



### IMPORTANT INFORMATION



When working on the engine, for example adjusting drive belts, changing the oil or adjusting the clutch, it is important not to start the engine. The engine may be damaged and there is

### SERIOUS RISK OF INJURY

For this reason, always secure the starting device or disconnect a battery cable before working on the engine.

This is especially important if the engine has a remote starter or automatic starting.

This warning symbol and text is reproduced beside those maintenance points where the risk of injury is particularly great.

## Operator's Manual

DC16

EMS with S6/PDE

Industrial engine

*opm\_d16ind\_en-GB01 1 920 792*

## COMMISSIONING REPORT - WARRANTY

When the commissioning report has been filled in and sent to Scania, you have a 1-year warranty from the date of commissioning.

Also fill in the particulars below as this can make things easier if you need to contact, for example, a service workshop.

**Engine number**

.....

**Date of commissioning**

.....

**User's name and address**

.....

.....

.....

.....

**Signature**

.....

**Engine type**

.....

**Variant**

.....

Engine type and variant are indicated on the engine type plate

# Foreword

This Operator's Manual describes the handling and maintenance of Scania DC16 Industrial Engines with EMS S6/PDE injection systems.

The four stroke V8 diesel engines have direct-injection and are liquid-cooled. These engines have turbochargers and charge air coolers; see page 14.

Common applications are as power units in construction machines, generator sets, earth-moving, railway and forestry machines as well as in irrigation systems.

The engines can have different output and speed settings.

The normal output setting of the engine (performance code) is indicated on the type plate, see page 14.

**Note:** Only standard components are described in the Operator's Manual. Please see the manufacturer's instructions regarding special equipment.

In order to obtain the best value and service life from your engine, there are several points you should bear in mind:

- Read the manual before starting to use the engine. Even though you may have experience of Scania engines, you may find new information in this Operator's Manual.
- Follow the maintenance instructions. Good working order and service life are ensured if maintenance is carried out according to the instructions.
- In particular, read the safety information starting on page 10.
- Get to know your engine so that you know what it can do and how it works.
- If necessary, contact an authorised Scania workshop. They have special tools, genuine Scania parts and staff with training and practical experience of Scania engines.

**Note:** Always use genuine Scania parts during service and repair so as to keep your engine in the best possible working order.

The information in this manual was correct at the time of going to press. However, we reserve the right to make alterations without prior notice.



## ***Important***

**During the warranty period, only genuine Scania parts may be used during service and repair; otherwise the warranty will be invalidated.**

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## Environmental responsibility

Scania has always been very much at the leading edge when it comes to developing and producing engines which are as environmentally friendly as possible.

Major progress has been made on reducing harmful exhaust emissions as required to be able to meet the stringent environmental standards stipulated on almost all markets.

At the same time, we have been able to maintain high quality in terms of performance and operating economy for Scania Industrial and Marine Engines.

To preserve these qualities throughout the entire service life of the engine, it is important for the operator/owner to follow the instructions on running, maintenance and the choice of fuel and oil as outlined in the manual.

Other efforts to preserve the environment we all share are possible by ensuring that the person carrying out servicing and maintenance always makes sure that environmentally hazardous waste after servicing and repairs (oil, fuel, coolant, filters, batteries, etc.) is dealt with and disposed of in accordance with applicable environmental standards.

On a number of pages, this Operator's Manual contains specially highlighted text with instructions to help protect our environment during certain servicing and maintenance work.



***Help protect our  
environment!***

**Use a container to avoid spillage  
when bleeding and renewing  
components.**

See example →

## Certified engines

Emissions-certified engines have been approved in accordance with a special certification standard. The certified engines supplied by Scania meet the most stringent emissions standards which apply on European (EU) and non-European (USA) markets.

Scania guarantees that all the engines it supplies of a certified type are equivalent to the engine approved for certification.

The engine comes with a special certification plate which indicates the certification rules (standard) to which the engine has been approved. See page 14.

The following is required for the certified engine to meet emissions standards once it has been commissioned:

- Servicing and maintenance must be carried out in accordance with the instructions in this manual.
- Only genuine Scania parts are to be used.
- Injection equipment is to be serviced by an authorised Scania workshop.
- The engine must not be modified with equipment not approved by Scania.
- Seals may be broken and setting data edited only once approval has been granted by Scania in Södertälje. Changes may be made by authorised personnel only.
- Changes which affect the exhaust system and intake system must be approved by Scania.

Otherwise, the instructions in the manual in respect of running, care and maintenance of the engine shall apply. The safety precautions described over the next four pages must also be observed.

