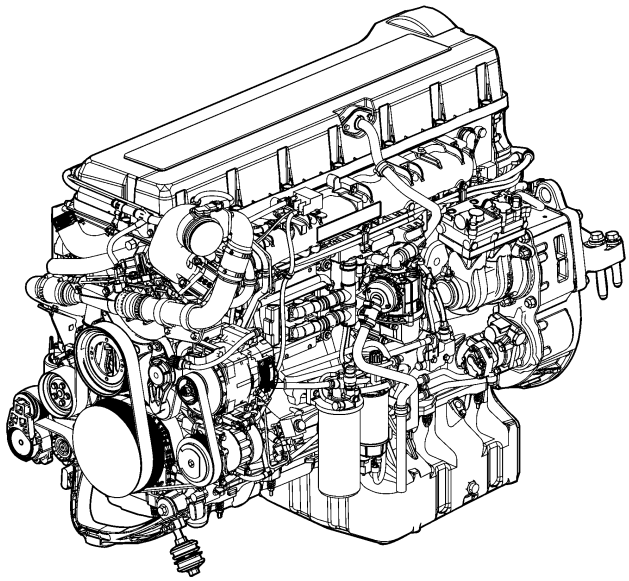
Valves and Unit Injectors, Adjustment



W2005773

This information covers the correct procedure for adjusting the valves and unit injectors on the Volvo D16F engine.

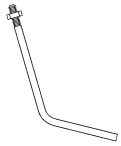
Contents

Note: Information is subject to change without notice.
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

Tools

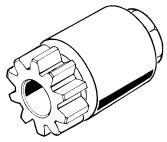
Special Tools

For special tools ordering instructions, refer to Tool Information, group 08.

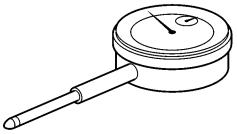


W0002414

85111493
Dial Indicator Extension

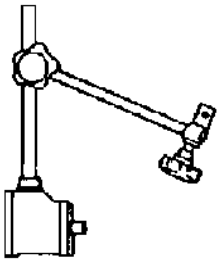


88800014
Flywheel Turning Tool



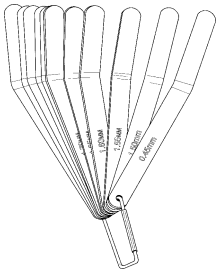
T0010788

9989876
Dial Indicator



W0001790

9999696
Magnetic Base



85111377
Feeler Gauge Set

Service Procedures

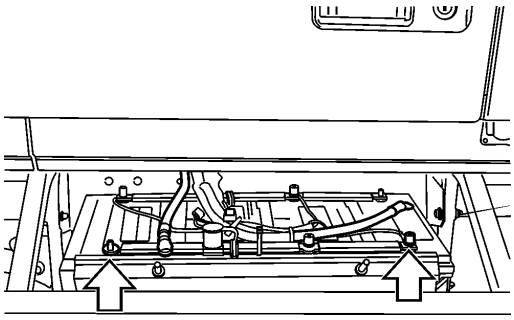
2140-05-02-03
Valves and Unit Injectors, Adjustment

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Special tools: 85111493, 88800014, 9989876, 9999696, 85111377

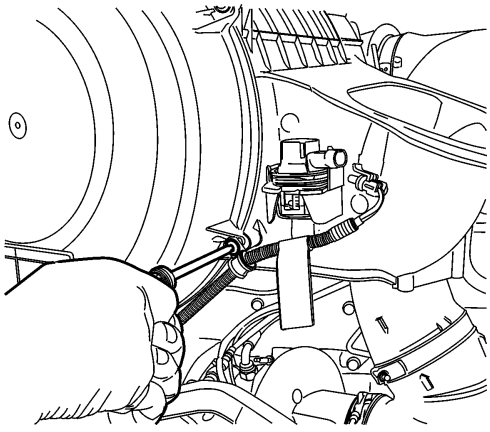
1
Apply the parking brake and place the shift lever in neutral.

