Document Title:	Function Group:	Information Type:	Date:
Engine, description	**200**	**Service Information**	**2014/6/23**
Profile: **ART, A40E [GB]**			

Engine, description

D16E

NOTE!

Since the illustrations in the service literature are reused for different engine version certain parts may differ from the version in question. However, the essential information in the illustrations is always correct.

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.

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

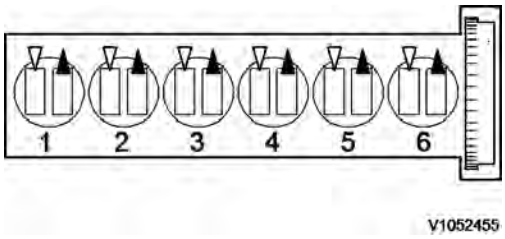


Figure 1
Cylinder numbering in relation to the flywheel

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.

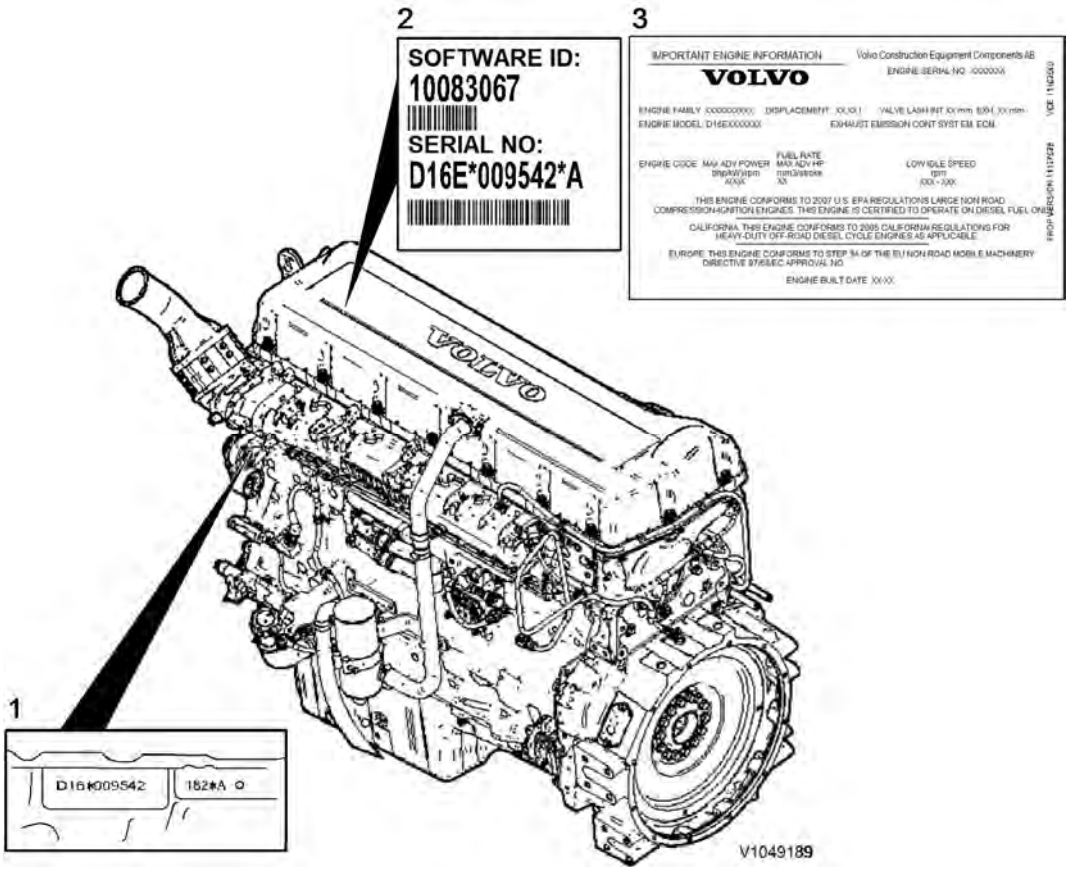


Figure 2
Engine identification, D16E

Document Title: **Engine Protection**	Function Group: **200**	Information Type: **Service Information**	Date: **2014/6/23**
Profile: **ART, A40E [GB]**			