**Important!** *If servicing and maintenance are not carried out as specified above, Scania can no longer guarantee that the engine will comply with the certified design, nor can it take responsibility for any damage that occurs.*

# Scania industrial and marine engine warranty for industrial engines

## Emission Control Systems Warranty

**Important!** *Only applicable to engines used in the U.S.A.*

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## Emission Control System Warranty Statement

### General warranty provisions

The emission control systems of your new Scania Industrial and Marine ("Scania") industrial diesel engine were designed, built and tested using genuine parts, and were certified as being in conformity with federal emission control regulations. Scania warrants to the original owner, and to each subsequent owner, of a new Scania industrial diesel engine that the engine:

1. Was designed, built and equipped so as to conform at the time of sale with all applicable regulations under Section 213 of the Clean Air Act 42 U.S.C. § 7547, and all applicable regulations under Chapter 1 and 2, Part 5, Division 26 of Health and Safety Code, and;
2. Is free from defects in material and workmanship which would cause such engine to fail to conform to applicable regulations for its warranty period.

## Warranty Period

This warranty shall apply for one of the following periods, whichever occurs first:

- 3,000 hours of operation, or
- Five years of use

The warranty period shall begin:

- "On the date the engine is delivered to the first retail purchaser, or
- "If the engine is placed in service for demonstration purposes prior to sale at retail, on the date the engine is first placed in service.

## Parts covered by the Warranty

The following is a list of parts considered to be part of the Emission Control Systems covered by the Emission Warranty for Scania industrial engines which were built to conform to federal emission control regulations:

1. Fuel injection system
2. Air intake system
  - Intake manifold
  - Turbocharger system
  - Charge air cooler system
3. Exhaust manifold
4. Combustion chamber
  - Piston
  - Cylinder head
5. Components used in the above mentioned systems

**Important!** *This list does not include all expendable maintenance parts. Expendable emission related parts requiring scheduled maintenance are warranted until their first scheduled replacement point. See Specific Warranty Exclusions below.*

## **General Warranty Limitations**

To retain the dependability of the exhaust emission control originally built into your Scania industrial diesel engine, it is essential that the engine is installed according to Scania installation instructions and emission certificates.

In addition, you are responsible for the performance of all scheduled maintenance and necessary repairs on your new Scania industrial diesel engine. Scania may deny a warranty claim if your failure to perform maintenance resulted in the failure of the warranted part, listed under Parts covered by the Warranty above.

Receipts covering the performance of regular maintenance should be retained in the event questions arise concerning maintenance. The receipts should be transferred to each subsequent owner of the engine with the emission warranted engine.

The Warranty covers the cost of repair and replacement parts and services of warranted components and systems performed by an authorized Scania distributor or dealer using genuine Scania parts. You may elect to have maintenance, replacement or repair of these components and systems performed by any repair establishment or individual without invalidating the Warranty.

The use of other than Scania replacement parts also does not invalidate the warranty on other components unless such parts cause damage to warranted parts. However, the cost of such services or parts will not be covered by the Warranty.

**WARNING! Use of replacement parts which are not of equivalent quality may impair the effectiveness of emission control systems. Accordingly, it is recommended that only Scania repair or replacement parts be used for maintenance, repair or replacement of emission control systems. If other than Scania parts are used for maintenance, repair or replacement, the owner should obtain assurance that such parts are warranted by their manufacturer to be equivalent to genuine Scania parts**



## **Specific Warranty Exclusions**

This warranty does not cover:

1. Malfunctions in any part caused by any of the following: misuse, abuse, improper adjustments, modifications, alteration, tampering, disconnection, improper or inadequate maintenance, or use of fuels not recommended for the engine as described in the Operator's Manual.
2. Engine installation, including cooling system, intake system and exhaust system installation, that is not completed in accordance with the Scania installation instructions and emissions certificate for this engine type.
3. Damage resulting from accidents, acts of nature or other events beyond the control of Scania.
4. The replacement of expendable maintenance items such as filters, hoses, belts, oil, thermostat, exhaust system and coolant made in connection with scheduled maintenance services once these parts have been replaced.
5. Replacement items which are not genuine Scania parts or not authorized by Scania.
6. Inconvenience, loss of use of the engine or commercial loss.
7. Any engine on which the actual use cannot be accurately determined.
8. Any engine operating outside the United States.

## **Customer Support**

In the event that you do not receive the warranty service to which you believe you are entitled under the Warranty, or if you need additional support or information concerning the Warranty, please contact:

### **Scania USA, Inc**

**Address:** 121 Interpark Blvd, suite 601, 78216, San Antonio, Texas

**Mailing address:** 121 Interpark Blvd, suite 601, 78216, San Antonio, Texas

**Telephone:** +1 210 403 0007

**Fax:** +1 210 403 0211

**E-mail:** [contact@scaniausainc.com](mailto:contact@scaniausainc.com)

## Safety information

### General

This Operator's Manual contains safety information which is important so as to avoid both personal injury and damage to the product or other property. See also page 1.

The text highlighted in text boxes on the right of a number of pages is important for engine function and in order to avoid damage to the engine. If these instructions are not followed, your warranty may be invalidated. See example.

