

Document Title: <b>Engine, description</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/8/5 0</b>
Profile: <b>ART, A25F (37214) [GB]</b>			

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## Engine, description

Engines D11F, D13F, and D16F are straight six-cylinder, four-stroke, direct-injected diesel engines. Engines D13F and D16F are equipped with a single turbocharger with wastegate and engine D11F has a turbocharger without wastegate. They have charge-air cooling with mechanically actuated electronically controlled unit injectors, controlled by the EMS-system. The engines have a one-piece cylinder head with four valves per cylinder and a single overhead camshaft. Rear-mounted timing gear results in a shorter engine and lighter drivetrain installation. Engine brake for Articulated Hauler; VEB+ (EPG, Exhaust Pressure Governor, and VCB, Volvo Compression Brake).

For more information, see:

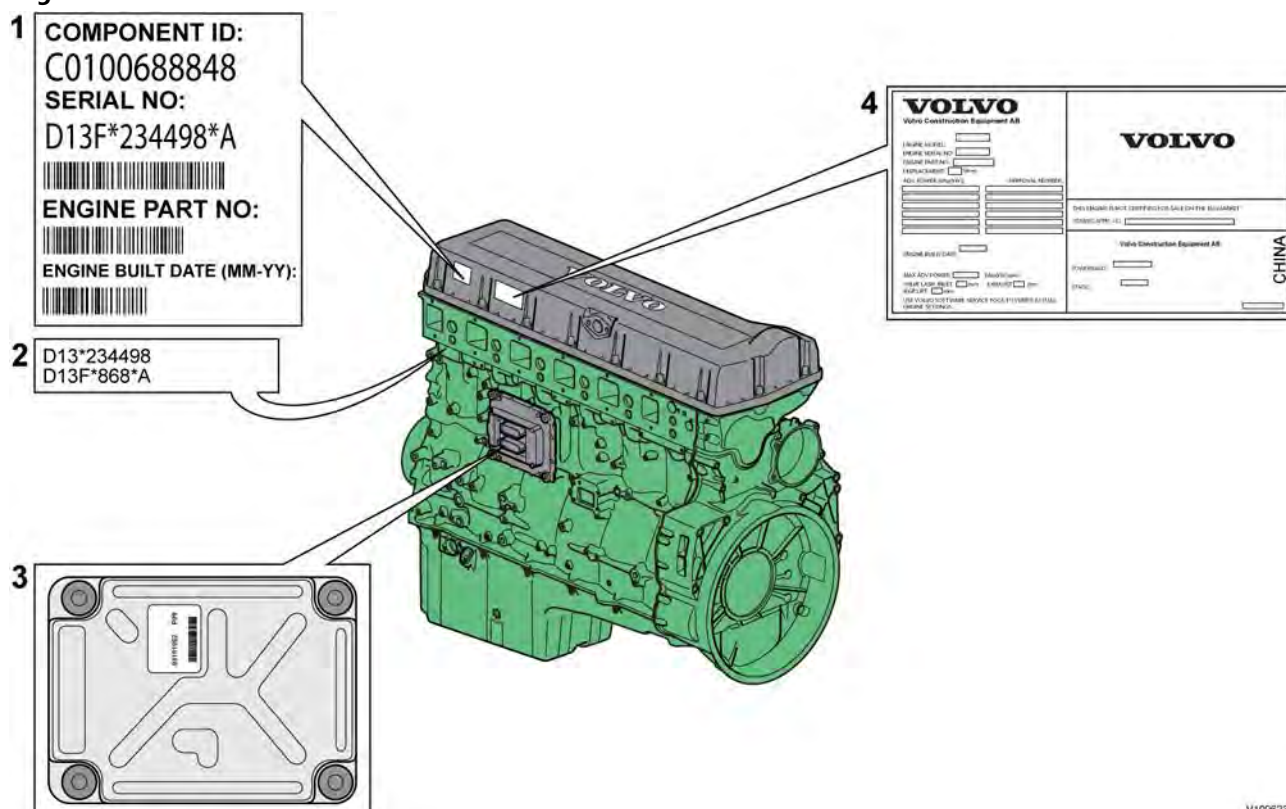
- [220 Lubrication system, description](#)
- [230 Fuel system, description](#)
- [250 Inlet and exhaust system, description](#)
- [255 Turbocharger, description](#)
- [260 Cooling system, description](#)

For Articulated Haulers:

- [253 Auxiliary brake \(engine braking\), description](#)
- [253 Exhaust pressure governor](#)

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



## Figure 1

### Identification plates, D13F

#### Identification plate 1

A label located on the valve cover showing the engine's component ID-number, serial number, manufacturing site, engine part number, and engine build date, as well as their bar codes. Manufacturing sites:

- A = Skövde, Sweden
- E = Curitiba, Brazil
- F = Flen, Sweden
- L = Lyon, France

#### Identification plate 2

The engine's serial number, part number, and manufacturing site are stamped into the engine's cylinder block.

