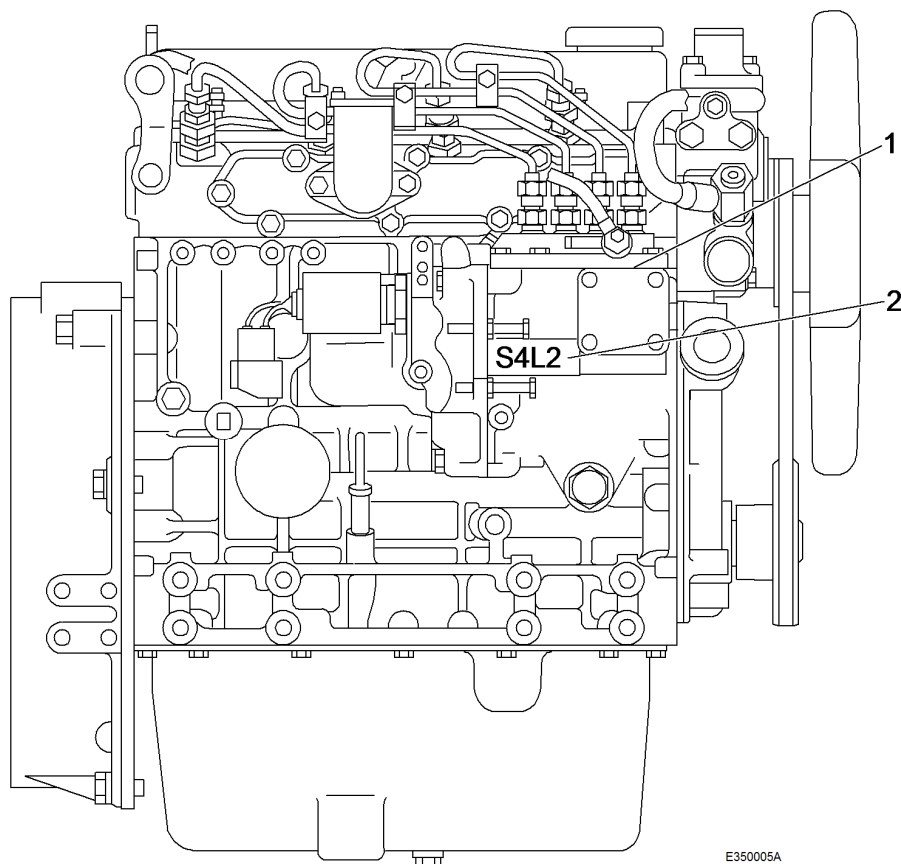


Document Title: Description	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Description

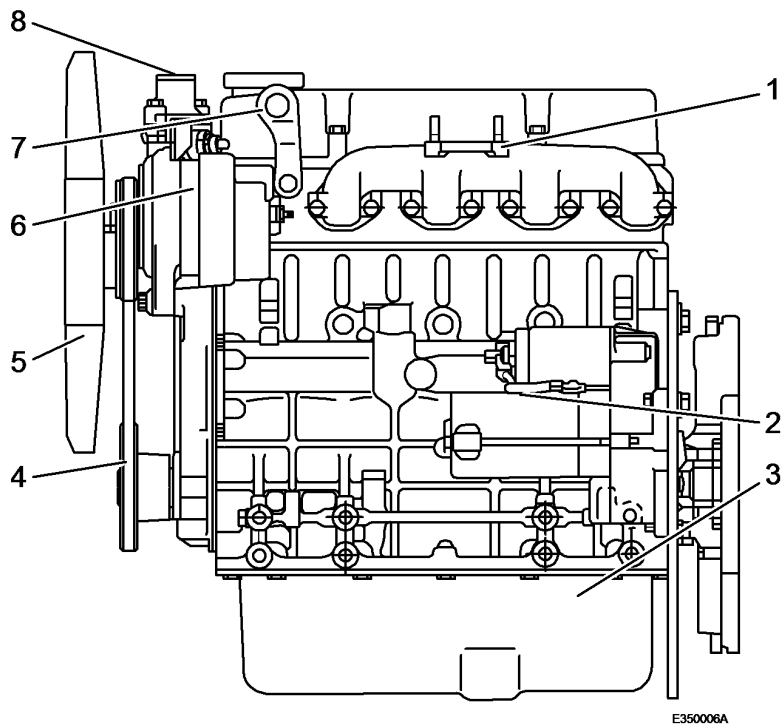
The EC35 is powered by a 4-cylinder four-stroke diesel inline engine with water cooling.



E350005A

Figure 1
Engine, side view

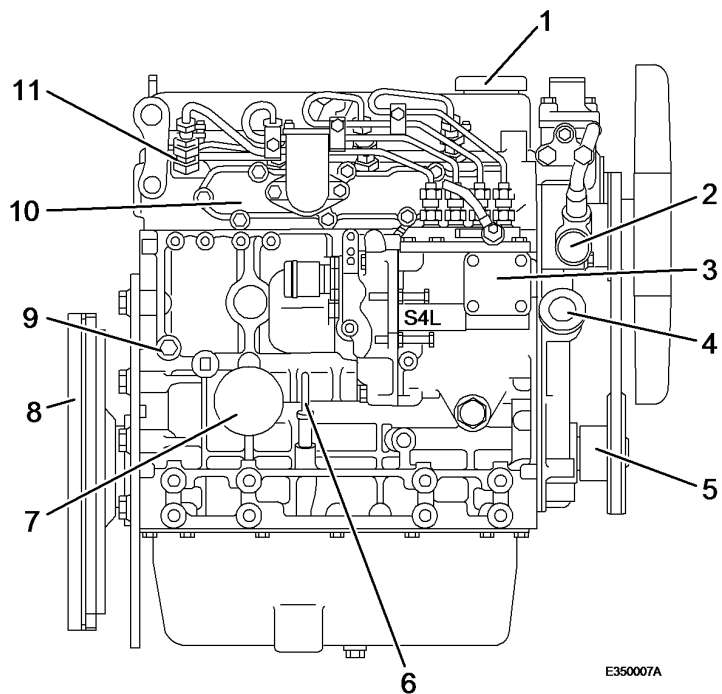
1. Serial number
2. Engine type



E350006A

Figure 2
Left hand side view

- | | | |
|--------------------|-------------|--------------|
| 1 Exhaust manifold | 4 V-belt | 7 Bracket |
| 2 Starter | 5 Fan | 8 Thermostat |
| 3 Oil sump | 6 Generator | |



E350007A

Figure 3
Right hand side view

- | | | | |
|------------------|----------------------------|--------------|---------------------|
| 1 Oil filler cap | 4 Oil filler cap | 7 Oil filter | 10 Intake manifold |
| 2 Water pump | 5 Crankshaft V-belt pulley | 8 Flywheel | 11 Injection nozzle |

3 Injection pump

6 Oil dipstick

9 Coolant drain plug

Document Title: Precautions	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Precautions

Make preparation as follows before starting engine inspection and service.

