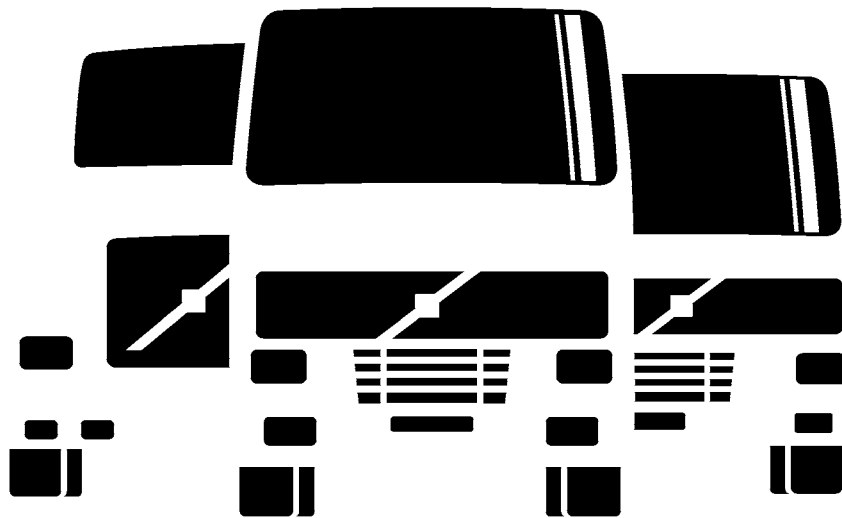


# Service Manual Trucks

Group **200**

Specifications  
D12C



# Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to August 2000.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is believed to have a significant bearing on this manual, supplementary service bulletins will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to an S.R.T. (Standard Repair Time).

Service procedures which do not include an operation number in the title are for general information and no reference is made to an S.R.T.

The following levels of observations, cautions and warnings are used in this Service Documentation:

**Note:** Indicates a procedure, practice, or condition that must be followed in order to have the vehicle or component function in the manner intended.

**Caution:** Indicates an unsafe practice where damage to the product could occur.

**Warning:** Indicates an unsafe practice where personal injury or severe damage to the product could occur.

**Danger:** Indicates an unsafe practice where serious personal injury or death could occur.

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

**Order number: PV776-TSP142885**

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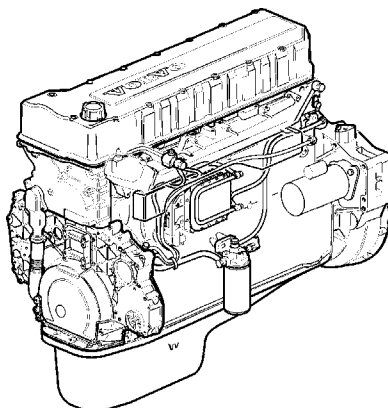
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**Feedback**

# Specifications

## Engine Designation



W2003244

Type designation .....	D12C	
Max power at 30.0 r/s (1800 rpm) <sup>1</sup>		
D12C345 .....	250 kW	(345 HP)
D12C385 .....	279 kW	(385 HP)
D12C425 .....	309 kW	(425 HP)
D12C465 .....	338 kW	(465 HP)
Max torque at 20.0 r/s (1200 rpm)		
D12C345 .....	1700 Nm	(1255 ft-lb)
D12C385 .....	1850 Nm	(1365 ft-lb)
D12C425 .....	2000 Nm	(1476 ft-lb)
D12C465 .....	2200 Nm	(1624 ft-lb)
No. of cylinders .....	6	
Cylinder diameter (bore) .....	131 mm	(5.16 in.)
Stroke .....	150 mm	(5.91 in.)
Displacement .....	12.13 l	
Compression ratio .....	18.5:1	
Firing sequence .....	1-5-3-6-2-4	
Low idle .....	8.3 - 10.8 r/s	(500 - 650 rpm)
High idle .....	34.7 ± 3.3 r/s	(2080 ± 20 rpm)
Maximum full load speed .....	31.6 r/s	(1900 rpm)
Weight of engine with flywheel, flywheel housing, without starter motor (dry) .....	1120 kg	(2465 lb)
Maximum length .....	1350 mm	(53.2 in.)
Maximum width .....	749 mm	(29.5 in.)
Maximum height .....	1153 mm	(45.4 in.)

<sup>1</sup> Net power acc. to ISO 1585. Smoke requirements of ECE reg 24 Federal Register and Swedish regulations complied with.

# Performance Curves

## Power

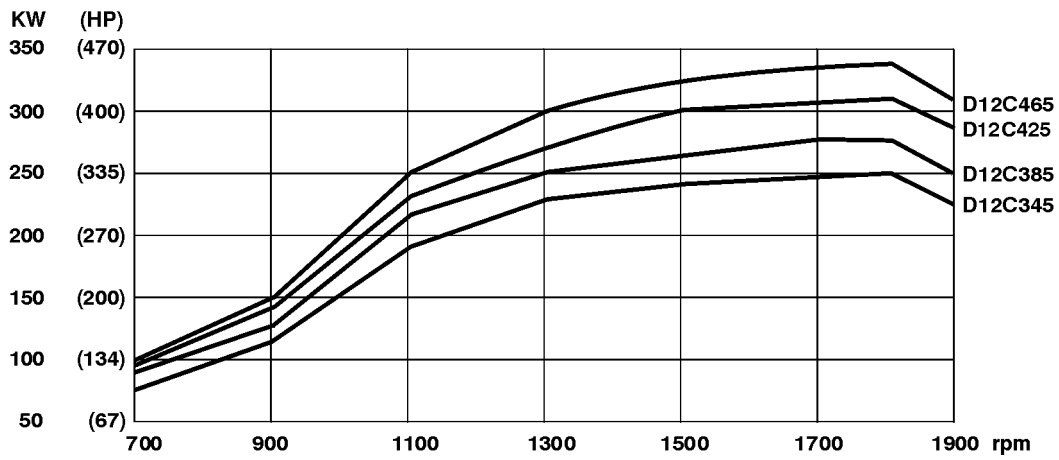


Fig. 1: D12C, power curve

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## Torque

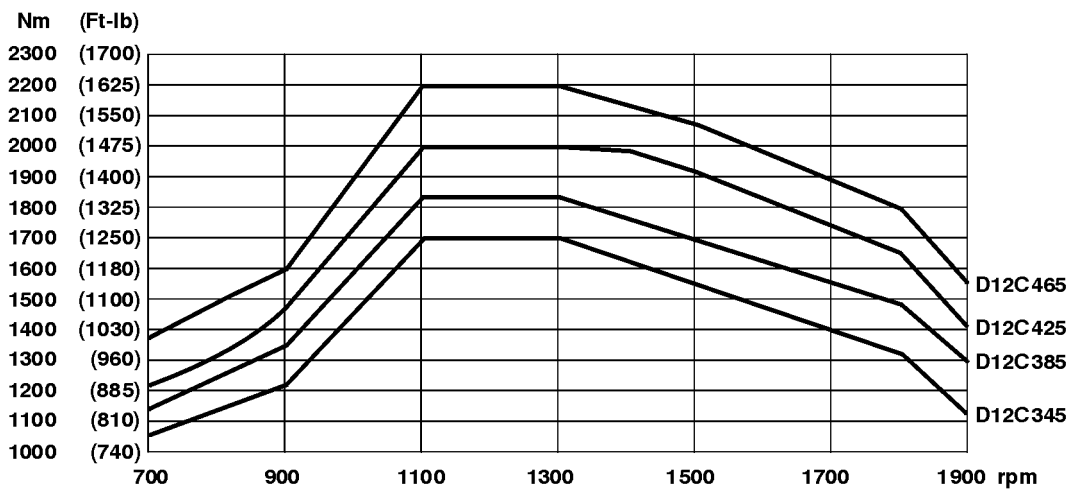


Fig. 2: D12C, torque curve

W2003458

# Engine

## Cylinder Head

Type .....	6 cyl.
Length .....	1078 mm (42.4 in.)
Width .....	397 mm (15.6 in.)
Height .....	135 mm (5.3 in.)
Max. deviation on bottom face .....	0.2 mm (0.008 in.)

## Cylinder Head Bolts

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

## Cylinder Liner

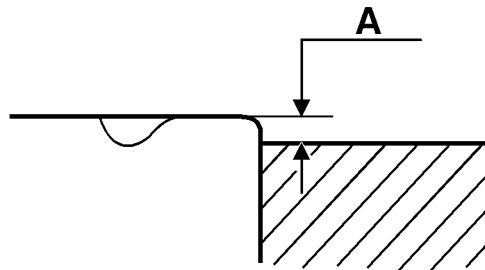


Fig. 3: D12C cylinder liner.