#### Identification plate 3

The hardware component number of the Engine Control Unit (ECU) is located on a label on the back of the ECU.

#### Identification plate 4

The certification label is located on the valve cover as well as the machine's frame.

### Automatic Engine Shutdown

This is a function used to automatically shut down the engine after idling for a certain time. The operator is informed and has the opportunity to cancel the function within one minute, either by increasing the engine speed, shifting gear, or by activating the hand throttle.

### Engine protection

The ECU contains functionality designed to protect the engine from damage during extreme operating conditions or from further damage when an essential engine component fails. There are several proactive functions, and different applications have different functions activated. The ones that can be activated are:

- ☐ High coolant temperature
- ☐ High intake manifold air pressure
- ☐ High intake manifold air temperature
- ☐ High oil temperature
- ☐ Low oil pressure
- ☐ Low coolant level
- ☐ High crankcase pressure
- ☐ High ECU temperature

Various protective actions such as warning lights, engine torque reduction, engine speed limitation, and vehicle speed limitation may be taken when the above functions reach dangerous levels that may damage the engine. In order to always allow the operator to move a machine away from an unsafe situation, there is a delay of at least 30 seconds before the protective actions (such as forced idle and forced shutdown) are activated after a Key-ON. If the engine has been forced to shutdown or forced to idle due to an active engine protection function, the operator can obtain a 30 second delay by powering down the EMS with a Key-OFF for 7 seconds and then a Key-ON (the EMS is powered down by the Vehicle-ECU (V-ECU) after the ignition key has been in its OFF position for approx. 7 seconds). In addition to the above protective functions, other software functions could request engine protection, such as:

- ☐ High Altitude (ensures that high compressor discharge temperature is never reached)
- ☐ Turbo OverSpeed
- ☐ Low Coolant Temp
- ☐ Crank Sensor Failure
- ☐ Gear Ratio

### Warning lights

There are two levels for warning lights, an amber caution light and a red stop light.

- The **amber light** indicates a warning situation
- The **red light** indicates that the vehicle must be stopped.

### Engine torque limitation

The engine torque can be limited by the engine protection function. Engine torque limitation is active until the parameter

has reached a safe level or until the EMS is powered down.

#### **Forced Idle**

The engine can be forced to idle speed by the engine protection function. Forced idle is active until conditions triggering the problem are back within normal working range or the EMS is powered down.

#### **Engine Shutdown**

The engine can be forced to shut down after conditions have reached levels that may cause engine failure and the machine speed is below a specified value.

#### **Machine Speed and Engine Speed Limits**

The engine protection function can limit the speed of the vehicle and/or the engine's rpm.

#### **Levels of engine protection**

Available proactive functions depend not only on the application but also on what level of protection has been activated for the specific machine. Two levels of engine protection are offered, the standard level is Basic protection and the optional level Extended protection. The general difference between basic and extended engine protection is that no active actions such as forced idle and forced shutdown will be taken in basic engine protection (with the exception of crankcase pressure that can cause shutdown in either setup). Warnings will be given to the operator regardless of engine protection level.

#### **Parameters**

- (ATJ) Injector cylinder 1, calibration
- (ATK) Injector cylinder 2, calibration
- (ATL) Injector cylinder 3, calibration
- (ATM) Injector cylinder 4, calibration
- (ATN) Injector cylinder 5, calibration
- (ATO) Injector cylinder 6, calibration
- (FAU) Automatic engine shut off
- (FAV) Automatic engine shut off, time
- (YA) Idle speed, setting

#### **Supplementary information**

- [200 Component locations](#)

#### **Function check**

- 17030-3 Parameter, programming

#### **Diagnostics**

Detailed information about the following relevant warnings and error codes is available under the diagnostics tab.

