

Document Title: Engine, description	Function Group: 200	Information Type: Service Information	Date: 2014/3/20
Profile: WLO, L350F [GB]			

Engine, description

D16E

D16E is a straight six-cylinder, four-stroke, turbocharged diesel engine with direct injection and intercooler, as well as wet replaceable cylinder liners. The engine is equipped to meet governing legislation according to Tier 3/stage IIIA for exhaust emissions.

The D16E uses V-ACT (Volvo Advanced Combustion Technology). Engine D16EV with ACT features split injection, optimized air handling and turbocharger with wastegate. Electronically controlled IEGR (Internal Exhaust Gas Recirculation) reduces NO_x contents and reduces emissions without the need for after-treatment of exhausts. All electronic functions in the engine are controlled by Volvo's latest engine management system, EMS2.

The cylinders are numbered in sequence, starting farthest from the flywheel. Ignition order: 1-5-3-6-2-4. The engine's rotational direction is counter-clockwise, seen from the flywheel.

Engine identification

Identification plate 1

Engine designation, serial number, part number and assembly plant are stamped in one field on the engine block's left front edge.

Identification plate 2

A decal with the software's ID-number, the engine's serial number and assembly plant is located on the valve cover to ensure installation of correct ECU on the engine in production. On the back of the ECU, there is a decal indicating its hardware number.

Assembly plants:

A = Skövde, Sweden

E = Curitiba, Brazil

F = Flen, Sweden

L = Lyon, France

Identification plate 3

The certification decal is located on the valve cover as well as on the machine frame.

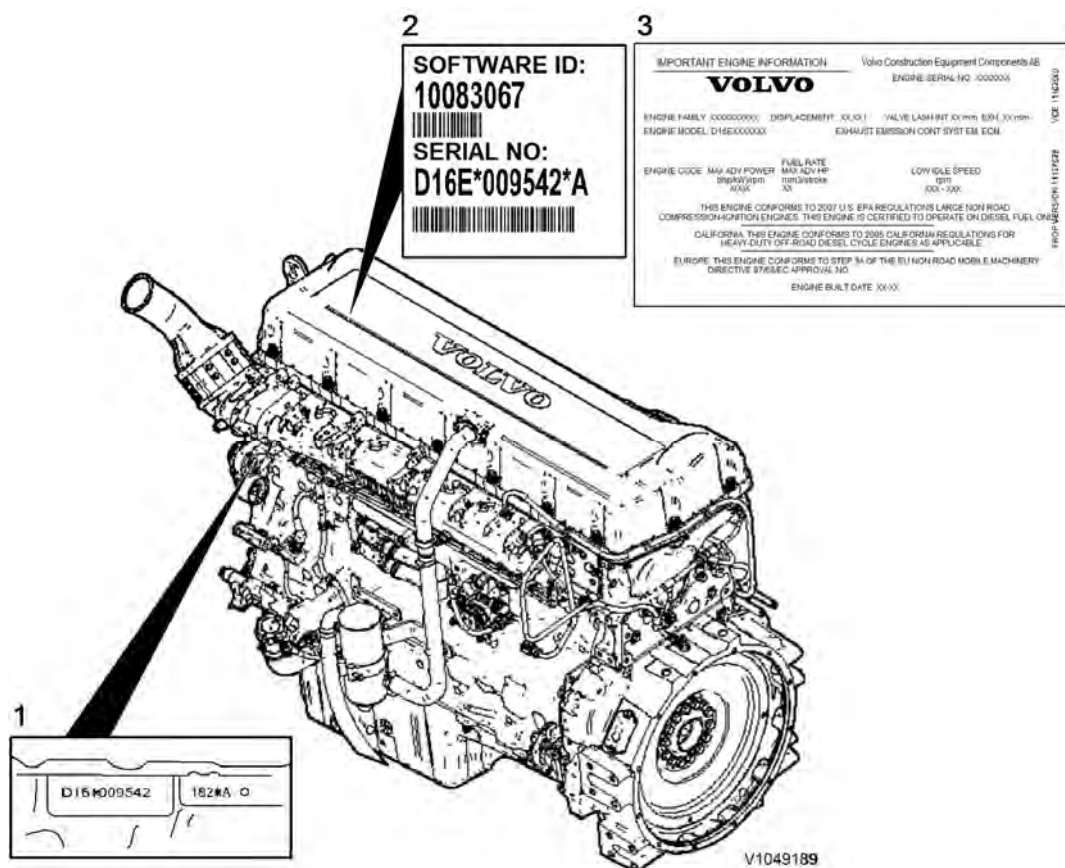


Figure 1
Engine identification, D16E

Engine protection — Software

The function informs the operator and limits the engine's rpm and torque as well as machine speed to prevent any engine damage. Engine shut-off takes place first when speed is below 2 km/h (1.2 mph). This makes it possible to move the machine away from hazardous situations before engine shut-off takes place.