T2014121

Type .....	Wet, replaceable
Height of sealing surface above block plane (A) .....	0.15 - 0.21 mm (0.006 - 0.008 in.)
Variance between all cylinders .....	0.05 mm (0.002 in.)
Variance between adjacent cylinders .....	0.05 mm (0.002 in.)
Number of sealing rings per cylinder liner .....	4

## Pistons

### Height above cylinder block face:

steel piston .....	0.15 - 0.65 mm (0.006 - 0.026 in.)
aluminum piston .....	0.05 - 0.45 mm (0.002 - 0.018 in.)

### Diameter, combustion chamber:

steel piston .....	89 mm (3.50 in.)
aluminum piston .....	89 mm (3.50 in.)

### Depth, piston ball:

steel piston .....	
aluminum piston .....	17.1 mm (0.67 in.)

Number of ring grooves ..... 3

Front marking ..... arrow turned forward

Diameter, wrist pin ..... 55 mm (2.17 in.)

## Piston Rings

### Compression Rings

	Specifications	Wear Tolerances
Number .....	2	
Piston ring clearance in groove:		
upper compression ring .....	trapezoid profile	
lower compression ring, height .....	0.07 - 0.10 mm (0.003 - 0.004 in.)	
Piston ring gap measured in ring opening:		
upper compression ring .....	0.4 - 0.7 mm (0.016 - 0.028 in.)	1.0 mm (0.039 in.)
lower compression ring .....	0.8 - 1.0 mm (0.032 - 0.039 in.)	1.3 mm (0.051 in.)

### Oil Scraper Ring

Number .....	1
Piston ring clearance in groove .....	0.05 - 0.08 mm (0.002 - 0.003 in.)
Piston ring gap measured in ring opening .....	0.4 - 0.75 mm (0.016 - 0.030 in.)

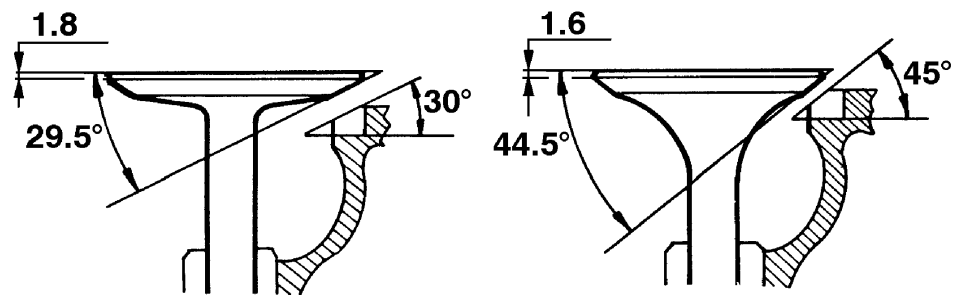


# Valve Mechanism

## Valves

Valve head diameter:	Specifications	Wear limit
Intake .....	40 ± 0.1 mm (1.6 ± 0.004 in.)	
Exhaust .....	40 ± 0.1 mm (1.6 ± 0.004 in.)	
Valve stem diameter:		
Intake .....	7.964 - 7.975 mm (0.313 - 0.314 in.)	
Exhaust .....	7.951 - 7.962 mm (0.313 - 0.314 in.)	
Valve seat angle:		
Intake .....	29.5°	
Exhaust .....	44.5°	
Valve head edge:		
Intake (new valve) .....	1.8 mm (0.07 in.)	1.4 mm (0.055 in.)
Exhaust (new valve) .....	1.6 mm (0.06 in.)	1.2 mm (0.047 in.)
Cylinder head seat angle:		
Intake .....	30°	
Exhaust .....	45°	
Clearance between valve stem and valve guide:		
Intake* .....	0.9 - 1.4 mm (0.004 - 0.055 in.)	max. 1.5 mm (0.059 in.)
Exhaust* .....	1.2 - 1.7 mm (0.047 - 0.067 in.)	max. 1.8 mm (0.071 in.)

\*With a greater distance, the valve seats must be replaced.



W2003246

Fig. 4: D12C valves.

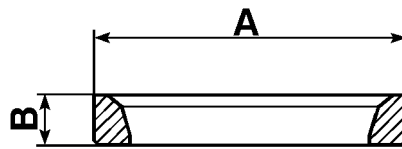
Valve clearance, cold engine, setting value

Inlet .....	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, check value

Inlet .....	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**



T2014128

Fig. 5: D12C, valve seats

Outer diameter (A), standard:

Intake .....	43.1 mm	(1.697 in.)
Exhaust .....	43.1 mm	(1.697 in.)

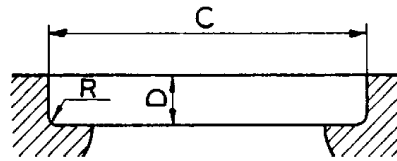
Outer diameter (A), oversize:

Intake .....	43.3 mm	(1.705 in.)
Exhaust .....	43.3 mm	(1.705 in.)

Height (B):

Intake .....	8.4 - 8.6 mm	(0.331 - 0.339 in.)
Exhaust .....	7.9 - 8.1 mm	(0.311 - 0.319 in.)

### Valve Seat Location



T2012872

Fig. 6: D12C, valve seat location

#### Diameter (C), standard:

Intake .....	43.0 mm	(1.693 in.)
Exhaust .....	43.0 mm	(1.693 in.)

#### Diameter (C), oversize:

Intake .....	43.200 - 43.225 mm	(1.701 - 1.702 in.)
Exhaust .....	43.200 - 43.225 mm	(1.701 - 1.702 in.)

#### Depth (D):

Intake .....	11.2 ± 0.1 mm	(0.441 ± 0.004 in.)
Exhaust .....	11.2 ± 0.1 mm	(0.441 ± 0.004 in.)

#### Seat bottom (R), max:

Intake .....	0.8 mm	(0.032 in.)
Exhaust .....	0.8 mm	(0.032 in.)

#### Measurement between valve disc and cylinder head face:

Intake .....	0.9 - 1.4 mm	(0.035 - 0.055 in.)
Exhaust .....	0.9 - 1.4 mm	(0.035 - 0.055 in.)

## Valve Guides

Length:	Specifications	Wear limit
Intake .....	83.2 - 83.5 mm (3.276 - 3.287 in.)	
Exhaust .....	83.2 - 83.5 mm (3.276 - 3.287 in.)	
Inner diameter:		
Intake .....	8.0 mm (0.315 in.)	
Exhaust .....	8.0 mm (0.315 in.)	
Height above cylinder head face:		
Intake .....	26.5 ± 0.4 mm (1.043 ± 0.016 in.)	
Exhaust .....	18.5 ± 0.4 mm (0.728 ± 0.016 in.)	
Clearance, valve stem—guide:		
Intake .....	0.03 ± 0.05 mm (0.0012 ± 0.0020 in.)	0.2 mm (0.008 in.)*
Exhaust .....	0.04 ± 0.06 mm (0.0016 ± 0.0024 in.)	0.2 mm (0.008 in.)*

\*With a greater distance, the valve seats must be replaced.

## Valve Springs

### Exhaust

External valve spring:

Length, unladen .....	72 - 73 mm	(2.83 - 2.87 in.)
With load of 600 Nm (135 ft-lb) .....	56 mm	(2.20 in.)
With load of 1076 Nm (242 ft-lb) .....	43 mm	(1.69 in.)
Rigid length, max. ....	41 mm	(1.61 in.)

Inner valve spring:

Length unladen .....	67 - 68 mm	(2.64 - 2.67 in.)
With load of 243 Nm (55 ft-lb) .....	52 mm	(2.05 in.)
With load of 447 Nm (100 ft-lb) .....	39 mm	(1.54 in.)
Rigid length, max. ....	36 mm	(1.42 in.)

### Intake

Length, unladen .....	72 - 73 mm	(2.83 - 2.87 in.)
With load of 600 N (135 lbf) .....	56 mm	(2.20 in.)
With load of 1076 N (242 lbf) .....	43 mm	(1.69 in.)
Rigid length, max. ....	41 mm	(1.61 in.)