Component	Control unit	Message ID
EF2117 (ART) PPID55 (WLO, EXC)	MID128	PPID55
SE2202 FX1006 (WLO)	MID128	PID175
SE2507 FX1007 (WLO)	MID128	PID105
SE2203	MID128	PID100
SE2509	MID128	PID153
SE2603	MID128	PID111
SE2606	MID128	PID110

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## Engine, description

Engines D11H, D13H, and D16H are straight six-cylinder, four-stroke, direct-injected diesel engines. They are equipped with a single variable geometry turbocharger (VGT) and feature cooled external exhaust gas recirculation (EGR). They have charge-air cooling with mechanically actuated electronically controlled unit injectors, controlled by the EMS-system. The engines have a one-piece cylinder head with four valves per cylinder and a single overhead camshaft. Rear-mounted timing gear results in a shorter engine and lighter drivetrain installation. The engine brake for articulated haulers, VEB7, does not have the additional Exhaust Pressure Governor, EPG. Sufficient exhaust back-pressure will be controlled via the VGT.

For more information, see:

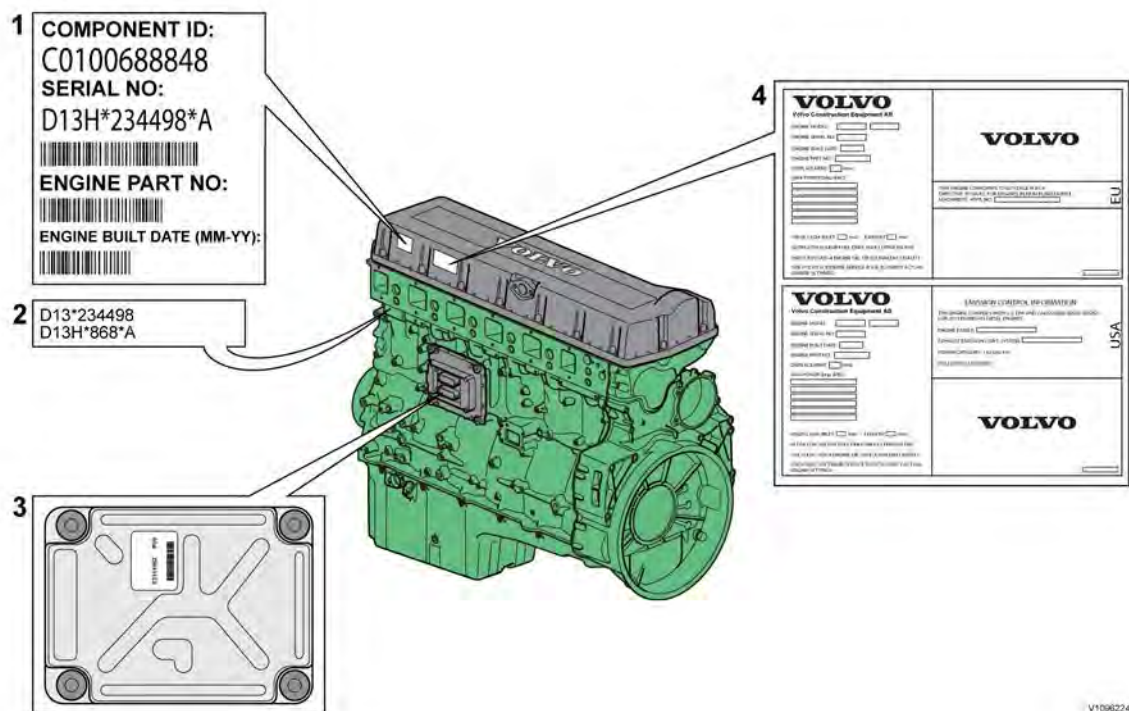
- [220 Lubrication system, description](#)
- [230 Fuel system, description](#)
- [250 Inlet and exhaust system, description](#)
- [254 Exhaust Aftertreatment System, description](#)
- [255 Turbocharger, description](#)
- [260 Cooling system, description](#)
- [293 Exhaust Gas Recirculation \(EGR\), description](#)

For Articulated Haulers:

- [253 Auxiliary brake \(engine braking\), description](#)

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



V1098224

**Figure 1**  
**Identification plates, D13H**

#### Identification plate 1

A label located on the valve cover showing the engine's component ID-number, serial number, manufacturing site, engine part number, and engine build date, as well as their bar codes. Manufacturing sites:

- A = Skövde, Sweden
- E = Curitiba, Brazil
- F = Flen, Sweden
- L = Lyon, France

#### Identification plate 2

The engine's serial number, part number, and manufacturing site are stamped into the engine's cylinder block.