Engine Protection

Engine protection, function description

Introduction

The engine control unit contains functionality that is to protect the engine from damage and minimize repair costs for damages that may occur in the engine's different systems. The parameters that activate the engine's protection system are:

- Low oil pressure
- Increased oil temperature
- Increased coolant temperature
- Low coolant level
- Increased crankcase pressure
- Increased charge-air temperature
- Increased boost pressure
- EGR-system
- Failure of flywheel's speed (rpm) sensor
- Water in fuel

When the level of any of these parameters reaches the risk zone, different protective actions may be activated:

- Warnings
- Reduced torque (only in case of signal from sensors for EGR-system or in case of failure of the flywheel's speed (rpm) sensor)

For examples of levels where engine protection is activated and which limitations are activated, see 3012 12F2604, brake cooling oil, circulation and 3012 1F2003, limitation engine protection (EMS)

Warnings

There are several alarm levels for warnings. Yellow warning indicates a less serious malfunction or level, and red warning indicates that the engine must be turned off. For detailed description, see 387 Warning screens, general

Reduced torque

The engine protection function can limit the torque to reduce damage and repair costs in case the operator does not notice that a warning has been activated. Limited torque is activated in two cases:

Error	Limitation
EGR-system	7 %
Failure of flywheel's speed (rpm) sensor	10 %

The limitation is active until the parameter has returned to a safe level or until EMS is powered down.

Degrees of engine protection

By using different programs (software) it is possible to set different degrees of engine protection. Regardless of what degree of engine protection that has been selected, the operator always receives a warning when there is a malfunction.

Oil pressure

Since it takes a little while for the oil pressure to build up, there is a delay after the engine has been started until the pressure measurement takes place. The oil pressure is dependent on the engine speed, and thus there is no fixed limit for when the oil pressure warning is activated. Instead the pressure is compared to the current engine rpm.

Coolant temperature

The coolant's boiling point is dependent on the ambient air pressure, that is, at which altitude the machine is operated,

which also decides at what temperature the warning is activated.

Increased crankcase pressure

The function measures and warns in case of increased crankcase pressure in a way that the pressure-increase value is obtained by comparing unfiltered and filtered crankcase pressure. The filter is designed so that a sudden pressure-increase gives a warning while a slowly increasing pressure, caused by normal wear, does not generate a warning.

Water in fuel

A sensor in the fuel system's pre-filter activates yellow warning when the water level becomes too high.

Document Title:	Function Group:	Information Type:	Date:
Engine, identification	**200**	**Service Information**	**2014/6/23**
Profile: **ART, A40E [GB]**			

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 left side of the machine's front frame.