# Timing Gears and Camshaft

## Timing Gears

- 1 Camshaft gear
- 2 Adjustable idler (intermediate) gear
- 3 Air compressor drive gear
- 4 Coolant pump gear
- 5 Intermediate gear
- 6 Crankshaft gear
- 7 Oil pump gear
- 8 Idler/intermediate gear
- 9 Intermediate gear
- 10 PTO gear
- 11 Fuel pump and pulley gear
- 12 Servo pump gear
- 13 Oil jet
- 14 Gasket (between upper and lower covers)
- A-C Idler gear hubs

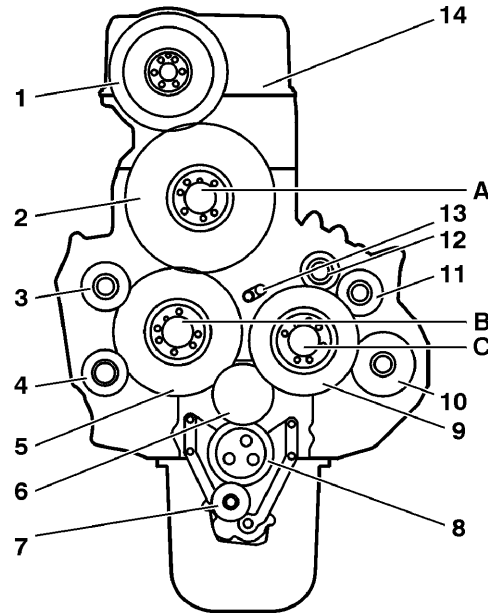


Fig. 7: D12C Timing Gears W2003325

Backlash (adjustable idler gear) .....	0.05 - 0.17 mm	(0.002 - 0.007 in.)
Axle journal for idler gear, diameter .....	99.99 ± 0.01 mm	(3.937 ± 0.0004 in.)
Bushing for idler gear, diameter .....	100.04 ± 0.01 mm	(3.939 ± 0.0004 in.)
Radial clearance for idler gear, max. diameter .....	0.03 ± 0.07 mm	(0.001 ± 0.003 in.)
Axial clearance for idler gear .....	0.07 ± 0.17 mm	(0.003 ± 0.007 in.)

Number of teeth:

Drive gear, crankshaft (6) .....	38
Idler gear, coolant pump (5) .....	83
Drive gear, coolant pump (4) .....	27
Drive gear, air compressor (3) .....	29
Drive gear, camshaft (1) .....	76
Adjustable idler gear (2) .....	97
Drive gear, servo pump (7) .....	23
Drive gear assembly, pulley and fuel pump (11) .....	27
Idler gear, hydraulic pump (9) .....	71
Drive gear, hydraulic pump (10) .....	39

## Camshaft

Check the camshaft setting, cold engine, and valve clearance = 0.

The inlet valve for no.1 cylinder must open  $1.6 \pm 0.3$  mm ( $0.063 \pm 0.001$  in.) with flywheel position at  $6^\circ \pm 0.3$  mm (0.001 in.)

During this check, the timing gear must be turned in the correct direction (clockwise, viewed from the front) to take up any backlash.

	Specifications	Wear limit
Drive .....	Gear	
Number of bearings .....	7	
Diameter, bearing pins, standard .....	70.0 mm (2.76 in.)	
Diameter, bearing pins, undersize:		
0.25 mm (0.01 in.) .....	69.720 - 69.780 mm (2.746 - 2.747 in.)	
0.50 (0.02 in.) .....	69.470 - 69.530 mm (2.735 - 2.737 in.)	
0.75 (0.03 in.) .....	69.220 - 69.280 mm (2.725 - 2.728 in.)	
Axial clearance, max. ....		0.35 mm (0.014 in.)
Radial clearance, max. ....		0.01 mm (0.0004 in.)
Valve lift:		
Intake .....	13.1 mm (0.52 in.)	0.3 mm (0.001 in.)
Exhaust (VEB engine) .....	13.1 mm (0.52 in.)	0.3 mm (0.001 in.)
Exhaust (EPG engine) .....	12.0 mm (0.47 in.)	
Unit injector, stroke .....	17 mm (0.67 in.)	

## Camshaft Bearings

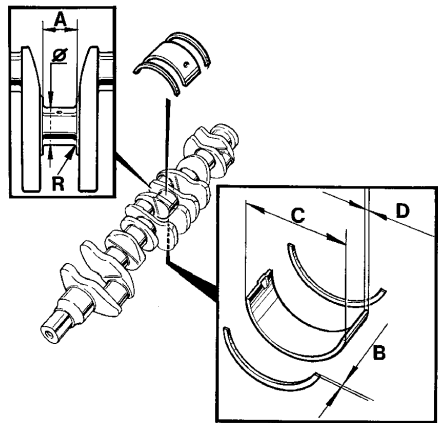
Camshaft bearing thickness, standard .....	1.9 mm (0.075 in.)
Oversize:	
0.25 mm (0.01 in.) .....	2.0 mm (0.079 in.)
0.50 mm (0.02 in.) .....	2.2 mm (0.087 in.)
0.75 mm (0.03 in.) .....	2.3 mm (0.091 in.)

# Crank Mechanism

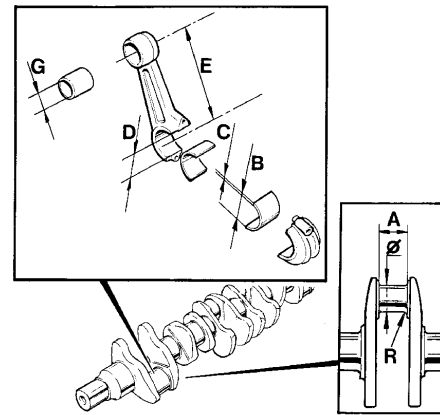
## Crankshaft

Length .....	1203 mm	(47.36 in.)
Crankshaft axial clearance (rubbed with oil) .....	0.10 - 0.40 mm	(0.0039 - 0.0158 in.)
Main bearing radial clearance (rubbed with oil) .....	0.01 - 0.15 mm	(0.0004 - 0.0059 in.)
Max. permitted out-of-round, main and connecting rod bearing journals .....	<0.08 mm	(<0.0032 in.)
Max. permitted taper, main and connecting rod bearing journals .....	<0.05 mm	(<0.0020 in.)
Max. axial clearance on crankshaft .....	<0.15 mm	(<0.0059 in.)

## Main Bearing Journals



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Fig. 8: D12C, main bearing journals

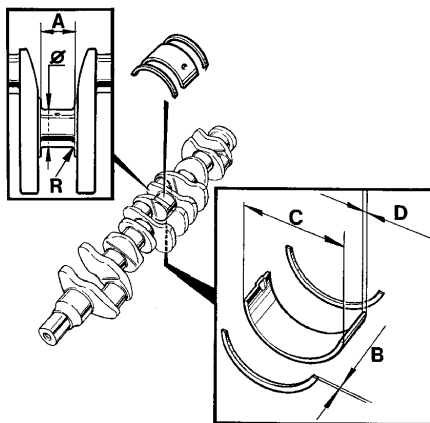
Diameter for machining ( $\varnothing$ ), standard .....	108.0 mm	(4.25 in.)
Undersize:		
0.25 mm (0.01 in.) .....	107.73 - 107.75 mm	(4.2413 - 4.2421 in.)
0.50 mm (0.02 in.) .....	107.48 - 107.50 mm	(4.2315 - 4.2323 in.)
0.75 mm (0.03 in.) .....	107.23 - 107.25 mm	(4.2216 - 4.2224 in.)
1.00 mm (0.04 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.), thrust bearing 0.1 mm (0.004 in.) .....	47.175 - 47.225 mm	(1.8573 - 1.8593 in.)
0.4 mm (0.016 in.), thrust bearing 0.2 mm (0.008 in.) .....	47.375 - 47.425 mm	(1.8652 - 1.8671 in.)
0.6 mm (0.024 in.), thrust 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.)



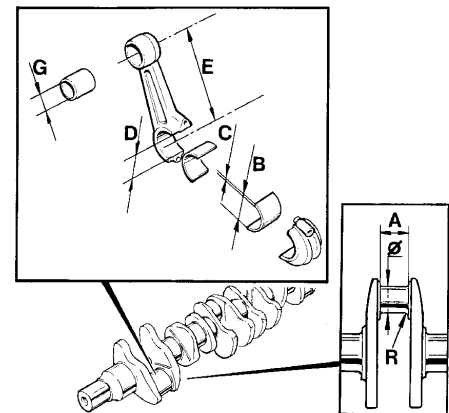
## Main Bearing Shells

Type .....	Replaceable	
Outer diameter (C) .....	113.0 mm	(4.445 in.)
Thickness (D), standard .....	2.5 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 - 0.110 in.)
0.75 mm (0.03 in.) .....	2.8 - 2.9 mm	(0.110 - 0.114 in.)
1.00 mm (0.04 in.) .....	2.9 - 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)



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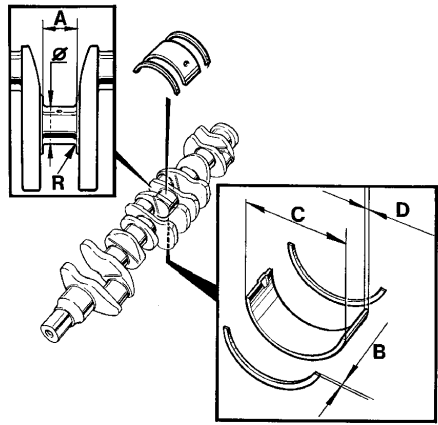


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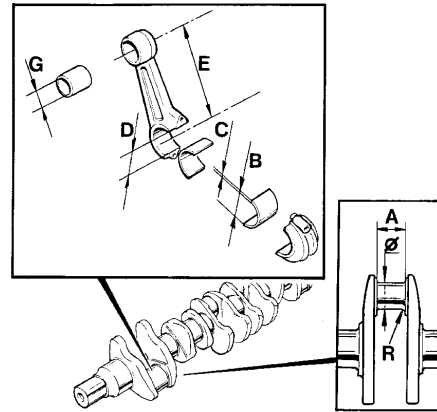
Fig. 9: D12C, axial bearings and bearing shells

Width (B), standard .....	3.1 - 3.2 mm	(0.122 - 0.126 in.)
Oversize:		
0.1 mm (0.004 in.) .....	3.2 - 3.3 mm	(0.126 - 0.130 in.)
0.2 mm (0.008 in.) .....	3.3 - 3.4 mm	(0.130 - 0.134 in.)
0.3 mm (0.012 in.) .....	3.4 - 3.5 mm	(0.134 - 0.138 in.)