- Fix the engine on a horizontal base.
- Remove the coolant hoses, fuel oil pipes, wire harness, control wires etc. connecting the driven machine and engine, and drain coolant, lubricating oil and fuel.
- Remove soil, oil, dust, etc. from the engine by washing with solvent, air, steam, etc. Carefully operate so as not to let any foreign matter enter the engine.
- Any part which is found defective as a result of inspection or any part whose measured value does not satisfy the standard or limit shall be replaced.
- Any part predicted to dissatisfy the standard or limit before the next service as estimated from the state of use should be replaced even when the measured value then satisfies the standard or limit.

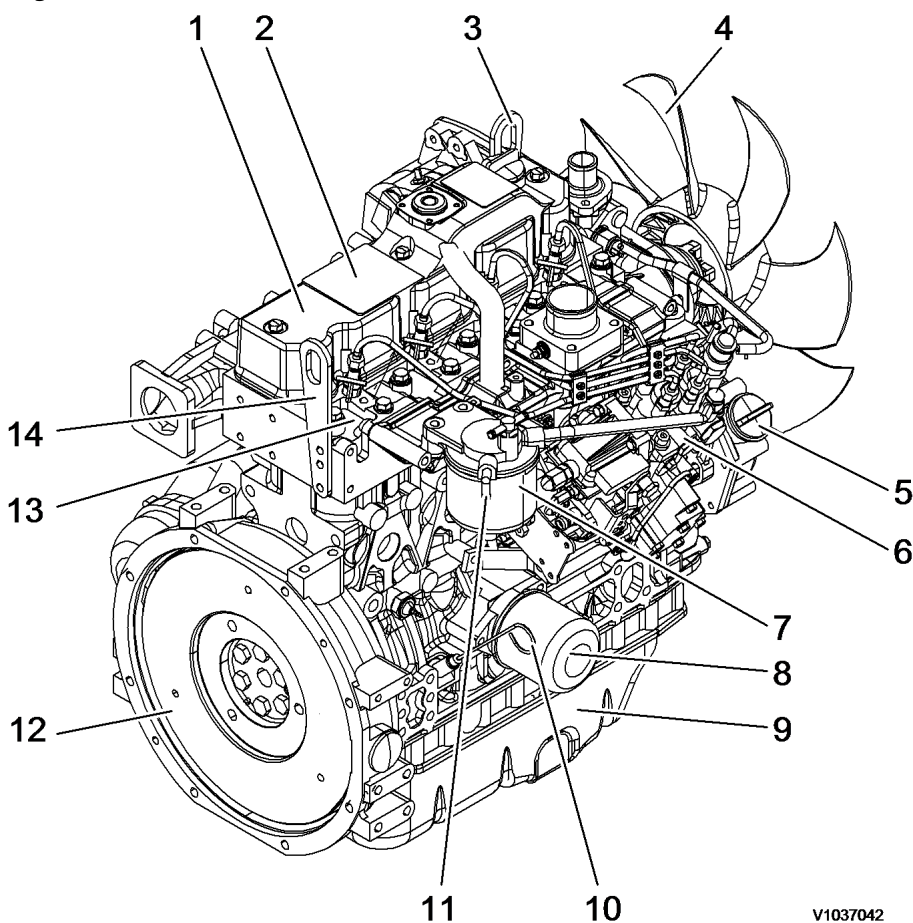
Document Title: Engine, description	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Engine, description

General description

- The engine is a 4-cycle, 4-cylinders, direct injected, water cooled diesel engine.
- The engine produces powerful performance using direct injection type combustion chamber.

Engine external views



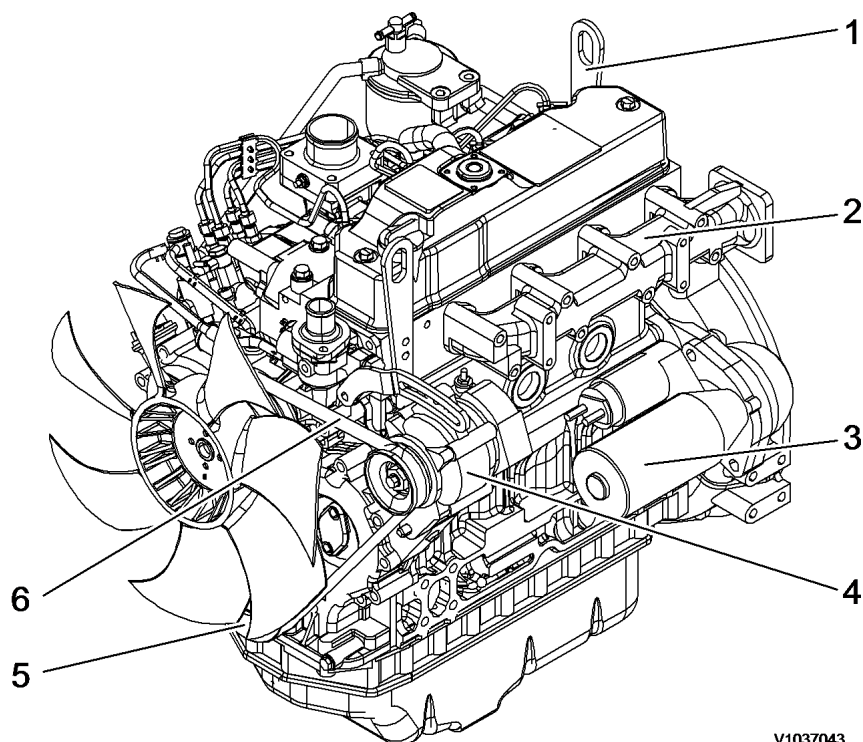
V1037042

Figure 1

Engine, rear view

1. Rocker arm cover
2. Engine name plate
3. Lifting eye
4. Fan
5. Oil filler port
6. Injection pump
7. Fuel filter
8. Oil filter
9. Oil pan
10. Dipstick

11. Fuel oil inlet
12. Flywheel
13. Intake manifold
14. Lifting eye



V1037043

Figure 2
Engine, front view

1. Lifting eye
2. Exhaust manifold
3. Starter motor
4. Alternator
5. Crankshaft V-pulley
6. V-belt

Document Title: Troubleshooting chart	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Troubleshooting chart

The following table summarizes the general trouble symptoms and their causes. If any trouble symptom occurs, take corrective action before it develops into a serious problem so as not to shorten the engine service life.