#### Identification plate 3

The hardware component number of the Engine Control Unit (ECU) is located on a label on the back of the ECU.

#### Identification plate 4

The certification label is located on the valve cover as well as the machine's frame.

#### Automatic Engine Shutdown

This is a function used to automatically shut down the engine after idling for a certain time. The operator is informed and has the opportunity to cancel the function within one minute, either by increasing the engine speed, shifting gear, or by activating the hand throttle.

#### Engine protection

The ECU contains functionality designed to protect the engine from damage during extreme operating conditions or from further damage when an essential engine component fails. There are several proactive functions, and different applications have different functions activated. The ones that can be activated are:

- High coolant temperature

- High intake manifold air pressure
- High intake manifold air temperature
- High oil temperature
- Low oil pressure
- Low coolant level
- High temperature of cooled EGR exhausts after the EGR-cooler
- High crankcase pressure
- Variable Geometry Turbo valve and position error
- High temperature of Smart Remote Actuator
- High compressor charge-air temperature (calculated)
- High soot load
- High differential pressure across Diesel Particulate Filter (DPF)
- High exhaust temperature
- High ECU temperature
- High DPF temperature

Various protective actions such as warning lights, engine torque reduction, engine speed limitation, and vehicle speed limitation may be taken when the above functions reach dangerous levels that may damage the engine. In order to always allow the operator to move a machine away from an unsafe situation, there is a delay of at least 30 seconds before the protective actions (such as forced idle and forced shutdown) are activated after a Key-ON. If the engine has been forced to shutdown or forced to idle due to an active engine protection function, the operator can obtain a 30 second delay by powering down the EMS with a Key-OFF for 7 seconds and then a Key-ON (the EMS is powered down by the Vehicle-ECU (V-ECU) after the ignition key has been in its OFF position for approx. 7 seconds). In addition to the above protective functions, other software functions could request engine protection, such as:

- High Altitude (ensures that high compressor charge-air temperature is never reached)
- Turbo OverSpeed
- Low Coolant Temp
- Crank Sensor Failure
- Gear Ratio
- Regeneration

### Warning lights

There are two levels for warning lights, an amber caution light and a red stop light.

- The **amber light** indicates a warning situation
- The **red light** indicates that the vehicle must be stopped.

### Engine torque limitation

The engine torque can be limited by the engine protection function. Engine torque limitation is active until the parameter has reached a safe level or until the EMS is powered down.

### Forced Idle

The engine can be forced to idle speed by the engine protection function. Forced idle is active until conditions triggering the problem are back within normal working range or the EMS is powered down.

### Engine Shutdown

The engine can be forced to shut down after conditions have reached levels that may cause engine failure and the machine speed is below a specified value.

### Machine Speed and Engine Speed Limits

The engine protection function can limit the speed of the vehicle and/or the engine's rpm.

### Levels of engine protection

Available proactive functions depend not only on the application but also on what level of protection has been activated for the specific machine. Two levels of engine protection are offered, the standard level is Basic protection and the optional level Extended protection. The general difference between basic and extended engine protection is that no active actions such as forced idle and forced shutdown will be taken in basic engine protection (with the exception of crankcase pressure that can cause shutdown in either setup). Warnings will be given to the operator regardless of engine protection level.

### Parameters

- (FAU) Automatic engine shut off
- (FAV) Automatic engine shut off, time

- (JVL) Injector cylinder 1, calibration E3 Glitch Trim
- (JVM) Injector cylinder 2, calibration E3 Glitch Trim
- (JVN) Injector cylinder 3, calibration E3 Glitch Trim
- (JVO) Injector cylinder 4, calibration E3 Glitch Trim
- (JVP) Injector cylinder 5, calibration E3 Glitch Trim
- (JVQ) Injector cylinder 6, calibration E3 Glitch Trim
- (YA) Idle speed, setting

### Supplementary information

- [200 Component locations](#)

### Function check

- 17030-3 Parameter, programming

### Diagnostics

Detailed information about the following relevant warnings and error codes is available under the diagnostics tab.