The function is monitored by the engine control unit E-ECU and, depending on which component is generating the alarm, then any of the following functions is activated:

- reduction of engine's torque
- limitation of engine's rpm
- limitation of machine speed
- engine shut-down

See also [370 Wiring diagram 202](#), [370 Wiring diagram 203](#), [370 Wiring diagram 204](#) and [370 Wiring diagram 206](#)

Input signals	Conditions for output functions	Output functions
○ Engine oil pressure, SE2203	○ (Critical) Low engine oil pressure	○ Red central warning ○ Warning — Low engine oil press. ○ Warning — Stop vehicleTurn Off Engine ○ Reduction of engine's torque

	○ Low engine oil pressure ○ No or incorrect signal from the sensor	○ Amber central warning ○ Check — Engine failure
○ Engine oil temperature, SE2202	○ High engine oil temperature 127–130°C (260–266 °F) ○ No or incorrect signal from the sensor ○ (Critical) High engine oil temperature >130°C (266 °F)	○ Amber central warning ○ Check — High engine oil temp. ○ Red central warning ○ Warning — Stop vehicleTurn Off Engine ○ Warning — High engine oil temp.
○ EGR-valve, MA2504	○ Mechanical or electrical malfunction	○ Amber central warning ○ Check — Engine system failure ○ Reduction of engine's torque by max. 12% (to reduce the turbo's rpm)
○ Charge air temperature, SE2507	○ (Critical) High charge-air temperature > 83 °C (181 °F) ○ High charge-air temperature > 81°C ○ No or incorrect signal from the sensor	○ Red central warning ○ Warning — Stop vehicleTurn Off Engine ○ Warning — High charge-air temp. engine ○ Reduction of engine's torque dependent on charge-air temperature and engine rpm ○ Amber central warning ○ Check — High charge-air temp. engine ○ Reduction of engine's torque dependent on charge-air temperature and engine rpm ○ Amber central warning ○ Check — Engine system failure
○ Coolant level, SE2603	○ (Critical) Low coolant level ○ Low coolant level	○ Red central warning ○ Warning — Stop vehicleTurn Off Engine ○ Warning — Coolant level low ○ Amber central warning ○ Check — Coolant level lowCheck at next stop

	No or incorrect signal from the sensor	- Amber central warning - Check — Engine failure
Coolant temperature, SE2606	(Critical) High coolant temperature >104 °C (219 °F) - High coolant temperature 102–104 °C (216–219 °F) - Electrical malfunction.	- Red central warning - Warning — Stop vehicleTurn Off Engine - Warning — High coolant temp. engine - Reduction of engine's torque dependent on coolant temperature and engine rpm - Amber central warning - Check — High coolant temp. engine - Reduction of engine's torque dependent on coolant temperature and engine rpm - Amber central warning - Check — Engine failure
Crankcase pressure, SE2509	(Critical) High crankcase pressure > 5 kPa (0.73 PSI) above atmospheric pressure - Electrical malfunction.	- Red central warning - Warning — Stop vehicleTurn Off Engine - Warning — High crankcase pressure - Reduction of the engine's rpm (750 rpm) and the vehicle's speed (5 km/h). Limitation of the engine's torque. - Amber central warning - Check — Engine failure
Engine rpm flywheel, SE2701	No or incorrect signal from the sensor	- Amber central warning - Check — Engine failure - Reduction of engine's torque by 2% per second - Max. torque engine 90%

Engine speed (engine speed for E-ECU) — Software

This function monitors boost pressure and informs the operator if there is a system malfunction.

Engine speed is used internally in the E-ECU for engine control and as input signal for engine protection.

In case of engine speed sensor malfunction, the E-ECU uses sensor SE2703 for camshaft speed instead.