Engine troubleshooting chart

Trouble symptoms	Causes	Corrective actions
Engine does not start	Improper clearance of inlet/exhaust valve	Adjust the valve clearance
	Seizure of inlet/exhaust valve	Correct or replace
	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
	Seized crankpin metal or bearing	Repair or replace
	Foreign matter trapped in combustion chamber	Disassemble and repair
	Improper open/close timing of intake/exhaust valves	Adjust the valve clearance
	Improper properties of lubricating oil	Use proper lubricating oil
	Water entrance in fuel system	Perform draining from the fuel filter
	Clogged fuel filter	Clean or replace
	Air entrance in fuel system	Perform air bleeding
	Clogged or cracked fuel pipe	Clean or replace
	Insufficient fuel supply to fuel injection pump	Check the fuel tank cock, fuel tank, fuel pipe and fuel feed pump
	Priming failure (foreign matter trapped in the valve inside the priming pump)	Disassemble and clean
	Starting motor defect	Repair or replace
	Alternator defect	Repair or replace
	Open circuit in wiring harness	Repair
	Battery voltage drop	Inspect and charge the battery
Engine starts, but stops soon. Exhaust smoke none.	Improper clearance of inlet/exhaust valve	Adjust the valve clearance
	Seized crankpin metal or bearing	Repair or replace
	Improper arrangement of piston rings joint	Correct the ring joint positions
	Defective governor	Make adjustment
	Improper properties of lubricating oil	Use proper lubricating oil
	Insufficient lubricating oil level	Add proper lubricating oil
	Clogged fuel filter	Clean or replace
	Air entrance in fuel system	Perform air bleeding
	Clogged or cracked fuel pipe	Clean or replace
Engine starts, but stops soon. Exhaust smoke excessive.	Insufficient fuel supply to fuel injection pump	Check the fuel tank cock, fuel tank, fuel pipe and fuel feed pump
	Seizure of inlet/exhaust valve	Correct or replace
	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
	Water entrance in fuel system	Perform draining from the fuel filter

Insufficient engine output. Exhaust color : ordinary	Clogged air filter	Clean
	Improper clearance of inlet/exhaust valve	Adjust the valve clearance
	Compression leakage from valve seat	Lap the valve seat
	Seizure of inlet/exhaust valve	Correct or replace
	Blowout from cylinder head gasket	Replace the gasket
	Worn crankpin and journal bearing	Measure and replace
	Improper properties of lubricating oil	Use proper lubricating oil
	Improper properties of fuel oil	Use proper fuel oil
	Clogged fuel filter	Clean or replace
	Air entrance in fuel system	Perform air bleeding
	Clogged or cracked fuel pipe	Clean or replace
	Insufficient fuel supply to fuel injection pump	Check the fuel tank cock, fuel tank, fuel pipe and fuel feed pump
	Clogged strainer at fuel feed pump inlet	Clean the strainer
Insufficient engine output. (Exhaust color : white)	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
	Improper arrangement of piston rings joint	Correct the ring joint positions
	Reverse assembly of piston ring	Reassemble correctly
	Worn inlet/exhaust valve guide	Measure and replace
	Improper open/close timing of intake/exhaust valves	Adjust the valve clearance
	Timing of fuel injection pump too late	Check and adjust
	Improper properties of fuel oil	Use proper fuel oil
	Water entrance in fuel system	Perform draining from the fuel filter
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
Insufficient engine output. (Exhaust color : black)	Compression leakage from valve seat	Lap the valve seat
	Seizure of inlet/exhaust valve	Correct or replace
	Improper open/close timing of intake/exhaust valves	Adjust the valve clearance
	Insufficient cooling effect of radiator, Defective thermostat (kept opened) or slipping fan belt	Repair or replace thermostat and fan belt
	Insufficient coolant level	Check leakage from cooling system
	Slackened fan belt	Adjust the belt tension
	Defective thermostat	Check or replace
	Timing of fuel injection pump too late	Check and adjust
	Improper properties of fuel oil	Use proper fuel oil
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
	Clogged air filter	Clean
	Engine used at high temperature or at high altitude	Study output drop and load matching
	Clogged exhaust pipe	Clean
Poor exhaust color : white (During work)	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
	Reverse assembly of piston ring	Reassemble correctly
	Improper open/close timing of intake/exhaust valves	Adjust the valve clearance
	Excessive cooling effect of radiator,	Repair or replace

Poor exhaust color : black (During work)	Defective thermostat (kept closed)	
	Defective thermostat	Check or replace
	Timing of fuel injection pump too early	Check and adjust
	Timing of fuel injection pump too late	Check and adjust
	Improper properties of fuel oil	Use proper fuel oil
	Water entrance in fuel system	Perform draining from the fuel filter
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
	Compression leakage from valve seat	Lap the valve seat
	Seizure of inlet/exhaust valve	Correct or replace
	Improper open/close timing of intake/exhaust valves	Adjust the valve clearance
	Timing of fuel injection pump too early	Check and adjust
	Timing of fuel injection pump too late	Check and adjust
	Improper properties of fuel oil	Use proper fuel oil
	Uneven injection volume of fuel injection pump	Check and adjust
	Excessive fuel injection volume	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
	Clogged air filter	Clean
	Engine used at high temperature or at high altitude	Study output drop and load matching
	Clogged exhaust pipe	Clean
High knocking sound during compression	Timing of fuel injection pump too early	Check and adjust
Abnormal engine sound	Improper clearance of inlet/exhaust valve	Adjust the valve clearance
	Compression leakage from valve seat	Lap the valve seat
	Seizure of inlet/exhaust valve	Correct or replace
	Seized or broken piston ring	Replace the piston ring
	Seized crankpin metal or bearing	Repair or replace
	Worn crankpin and journal bearing	Measure and replace
	Loosened connecting rod screw	Tighten to specified torque
	Foreign matter trapped in combustion chamber	Disassemble and repair
	Excessive gear backlash	Adjust gear and repair
	Improper open/close timing of intake/exhaust valves	Adjust the valve clearance
Uneven combustion sound	Improper properties of fuel oil	Use proper fuel oil
	Water entrance in fuel system	Perform draining from the fuel filter
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
	Clogged air filter	Clean
	Clogged exhaust pipe	Clean
Hunting during idling	Seized or broken piston ring	Replace the piston ring
	Seized crankpin metal or bearing	Repair or replace
	Worn crankpin and journal bearing	Measure and replace
	Defective governor	Make adjustment
	Water entrance in fuel system	Perform draining from the fuel filter
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
Hunting during work	Seizure of inlet/exhaust valve	Correct or replace