# Connecting Rods



T2012873



T2012874

Fig. 10: D12C, connecting rods

Length (E), center .....	260 mm	(10.236 in.)
Marking:		
Connecting rod resp cap* .....	1 - 6	
"FRONT" on rod turned .....	Forward	
Connecting rod bushing bore (G) .....	55 mm	(2.165 in.)
Axial clearance, connecting rod — crankshaft** .....	<0.25 mm	(<0.0059 in.)
Connecting rod bearing, radial clearance** .....	<0.10 mm	(<0.0039 in.)
Straightness max. deviation on a measuring length of 100 m (330 ft) .....	0.06 mm	(0.0024 in.)
Warp, max. deviation on a measuring length of 100 m (330 ft) .....	0.15 mm	(0.0059 in.)

\* With marking faces to each other.

\*\* Measurements concern detail rubbed with oil.

## Connecting Rod Bearing Pins

Diameter for machining (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 - 0.0945 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 - 0.1091 in.)
1.00 mm (0.04 in.) .....	2.89 - 2.90 mm	(0.1138 - 0.1142 in.)
1.25 mm (0.05 in.) .....	3.01 - 3.02 mm	(0.1185 - 0.1189 in.)
Diameter, bearing shell bearing seat (D) .....	96.84 - 96.85 mm	(3.8126 - 3.8130 in.)

## Flywheel

Max permitted axial runout (manual transmission) measurement radius 150 mm (6 in.) .....	<0.20 mm	(<0.008 in.)
No. of teeth on starter ring gear .....	153	
Sensor groove in flywheel .....	3 x 18	

## Flywheel Housing, Installed

Max. permitted axial runout for mating surface against clutch housing. ....	<0.20 mm (<0.008 in.)
Max. permitted axial runout for location against clutch housing .....	<0.25 mm (<0.010 in.)

## Lubrication and Oil System

### Oil

Refer to:

**Service Bulletin** 175-001SB  
*Oil and Filter Change Intervals for VOLVO Components*

**IMPACT** Function Group: 175  
Information Type: Service and Maintenance  
"Oil"

### Oil Pressure

Running speed 1100 rpm or higher .....	300 - 550 kPa	(45 - 80 psi)
Idling, min. ....	150 kPa	(22 psi)

### Oil Pressure, Rocker Shaft

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

### Oil Pump

Type .....	Gear driven	
Number of teeth:		
drive gear .....	23	
idler gear .....	44	
Diameter:		
hub, idler gear .....	69.99 ± 0.01 mm	(2.7555 ± 0.0004 in.)
bushing, idler gear .....	70.04 ± 0.02 mm	(2.7575 ± 0.0008 in.)
Axial clearance:		
drive gear, pump .....	0.11 mm	(0.0043 in.)
idler 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 Filters

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

## Oil Valves

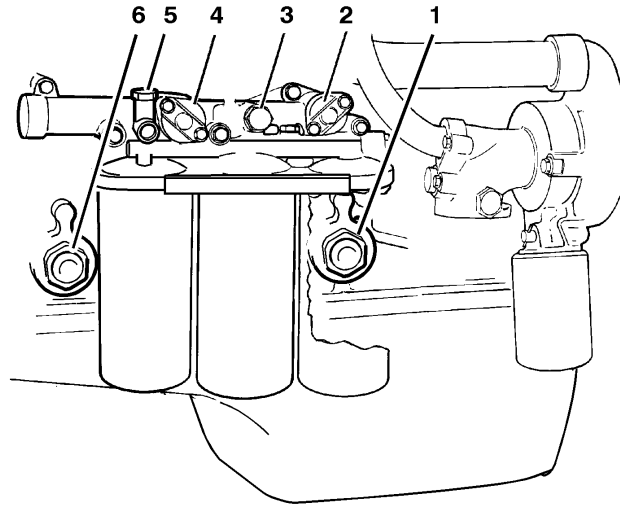


Fig. 11: D12C oil valves

T2012843

### 1. Safety valve

Marking .....	Yellow
---------------	--------

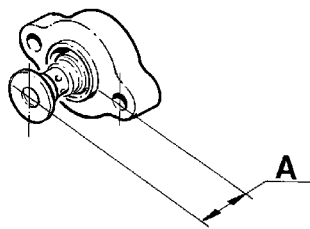


Fig. 12: D12C, oil cooler thermostatic valve (discontinued)

T2012844

A Length (see below)

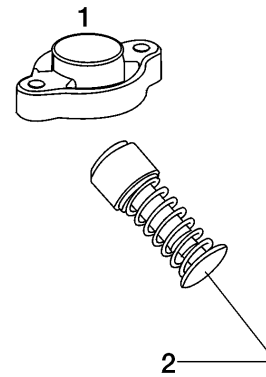


Fig. 13: D12C, oil cooler pressure valve

W2003487

1	Valve
2	Position for marking; marked "124" for D12C

**2. Thermostatic valve, oil cooler**

Length (A); see Fig. 12: D12C, oil cooler thermostatic valve (discontinued), page 19 ..... 40.1 ± 0.5 mm (1.58 ± 0.02 in)

**Note:** The thermostatic valve has been replaced by a pressure valve (see Fig. 13: D12C, oil cooler pressure valve, page 19).

**3, 5. Bypass valve, oil filter full flow/bypass**

Free length ..... 68.8 mm (2.71 in.)

Loaded with 13 - 15 Nm (9.6 - 11 ft-lb) ..... 40.0 mm (1.57 in.)

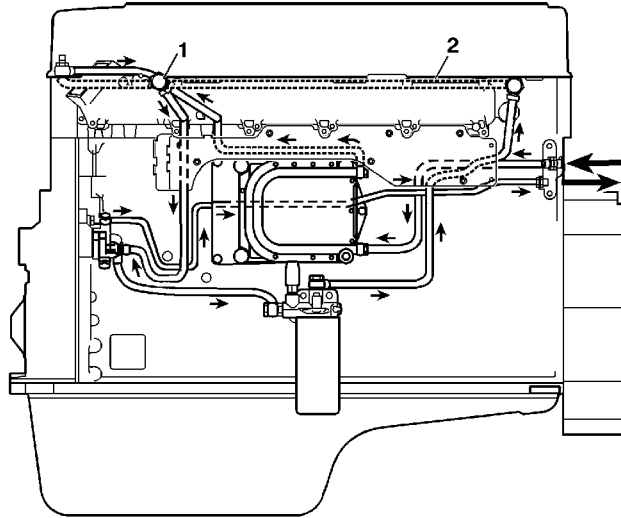
**4. Piston cooling valve**

Marking ..... Orange

**6. Reduction valve**

Marking ..... Blue

# Fuel System

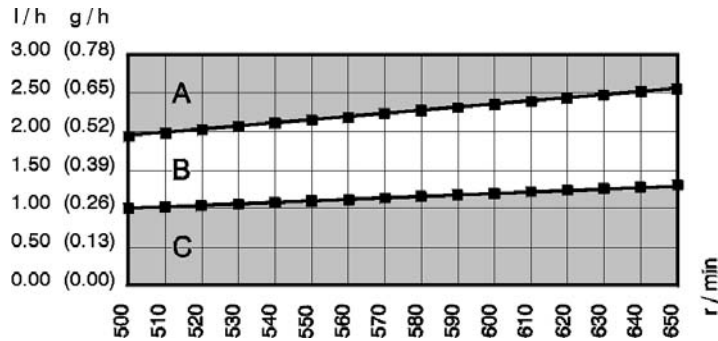


W2003243

Fig. 14: D12C, fuel system

- 1. Bypass valve
- 2. Fuel duct in cylinder head

# Fuel Quantity



W2003250

Fig. 15: D12C fuel consumption

At low idle or with the engine unloaded, the fuel volume should lie within area B. The vehicle must have been run in for at least 30,000 km (18,750 miles).