**!**  
**Important**

**Only use genuine Scania fuel filters.**

Similar text may also appear in the text column, and in this instance it will be marked **Note:** or **Important!**.

The warning text found in text boxes on the right of a number of pages which is marked with a warning triangle and starts with **WARNING** is extremely important and warns you of serious engine faults or incorrect handling which may lead to injury.

  
**WARNING**

**Block the starting device when working on the engine.  
If the engine starts accidentally, there is a  
SERIOUS RISK OF INJURY.**

See example.

A list of the safety precautions to be followed when running and maintaining Scania engines can be found on the next three pages. Similar text can often be found at the relevant maintenance points, and here different levels of importance are attached to such text in accordance with the above description.

All points are marked **!**, so as to indicate how important it is to read through each point in this section.

### For safety reasons, smoking is not allowed:

- In the vicinity of the engine and in the engine room
- When fuelling and close to the filling station
- When working on the fuel system
- In the vicinity of flammable or explosive material (fuel, oils, batteries, chemicals, etc.)

## **Safety precautions for running the engine**

### **! Daily inspection**

Always carry out a visual check of the engine and engine room before starting the engine and once you have stopped the engine after running.

This will enable you to easily detect fuel, oil or coolant leaks, or any other abnormalities which may require rectification.

### **! Filling with fuel**

There is a risk of fire and explosion when refuelling. The engine must be stopped and smoking is not allowed.

Do not overfill the tank due to a risk of expansion, and close the filler cap properly.

Use only fuel recommended in the service literature. Fuel of the wrong quality can cause the engine to malfunction or stop by preventing the injection pump and injectors from operating as they should.

This can cause damage to the engine and, possibly, injury.

### **! Hazardous gases**

Only start the engine in a well ventilated area. The exhaust fumes contain carbon monoxide and nitrogen oxides, which are toxic.

If it is run in an enclosed space, there should be an effective device to extract exhaust gases and crankcase gases.

### **! Starter lock**

If the control panel is not fitted with a key operated switch, there should be a lock on the engine room to prevent unauthorised starting of the engine.

Alternatively, a lockable on/off master switch or battery master switch can be used.

### **! Starter spray**

Never use starter spray or similar agents to help start the engine. This can cause an explosion in the intake manifold and possible injury.

### **! Running**

The engine must not be run in environments where there is a risk of explosion as all of the electrical or mechanical components can generate sparks.

Approaching a running engine always poses a safety risk. Parts of the body, clothes or dropped tools can get caught in rotating parts such as the fan and cause injury.

For personal safety all rotating parts and hot surfaces must therefore be shielded as much as possible.

## Safety precautions for handling materials

### ! Fuel and oil

All fuels and lubricants and many chemicals are flammable. Always follow the instructions on the relevant packaging.

All work on the fuel system must be done with the engine cold. Fuel leaks and spillage on hot surfaces can cause fire.

Store soaked rags and other flammable materials safely so as to avoid spontaneous combustion.

### ! Batteries

The batteries contain and emit oxyhydrogen gas, particularly during charging, and this gas is flammable and highly explosive. There must be no smoking, naked flames or sparks near the batteries or the battery compartment.

Incorrect connection of a battery cable or jump lead can cause a spark, which in turn can cause the battery to explode.

### ! Chemicals

Most chemicals such as glycol, corrosion inhibitors, preservative oils, degreasing agents, etc. are hazardous to health. Always follow the safety precautions on the relevant packaging.

Some chemicals, such as preservative oil, are also flammable.

Store chemicals and other materials which are hazardous to health in approved containers, marking them clearly and storing them where they are inaccessible to unauthorised persons. Always hand in leftover or used chemicals to an authorised waste disposal contractor.

## Safety precautions for care and maintenance

### ! Stop the engine

Always stop the engine before maintenance and servicing unless stated otherwise.

Prevent unwanted starting by taking out the starter key where applicable and disconnecting the power using the master switch or battery master switch and locking them. Also put up a warning sign somewhere appropriate, indicating that work is in progress on the engine.

Working with a running engine always poses a safety risk. Parts of the body, clothes or dropped tools can get caught in rotating parts and cause injury.

### ! Hot surfaces and fluids

There is always a risk of sustaining burns when an engine is hot. Therefore, take care not to come into contact with manifolds, the turbocharger, the sump, hot coolant and oil in pipes and hoses.

### ! Lifting the engine

The engine lifting eyes must be used when lifting the engine. Check first that your lifting devices are in good condition and of the correct size to lift the weight.

Extra equipment on the engine can alter the centre of gravity, which is why you may need additional lifting devices to balance the engine correctly and lift it safely.

***Never work underneath a suspended engine!***

### ! Batteries

The batteries contain a highly corrosive electrolyte (sulphuric acid). Take care to protect your eyes, skin and clothes when charging or handling batteries. Wear protective gloves and goggles.