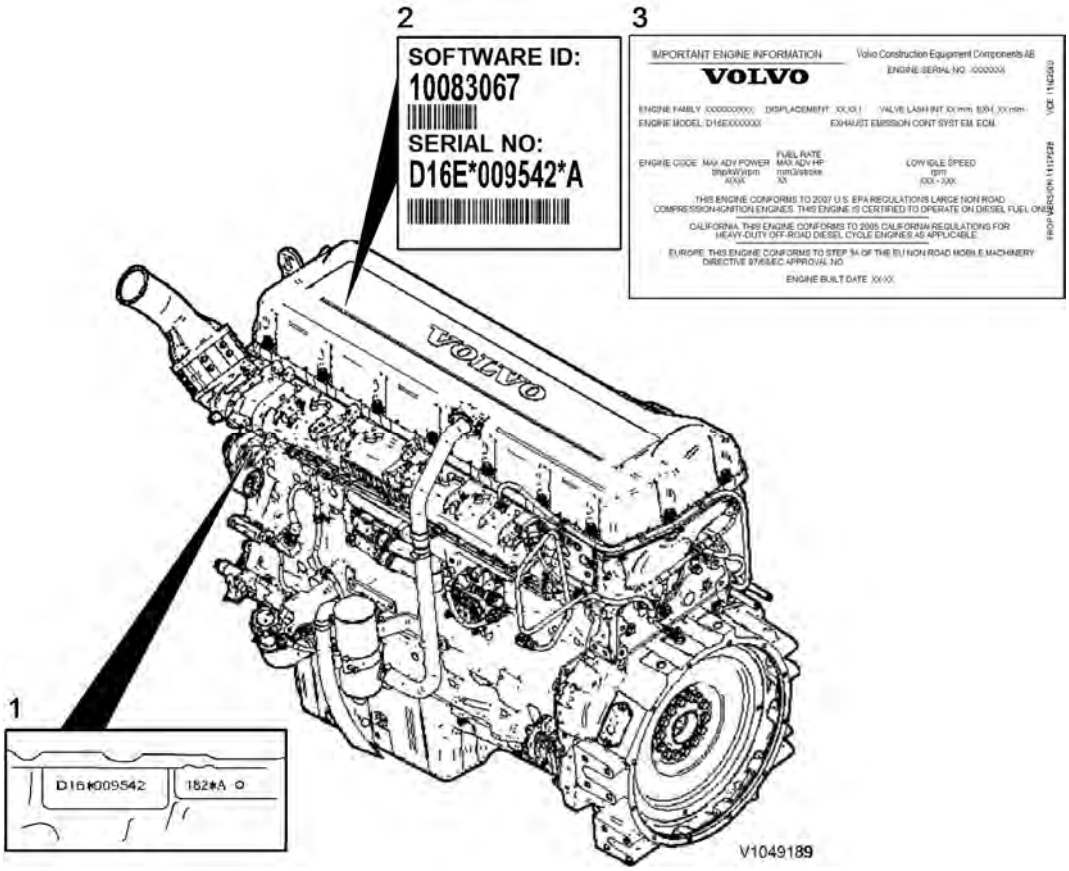
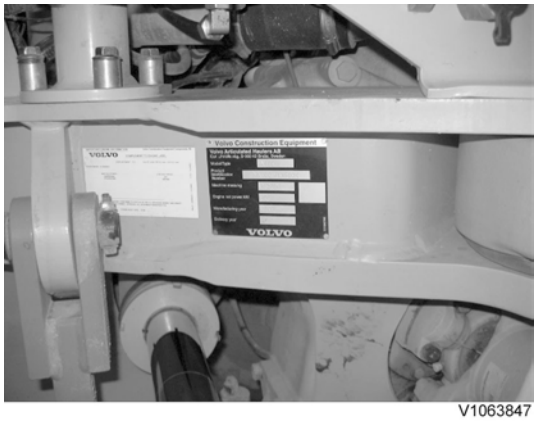


Figure 1
Engine identification, D16E



V1063847

Figure 2
Certification decal

Document Title: **E-ECU, MID 128, changing pre-programmed ECU**	Function Group: **200**	Information Type: **Service Information**	Date: **2014/6/23**
Profile: **ART, A40E [GB]**			

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

Op nbr 200-070

This operation also includes required tools and times for applicable parts of the following operations:

- 200 E-ECU, MID 128, changing non-programmed ECU

1. Connect VCADS Pro computer and perform 17030-3 Parameter, programming.
   - Use the function: Save all read parameters to job card.
2. Perform 200 E-ECU, MID 128, changing non-programmed ECU step 2–14.
3. Connect VCADS Pro computer and perform 17030-3 Parameter, programming.
   - Program earlier read-out parameters according to the job card.

Document Title: **E-ECU, MID 128, changing non-programmed ECU**	Function Group: **200**	Information Type: **Service Information**	Date: **2014/6/23**
Profile: **ART, A40E [GB]**			

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

Op nbr 200-068

1. Connect VCADS Pro computer and perform 28423-3 MID 128 ECU, programming
   - When instructed to connect the new control unit, perform steps 2–15.