# Fuel Pump

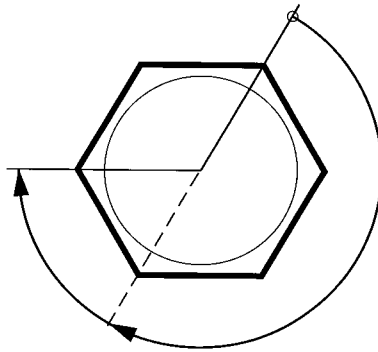
Feed pressure at 1000 rpm, min. .... 350 kPa (50 psi)

Feed pressure at full load, min. .... 350 kPa (50 psi)

# Bypass Valve

Opening pressure ..... 300 - 350 kPa (43 - 50 psi)

# Unit Injector



T2008541

Fig. 16: D12C unit injector adjustment screw

Tighten the adjustment screw to zero clearance against the camshaft, then turn it another 3-4 spanner flats.

Type .....	D12C	
Preload (setting with gauge block) .....	68.9 ± 0.1 mm	(2.71 ± 0.004 in)



## Intake and Exhaust System

### Turbocharger

End float, turbine wheel shaft (max.):

Holset HX55 (465HP only) .....	0.105 mm	(0.004 in.)
Garrett GT45 (345HP, 385HP, 425HP) .....	0.119 mm	(0.005 in.)

## Measurement of Charge Pressure

### Measurement When Driving

Accelerator on floor and vehicle with maximum load

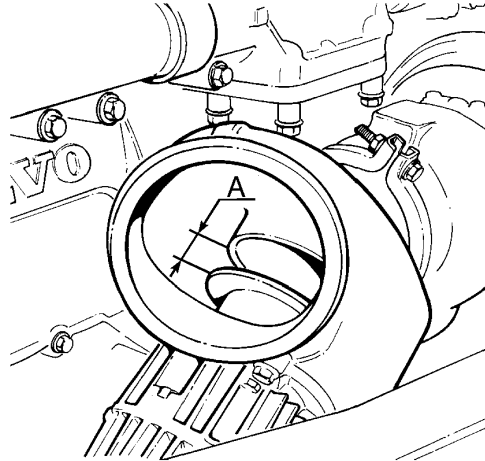
	Voltage, sensor	Pressure	
Charge pressure, lowest permissible			
1200 rpm .....	1.86 V	162 kPa	(23.5 psi)
1400 rpm .....	2.06 V	180 kPa	(26.2 psi)
1600 rpm .....	2.11 V	185 kPa	(26.8 psi)
1800 rpm .....	2.08 V	182 kPa	(26.4 psi)

## Measurement of Response Time

Response time

1200 rpm .....	2.5 s
1400 rpm .....	1.9 s
1600 rpm .....	1.6 s
1800 rpm .....	1.3 s

## Exhaust Pressure Governor



T2013094

Fig. 17: D12C exhaust pressure governor (EPG)

EPG travel (A), min .....	29 mm	(1.14 in.)
Air valve, pressure for keeping warm .....	200 ± 30 kPa	(29 ± 4 psi)
Pressure during exhaust retarding .....	750 ± 30 kPa	(109 ± 4 psi)

## Exhaust Back Pressure

Exhaust back pressure, (EPG not activated) max .....	15 kPa	(2.2 psi)
--	--------	-----------

## Air Filter Restriction Indicator

Level for indication (vacuum) .....	500 mm VP	(20 in. VP)
-------------------------------------	-----------	-------------

## Cooling System

Pressure cap opens at .....	75 kPa	(10.9 psi)
Capacity, cooling system:*		
Autocar .....	49.2 l	(13 gal)
WG .....	42.3 l	(11.2 gal)
VN .....	39 l	(9.8 gal)
VHD .....	39 l	(9.8 gal)

\*Capacity is approximate and depends on cab configuration.

## Coolant

Refer to:

Information Type: Maintenance  
"Coolant"

**Service Information** 184-001  
*Coolant Requirements, Volvo Engines*

**IMPACT** Function Group 184

## Fan

Speed, engaged (at 1800 rpm)

Fan pulley diameter 167 mm (6.58 in.) .....	2400 rpm
Fan pulley diameter 188 mm (7.40 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

## Thermostat

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

## Engine Control

### Sensors

		Distance
Camshaft .....	0.3 - 1.0 mm	(0.012 - 0.040 in.)
Flywheel .....	0.75 - 2.1 mm	(0.030 - 0.085 in.)

## Tightening Torques and Patterns

### Tightening Specifications, Group 20

<b>General tightening torques, Group 20</b>	<b>Nm</b>	<b>ft-lb</b>
M6 standard screws 8.8 .....	10 ± 1.5	7.4 ± 1
M8 standard screws 8.8 .....	24 ± 4	18 ± 3
M10 standard screws 8.8 .....	48 ± 8	35 ± 6
M12 standard screws 8.8 .....	85 ± 15	63 ± 11
M14 standard screws 8.8 .....	140 ± 25	103 ± 18

## Tightening Specifications, Group 21

### Special tightening torques, Group 21

	Nm	ft-lb	Angle tightening
Front engine mounting, cylinder block (M14) .....	175 ± 20	129 ± 15	
Front engine mounting, cross member (M12) .....	85 ± 15	63 ± 11	
Rear engine mounting, flywheel housing (M16) .....	245 ± 36	181 ± 27	
Rear engine mounting, rubber pad:			
Stage 1 .....	170 - 180	125 - 133	
Stage 2 .....	255 ± 38	188 ± 28	
Main bearings:			
Stage 1 .....	150 ± 20	110 ± 15	
Stage 2 .....			120 ± 5°
Stiffening frame (see Fig. 18: D12C stiffening frame, tightening sequence, page 28):			
Stage 1 .....	48 ± 8	36 ± 6	
Stage 2 .....	15	11	90 ± 5°
Connecting rod bearings .....	275 ± 15	205 ± 10	
Screw, piston cooling nozzle .....	24 ± 4	18 ± 3	
Flywheel (see Fig. 19: D12C flywheel, tightening sequence, page 29) .....	245 $^{+25}_{-0}$	180 $^{+18}_{-0}$	
Flywheel housing .....	140 ± 14	105 ± 10	
Vibration damper (see Fig. 20: D12C vibration damper, tightening sequence, page 29):			
Stage 1 (without washer A) .....	35 ± 5	26 ± 4	
Stage 1 (with washer A) .....	20 ± 3	15 ± 2	
Stage 2 .....			90 ± 5°
Valve cover (see Fig. 21: D12C valve cover, tightening sequence, page 30) .....	20 ± 2	15 ± 1.5	
Stud, valve cover .....	40 ± 3	29 ± 2	
Cooling duct cover (see Fig. 31: D12C cooling duct cover, tightening sequence, page 39)			
Cylinder head (see Fig. 22: D12C cylinder head, tightening sequence, page 30):			
Stage 1 .....	60 ± 10	44 ± 7	
Stage 2 (check tightening) .....	60 ± 10	44 ± 7	
Stage 3 .....			90 ± 5°
Stage 4 .....			90 ± 5°
Core plugs, cylinder head (M38 x 1.5) .....	60 ± 10	44 ± 7	
Lock nut, valve adjustment screw .....	38 ± 4	28 ± 3	

**Special tightening torques, Group 21**

Screws for camshaft bearing caps must be tightened in 5 stages (see Fig. 23: D12C bearing caps and camshaft/rocker shaft, tightening sequence, page 31).

**Note:** In stage 4, the marked screws must be loosened before stage 5 is done. Also, if the rocker shaft has been loosened or has been removed, only the screws holding the shaft should be tightened as in the schedule.

Camshaft, toothed wheel:

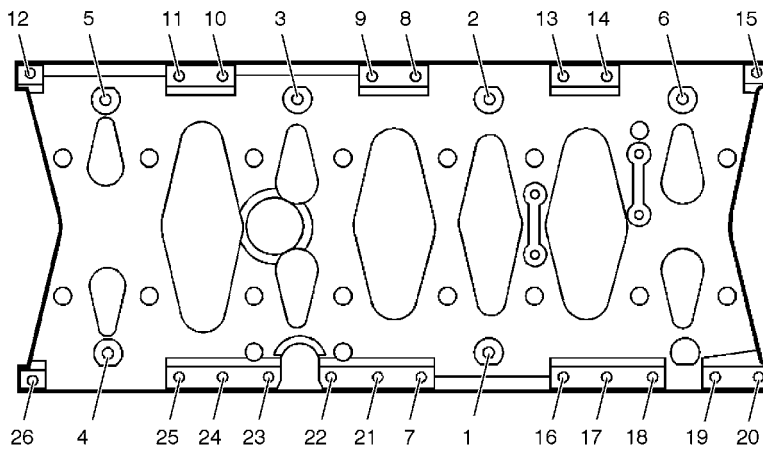
	Nm	ft-lb	Angle tightening
Stage 1 .....	35 ± 3		
Stage 2 .....			90 ± 5°
Valve timing gear plate (see Fig. 24: D12C timing gear plate, tightening sequence, page 32) .....	34 ± 4	25 ± 3	
Valve timing gear plate, upper (see Fig. 25: D12C timing gear cover (upper), tightening sequence, page 33).			
Valve timing gear plate, lower (see Fig. 26: D12C timing gear cover (lower), page 34			
Valve timing gear, including toothed wheel (see Fig. 27: D12C gear train, tightening sequence, page 35).			