If the acid splashes on your skin, wash it off with soap and copious amounts of water. If acid splashes in your eyes, flush them immediately with copious amounts of water and contact a doctor.

Dispose of used batteries through an authorised waste disposal contractor.

### **! Electrical systems**

The engine must be stopped and the power disconnected using the master switch or battery master switch before working on the electrical system.

External power supplies to extra equipment on the engine must also be disconnected.

### **! Electric welding**

When carrying out welding work close to and on the engine, remove the battery leads and the cables to the alternator. Also remove the multi-pin connector to the control unit.

Connect the weld clamp to the component to be welded and close to the welding point, never to the engine or in such a manner that the current can pass over to a mounting.

When you have finished welding, connect the cables to the alternator and control unit before connecting the batteries.

### **! Lubrication system**

Hot oil can cause burns and skin irritation. Therefore, avoid skin contact with hot oil.

Make sure that there is no pressure in the lubrication system before starting work on it. Never start or run the engine with the oil filler cap removed, as this may cause oil to be thrown out.

Dispose of used oil through an authorised waste disposal contractor.

### **! Cooling system**

Never open the coolant filler cap if the engine is hot. Hot coolant or steam may spray out and cause burns.

If you have to open or remove a cooling system component when the engine is hot, open the cap very carefully and slowly to relieve the system pressure before removing the cap. Wear gloves as the coolant is still very hot.

Dispose of used coolant through an authorised waste disposal contractor.

### **! Fuel system**

Always wear gloves when looking for leaks or carrying out any other work on the fuel system. Also wear protective goggles when testing injectors.

Fuel escaping at high pressure can penetrate tissues and cause serious injury.

Never use non-genuine parts in the fuel and electrical systems as genuine parts are designed and manufactured to minimise the risk of fire and explosion.

### **! Before starting**

Fit all removed shields before starting the engine again. Check that you have not left any tools or other objects on the engine.

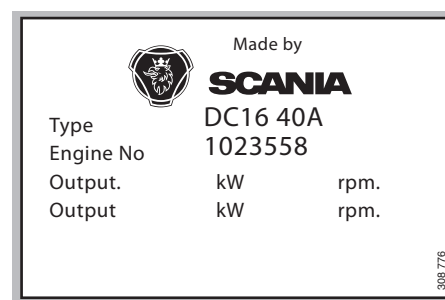
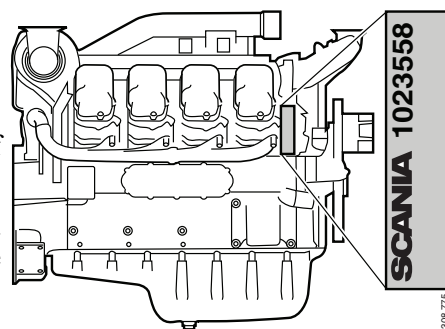
Never start the engine without the air filter fitted. There is a risk of objects being sucked into the compressor impeller or of injury if you come into contact with it.

# Type designations

The engine type designation indicates, in the form of a code, the type of engine, its size and applications.

The engine number is stamped on the right-hand side of the engine in front of cylinder head 1. See illustration.

Engines which hold certification in respect of smoke and emissions are fitted with a plate which indicates the documents in accordance with which they are certified.