Large engine vibration	Seized crankpin metal or bearing	Repair or replace
	Worn crankpin and journal bearing	Measure and replace
	Defective governor	Make adjustment
	Water entrance in fuel system	Perform draining from the fuel filter
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
	Seizure of inlet/exhaust valve	Correct or replace
	Seized or broken piston ring	Replace the piston ring
	Seized crankpin metal or bearing	Repair or replace
	Worn crankpin and journal bearing	Measure and replace
	Loosened connecting rod screw	Tighten to specified torque
	Defective governor	Make adjustment
	Timing of fuel injection pump too early	Check and adjust
	Uneven injection volume of fuel injection pump	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
Difficulty in returning to low speed	Defective governor	Make adjustment
Excessive fuel consumption	Compression leakage from valve seat	Lap the valve seat
	Excessive cooling effect of radiator, Defective thermostat (kept closed)	Repair or replace
	Timing of fuel injection pump too late	Check and adjust
	Excessive fuel injection volume	Check and adjust
	Poor spray pattern from fuel injection nozzle	Check and adjust
	Engine used at high temperature or at high altitude	Study output drop and load matching
Excessive lubricating oil consumption	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
	Improper arrangement of piston rings joint	Correct the ring joint positions
	Reverse assembly of piston ring	Reassemble correctly
	Foreign matter trapped in combustion chamber	Disassemble and repair
	Worn inlet/exhaust valve guide	Measure and replace
	Improper properties of lubricating oil	Use proper lubricating oil
	Leakage from lubricating oil piping system	Repair
	Excessive fuel injection volume	Check and adjust
Lubricating oil diluted by fuel	Seizure of inlet/exhaust valve	Correct or replace
	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
Lubricating oil mixed with water	Blowout from cylinder head gasket	Replace the gasket
	Cracked water jacket	Repair or replace
Low lubricating oil pressure	Worn crankpin and journal bearing	Measure and replace
	Loosened connecting rod screw	Tighten to specified torque
	Cracked water jacket	Repair or replace
	Improper properties of lubricating oil	Use proper lubricating oil
	Leakage from lubricating oil piping system	Repair
	Insufficient delivery capacity of trochoid pump	Check and repair
	Clogged lubricating oil filter	Clean or replace
	Defective pressure regulating valve	Check, adjust or replace
	Insufficient lubricating oil level	Add proper lubricating oil
Excessive blow-by gas	Compression leakage from valve seat	Lap the valve seat

Overheating of coolant	Seizure of inlet/exhaust valve	Correct or replace
	Seized or broken piston ring	Replace the piston ring
	Worn piston ring, piston or cylinder	Perform honing and use oversize parts
	Seized crankpin metal or bearing	Repair or replace
	Improper arrangement of piston rings joint	Correct the ring joint positions
	Reverse assembly of piston ring	Reassemble correctly
	Foreign matter trapped in combustion chamber	Disassemble and repair
	Worn inlet/exhaust valve guide	Measure and replace
	Improper properties of lubricating oil	Use proper lubricating oil
	Clogged lubricating oil filter	Clean or replace
	Excessive fuel injection volume	Check and adjust
	Blowout from cylinder head gasket	Replace the gasket
	Seized or broken piston ring	Replace the piston ring
	Insufficient cooling effect of radiator, Defective thermostat (kept opened) or slipping fan belt	Repair or replace thermostat and fan belt
	Insufficient coolant level	Check leakage from cooling system
	Cracked water jacket	Repair or replace
	Slackened fan belt	Adjust the belt tension
	Defective thermostat	Check or replace
	Excessive fuel injection volume	Check and adjust
	Engine used at high temperature or at high altitude	Study output drop and load matching
Low coolant temperature	Excessive cooling effect of radiator, Defective thermostat (kept closed)	Repair or replace
	Defective thermostat	Check or replace
Air inlet pressure drop	Improper clearance of inlet/exhaust valve	Adjust the valve clearance
	Compression leakage from valve seat	Lap the valve seat
	Seizure of inlet/exhaust valve	Correct or replace
	Clogged air filter	Clean
	Engine used at high temperature or at high altitude	Study output drop and load matching
Air inlet pressure rise	Excessive fuel injection volume	Check and adjust
Exhaust temperature rise	Improper clearance of inlet/exhaust valve	Adjust the valve clearance
	Compression leakage from valve seat	Lap the valve seat
	Seized or broken piston ring	Replace the piston ring
	Insufficient cooling effect of radiator, Defective thermostat (kept opened) or slipping fan belt	Repair or replace thermostat and fan belt
	Insufficient coolant level	Check leakage from cooling system
	Slackened fan belt	Adjust the belt tension
	Timing of fuel injection pump too late	Check and adjust
	Uneven injection volume of fuel injection pump	Check and adjust
	Excessive fuel injection volume	Check and adjust
	Clogged exhaust pipe	Clean

Document Title: Maintenance standards	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Maintenance standards

Engine tuning

Maintenance standard, engine tuning

Inspection item			Unit	Standard	Limit
Gap at inlet/exhaust valve heads			mm (in)	0.15 ~ 0.25 (0.006 ~ 0.010)	—
V-belt tension at 98 N (10 kgf) finger pressure	Between alternator and crank pulley	Used part	mm (in)	10 ~ 14 (0.39 ~ 0.55)	—
		New part	mm (in)	8 ~ 12 (0.31 ~ 0.47)	—
	Between alternator and radiator fan	Used part	mm (in)	7 ~ 10 (0.28 ~ 0.39)	—
		New part	mm (in)	5 ~ 8 (0.20 ~ 0.31)	—
	Between radiator fan and crank pulley	Used part	mm (in)	9 ~ 13 (0.35 ~ 0.51)	—
		New part	mm (in)	7 ~ 11 (0.28 ~ 0.43)	—
Fuel injection pressure			kgf/cm2 (psi)	220 ~ 230 (3129 ~ 3271)	—
Compression at 250 rpm			kgf/cm2 (psi)	35 ± 1 (498 ± 14)	28 ± 1
Coolant capacity (engine only)			Liter (gal)	2.7 (0.71)	—
Lubricating oil capacity (oil pan)		High	Liter (gal)	7.4 (1.95)	—
		Low	Liter (gal)	3.4 (0.89)	—
Oil pressure switch operating pressure			kgf/cm2 (psi)	0.5 ± 0.1 (7 ± 1)	—
Thermostat	Valve opening temperature		°C (°F)	69.5 ~ 72.5 (157 ~ 163)	—
	Full opening lift (temperature)		mm (in) / °C (°F)	8 (0.31) or more / 85 (185)	
Thermostat switch actuating temperature			°C (°F)	107 ~ 113 (225 ~ 235)	—

Engine body

Maintenance standard, cylinder head, unit: mm (in)

Inspection item			Standard	Limit
Combustion surface distortion			0.05 (0.002) or less	0.15 (0.006)
Valve sink		Inlet	0.30 ~ 0.50 (0.01 ~ 0.02)	0.8 (0.03)
		Exhaust	0.30 ~ 0.50 (0.01 ~ 0.02)	0.8 (0.03)
Valve seat	Seat angle (degree)	Intake	120	—
		Exhaust	90	—
	Seat correction angle (degree)		q1: 40, q2: 150	—

Maintenance standard, inlet/exhaust valve guide, unit: mm (in)

Inspection item		Standard	Limit
Inlet	Guide inside diameter	8.010 ~ 8.025 (0.3153 ~ 0.3159)	8.10 (0.3189)
	Valve stem outside diameter	7.955 ~ 7.975 (0.3132 ~ 0.3140)	7.90 (0.3110)