2
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

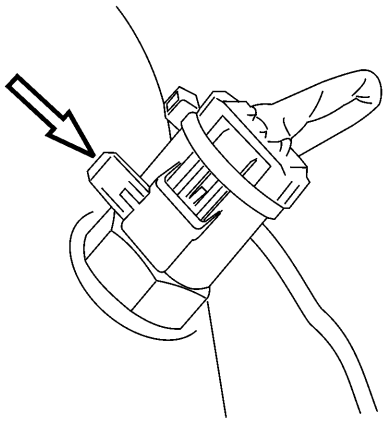


W2003815

3
Disconnect and remove the air filter restriction gauge wiring harness from air filter housing.

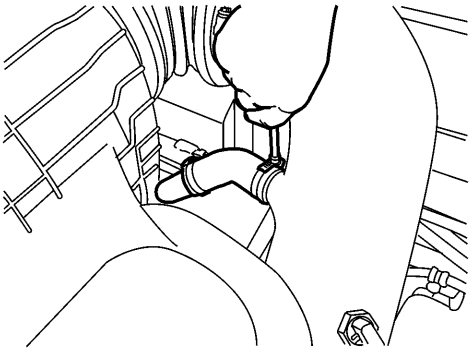


W2003861



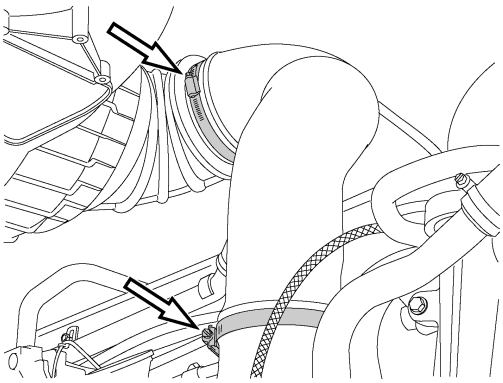
W2004720

4
Unplug the air temperature sensor wiring harness connector. Remove the lock tab and separate the connector from the sensor. Remove the sensor harness clamp from the main fresh air pipe.



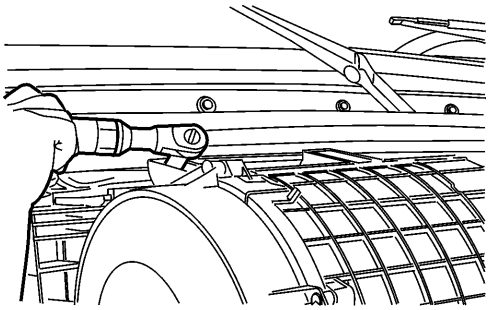
W2004719

5
Loosen the hose clamp and disconnect the air compressor air inlet pipe from the main fresh air pipe.



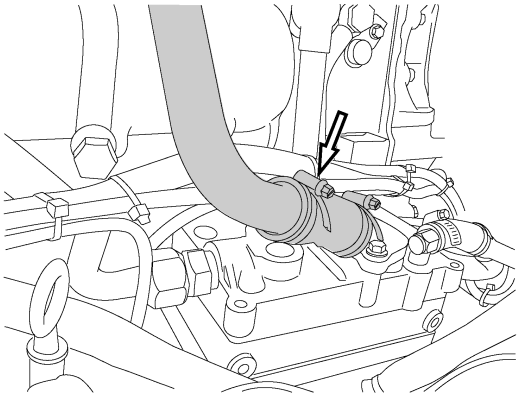
W2006005

6
Loosen the clamps securing the main fresh air pipe at the air filter housing and the turbocharger air inlet elbow. Remove the pipe from the engine.



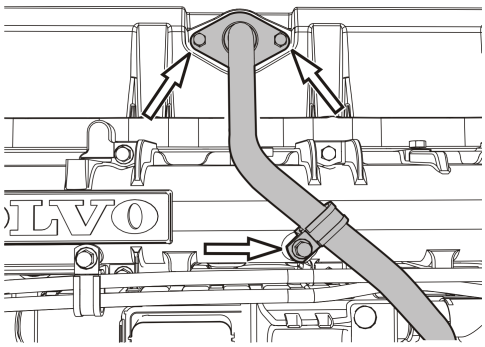
W2003858

7
Remove the fasteners at the top of the air filter housing and remove the housing from the cab.



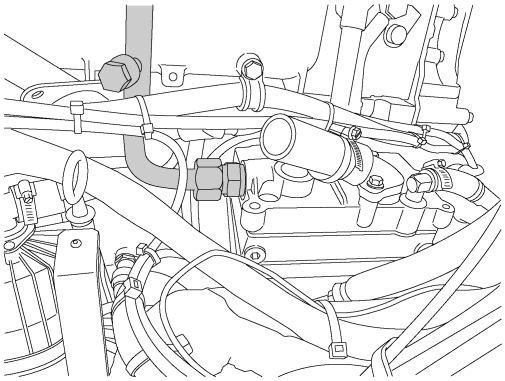
W5001571

8
Remove the coupling hose clamp securing the air inlet pipe at the air compressor. Remove the clamp bracket fasteners at the cylinder head and remove the air compressor air inlet pipe from the engine.



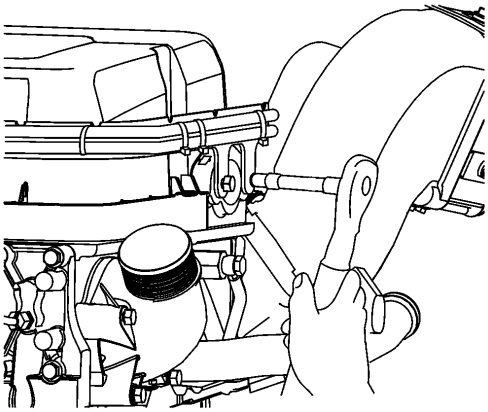
W2005747

9
Disconnect the crankcase ventilation tube from the side of the valve cover. Remove the P-clamp securing the tube to the intake manifold and position the tube out of the way.



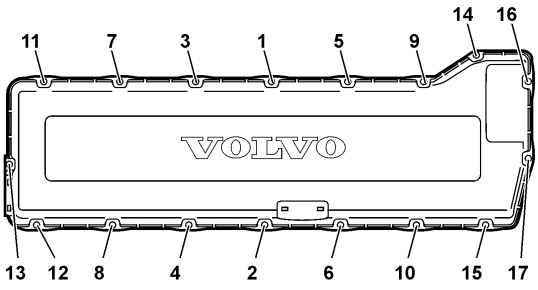
W5001572

10
Disconnect the air discharge pipe at the air compressor and remove the clamp bracket securing the pipe to the intake manifold. Position the pipe out of the way.