**Version** \_\_\_\_\_ **DC 16 40 A**

DC Supercharged diesel engine with air-cooled charge air cooler

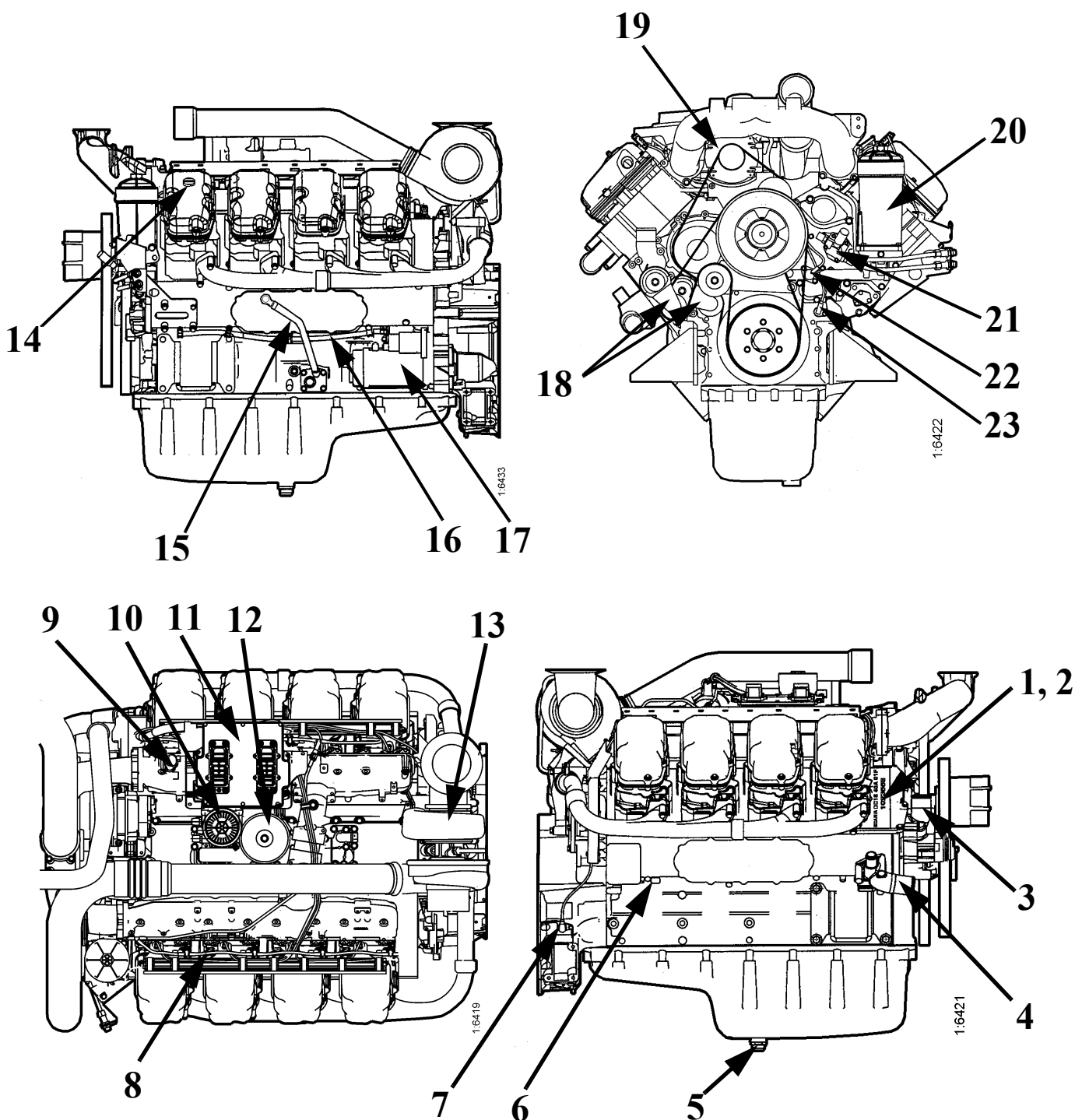
**Displacement in whole dm<sup>3</sup>** \_\_\_\_\_

**Performance and certificate** \_\_\_\_\_

Indicates, together with the application code, the normal gross engine output.  
The actual output setting of the engine is indicated on the engine card.

**Application** \_\_\_\_\_

A For general industrial use



The illustrations show a normal version of a DC16 engine.  
Your engine may have different equipment from that illustrated.

- |                                                          |                              |                                |
|----------------------------------------------------------|------------------------------|--------------------------------|
| 1. Type number, stamped into the cylinder block          | 9. Charge air sensor         | 19. Alternator                 |
| 2. Engine serial number, stamped into the cylinder block | 10. Fuel filter              | 20. Oil filter                 |
| 3. Outlet to radiator                                    | 11. S6 control unit          | 21. Fuel pump with hand pump   |
| 4. Inlet from radiator                                   | 12. Oil filter unit          | 22. Oil pressure sensor        |
| 5. Draining, engine oil                                  | 13. Turbocharger             | 23. Coolant temperature sensor |
| 6. Draining, coolant                                     | 14. Oil filler               |                                |
| 7. Rotation speed sensor                                 | 15. Oil dipstick             |                                |
| 8. Cylinder head ventilation                             | 16. Draining, coolant        |                                |
|                                                          | 17. Starter motor            |                                |
|                                                          | 18. Automatic belt tensioner |                                |

# EMS engine management system

This engine has an electronic management system, EMS (Engine Management System), with unit injectors (PDE) which provide each cylinder with the right amount of fuel, at the right time, in all operating situations.

The EMS system consists of a control unit (S6) and sensors for speed, charge air temperature and pressure, coolant temperature, oil pressure, accelerator pedal/throttle actuation which constantly emit signals to the control unit. With the aid of this input data and the programmed control software, the correct amount of fuel and the correct injection time are calculated for each unit injector under the specific operating conditions.

The EMS system sensors can also be used to emit signals to the instruments in the instrument panel.

The control unit constantly checks the sensors to make sure they are operational.

The control unit contains monitoring functions to protect the engine in the event of a fault which would otherwise damage it. In the event of a fault, for example, alarm level for low oil pressure or high coolant temperature, the S6 control unit sends a CAN message to a coordinator.

The main task of the coordinator is to pass on data by means of CAN communication from the engine control unit to other control units and signals to gauges and lamps in the instrument panel. The coordinator also has monitoring functions.