Outlet	Clearance	0.035 ~ 0.070 (0.0014 ~ 0.0027)	0.18 (0.0071)
	Guide inside diameter	8.015 ~ 8.030 (0.3155 ~ 0.3161)	8.10 (0.3189)
	Valve stem outside diameter	7.955 ~ 7.960 (0.3132 ~ 0.3134)	7.90 (0.3110)
	Clearance	0.045 ~ 0.075 (0.0018 ~ 0.0029)	0.18 (0.0071)
Valve guide driving-in method		Cold-fitted	–
Valve guide protection from cylinder head		14.7 ~ 15.0 (0.5787 ~ 0.5905)	–

Maintenance standard, valve spring, unit: mm (in)

Inspection item	Standard	Limit
Free length	42.0 (1.6535)	41.5 (1.6339)
Inclination	–	1.4 (0.055)

Maintenance standard, rocker arm and shaft, unit: mm (in)

Inspection item	Standard	Limit
Arm shaft hole diameter	16.000 ~ 16.020 (0.6299 ~ 0.6307)	16.07 (0.6327)
Shaft outside diameter	15.966 ~ 15.984 (0.6286 ~ 0.6292)	15.94 (0.6276)
Clearance	0.016 ~ 0.054 (0.0006 ~ 0.0021)	0.13 (0.0051)

Maintenance standard, push rod, unit: mm (in)

Inspection item	Standard	Limit
Bend	–	0.03 (0.0012)

Maintenance standard, camshaft, unit: mm (in)

Inspection item		Standard	Limit
Side gap		0.05 ~ 0.20 (0.002 ~ 0.008)	0.30 (0.012)
Bending (1/2 the dial gauge reading)		0.0 ~ 0.02 (0.00 ~ 0.0008)	0.05 (0.002)
Cam height		38.600 ~ 38.800 (1.5197 ~ 1.5276)	38.350 (1.5098)
Gear end	Camshaft outside diameter	44.925 ~ 44.950 (1.7687 ~ 1.7697)	44.890 (1.7673)
	Bushing inside diameter	44.990 ~ 45.055 (1.7713 ~ 1.7738)	45.130 (1.7768)
	Clearance	0.040 ~ 0.130 (0.0016 ~ 0.0051)	0.240 (0.0094)
Intermediate	Camshaft outside diameter	44.910 ~ 44.935 (1.7681 ~ 1.7691)	44.875 (1.7667)
	Block inside diameter	45.000 ~ 45.025 (1.7716 ~ 1.7726)	45.100 (1.7756)
	Clearance	0.065 ~ 0.115 (0.0026 ~ 0.0045)	0.225 (0.0089)
Flywheel end	Camshaft outside diameter	44.925 ~ 44.950 (1.7688 ~ 1.7697)	44.980 (1.7673)
	Block inside diameter	45.000 ~ 45.025 (1.7716 ~ 1.7726)	45.100 (1.7756)
	Clearance	0.050 ~ 0.100 (0.0020 ~ 0.0039)	0.210 (0.0083)

Maintenance standard, idle gear shaft and bushing, unit: mm (in)

Inspection item	Standard	Limit
Shaft outside diameter	45.950 ~ 49.975 (1.8091 ~ 1.9675)	45.900 (1.8071)
Bushing inside diameter	46.000 ~ 46.025 (1.8110 ~ 1.8120)	46.075 (1.8140)
Clearance	0.025 ~ 0.075 (0.0010 ~ 0.0030)	0.175 (0.007)

Maintenance standard, backlash of each gear, unit: mm (in)

Inspection item	Standard	Limit
Crank gear, cam gear, idle gear, fuel injection pump, gear	0.07 ~ 0.15 (0.0028 ~ 0.0059)	0.17 (0.0067)

and PTO (Power Take-Off) gear

Maintenance standard, cylinder block, unit: mm (in)

Inspection item		Standard	Limit
Cylinder bore	Inner diameter	88.000 ~ 88.030 (3.4646 ~ 3.4657)	88.200 (3.4724)
	Roundness	0.01 (0.0004) or less	0.03 (0.012)
	Inclination	0.01 (0.0004) or less	0.03 (0.012)

Maintenance standard, crankshaft, unit: mm (in)

Inspection item		Standard	Limit
Bending (1/2 the dial gauge reading)		–	0.02 (0.0008)
Crankpin	Pin outside diameter	47.952 ~ 47.962 (1.8879 ~ 1.8883)	47.902 (1.8859)
	Metal inside diameter	48.000 ~ 48.026 (1.8898 ~ 1.8908)	–
	Metal thickness	1.492 ~ 1.500 (0.0587 ~ 0.0591)	–
	Clearance	0.038 ~ 0.074 (0.0015 ~ 0.0029)	0.150 (0.0059)
Crank journal	Journal outside diameter	53.952 ~ 53.962 (2.1241 ~ 2.1245)	53.902 (2.1221)
	Metal inside diameter	54.000 ~ 54.020 (2.1260 ~ 2.1268)	–
	Metal thickness	1.995 ~ 1.990 (0.0785 ~ 0.0783)	–
	Clearance	0.038 ~ 0.068 (0.0015 ~ 0.0028)	0.150 (0.0059)

Maintenance standard, thrust bearing, unit: mm (in)

Inspection item	Standard	Limit
Crankshaft side gap	0.13 ~ 0.23 (0.0051 ~ 0.0091)	0.28 (0.0110)

Maintenance standard, piston and ring, unit: mm (in)

Inspection item		Standard	Limit
Piston outside diameter (Measure in the direction vertical to the piston pin)		87.940 ~ 87.970 (3.4622 ~ 3.4634)	87.895 (3.4604)
Piston diameter measure position (Upward from the bottom end of the piston)		24 (0.9449)	–
Piston pin	Pin outside diameter	25.995 ~ 26.000 (1.0218 ~ 1.0236)	25.965 (1.0222)
	Hole inside diameter	26.000 ~ 26.009 (1.0236 ~ 1.0240)	26.039 (1.0252)
	Clearance	0.000 ~ 0.014 (0.000 ~ 0.0006)	0.074 (0.0029)
Top ring	Ring groove width	2.060 ~ 2.075 (0.0811 ~ 0.0817)	–
	Ring width	1.970 ~ 1.990 (0.0775 ~ 0.0783)	1.950 (0.0767)
	Side clearance	0.070 ~ 0.105 (0.0027 ~ 0.0041)	–
	End clearance	0.200 ~ 0.400 (0.0078 ~ 0.0157)	0.490 (0.0192)
Second ring	Ring groove width	2.025 ~ 2.040 (0.0797 ~ 0.0803)	2.140 (0.0842)
	Ring width	1.970 ~ 1.990 (0.0776 ~ 0.0783)	1.950 (0.0768)
	Side clearance	0.035 ~ 0.070 (0.0013 ~ 0.0027)	0.190 (0.0074)
	End clearance	0.200 ~ 0.400 (0.0078 ~ 0.0157)	0.490 (0.0192)
Oil ring	Ring groove width	4.015 ~ 4.030 (0.1580 ~ 0.1586)	4.130 (0.1626)
	Ring width	3.970 ~ 3.990 (0.1563 ~ 0.1570)	3.950 (0.1555)
	Side clearance	0.025 ~ 0.060 (0.0010 ~ 0.0024)	0.180 (0.0071)
	End clearance	0.200 ~ 0.400 (0.0078 ~ 0.0157)	0.490 (0.0192)