W2004679

11
Remove the engine wiring harness support bracket from the front of the valve cover.

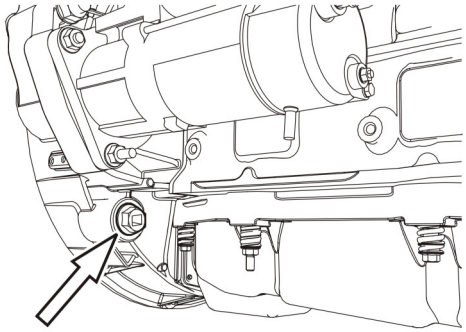


T2020552

12
Remove the spring-loaded attaching bolts from the valve cover.

13
Lift and remove the valve cover. Rotate the valve cover as needed, to clear the camshaft gear and damper.

Note: Depending on the chassis, the engine cover may need to be removed to provide clearance for removal of the valve cover.



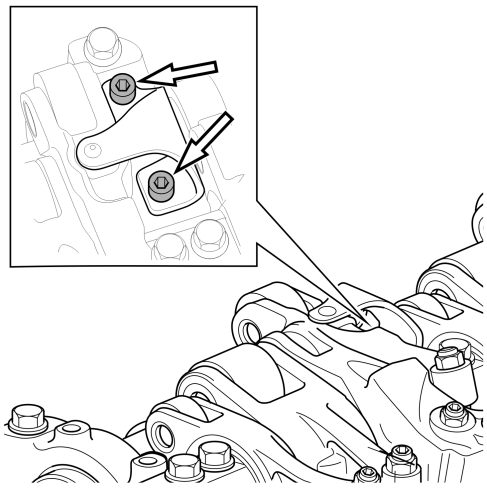
W0002368

14
Remove the plug from the lower right side of the flywheel housing and install flywheel turning tool 88800014.

Note: Ensure the turning tool is well greased before attempting to turn the flywheel.

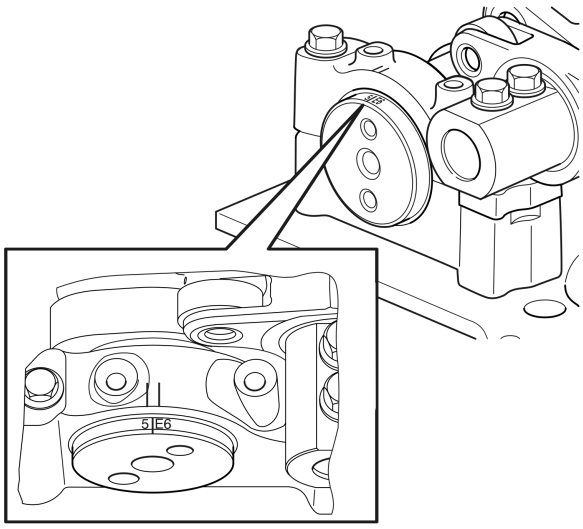
88800014

Valve and Unit Injector Adjustment Procedure



T2022951

15
On engines equipped with an engine compression brake, loosen the fasteners retaining the leaf springs to release spring tension on the VCB rocker arms.



T2022952

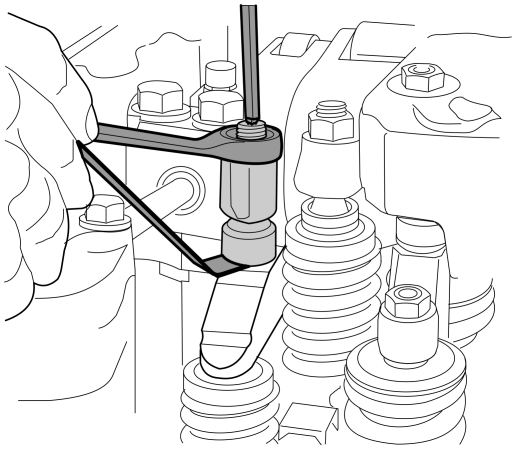
16
Using the flywheel turning tool, turn the engine in the normal direction of rotation to the next camshaft marking for the adjustment of the valves and unit injector. Camshaft settings for adjustment of the valves and unit injectors are shown in the following chart.

- Markings 1–6 apply to adjustment of inlet valves and unit injectors.
- Markings E1–E6 apply to adjustment of exhaust valves and VCB rockers.

Camshaft Markings

Cam Position	Injector	Intake	Exhaust	VCB
5	X	X		
E6			X	X
3	X	X		
E2			X	X
6	X	X		
E4			X	X
2	X	X		
E1			X	X
4	X	X		
E5			X	X
1	X	X		
V3			X	X

For the camshaft setting in this example (5 | E6), the inlet valves and unit injector can be adjusted for cylinder No. 5, and the exhaust valves (including VCB rockers) for cylinder No. 6.