Drain plug, oil pan ..... 60 ± 15      44 ± 11

Engine oil pan  
(see Fig. 28: D12C oil pan, tightening sequence, page 36) ..... 24 ± 4      18 ± 3

**Note:** First tighten the highlighted screws before tightening the other screws.

**Stiffening Frame**



T2014149

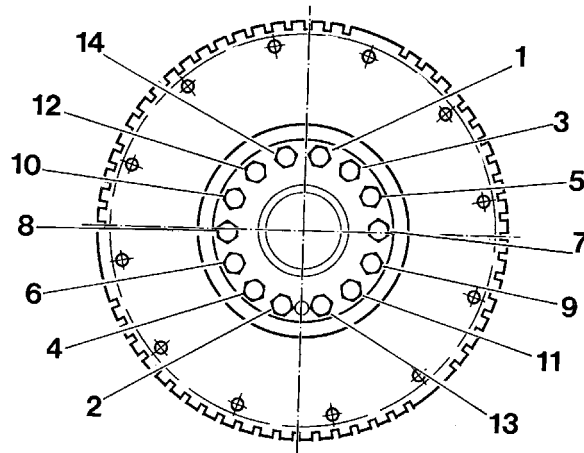
Fig. 18: D12C stiffening frame, tightening sequence

All screws must be tightened according to Stage 1, before tightening according to Stage 2:

**Stage 1**      Tighten screws 1–6 in numerical sequence.

**Stage 2**      Tighten screws 7–26 in numerical sequence.

## Flywheel

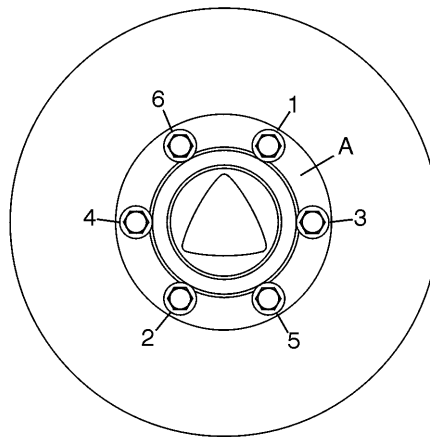


T2006973

Fig. 19: D12C flywheel, tightening sequence

The flange must be dry and clean.

## Vibration Damper



T2014027

Fig. 20: D12C vibration damper, tightening sequence

Screws for the vibration damper must be tightened in numerical sequence. All screws must be tightened according to Stage 1, before they are tightened according to Stage 2.

**Note:** These 8.8 screws must NOT be reused if they have been tightened with torque and angle.

### Valve Cover

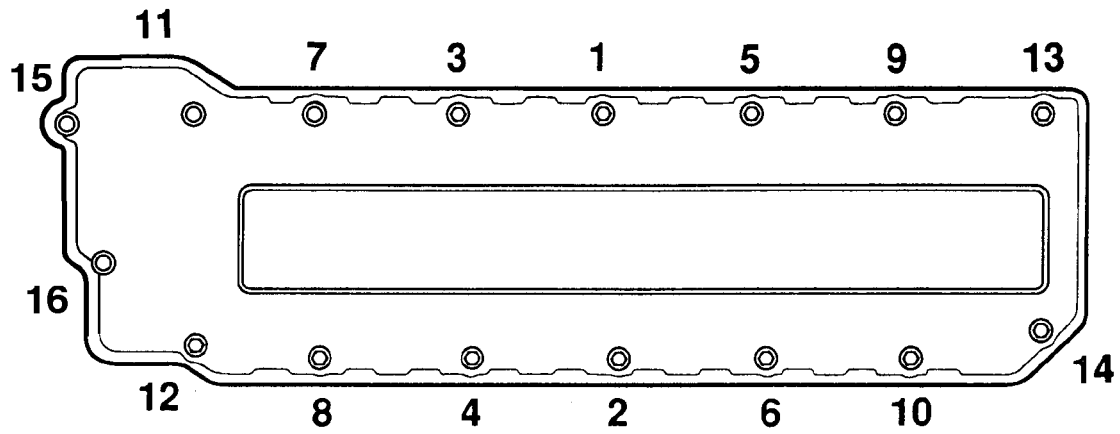


Fig. 21: D12C valve cover, tightening sequence

T2012845

### Cylinder Head

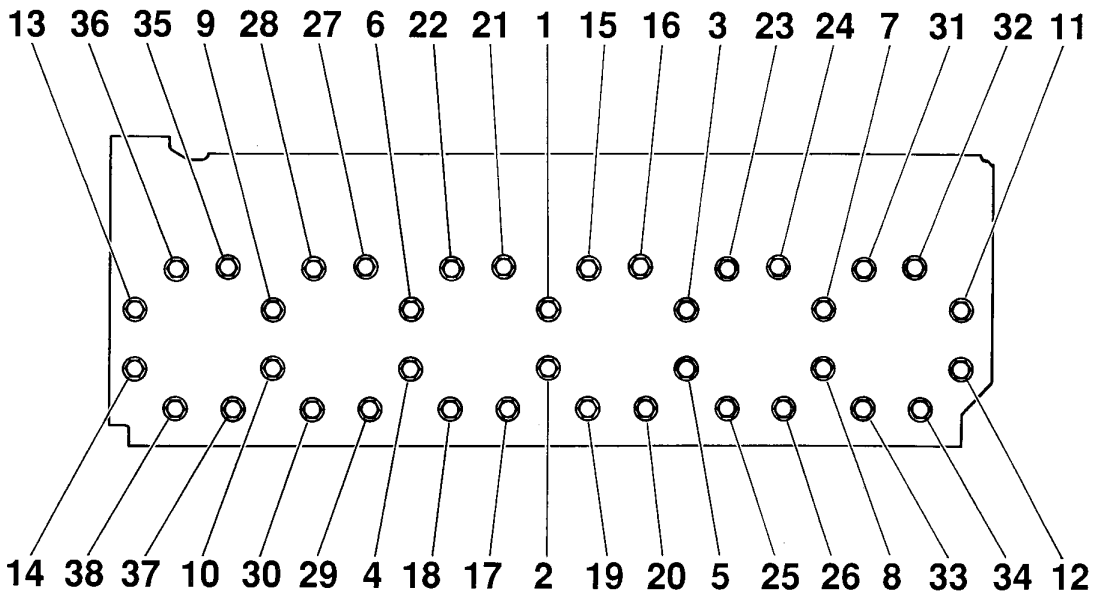
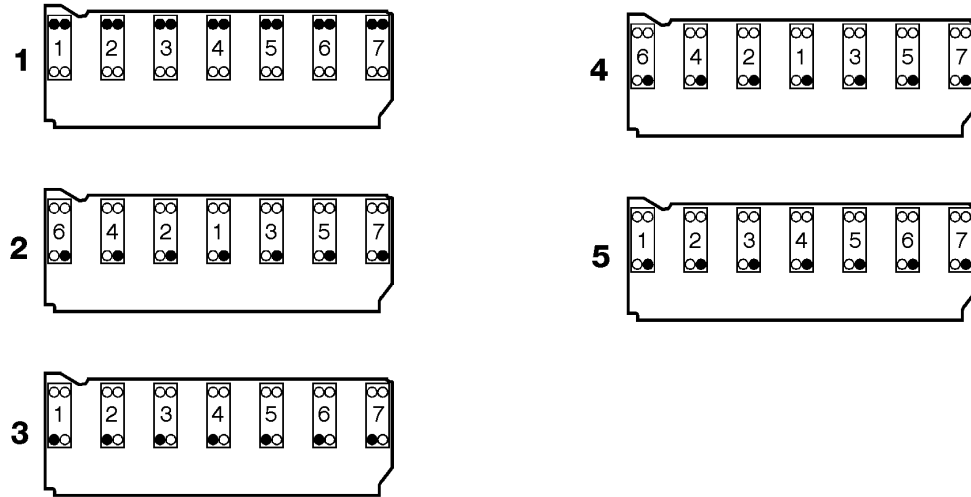


Fig. 22: D12C cylinder head, tightening sequence

T2007004



## Bearing Caps, Camshaft/Rocker Shaft



W2003247

Fig. 23: D12C bearing caps and camshaft/rocker shaft, tightening sequence

- 1  $15 \pm 5$  Nm ( $11 \pm 4$  ft-lb);  $90 \pm 5^\circ$
- 2  $60 \pm 5$  Nm ( $44 \pm 4$  ft-lb)
- 3  $15 \pm 5$  Nm ( $11 \pm 4$  ft-lb);  $120 \pm 5^\circ$
- 4 60 Nm (44 ft-lb) to 0 Nm (0 ft-lb)
- 5  $15 \pm 5$  Nm ( $11 \pm 4$  ft-lb);  $120 \pm 5^\circ$