Maintenance standard, connecting rod, unit: mm (in)

Inspection item		Standard	Limit
Thrust clearance		0.2 ~ 0.4 (0.0079 ~ 0.0157)	–
Small end of rod	Bushing inside diameter	26.025 ~ 26.038 (1.0246 ~ 1.0251)	26.068 (1.0263)
	Pin outside diameter	25.995 ~ 26.000 (1.0234 ~ 1.0236)	25.967 (1.0223)
	Clearance	0.025 ~ 0.043 (0.0010 ~ 0.0016)	0.101 (0.0039)

Maintenance standard, tappet, unit : mm (in)

Inspection item	Standard	Limit
Tappet stem outside diameter	11.975 ~ 11.990 (0.4715 ~ 0.4720)	11.955 (0.4707)
Tappet hole (block) inside diameter	12.000 ~ 12.025 (0.4724 ~ 0.4734)	12.045 (0.4742)
Clearance	0.010 ~ 0.050 (0.0004 ~ 0.0019)	0.090 (0.0035)

Maintenance standard, trochoid pump (lubrication oil pump), unit: mm (in)

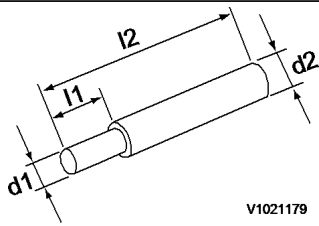
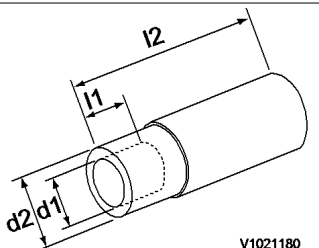
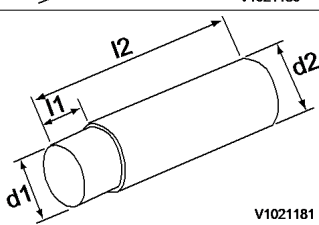
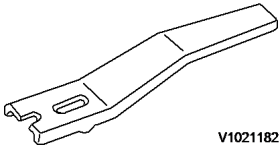
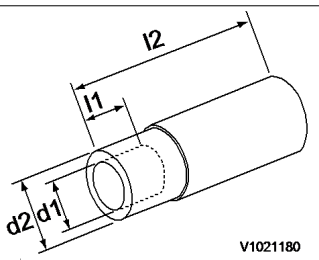
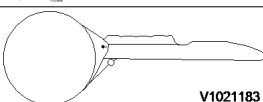
Inspection item	Standard	Limit
Clearance between outer rotor and gear case	0.12 ~ 0.21 (0.0047 ~ 0.0082)	0.30 (0.0118)
Side clearance between outer rotor and gear case	0.02 ~ 0.07 (0.0007 ~ 0.0027)	0.12 (0.0047)
Inner clearance between inner rotor and gear case	0.30 ~ 0.50 (0.0118 ~ 0.0197)	0.60 (0.0236)
Width across flat clearance of inner rotor	0.20 ~ 0.60 (0.0079 ~ 0.0236)	0.67 (0.0276)

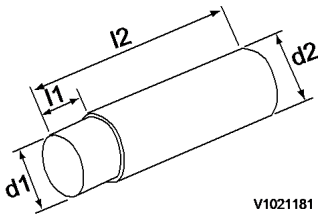



Document Title: Special tools	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Special tools

Special tools



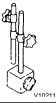











Special tools





Tool name	Applicable model and tool size	Illustration
Valve guide tool (for extracting valve guide)	<ul style="list-style-type: none"> ○ l1 : 20 mm (0.787 in) ○ l2 : 75 mm (2.953 in) ○ d1 : 7.5 mm (0.295 in) ○ d2 : 11 mm (0.433 in) 	 <p>V1021179</p>
Valve guide tool (for inserting valve guide)	<ul style="list-style-type: none"> ○ l1 : 15 mm (0.590 in) ○ l2 : 65 mm (2.559 in) ○ d1 : 14 mm (0.551 in) ○ d2 : 20 mm (0.787 in) 	 <p>V1021180</p>
Connecting rod bushing replacer (for removal/installation of connecting rod bushing)	<ul style="list-style-type: none"> ○ l1 : 20 mm (0.787 in) ○ l2 : 100 mm (3.937 in) ○ d1 : 26 mm (1.023 in) ○ d2 : 29 -0.3/-0.6 mm (1.141 -0.012/-0.024 in) 	 <p>V1021181</p>
Valve spring compressor (for removal/installation of valve spring)	Part number : VOE 11713128	 <p>V1021182</p>
Stem seal inserter (for inserting stem seal)	<ul style="list-style-type: none"> ○ l1 : 18.8 mm (0.740 in) ○ l2 : 65 mm (2.559 in) ○ l3 : 4 mm (0.157 in) ○ d1 : 16.2 mm (0.637 in) ○ d2 : 22 mm (0.886 in) ○ d3 : 13.5 mm (0.531 in) 	 <p>V1021180</p>
Filter wrench (for removal/installation of lubrication oil filter)	Available on the market	 <p>V1021183</p>

Camshaft bushing tool (for removing camshaft bushing)	<ul style="list-style-type: none"> ○ l1 : 18 mm (0.709 in) ○ l2 : 70 mm (2.756 in) ○ d1 : 45 -0.3/-0.6 mm (1.771 -0.012/-0.024 in) ○ d2 : 48-0.3/-0.6 mm (1.889 -0.012/-0.024 in) 	 <p>V1021181</p>
Flex-hone (for re-honing of cylinder liner)	<ul style="list-style-type: none"> ○ Part number : VOE 11713130 ○ Applicable bore : 83 ~ 95 mm (3.268 ~ 3.740 in) 	
Piston insertion tool (for inserting piston)	Part number : VOE 11713129 The above piston insertion tool is applicable to 60 ~ 125 mm (2.362 ~ 4.921 in) diameter piston.	
Piston ring replacer (for removal/installation of piston ring)	Available on the market	

Measuring tools

Measuring tools

Instrument name	Application	Illustration
Dial gauge	Measurements of shaft bending, strain and gap of surface	
Test indicator	Measurements of narrow or deep portions that cannot be measured by dial gauge.	
Magnetic stand	For holding the dial gauge when measuring using a dial gauge, standing angles adjustable	
Micrometer	For measuring the outside diameter of crankshaft, pistons, piston pins, etc.	
Cylinder gauge	For measuring the side diameters of cylinder liners, rod metal, etc.	
Callipers	For measuring outside diameters, depth, thickness and width	
Depth micrometer	For measuring of valve sink	
Square	For measuring valve spring inclination and straightness of parts	
V-block	For measuring shaft bend	
Torque wrench	For tightening nuts and screws to the specified torque	
Feeler gauge	For measuring gaps between ring and ring groove, and shaft joints during assembly	
Cap tester	For checking water leakage	
Battery/coolant tester	For checking concentration of antifreeze and the battery electrolyte charge status	
Nozzle tester	For measuring injection spray pattern of fuel injection nozzle and injection pressure	
Digital thermometer	For measuring temperature	 <p>I : Float</p>

Speedometer (contact type)	For measuring revolution by contacting the mortise in the revolving shaft	
Speedometer (photoelectric type)	For measuring revolution by sensing the reflecting mark on the outer periphery of the revolving shaft	 1 : Revolving shaft 2 : Reflection mark
Circuit tester	For measuring resistance voltage and continuity of electrical circuits	
Compression gauge kit	For measuring compression pressure Part number : VOE 11713131	

Document Title: Periodic maintenance chart	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Periodic maintenance chart

NOTE!