W2005814

Inlet Valve Adjustment

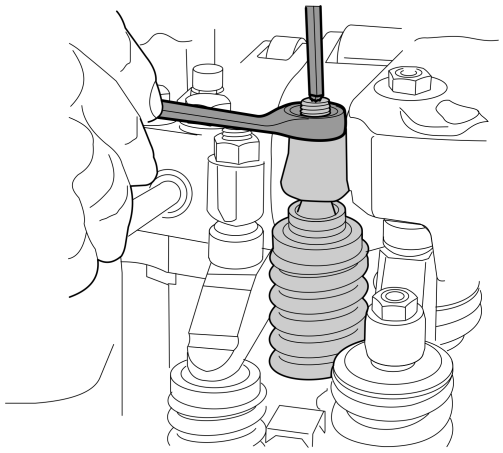
17
With the engine cold, check the inlet valve clearance for cylinder No. 5 by pushing down on the back of the rocker and inserting a feeler gauge of the proper specification between the bridge and the adjustment screw. If the clearance is not within specification, 0.30 ± 0.05 mm (0.012 ± 0.002 inch), loosen the locknut on the rocker and adjust the plunger as required. Once the adjustment is within specification, hold the adjusting screw in place and tighten the locknut to 38 ± 4 Nm (28 ± 3 ft-lb).

38 ± 4 Nm
(28 ± 3 ft-lb)

18
Recheck the valve clearance after the nut is tightened.

Note: Mark the rocker arm with a marker pen as each adjustment is completed.

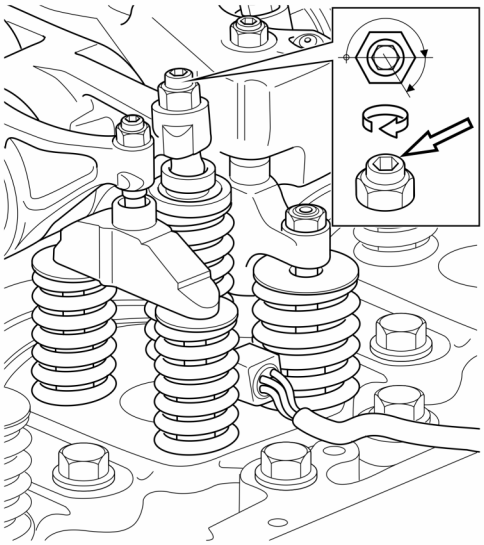
Unit Injector Adjustment



W2005816

19
To adjust the injector at the same cylinder location, loosen the locknut and back off the adjusting screw until it no longer makes contact.

20
Turn the adjusting screw in until it contacts the unit injector (zero clearance).



T2022954

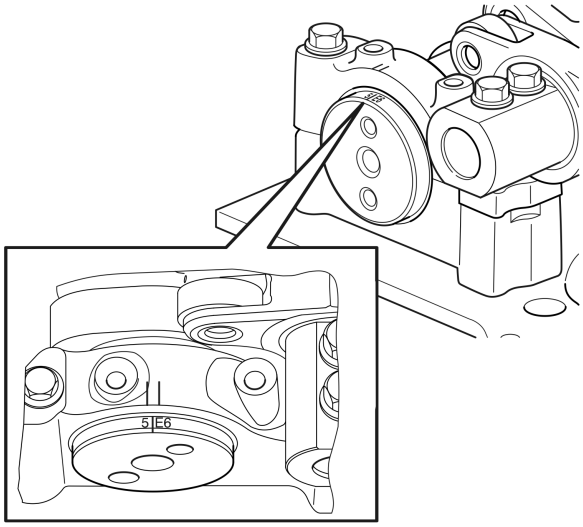
21
Tighten the adjusting screw an additional 4 flats or 240 degrees of clockwise rotation.

22
Torque-tighten the adjusting screw locknut to 52 ± 4 Nm (38 ± 3 ft-lb).

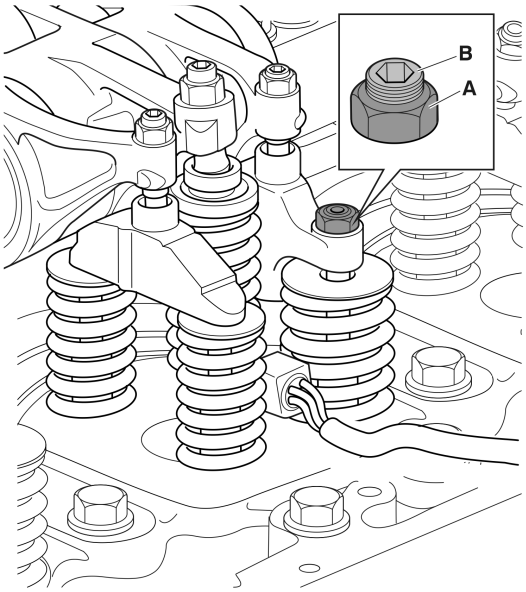
52 ± 4 Nm
(38 ± 3 ft-lb)

Exhaust Valve Adjustment

23
At the current camshaft setting (5 | E6 in this example), adjust the exhaust valves for cylinder No. 6.



T2022952



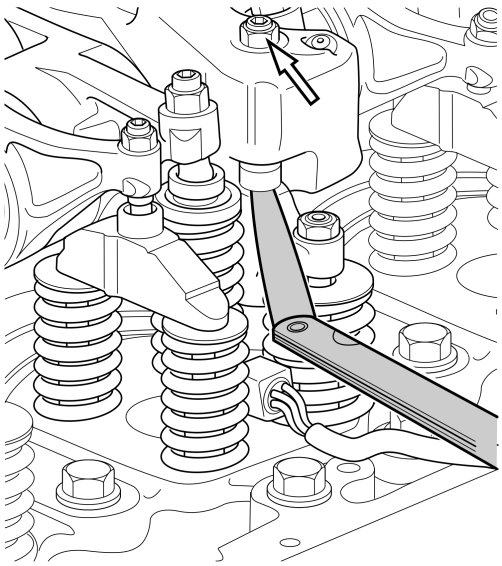
T2023642

24
Loosen the locknut (A) and turn the bridge adjusting screw out so that there is clearance between the screw and the valve stem end.