Component	Control unit	Message ID
EF2112 (ART) PID404 (EXC, WLO)	MID128	PID404
EF2117 (ART) PPID55 (WLO, EXC)	MID128	PPID55
EF2127 (ART) PPID89 (EXC, WLO)	MID128	PPID89
EF2515 (ART) PSID28 (WLO, EXC)	MID128	PSID28
EF2525 (ART) PID173 (EXC) SE2510 (WLO)	MID128	PID173
SE2202 FX1006 (WLO)	MID128	PID175
SE2507 FX1007 (WLO)	MID128	PID105
MO2501	MID128	SID27
PPID326 (WLO, EXC)	MID128	PPID326
SE2203	MID128	PID100
SE2509	MID128	PID153
SE2516	MID128	PID412
SE2519	MID128	PID81
SE2603	MID128	PID111
SE2606	MID128	PID110

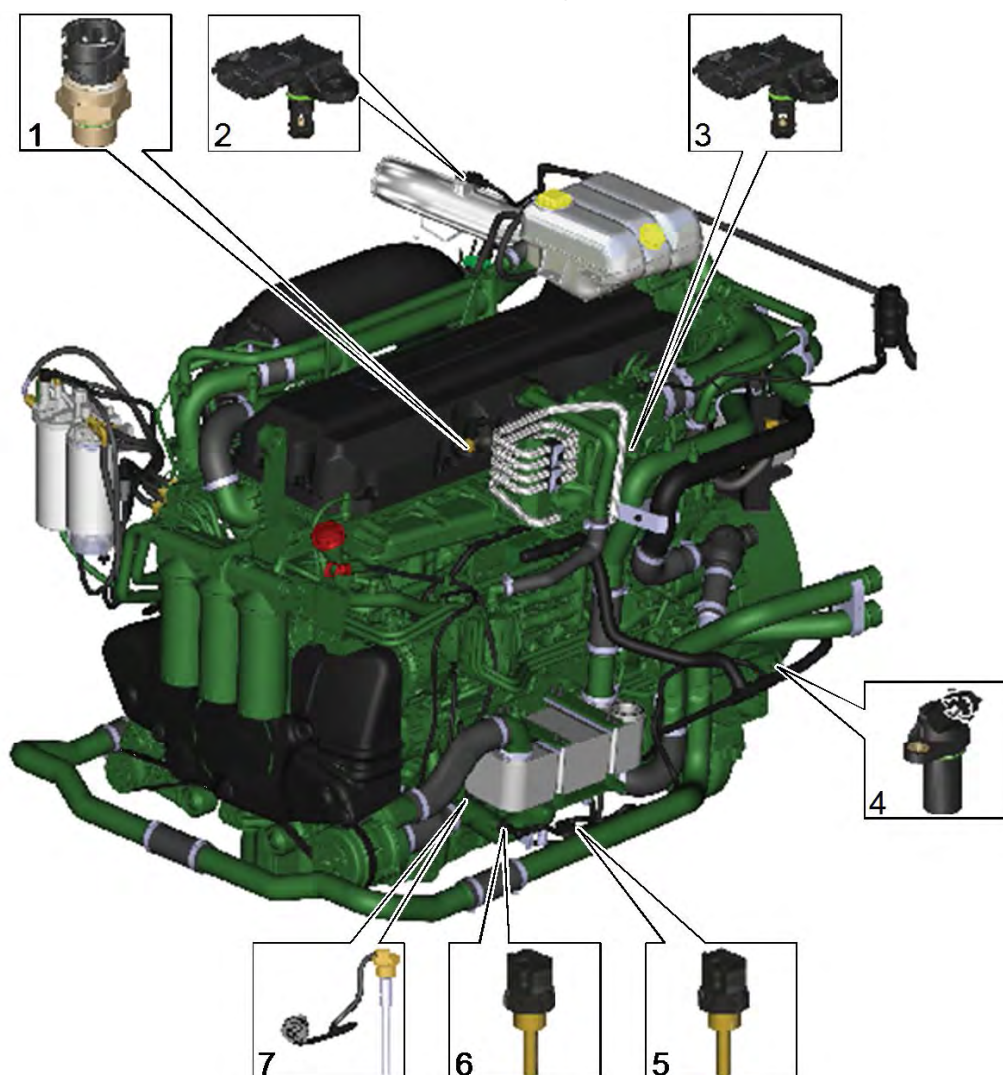


Document Title: <b>Engine, sensor positions</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/8/5 0</b>
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## Engine, sensor positions

### Control unit sensors

This is a brief description of the sensors that are found on the engine.