Make a periodic inspection plan according to the state of use. Perform periodic inspections accurately so that inspection items will not be skipped. If periodic inspection is neglected, failures may occur or durability may be lost. Inspection and maintenance after 1000 hours require expertise and skill, so consult our dealer or distributor.

Periodic maintenance chart

Part	Item	Daily	Maintenance period				
			Every 50 hours	Every 250 hours or 3 months	Every 500 hours or 6 months	Every 1000 hours or one year	Every 2000 hours or two years
Fuel oil system	Check the fuel level and refill	O (before operation)					
	Drain the fuel tank sediment		O				
	Drain the water separator		O				
	Bleeding the fuel system		O				
	Clean the water separator				O		
	Replace the fuel filter element				O		
Lube oil system	Check the lube oil level	O (before operation)					
	Replace the lube oil		O (1st time)	O (2nd time and thereafter)			
	Replace lube oil filter element		O (1st time)	O (2nd time and thereafter)			
Cooling system	Check the coolant level and refill	O (before operation)					
	Clean the radiator fins			O			
	Check the cooling fan V-belt tension		O (1st time)	O (2nd time and thereafter)			
	Replace the coolant					O	
	Check and maintain the coolant system						O
Rubber hose	Inspect and maintain the fuel pipe and coolant pipe	O (before operation)					O
Governor	Inspect and adjust the governor and accelerator	O (before operation)		O			
Air intake system	Clean and replace the air cleaner element			O	O		

Electrical system	Check warning lamps and instruments function	O					
	Check the battery electrolyte level and refill		O				
Cylinder body	Adjust the inlet and exhaust valve clearance					O (S)	
	Lap the inlet and exhaust valve seat						O (S)
Fuel injection pump and nozzle	Inspect the fuel injection nozzle pressure					O (S)	
	Inspect the fuel injection timing						O (S)

NOTE!

Item marked "S" should be serviced by an authorized Volvo Construction Equipment dealer, unless the owner has proficient mechanical ability and the proper tools.

Document Title: Periodic inspection and maintenance procedure	Function Group: 200	Information Type: Service Information	Date: 2014/4/16
Profile: CEX, EC35 [GB]			

Periodic inspection and maintenance procedure

Check before daily operation

Be sure to check the following points before starting the engine every day.

Visual check around engine

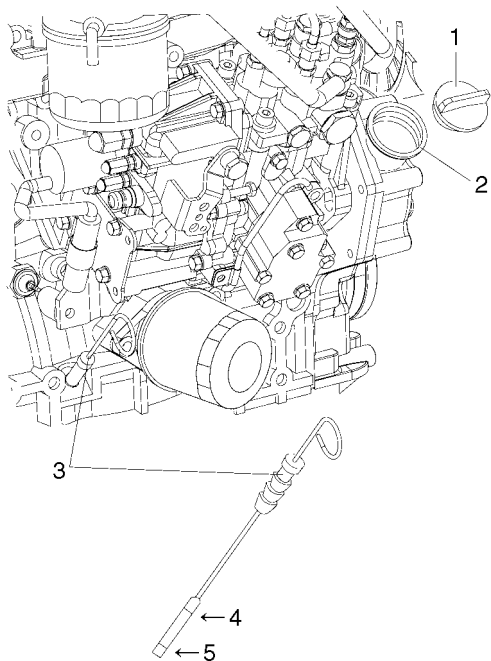
- Oil leak from the lubrication system
- Fuel leak from the fuel system
- Cooling water leak from the cooling water system
- Damaged parts
- Loosened or lost bolts
- Fuel, radiator rubber hoses, V belt cracked, loosened clamp

Fuel tank level check and fuel supply

Check the remaining fuel oil level in the fuel tank and refuel the recommended fuel if necessary.

Lube oil level check and replenishment

- Checking oil level.
Check the engine oil level with the dipstick, after adjusting the posture of the machine unit so that the engine is level. Insert the dipstick fully and check the oil level. The oil shall not be contaminated heavily and have appropriate viscosity. No coolant or diesel oil shall be mixed.
The level shall be between the upper and lower limit lines on the dipstick.



V1020549

Figure 1
Checking oil level and replenishing with engine oil

1. Filler cap

2. Filler port (engine oil)
3. Dipstick gauge
4. Upper limit
5. Lower limit

Engine oil capacity, unit: liter (gal.)

Total volume	Effective volume
7.4 (1.95)	3.4 (0.89)

- Replenishing oil pan with engine oil.
If the remaining engine oil level is low, fill the oil pan with the specified engine oil to the specified level through the filler port.

NOTE!

The oil should not be overfilled to exceed the upper limit line. Otherwise, oil may jet out from the breather or the engine may become faulty.

Coolant inspection

Daily inspection of the coolant should be done only by sub-tank.



WARNING

Risk of scalding and burns when the expansion tank cap (radiator cap) is opened due to high pressure in the cooling system.



WARNING

Before removing the radiator cap, stop the engine and let it cool down sufficiently. When removing it, turn it slowly to release the pressure.

NOTE!

Securely tighten the filler cap after checking the radiator. Steam can spurt out during operation, if the cap is not properly tightened.

- Checking coolant volume
Check the coolant level in the sub-tank. If the water level is close to the LOW mark, open the sub-tank cap and replenish the sub-tank with clean soft water or premix to the FULL mark.
The coolant level of the sub-tank shall be between the upper and lower limit lines.

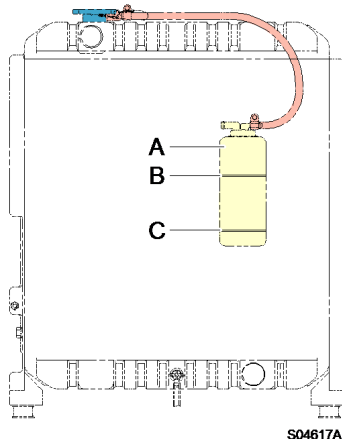


Figure 2

Checking, coolant level in the sub-tank

- A. Sub-tank
- B. Upper limit
- C. Lower limit

- Replenishment engine with coolant
If the sub-tank coolant level is lower than the LOW mark, open the radiator cap and check the coolant level in the

radiator. Replenish the radiator with coolant, if the level is low.