When the EMS control unit or the coordinator detects a fault, the diagnostics lamp on the instrument panel(s) comes on, and it stays on as long as the fault is active. At the same time, a fault code is generated which can be read off via the coordinator on the diagnostics lamp in the form of a flash code when the diagnostics switch is activated. A flash code may consist of a number of different fault codes.

Diagnosis and troubleshooting using *Scania EMS Display* is described in the Operator's Manual for *Scania EMS Instrumentation*.

If the torque reduction function is activated, the amount of fuel and the engine power output are reduced to 70%, and if the engine shutdown function is activated, the engine is switched off at programmed alarm levels.

A separate PC-based diagnostics program is used to read off the contents of the flash codes. For an in-depth analysis of fault codes, contact an authorised Scania dealer.

Reading off the fault codes, and descriptions of these, are also covered in a separate document in the workshop manual, *Engine Management System EMS-S6: Troubleshooting*.

***Only authorised personnel are allowed to carry out diagnostic procedures and program changes.***

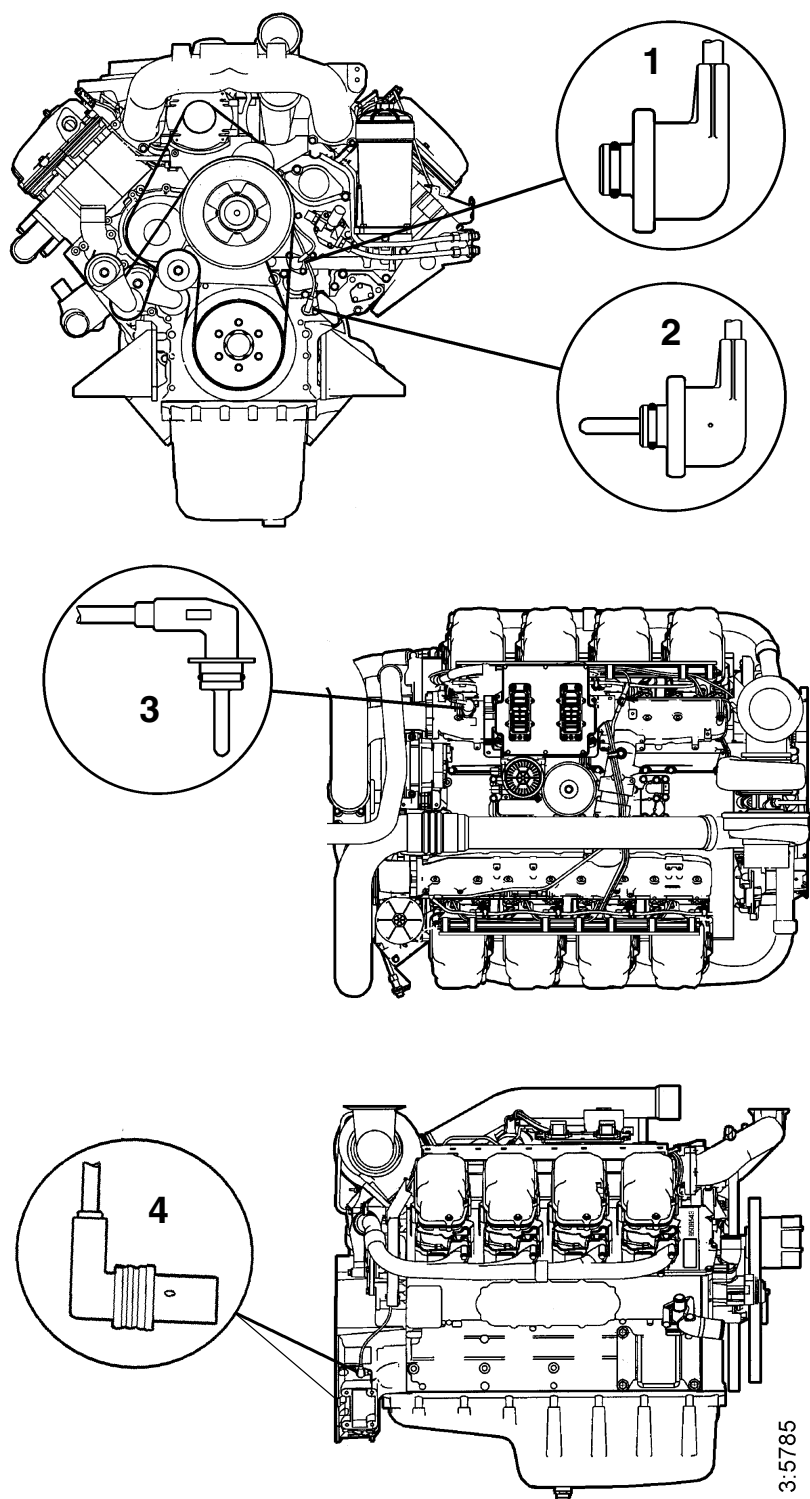
The positions of the sensors which emit signals to the control unit are shown in the illustrations on page 17.