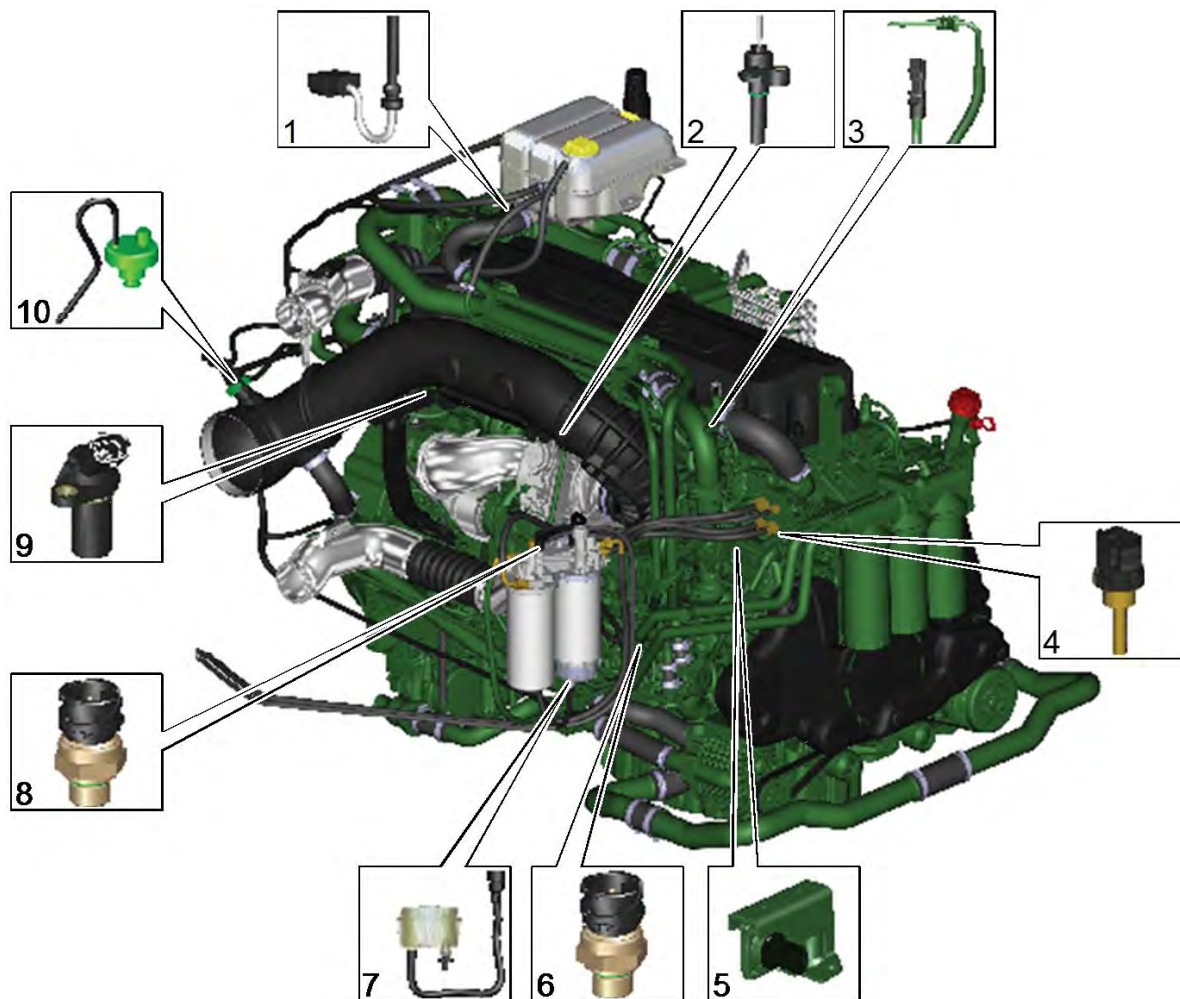


V109660!

**Figure 1**

1. Sensor for crankcase pressure, SE2509
2. Sensor for charge-air temperature, SE2512 (only engine with EGR)
3. Sensor for boost pressure/charge-air temperature, SE2507/SE2508 FX1007
4. Tachometer sensor, flywheel, SE2701
5. Sensor for coolant temperature, cooling circuit engine/retarder, SE2602
6. Sensor for coolant temperature, cooling circuit converter, SE2601
7. Sensor for oil level/oil temperature, SE2205/SE2202 FX1006





V109660

**Figure 2**

1. Sensor for coolant level, SE2603
2. Speed sensor (rpm), turbocharger SE2514
3. Temperature sensor EGR SE2516
4. Sensor, coolant temperature SE2606
5. Sensor, EGR-flow SE2515
6. Sensor for oil pressure, SE2203
7. Sensor for water indicator, SE2302
8. Sensor for fuel pressure, SE2301
9. Camshaft sensor, engine position, SE2703
10. Sensor for air pressure/air temperature, SE2501/SE2502 FX1008

Document Title: <b>Engine, identification</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/8/5 0</b>
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## Engine, identification

### Identification plate 1

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.