25
Press down on the center of the bridge and tighten the adjusting screw (B) until it just contacts the valve stem end. Then, tighten the screw an additional 1 flat or 60 ± 20 degrees.

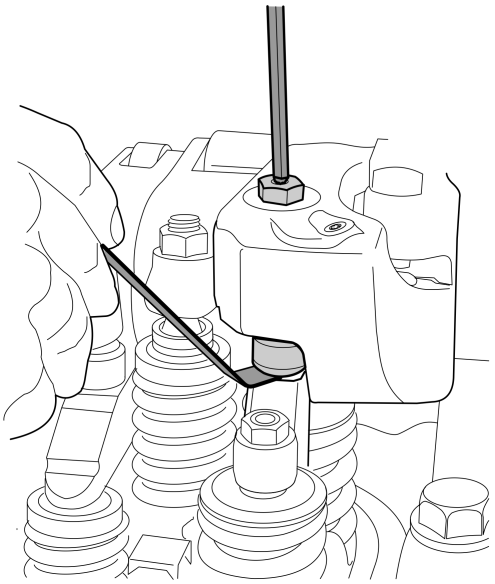
26
Tighten the locknut to 38 ± 4 Nm (28 ± 3 ft-lb).

38 ± 4 Nm
(28 ± 3 ft-lb)



T2022958

27
Check the exhaust rocker valve clearance. Push down on the back of the exhaust rocker and measure the clearance between the bridge and the plunger, using a feeler gauge. The clearance should be 0.60 ± 0.05 mm (0.024 ± 0.002 inch).



W2005812

28
If the exhaust rocker requires adjustment, loosen the locknut on the rocker. Place a 0.60 mm (0.024 inch) feeler gauge between the bridge and plunger and adjust the screw accordingly.

Note: After adjustment, leave the feeler gauge in place. It is required for adjustment of the VCB rocker clearance.

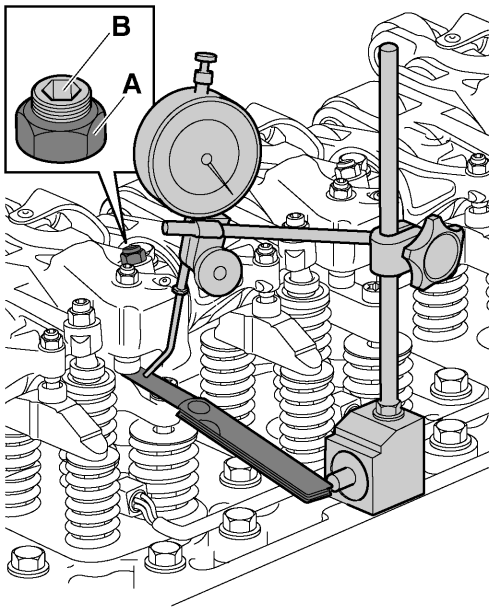
29
Hold the plunger adjusting screw in place to prevent it from turning and tighten the locknut to 38 ± 4 Nm (28 ± 3 ft-lb).

38 ± 4 Nm
(28 ± 3 ft-lb)

VCB Rocker Adjustment

30
With the exhaust valve adjustment completed, check the VCB rocker clearance for cylinder No. 6.

31
Loosen the locknut (A) on the VCB rocker adjusting screw (B). Then, place a dial indicator in position on the feeler gauge (still in place from exhaust valve adjustment) and set the gauge to zero.



W2006207

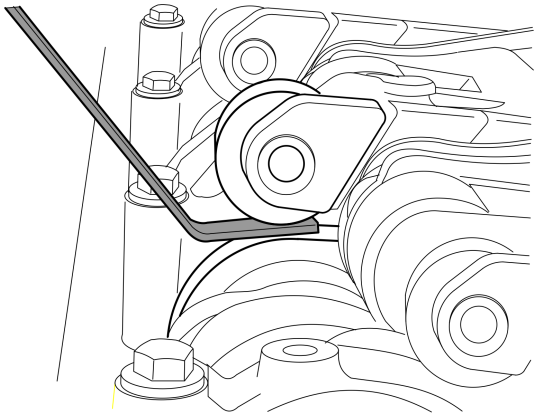
32
Turn the adjusting screw so that it removes all clearance in the ball socket. Continue to tighten the adjusting screw until the dial indicator shows that the valve bridge has moved down 0.25 ± 0.05 mm (0.010 ± 0.002 inch).