See also [370 Wiring diagram 202](#)

Input signals	Conditions for output functions	Output functions
Monitoring,	System malfunction, signal missing or abnormal	Amber central warning

SE2701	frequency See Diagnostics	○ Check — Engine system failure ○ Reduction of engine's torque by 2% per second ○ Max. torque engine 90%. Included in (engine protection)
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Motor On/Off — Software

Engine On/Off is used as a condition in software functions to define when the engine is considered to be On and Off, respectively.

See also [370 Wiring diagram 201](#).

Input signals	Conditions for output functions	Output functions
○ Engine speed, SE2704	○ Engine speed < 50 rpm	○ Engine = Off
	○ Engine speed > 600 rpm	○ Engine = On

Automatic engine shutdown — Software

The function control engine shut-off when the conditions according to the table have been fulfilled, and informs the operator that the engine will be shut off within 1 minute. When the engine is shut off the parking brake will also be applied.

The operator can interrupt engine shutdown by affecting the throttle pedal, hand throttle, or the gear selector.

See also [370 Wiring diagram 201](#), [370 Wiring diagram 205](#), [370 Wiring diagram 404](#) and [370 Wiring diagram 408](#)

Input signals	Conditions for output functions	Output functions
○ VCADS Pro parameter FAU ○ VCADS Pro parameter FAV ○ Directional gear, SW4205 ○ Throttle pedal, SE2702 APS ○ Hand throttle, SE2701 ○ Engine On/Off ○ Travel speed	Overall conditions for the function ○ VCADS Pro parameter FAU "On"	1. Activation of the function automatic engine shut-off (4–50 min.) 2. When 1 minute remains of set time Check — AutomaticEngine shutdown is shown. [T1] 3. Engine shutdown and parking brake is applied (MA5501 without voltage)
	○ VCADS Pro parameter FAV "4–99 minutes" ○ Directional gear in position N ○ Accelerator pedal < 5% ○ Hand throttle not activated ○ Engine On ○ Travel speed < 5 km/h (3 mph)	

[T1]Engine shutdown is interrupted in case of activation of throttle pedal, hand throttle, or if the gear selector is moved to position F or R.

Document Title: E-ECU, MID 128, changing non-programmed ECU	Function Group: 200	Information Type: Service Information	Date: 2014/3/20
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E-ECU, MID 128, changing non-programmed ECU

Op nbr 200-068

[VCADS Pro VCADS Pro Service Tool](#)
[88890180 Interface](#)
[88890027 Cable](#)

1. Place the machine in service position 1, see [191 Service position](#).
2. Connect VCADS Pro and perform the operation 28423-3 MID 128 ECU, programming.
3. Open the engine hood on the right side.
4. Loosen and swing aside the cooling coil.
5. Unplug connectors from the E-ECU and loosen the cable harness clamps.

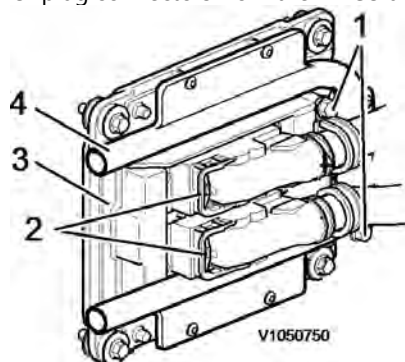


Figure 1

1. Cable harness clamps
 2. Connectors
 3. E-ECU
 4. Cooling coil
6. Change E-ECU.
 7. Install the cooling coil.
 8. Plug in the connectors for the E-ECU and install the cable harness clamps.
 9. Turn on the voltage with the battery disconnecter.
 10. Finish VCADS Pro operation 28423-3 MID 128 ECU, programming.
 11. Start the machine and check that no error messages appear.

12. Restore the machine to operating condition.

Document Title: E-ECU, MID 128, changing pre-programmed ECU	Function Group: 200	Information Type: Service Information	Date: 2014/3/20
Profile: WLO, L350F [GB]			

E-ECU, MID 128, changing pre-programmed ECU

Op nbr 200-070

[VCADS Pro VCADS Pro Service Tool](#)
[88890180 Interface](#)
[88890027 Cable](#)

1. Place the machine in service position 1, see [191 Service position](#).
2. The new control unit has basic set parameters for the machine. If it is possible to read out customer parameters, connect VCADS Pro and perform the operation 17030-3 Parameter, programming. Save all read parameters to job card.
The operation is used to read out customer parameters from the old control unit to enable later comparison with parameters in the new control unit.
3. Open the engine hood on the right side.
4. Loosen the cooling coil and swing it aside.