### Identification plate 2

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

Assembly plants:

A = Skövde, Sweden

E = Curitiba, Brazil

F = Flen, Sweden

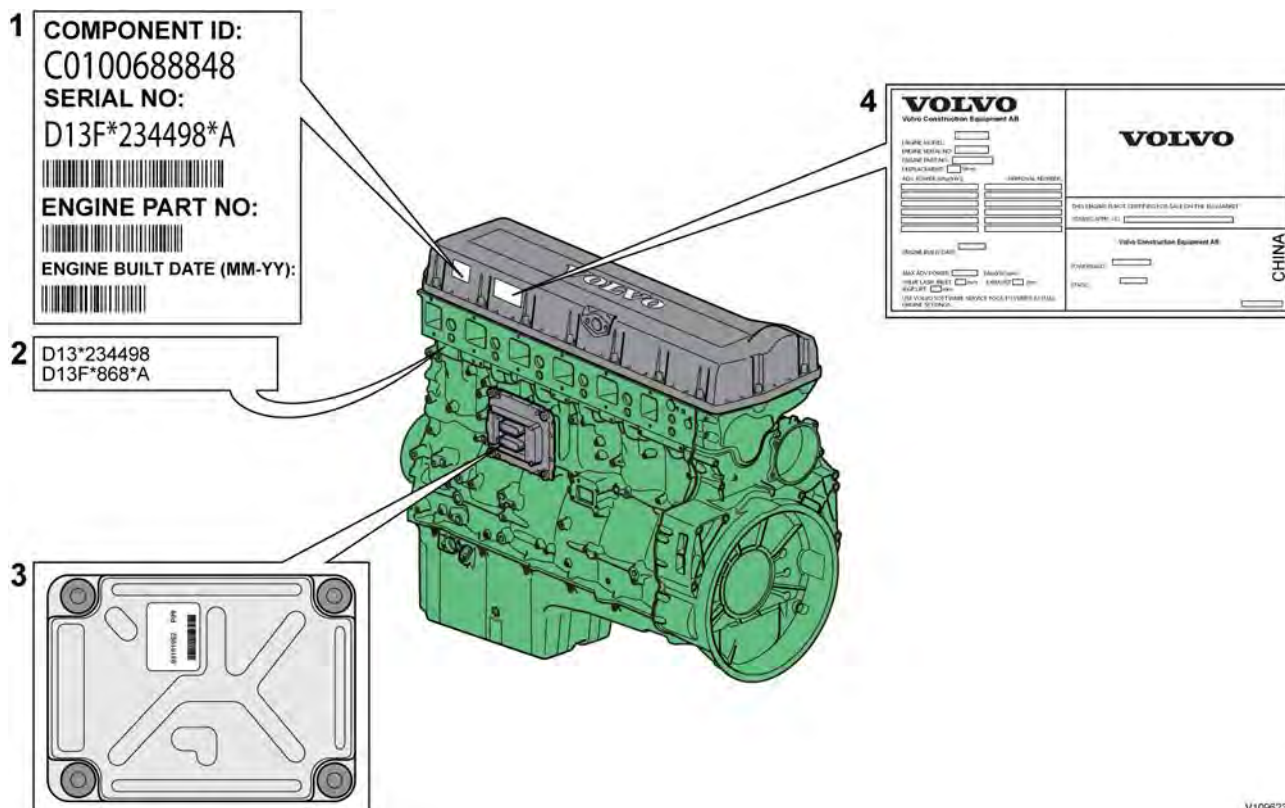
L = Lyon, France

### Identification plate 3

The engine control unit (ECU) has its component number on a plate on the back.

### Identification plate 4

The certification decal is located on the valve cover as well as on the left side of the machine's front frame.



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**Figure 1**

### Product plate



**Figure 2**

### Engine versions

In order to offer machines with lower environmental impact, two main engine types have been developed for machines in the F-series. One version developed for generally available fuel and oil grades, and a version that meets higher emission requirements. The easiest way to see on the machine what version it is, check if it has a diesel particle filter (Diesel Particulate Filter) in the muffler. See: [254 Exhaust Aftertreatment System description](#).