33
Back out the adjusting screw 2 turns plus 1 flat or 780 degrees.

34
Hold the adjusting screw to prevent it from turning and tighten the locknut to 52 ± 4 Nm (38 ± 3 ft-lb).

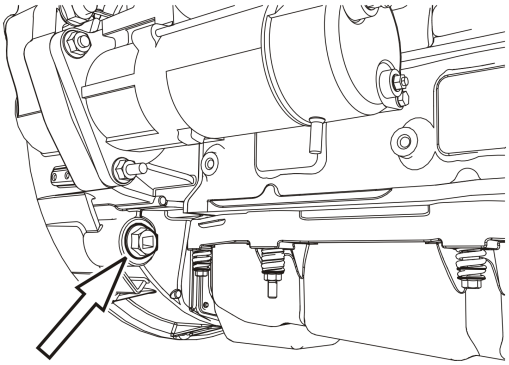
52 ± 4 Nm
(38 ± 3 ft-lb)

35
Remove the dial indicator and feeler gauge.


W2005815

36
Using a 4.2 mm (0.165 inch) feeler gauge, 85111377, check the VCB rocker arm clearance by placing the shim and feeler gauge between the rocker arm roller and the cam lobe. The clearance should be 4.2 ± 0.10 mm (0.165 ± 0.004 inch). If not within specification, repeat the VCB rocker adjustment procedure.

85111377



W0002368

Adjusting Remaining Cylinders

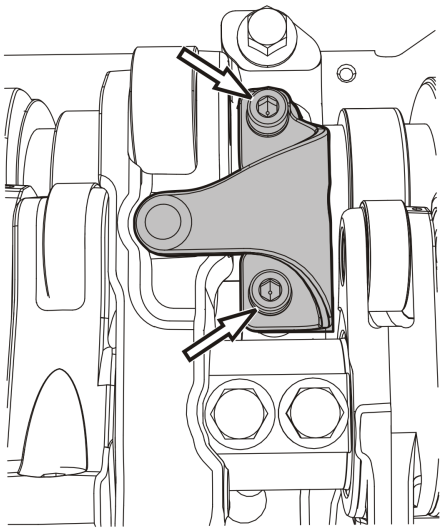
37
Repeat the preceding procedure to adjust all other unit injector and valve locations by rotating the engine to the next nearest camshaft mark. Adjust the inlet, exhaust and unit injectors using the pattern outlined in the chart below. Use the flywheel turning tool 88800014 to advance the engine to the next setting.

88800014

38
Note: Ensure the turning tool is well greased before attempting to turn the flywheel.

Camshaft Markings

Cam Position	Injector	Intake	Exhaust	VCB
5	X	X		
E6			X	X
3	X	X		
E2			X	X
6	X	X		
E4			X	X
2	X	X		
E1			X	X
4	X	X		
E5			X	X
1	X	X		
E3			X	X



W2005845

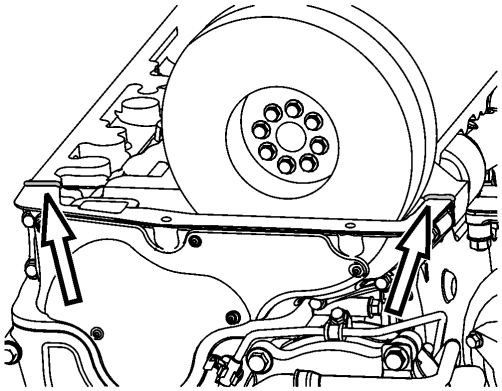
39
After all unit injectors and valves have been checked and adjusted, tighten all mounting screws on the VCB rocker leaf springs. Tighten the screws to specification, 25 ± 3 Nm (19 ± 2 ft-lb), using an Allen wrench and suitable torque wrench.

25 ± 3 Nm
(19 ± 2 ft-lb)

40
Clean and inspect the mating surface of the valve cover gasket. Replace the gasket if it is damaged or deformed.

41
Clean the valve cover contact surface on the cylinder head and the timing cover. All surfaces should be completely free of grease and oil.

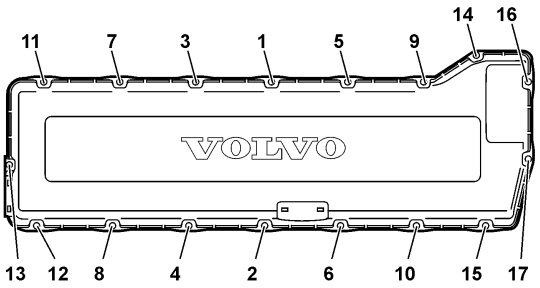
42
Apply a 2 mm (0.079 inch) bead of Volvo sealant to the area where the timing cover and the cylinder head meet. This parting line is on both sides of the cylinder head.



W2005157

43
Carefully position the valve cover on the cylinder head, making sure that the seal remains properly seated.

Note: The valve cover must be installed within 20 minutes of applying sealant to the parting line area.



T2020552

44
Install the spring-loaded attaching bolts in the valve cover. Tighten the attaching bolts to 24 ± 3 Nm (18 ± 2 ft-lb) in the sequence shown.

