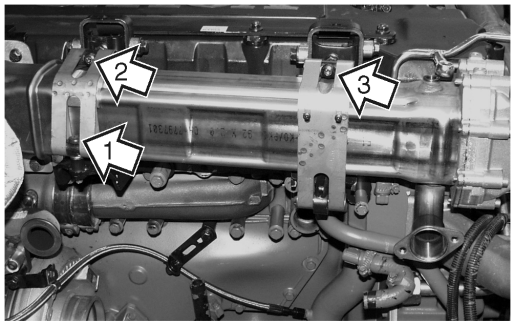
Tightening		Torque
EGR Pipes:		
	V-clamp	10 ± 2 Nm (88 ± 17 inch-lb)
	Hose clamp, mixing chamber	5 ± 1 Nm (35 ± 9 inch-lb)
Vibration Damper Assembly:		
	Bracket	15 ± 3 Nm (133 ± 3 inch-lb)
	Vibration Damper	24 ± 4 Nm (18 ± 3 ft-lb)



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Tightening sequence for EGR cooler mounting brackets

Note: Older version shown. Newer engine version “number 1” in the image has been removed. Front and rear bracket are the same on newer engines.

Tightening Sequence		Torque
EGR cooler mounting bracket, rear tensioning band:		
1.	Screw (against washer)	24 ± 4 Nm (18 ± 3 ft-lb)
2.	Screw/lock nut	12 ± 2 Nm (106 ± 17 inch-lb)
EGR cooler mounting bracket, front tensioning band:		
3.	Screw/lock nut	12 ± 2 Nm (106 ± 17 inch-lb)

Group 26

Thermostat, mounting bolts		**Torque**
	Bolt grade 8.8	24 ± 4 Nm (18 ± 3 ft-lb)
	Bolt grade 10.9	30 ± 4 Nm (22 ± 3 ft-lb)