See pages 18 and 20 for a description of how to read off flash codes.

See pages 19 and 21 for a list of flash codes for the control unit and coordinator.



## Positions of sensors for EMS with S6 on DC16



1. Oil pressure sensor
2. Coolant temperature sensor
3. Charge air temperature and pressure sensor
4. Engine speed sensor (2)

## Troubleshooting using flash codes for the EMS control unit

- The diagnostics lamp on the instrument panel(s) always comes on for two seconds when the system is powered up.
- As soon as a fault is detected by the control unit, it is stored in the EEPROM fault code memory and the diagnostics lamp on the instrument panel(s) comes on.
- The diagnostic lamp will stay on for as long as a fault is active. Even if the lamp has gone off and the fault is no longer active, the code can generally be read off by following the instructions below.

## Reading off control unit fault codes

1. Turn on the ignition.
2. Activate the diagnostics switch to the left to view the flash codes for the control unit (EMS).
3. A fault code will then flash on the diagnostics lamp. This flash code consists of long flashes (approximately 1 second long) and short flashes (0.3 seconds long). Long flashes are equivalent to tens and short flashes to ones.  
Example: *long - short - short = fault code 12.*
4. Repeat this procedure until the first flash code is repeated. This means that the entire fault code memory has been flashed out. If the fault code memory is empty, only one long flash approximately 4 seconds long will be given.
5. See the flash code table on the next page for a description and to locate the fault.
6. In order to obtain further information on the fault code, the PC-based diagnostics tool or Scania EMS Display must be used. Contact an authorised Scania workshop.
7. When a fault has been rectified the fault code can be erased as described below.

## Erasing fault codes

1. Switch off the ignition. If dual instrumentation has been fitted, the ignition must be switched off on both panels.
2. Activate the diagnostics switch in the same direction as the flash codes indicate, i.e. to the right for the coordinator (COO) or to the left for EMS.
3. Switch on the ignition and at the same time keep the diagnostics switch activated, to the right (COO) or to the left (EMS), for 3 seconds.
4. This will erase passive fault codes which can be read via flash codes for the relevant system. The rest of the fault codes will remain in the EEPROM and can only be deleted using the PC tool.

## Overview of flash codes for the EMS control unit

| Code      | Description                                                                                 | Code      | Description                                                             |
|-----------|---------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------|
| <b>0</b>  | No fault detected.                                                                          | <b>53</b> | PDE in cylinder 3: The solenoid valve is not working properly.          |
| <b>11</b> | Overrevving. One or both engine speed sensors are indicating speeds in excess of 3,000 rpm. | <b>54</b> | PDE in cylinder 4: The solenoid valve is not working properly.          |
| <b>12</b> | Engine speed sensor 1 faulty, or incorrect signal.                                          | <b>55</b> | PDE in cylinder 5: The solenoid valve is not working properly.          |
| <b>13</b> | Rotation speed sensor 2 faulty, or incorrect signal.                                        | <b>56</b> | PDE in cylinder 6: The solenoid valve is not working properly.          |
| <b>14</b> | Coolant temperature sensor faulty, or incorrect signal.                                     | <b>57</b> | PDE in cylinder 7: The solenoid valve is not working properly.          |
| <b>15</b> | Charge air temperature sensor faulty, or incorrect signal.                                  | <b>58</b> | PDE in cylinder 8: The solenoid valve is not working properly.          |
| <b>16</b> | Charge air pressure sensor faulty, or incorrect signal.                                     | <b>59</b> | Incorrect signal in extra analogue input.                               |
| <b>17</b> | Oil temperature sensor faulty, or incorrect signal.                                         | <b>61</b> | Incorrect control unit shutdown.                                        |
| <b>18</b> | Oil pressure sensor faulty, or incorrect signal.                                            | <b>66</b> | Shutdown due to coolant level.                                          |
| <b>21</b> | Coolant level sensor faulty.                                                                | <b>68</b> | Alternator charging incorrectly.                                        |
| <b>23</b> | Internal fault code in the coordinator.                                                     | <b>69</b> | Starter motor function interrupted or not activated.                    |
| <b>24</b> | Accelerator/brake. If the accelerator and brake pedals have been operated simultaneously.   | <b>82</b> | Rotation speed above ref.speed at start.                                |
| <b>25</b> | Accelerator pedal sensor/idling switch.<br>Accelerator pedal sensor/kickdown switch.        | <b>83</b> | Fault in memory circuit (EEPROM) in control unit.                       |
| <b>27</b> | Engine shutdown bypassed.                                                                   | <b>84</b> | Data transfer to the control unit memory (EEPROM) has been interrupted. |
| <b>28</b> | Shutdown due to oil pressure.                                                               | <b>85</b> | Incorrect internal temperature in the control unit.                     |
| <b>31</b> | Torque limitation due to oil pressure.                                                      | <b>86</b> | Internal fault in the control unit: Fault in hardware control.          |
| <b>32</b> | Incorrect parameters for <i>limp home</i> function.                                         | <b>87</b> | Fault in control unit RAM.                                              |
| <b>33</b> | Battery voltage incorrect or no signal.                                                     | <b>88</b> | Internal control unit fault: Memory fault.                              |
| <b>37</b> | Emergency shutdown switch activated in accordance with CAN message from coordinator.        | <b>89</b> | Defective seal: Prohibited changes in software.                         |
| <b>43</b> | CAN circuit faulty in the control unit.                                                     | <b>93</b> | Rotation speed sensors faulty or not connected.                         |
| <b>47</b> | Immobiliser function. Ignition key code incorrect.                                          | <b>94</b> | Shutdown due to high coolant temperature.                               |
| <b>48</b> | CAN message from the coordinator incorrect or missing.                                      | <b>96</b> | Torque limitation due to high coolant temperature.                      |
| <b>49</b> | Incorrect CAN version in control unit or coordinator.                                       | <b>98</b> | Incorrect voltage supply to one of the sensors.                         |
| <b>51</b> | PDE in cylinder 1: The solenoid valve is not working properly.                              | <b>99</b> | Internal hardware fault in the processor (TPU).                         |
| <b>52</b> | PDE in cylinder 2: The solenoid valve is not working properly.                              |           |                                                                         |