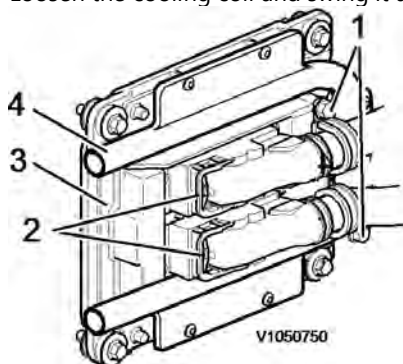


Figure 1

1. Cable harness clamps
 2. Connectors
 3. E-ECU
 4. Cooling coil
5. Unplug connectors from the E-ECU and loosen the cable harness clamps.
 6. Change E-ECU.
 7. Install the cooling coil.
 8. Plug in the connectors for the E-ECU and install the cable harness clamps.
 9. Turn on the voltage with the battery disconnecter.

10. If customer parameters have been read out from the old control unit, compare these to the parameters in the new control unit.
 - Connect VCADS Pro and perform the operation 17030-3 Parameter, programming. Save all read parameters to job card.
 - Compare parameter settings on the job cards.
 - Perform operation 17030-3 Parameter, programming and change customer parameters according to job card for the old control unit.
11. Start the machine and check that no error messages appear.
12. Restore the machine to operating condition.

Document Title: Engine, removing	Function Group: 210	Information Type: Service Information	Date: 2014/3/20
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Engine, removing

Op nbr 210-070

[9998547 Lifting tool](#)

Bolt, M16 x100, 2 pcs.

Washers, 9 mm, 6 pcs.

Lifting eyes 1500 kg, 2 pcs.

Lifting eyes, M16, 4 pcs.

Sling, 2 metres, 4 pcs.

The operation also includes tools and times for steps to which references are given.

1. Place the machine in service position, see [191 Safety rules when servicing](#)
2. Drain the coolant. Volume, coolant: see [030 Cooling system, volume](#)



Figure 1

1. Drain point coolant
3. Remove the engine hood, see [821 Engine hood, removing](#)
4. Remove the expansion tank (2) and the bracket (1). Remove the coolant pipe (4) together with its bracket (3).

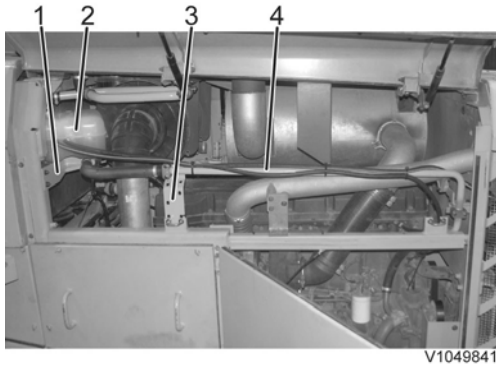


Figure 2

5. Drain the engine oil. Volume, engine oil: see [030 Engine capacities](#)
6. Remove the side panels.

Right side

7. Disconnect the cabling from the alternator and the preheating coil. Remove the protective plate over the alternator and the AC-compressor. Unplug the connectors from the AC-compressor.

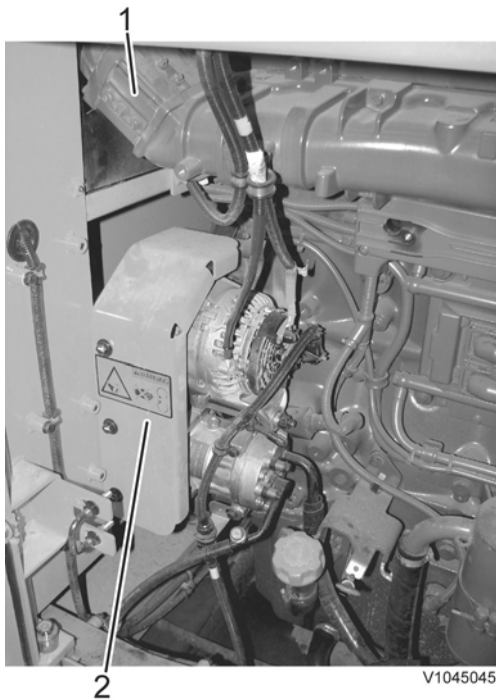


Figure 3

1. Preheating coil
2. Shield

8. Remove the charge-air pipe (1) and disconnect the coolant hose (3). Remove the preheating coil (2).



Figure 4

9. Disconnect the oil filler pipe from the bracket.

10. **NOTICE**

High-pressure refrigerant. Do not loosen air conditioning hoses or connections since this may lead to unintentional release of refrigerant.