   Removing E–ECU

   CAUTION
   Always follow instructions according to Electrical system, work instructions, electronic components

   3001 Electrical system, special instructions for servicing, electronic components

CAUTION
Always follow instructions according to Electrical system, work instructions, electronic components

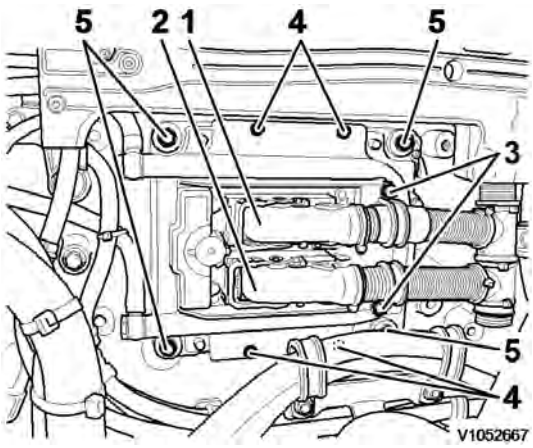
2. 

   Figure 1
   E-ECU

   1. Connector EA
   2. Connector EB
   3. Screw for clamp
   4. Screw for cooler
   5. Screw for ECU

   Place the machine in service position.

3. Open the engine hood.

   NOTICE
   Turn off the electric power with the battery disconnect switch before starting any work. Also remove the

fuse for respective component.

4. Remove the three screws (3) that disconnect the clamps from the E-ECU.
5. Unplug the connectors EA and EB from the E-ECU.
6. Remove th screws (4) (6 pcs.) that hold the cooler (3).
7. Remove the screws (5) (4 pcs.) that hold the E-ECU.
8. Carefully move aside the cooler and remove the E-ECU.
   NOTE!
   Work carefully so that hoses for the cooler are not damaged.

   Mounting E–ECU

9. Lift in the E-ECU inside of the cooler.
10. Install the screws (5) (4 pcs.) that hold the E-ECU against the engine block.
11. Install the screws (4) (6 pcs.) that hold the cooler against the E-ECU.
12. Plug in the connectors EA and EB for the E-ECU.
13. Install the screws (3 pcs.) that hold the clamps against the E-ECU.
14. Close the engine hood.
    NOTE!
    When changing pre-programmed ECU, return to 200 E-ECU, MID 128, changing pre-programmed ECU step 3.
15. Finish VCADS Pro operation 28423-3 MID 128 ECU, programming.

Document Title:	Function Group:	Information Type:	Date:
Cylinder compression, PC test	**210**	**Service Information**	**2014/6/23**
Profile: **ART, A40E [GB]**			

Cylinder compression, PC test

Connect the VCADS Pro computer and carry out 21006-3 Cylinder compression, test.
(21006-3) This test indicates if there is any deviation in compression in any cylinder in relation to the other cylinders.

Document Title: **Compression test**	Function Group: **210**	Information Type: **Service Information**	Date: **2014/6/23**
Profile: **ART, A40E [GB]**			

Compression test

Op nbr 210-002

9990006 Puller
9990185 Lifting tool
9990262 Adapter
9996400 Impact puller
9998599 Cleaning tool
9998248 Adapter
9998248 Adapter
9998248 Adapter
9998248 Adapter
9998248 Adapter
9998248 Adapter
88880003 Bracket
9988539 Pressure gauge
88820003 Setting tool
9993590 Gear wheel

This operation also includes required tools and times for applicable parts of the following operations:

- 191 Service positions
- 214 Valves, adjusting
- 233 Fuel system, bleeding

Removing

1. Place the machine in service position, see 191 Service positions.
2. Lower the front grill and pump up the engine hood.
3. Drain the fuel from the cylinder head by loosening the hose to the cylinder head. Install a drain nipple with hose.

V1060500

Figure 1

4. Drain the cylinder head to avoid fuel in the engine oil. Open the connection by the feed line on the cylinder head and use an air nozzle to get out all of the fuel. Lead down the feed hose into a container. Since the feed pump will pump out fuel during the test, the container's volume must be at least 5 litres (1.3 US gal).

V1060501

Figure 2

5. Remove the valve cover.

6. If it is difficult to reach the valve cover's front, right bolt, proceed as follows for easier access: Loosen the bolts for the coolant pipes' front bracket and move the pipe assembly approx. 10 mm from the cylinder head.

7. The condition for reading off correct compression pressure is that the valve clearance is correct, see: 214 Valves, adjusting

8. Remove the IEGR-valve with the seal for the oil channel and save the spacer between the valve and cylinder head.