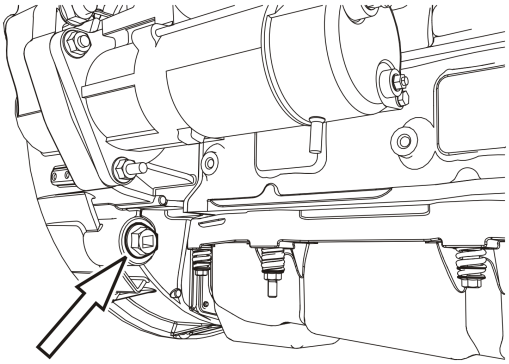
Note: The bolt spring provides even tension on the valve cover gasket.

24 ± 3 Nm
(18 ± 2 ft-lb)

45
If removed for clearance, install the engine cover.

46
Remove the flywheel turning tool, 88800014, and reinstall the dust plug.

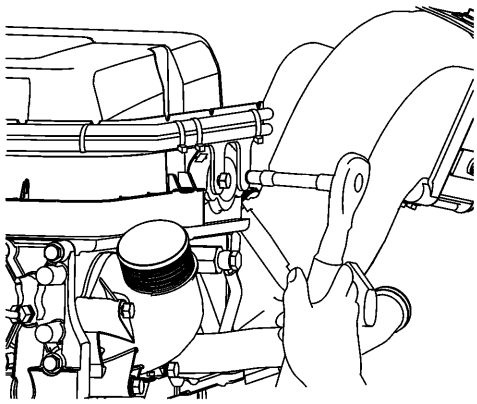
88800014



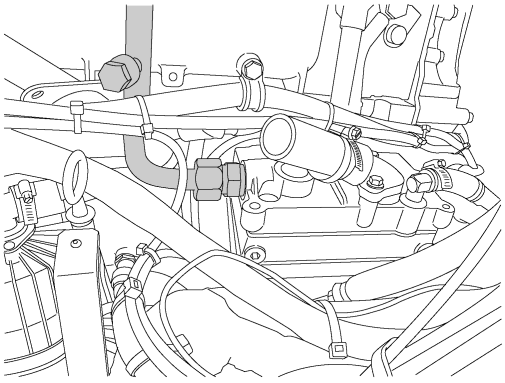
W0002368

47
Place the engine electrical wiring harness in position at the front of the valve cover and install the harness support brackets. Securely tighten the bolts.

Note: Ensure the same bolts removed at disassembly are reinstalled in their respective bracket locations. Damage to the valve cover will result if bolts that are too long are installed in the wrong locations.

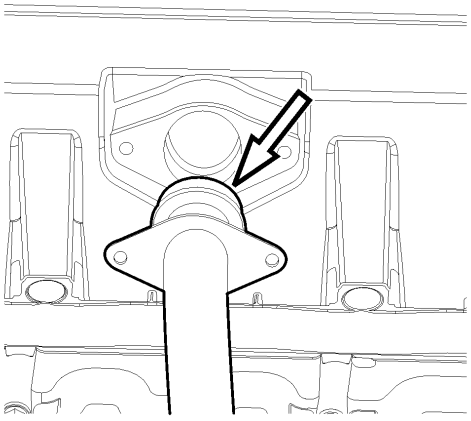


W2004679



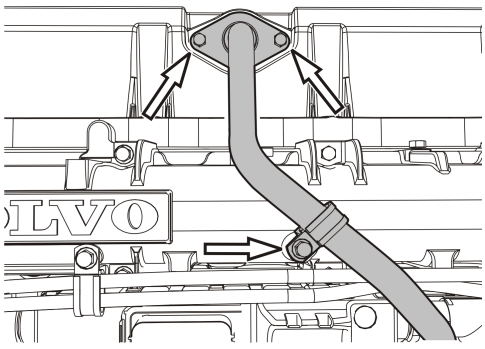
W5001572

48
Connect the air discharge line to the air compressor and install the clamp bracket securing the line to the intake manifold.



W2004681

49
Inspect the crankcase ventilation tube O-ring and replace if necessary.

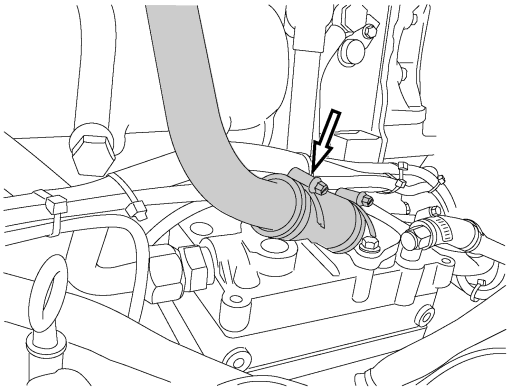


W2005747

50
Place the ventilation tube in position at the side of the valve cover and install the mounting bolts in the tube flange. Tighten the bolts to 24 ± 3 Nm (18 ± 2 ft-lb). Install the P-clamp to secure the tube to the intake manifold.

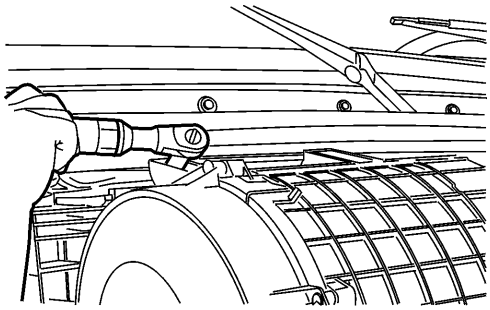
Note: Ensure that the bolts removed at disassembly are reinstalled in the same location. Damage to the valve cover will result if the bolts installed are too long.