Check the coolant level while the engine is cool. Checking when the engine is hot is dangerous. And the coolant volume is expanded due to the heat.

Daily coolant level check and replenishing shall be done only at the sub-tank. Usually do not open the radiator cap to check or replenish.

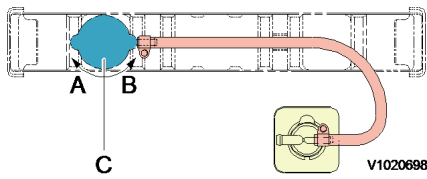


Figure 3
Replenishment, coolant

- A. Tighten
- B. Loosen
- C. Radiator cap

NOTE!

If the coolant runs short quickly or when the radiator runs short of coolant with the sub-tank level unchanged, coolant may be leaking or the air tightness may be lost. Increase in the sub-tank level during operation is not abnormal. The increased coolant in the sub-tank returns to the radiator when the engine is cooled down. If the level is normal in the sub-tank but low in the radiator, check for loosened clamping of the rubber hose between the radiator and sub-tank or a tear in the hose.

Engine: The radiator shall be filled up.

Coolant capacity, unit: liter (gal)

Coolant volume in the engine
2.7 (0.71)

Fuel pipe and cooling water pipe inspection and maintenance

Check the rubber hoses for fuel and cooling water pipes cracked. If the cracked hose is found, replace it with new one. Check the loosened clamp. If found, tighten it.

Warning lamp & instruments function check

Before and after starting the engine, check to see that the alarm function normally. Failure of alarm cannot warn the lack of the engine oil or the cooling water. Make it a rule to check the alarm operation before and after starting engine every day.

Checking accelerator operation

Make sure the accelerator of the machine unit can be operated smoothly before starting the engine. If it feels heavy to manipulate, lubricate the accelerator cable joints and pivots. Adjust the accelerator cable if there is a dislocation or excessive play between the accelerator and the governor lever.

Inspection after initial 50 hours operation



Hot oil and hot engine coolant can cause severe burns!

NOTE!

Replace engine oil after the engine oil becomes warm. It is most effective to drain the engine oil while the engine is still warm.

In early period of use, the engine oil gets dirty rapidly because of the initial wear of internal parts. Replace the engine oil earlier. Engine oil filter should also be replaced when the engine oil is replaced. Engine oil and engine oil filter replacing procedures are as follows. Remove the oil filler cap to drain easily while draining the engine oil.

- Drain engine oil
 - Prepare a waste oil container collecting waste oil.

- Remove the drain plug using a wrench to drain the engine oil.
- Securely tighten the drain plug after draining the engine oil.

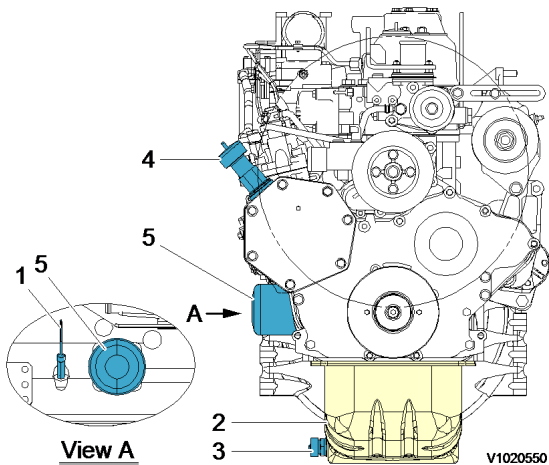
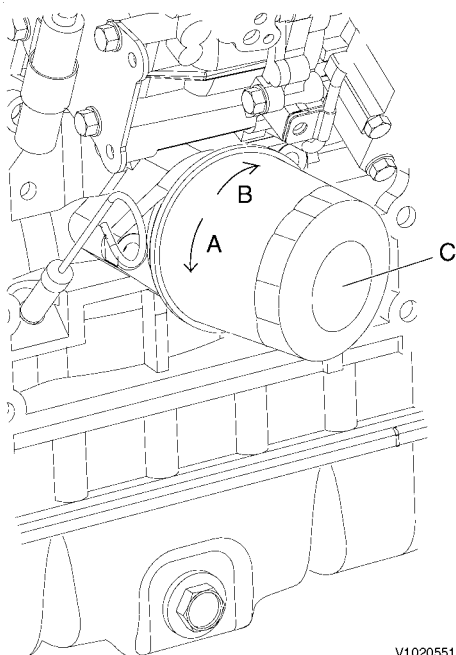


Figure 4
Dipstick gauge, oil pan and drain plug

1. Dipstick
2. Oil pan
3. Drain plug
4. Oil filler port
5. Oil filter

- Replacing oil filter

- Turn the engine oil filter counterclockwise using a filter wrench to remove it.
- Clean the mounting face of the oil filter.
- Moisten the new oil filter gasket with the engine oil and install the new engine oil filter manually turning it clockwise until it comes into contact with the mounting surface, and tighten it further to 3/4 of a turn with the filter wrench.
- Tightening torque: 2.0 ~ 2.4 kgf·m (14.4 ~ 17.3 lbf·ft).
- Applicable oil filter part number: 129150–35151.





Suggest:

If the above button click is invalid.

Please download this document first, and then click the above link to download the complete manual.

Thank you so much for reading

Figure 5
Replacement, engine oil filter

- A. Loosen

B. Tighten

C. Engine oil filter

Filling oil and inspection

Filling oil and inspection

NOTE!

Do not overfill the oil pan with engine oil. Be sure to keep the specified level between upper and lower limit on the dipstick.

Warm up the engine by running for 5 minutes while checking any oil leakage.

Stop the engine after warming up and leave it stopped for about 10 minutes then recheck the engine oil level with dipstick and replenish the engine oil. If any oil is spilled, wipe it away with a clean cloth.
- Checking and adjusting radiator fan V-belt**
- When there is not enough tension in the V-belt, the V-belt will slip making it impossible for the alternator to generate power and water pump and cooling fan will not work causing the engine to overheat. Check and adjust the V-belt tension (deflection) in the following manner.
- Press the V-belt with your thumb [approx. 98N (10kgf)] at the middle of the V-belt span to check the tension (deflection).

Available positions to check and adjust the V-belt tension (deflection) are at the A, B or C direction as shown in the illustration right.

You may choose a position whichever you can easily carry out the check and adjustment on the machine unit.

"New V-belt" refers to a V-belt which has been used less than 5 minutes on a running engine.

"Used V-belt" refers to a V-belt which has been used on a running engine for 5 minutes or more.

The specified deflection to be measured at each position should be as follows.

Figure 6
Checking and adjustment, radiator fan V-belt

1. Radiator fan

2. V-belt

3. Crankshaft V-pulley

4. Press with thumb

5. Deflection

6. Alternator

7. Set screw

V-belt deflection, unit: mm (in)

Direction	A	B	C
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