# Timing Gear Plate

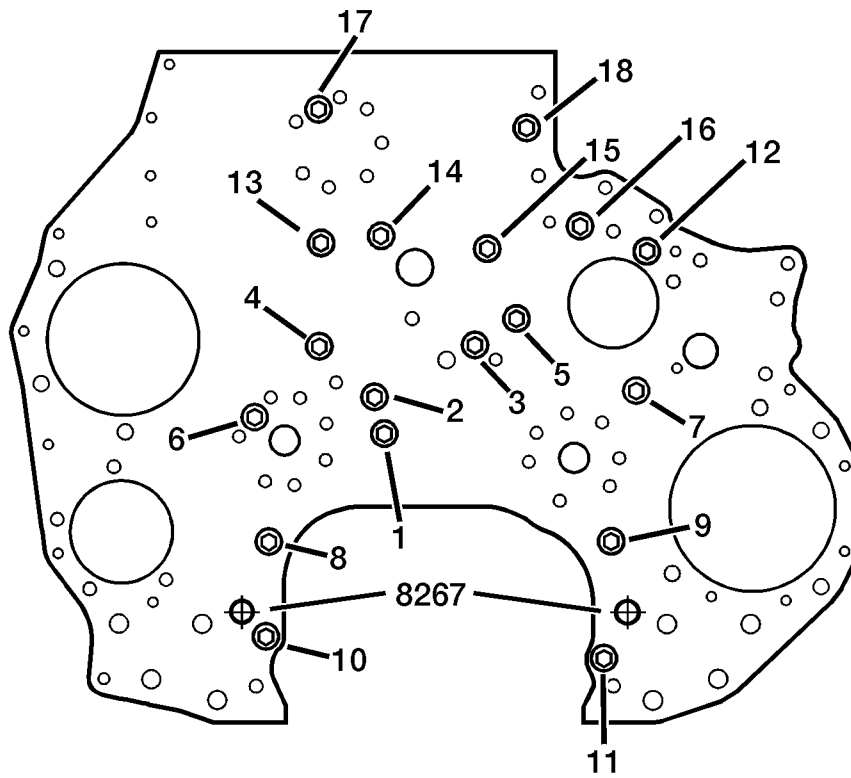


Fig. 24: D12C timing gear plate, tightening sequence

W2003462

1-18

34 ± 4 Nm (24 ± 3 ft-lb)

## Timing Gear Cover (Upper)

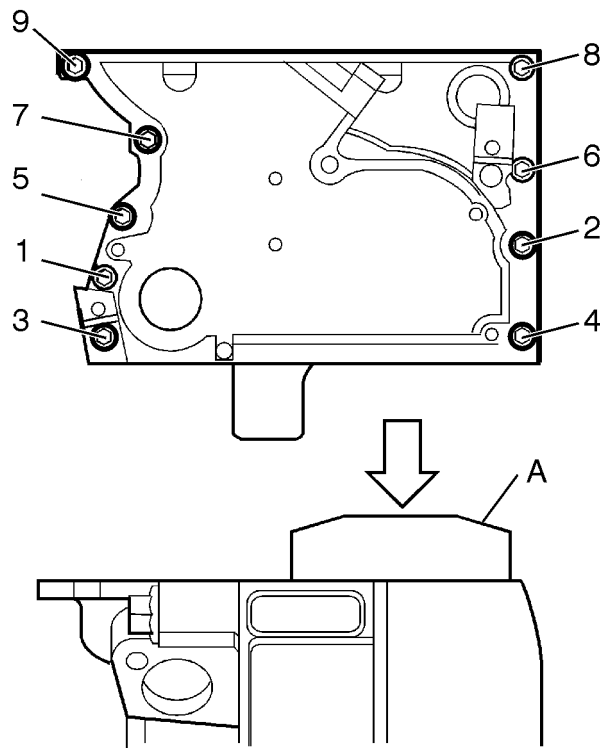


Fig. 25: D12C timing gear cover (upper), tightening sequence T2014150

When the timing gear cover (upper) is installed, the top section must be flush with the cylinder head. Press the timing gear cover down with jig A.

## Timing Gear Cover (Lower)

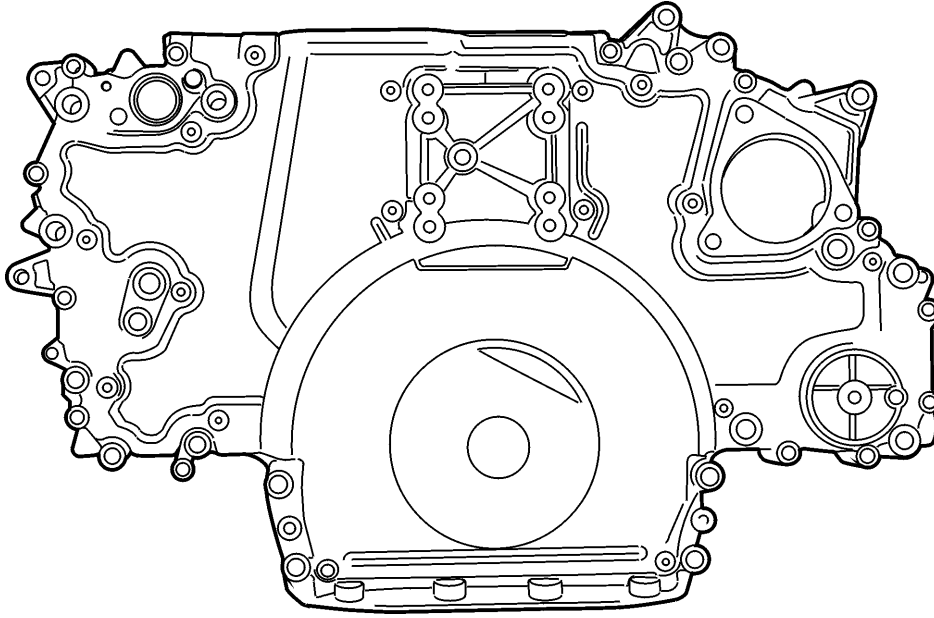
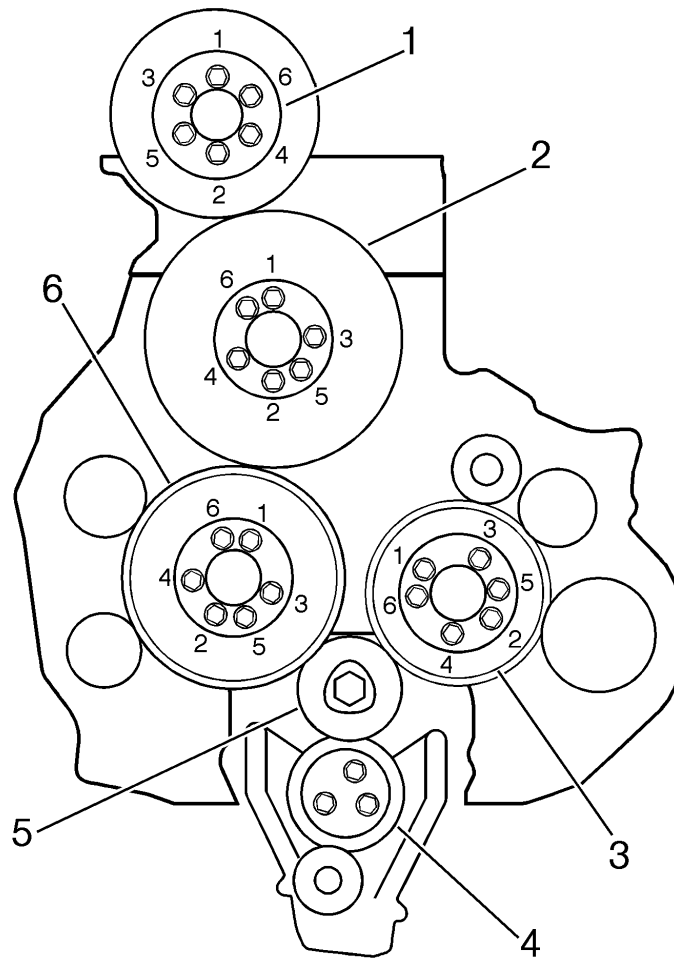


Fig. 26: D12C timing gear cover (lower)