Machine	Engine designation	Diesel Particulate Filter
A25F	D11F	No
A25F	D11H	Yes
A30F	D11F	No
A30F	D11H	Yes
A35F	D13F	No
A35F	D13H	Yes
A40F	D16F	No
A40F	D16H	Yes

Document Title: <b>VCADS Pro, Operations</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/8/5 0</b>
Profile: <b>ART, A25F (37214) [GB]</b>			

## VCADS Pro, Operations

The following VCADS Pro operations are available for function group 2. Operations used when changing or working on components are mandatory.

### NOTE!

Operations used when changing or repairing components are mandatory.

### NOTE!

New operations are developed regularly. For a current list of all tests, see VCADS Pro software.

### Tests

Operation	Application
20046-3 Read out engine information	The test is used to read out engine emissions and engine certification information.
21006-3 Cylinder compression, test	The test shows whether the compression of any cylinder differs from that of the other cylinders.
23016-3 Cylinder balancing, test	The test shows whether fuel injection on any cylinder differs from that on the other cylinders.
23017-3 Feed pressure, inspection	The test is used to check feed pressure.
23712-3 Injectors shut off, manual	The test supplements cylinder balancing. In the test, one injector at a time can be turned off manually.
25410-3 Air pump exhaust aftertreatment, test	The test is used to check cut-in and cut-out of the air pump for the exhaust aftertreatment system.
25411-3 Burner exhaust aftertreatment, test	The test is used to diagnose the exhaust aftertreatment system. The test activates the built-in diagnostic function in the control unit. The test indicates any failure with a red light. Read out error codes with operation 17012-3, Error codes.
25412-3 Components ASU, test	This subtest is used to check function of the atomization unit's air valve, main air valve, the fuel's shut-off valve, and the fuel pump.
25433-3 Fuel system exhaust aftertreatment, bleeding	The test is used to purge any air in the fuel system for the atomization unit.
25434-3 Atomization unit, fuel pressure, adjust	The test is used to adjust the fuel pressure in the atomization unit.
25456-3 Exhaust aftertreatment diagnostics	The test is used to check status of the included components for the exhaust aftertreatment.
25457-3 Diesel Particulate Filter Service Regeneration	This operation is used when the soot load is above 1.7, see <a href="#">254 Exhaust Aftertreatment System, description</a> . In this operation, status and a number of sensor values can be read out during on-going regeneration. Also check that "DPF differential pressure" is within permitted values, both before and after regeneration, see <a href="#">254 Exhaust aftertreatment system, specifications</a> .
25537-3 Variable geometry turbo function test	The test is used to check function of the variable geometry turbo (VGT).
26351-3 Hydraulic cooling fan, test	The test controls the cooling fans' speed control (independent of ordinary control) and is used when adjusting speed.
27102-3 Accelerator pedal, test	The test is used to check function of the throttle pedal.

28407-3 Sensor values, monitoring	The tests show values (temperature, rpm, etc.) that the system receives from connected sensors and monitors.
28420-3 Flywheel and camshaft signal, test	The test is used to use an oscilloscope to check signals from the flywheel and camshaft position sensors.
29332-3 Exhaust gas circulation, function test	The test is used to check function of the exhaust gas recirculation.

### Calibrations

Operation	Application
25536-3 Variable geometry turbo, calibration	When changing actuator, see <a href="#">255 Actuator, variable turbocharger, replacing</a> .

### Programming

Operation	Application
25801-3 MID 233 Control unit, programming	When changing control unit or when reprogramming complete or part of the software.
25802-3 MID 233 Control unit, campaign	Use for campaign programming of the control unit.
28422-3 MID 128 ECU, campaign	Use for campaign programming of the control unit.
28423-3 MID 128 ECU, programming	When changing control unit or when reprogramming complete or part of the software.

Document Title: <b>E-ECU, MID 128, changing pre-programmed ECU</b>	Function Group: <b>200</b>	Information Type: <b>Service Information</b>	Date: <b>2014/8/5 0</b>
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## 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:

- [191 Service positions](#)
  - [200 E-ECU, MID 128, changing non-programmed ECU](#)
1. Place the machine in service position, see [191 Service positions](#).
  2. Connect VCADS Pro computer and perform 17030-3 Parameter, programming.
    - Use the function: Save all read parameters to job card.
  3. Run [200 E-ECU, MID 128, changing non-programmed ECU](#) from and including step 3 and on.
  4. Connect VCADS Pro computer and perform 17030-3 Parameter, programming.
    - Program earlier read-out parameters according to the job card.
  5. Restore the machine to operating condition.



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