Loosen the belt for the alternator and the AC-compressor. Disconnect the AC-compressor and lay it aside on the frame and secure the compressor with a tensioning strap.

11. Disconnect:

- Hose from the oil trap (1)
- Clamps (2)
- Hose connection for the oil drain.

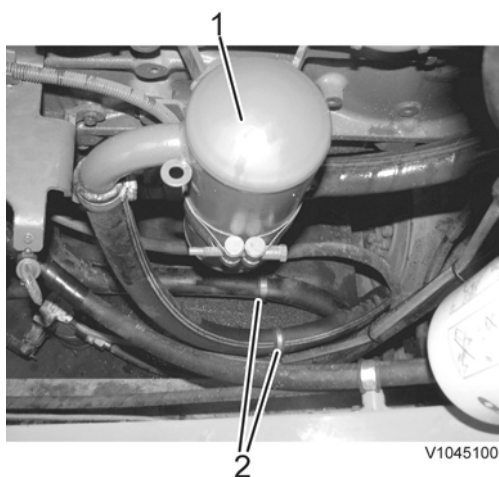


Figure 5

12. Disconnect:

- Fuel connections

- Connector SE2301
- Fuel filter bracket and secure it on the frame.

If the machine is equipped with fuel preheating, also disconnect:

- Clamp on the fuel filter bracket's rear edge
- Radiator hoses

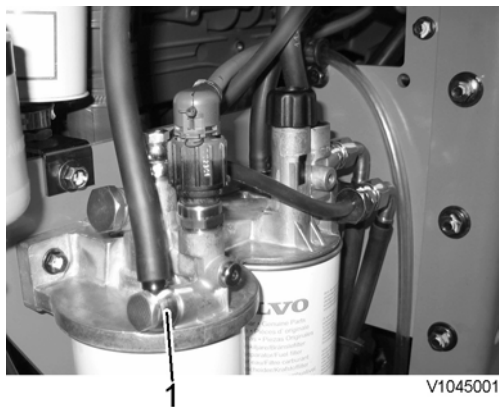


Figure 6

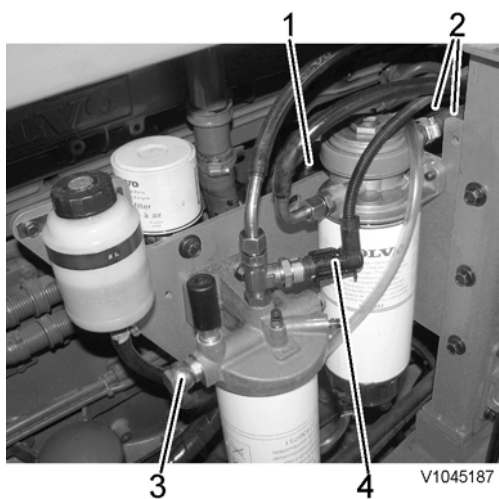


Figure 7
Fuel filter head, with preheating (optional equipment)

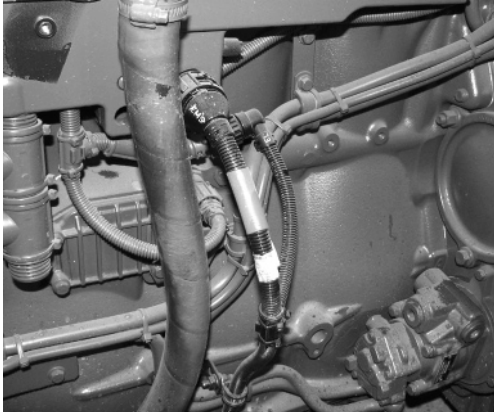
1. Fuel connection
2. Coolant hoses
3. Fuel connection
4. Connector SE2301

13. Mark up the connections on the fuel bracket. Disconnect the connections from the bracket.



Figure 8

14. Unplug connector EMS and EL as well as the clamp on the engine block.



V1045103

Figure 9

15. Disconnect the air filter bracket.



V1045104

Figure 10

16. Disconnect the cable clamps from the hydraulic tank's frame.

Left side

17. Disconnect:

- Coolant hoses (4, 6, and 3)
- Hose (1) and coolant pipe (2).

Remove the bracket (5) and the belt guard (7).

Pull out the coolant hose (3) through the hole in the intermediate wall



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