W2003326

## Gear Train



W2003248

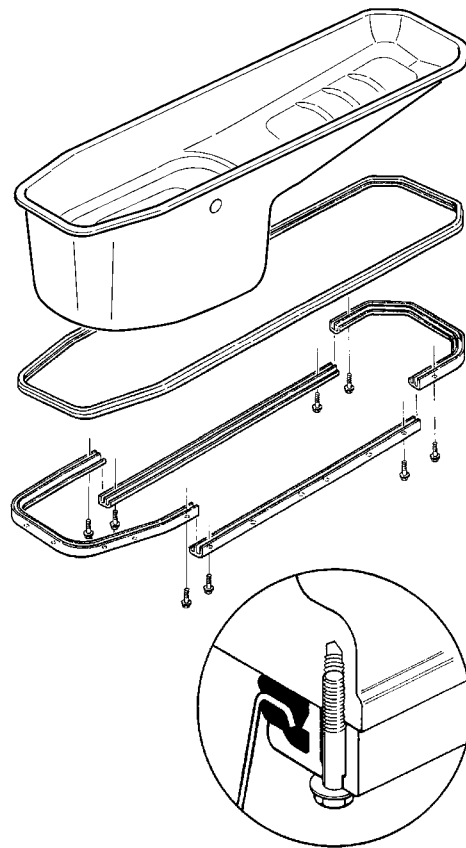
Fig. 27: D12C gear train, tightening sequence

- |   |   |
|---|---|
| 1 | $35 \pm 3 \text{ Nm}$ ( $26 \pm 2 \text{ ft-lb}$ ); $90 \pm 5^\circ$  |
| 2 | $15 \pm 3 \text{ Nm}$ ( $11 \pm 2 \text{ ft-lb}$ ); $120 \pm 5^\circ$ |
| 3 | $15 \pm 3 \text{ Nm}$ ( $11 \pm 2 \text{ ft-lb}$ ); $120 \pm 5^\circ$ |
| 4 | $24 \pm 4 \text{ Nm}$ ( $18 \pm 3 \text{ ft-lb}$ )                    |
| 5 | $645 \pm 25 \text{ Nm}$ ( $476 \pm 18 \text{ ft-lb}$ )                |
| 6 | $15 \pm 3 \text{ Nm}$ ( $11 \pm 2 \text{ ft-lb}$ ); $120 \pm 5^\circ$ |

## Tightening Specifications, Group 22

Special tightening torques, Group 22	Nm	ft-lb	Angle tightening
Bracket, oil pump/bearing cap .....	24 ± 4	18 ± 3	
Oil strainer, locator screws on pump .....	27 ± 4	20 ± 3	
Oil nozzles in timing gear .....	33 ± 4	24 ± 3	
Oil cooler, locator screws .....	27 ± 4	20 ± 3	

## Oil Pan



W2003249

Fig. 28: D12C oil pan, tightening sequence

Tighten the screws indicated in the illustration before tightening the other screws.

## Tightening Specifications, Group 23

<b>Special tightening torques, Group 23</b>	<b>Nm</b>	<b>ft-lb</b>	<b>Angle tightening</b>
<b>Screw, locator yoke, unit injector (new copper sleeve)</b>			
First tightening			
Stage 1 .....	20 ± 5	15 ± 4	
Stage 2 .....			180 ± 5°
Undo the unit injector fixing yoke screw before the second tightening			
Second tightening			
Stage 1 .....	20 ± 5	15 ± 4	
Stage 2 .....			60 ± 5°
<b>Screw, locator yoke, unit injector (old copper sleeve)</b>			
Stage 1 .....	20 ± 5	15 ± 4	
Stage 2 .....			60 ± 5°
Lock nut for adjustment screw, unit injector .....	52 ± 4	38 ± 3	
Nut, electrical connector, unit injector .....	1.4	1.0	

# Tightening Specifications, Group 25

Special tightening torques	Nm	ft-lb	Angle tightening
Exhaust manifold (see Fig. 29: Exhaust manifold, tightening sequence, page 38 or Fig. 30: Exhaust manifold (new style), tightening sequence, page 38)	52 ± 4	38 ± 3	
Exhaust back pressure regulator/turbine housing (M8 x 25)	24 ± 2	18 ± 1.5	
Control valve (VEB)	20 ± 3	15 ± 2	
Inlet pipe	24 ± 2	18 ± 1.5	

## Exhaust Manifold

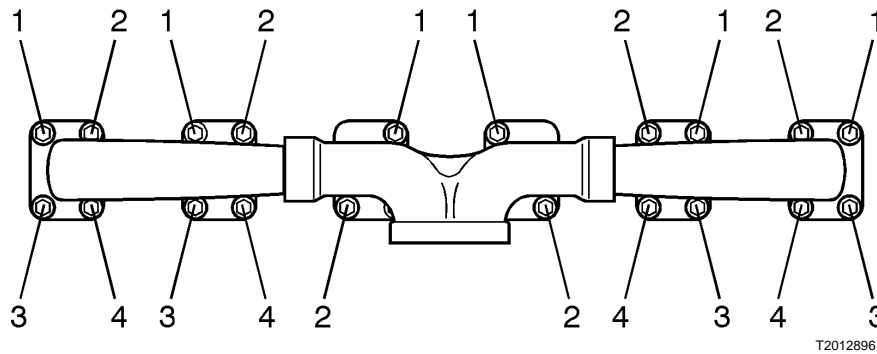


Fig. 29: Exhaust manifold, tightening sequence

- Stage 1. Torque bolts 1 to max. 10 Nm (7.4 ft-lb).
- Stage 2. Torque bolts 2 to max. 10 Nm (7.4 ft-lb).
- Stage 3. Torque bolts 3 to 52 ± 4 Nm (38 ± 3 ft-lb).
- Stage 4. Torque bolts 2 to 52 ± 4 Nm (38 ± 3 ft-lb).
- Stage 5. Torque bolts 4 to 52 ± 4 Nm (38 ± 3 ft-lb).
- Stage 6. Torque bolts 1 to 52 ± 4 Nm (38 ± 3 ft-lb).

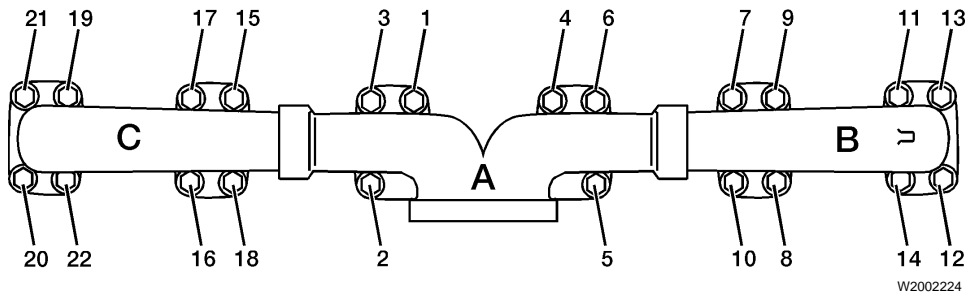


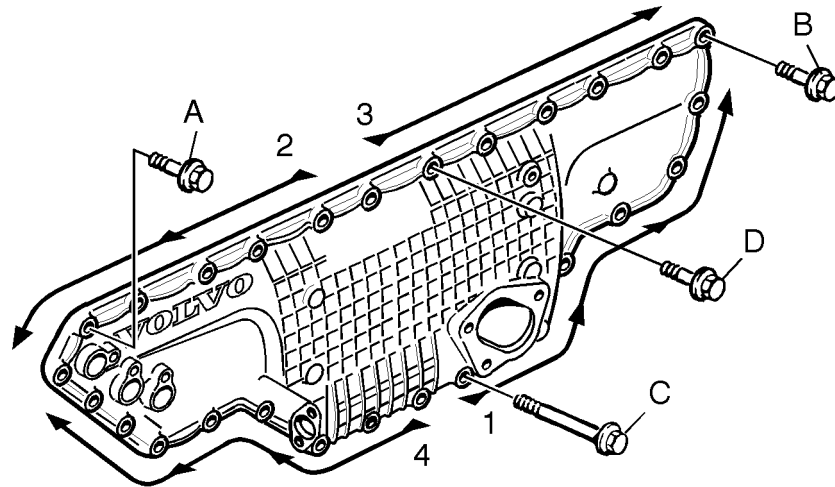
Fig. 30: Exhaust manifold (new style), tightening sequence

- Stage 1. Align all manifold sections onto cylinder head, starting with Section A.
- Stage 2. Hand tighten bolts, starting with Section A, then B and C.
- Stage 3. Torque bolts in Section A, then B and C, to 25 Nm (18 ft-lb).
- Stage 4. Torque bolts in Section A, then B and C, to 52 ± 4 Nm (38 ± 3 ft-lb).
- Stage 5. Start engine and run it to operating temperature.
- Stage 6. Verify torque at 52 ± 4 Nm (38 ± 3 ft-lb).



## Tightening Specifications, Group 26

### Cooling Duct Cover



T2014088

Fig. 31: D12C cooling duct cover, tightening sequence

Always use locating pins when assembling the cover on the engine.

- 1 Install screws A and B for alignment.
- 2 Tighten screws C and D.
- 3 Tighten screws of the cover in numerical sequence (1–4) from the middle and outward.
- 4 Check turn screws C and D.





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