24 ± 3 Nm
(18 ± 2 ft-lb)



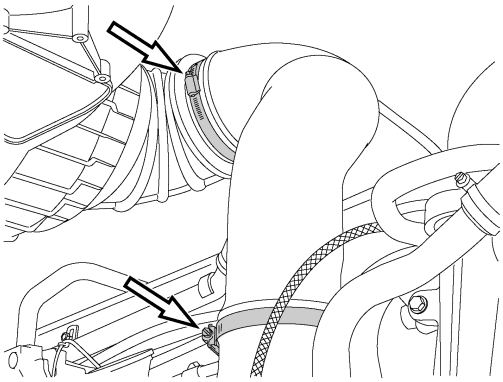
W5001571

51
Place the air compressor fresh air inlet pipe in position over the valve cover and connect the pipe to the coupling hose at the compressor. Tighten the coupling hose clamp and install the clamp brackets to secure the pipe.



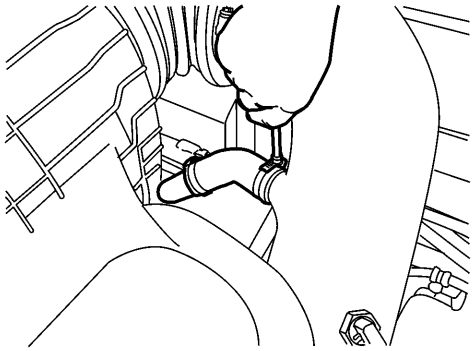
W2003858

52
Place the air filter housing in position against the cab and install the two mounting bolts at the top of the housing.



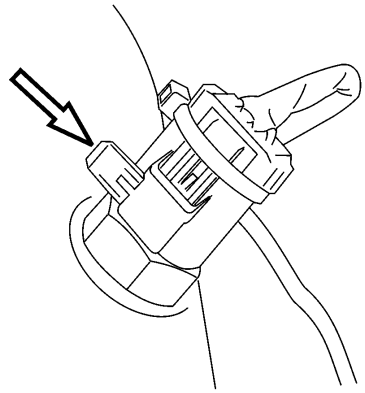
W2006005

53
Install the main fresh air pipe between the air filter housing and the turbocharger air inlet elbow. Position the clamps and tighten them securely.



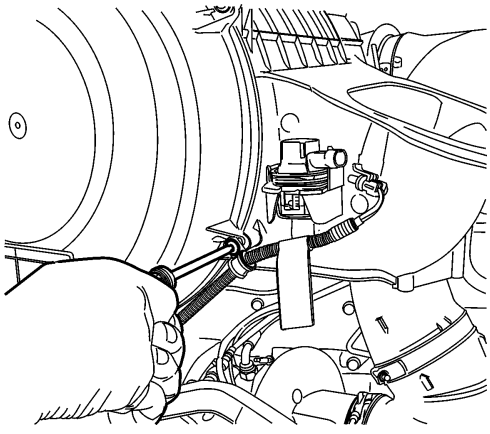
W2004719

54
Connect the air compressor air inlet pipe to the main fresh air pipe and tighten the hose clamp securely.



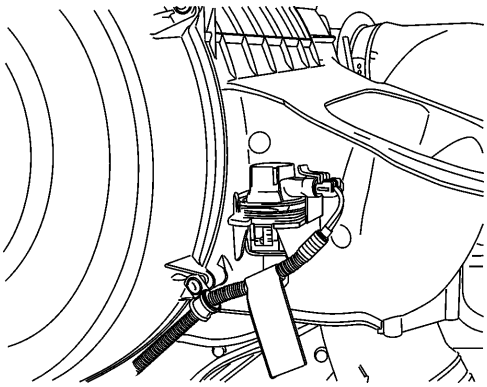
W2004720

55
Reattach the air temperature sensor harness connector to the sensor (located on the fresh air pipe). Push in the lock tab and install a new strap to secure the connector. Install the bolt and clamp to secure the sensor harness to the fresh air pipe.



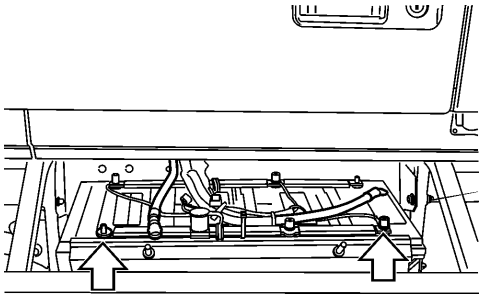
W2003861

56
Install the clamps to secure the restriction gauge wiring harness to the air filter housing.



W2004249

57
Connect the wiring harness to the air restriction gauge.



W2003815

58
Install all previously removed cables to the ground (negative) battery terminals.

59
Start the engine and check for leaks. Once normal operating temperature is attained, let the engine idle for an additional five minutes. During this time, the EECU will perform its own cylinder balancing, resulting in smooth engine idling.

Note: During cylinder balancing, do not use any form of power-consuming equipment, such as power take-off or air conditioning.

60
After engine shutdown, replenish fluids as necessary.