## Troubleshooting using flash codes for the EMS coordinator

- The diagnostics lamp on the instrument panel(s) always comes on for two seconds when the system is powered up
- As soon as a fault is detected by the coordinator, it is stored in the EEPROM fault code memory and the diagnostics lamp on the instrument panel(s) comes on.
- Even if the lamp has gone off and the fault is no longer active, the code can generally be read off by following the instructions below.

## Reading off coordinator fault codes

1. Turn on the ignition.
2. Activate the diagnostics switch to the right for 1 second to view the flash codes for the coordinator (COO).
3. A fault code will then flash on the diagnostics lamp. This flash code consists of long flashes (approximately 1 second long) and short flashes (0.3 seconds long). Long flashes are equivalent to tens and short flashes to ones.  
Example: *long - short - short = fault code 12.*
4. Repeat this procedure until the first flash code is repeated. This means that the entire fault code memory has been flashed out. If the fault code memory is empty, only one long flash (approximately 4 seconds long) will be given.
5. See the flash code table on the next page for a description and to locate the fault.
6. In order to obtain further information about the fault code, the PC-based diagnostics tool or *Scania EMS Display* must be used. Contact an authorised Scania workshop.
7. When a fault has been rectified the fault code can be erased as described below.

## Erasing fault codes

1. Switch off the ignition. If dual instrumentation has been fitted, the ignition must be switched off on both panels.
2. Activate the diagnostics switch in the same direction as the flash codes indicate, i.e. to the right for the coordinator (COO) or to the left for EMS.
3. Switch on the ignition and at the same time keep the diagnostics switch activated, to the right (COO) or to the left (EMS), for 3 seconds.
4. This will erase passive fault codes which can be read via flash codes for the relevant system. The rest of the fault codes will remain in the EEPROM and can only be deleted using the PC tool.

## Overview of flashing codes for coordinator

| Flash code             | Fault description                                                              |
|------------------------|--------------------------------------------------------------------------------|
| <b>11<sup>1)</sup></b> | Incorrect signal from the fine adjustment for the nominal engine speed signal. |
| <b>11<sup>2)</sup></b> | Incorrect signals from the accelerator pedal sensor.                           |
| <b>12<sup>1)</sup></b> | Incorrect signal from the resistor module for governor setting.                |
| <b>12<sup>2)</sup></b> | Incorrect signal from the resistor module for idle and fixed speed setting.    |
| <b>13</b>              | No communication (EMS) with the engine.                                        |
| <b>14</b>              | Short circuit in the tachometer signal cable.                                  |
| <b>15</b>              | Faulty atmospheric pressure sensor.                                            |
| <b>17</b>              | Short-circuit in the coolant temperature gauge signal cable.                   |
| <b>18</b>              | Short circuit in the oil pressure gauge signal cable.                          |
| <b>19</b>              | Short circuit in the oil pressure lamp signal cable.                           |
| <b>21</b>              | Different versions of the communications protocol in the coordinator and EMS.  |
| <b>22</b>              | Faulty start switch or short circuit.                                          |
| <b>23</b>              | The supply voltage is too high.                                                |
| <b>24</b>              | The supply voltage is too low.                                                 |
| <b>25</b>              | Check value from <i>End of line</i> (EOL) is incorrect.                        |
| <b>26</b>              | Speed sensor signal missing or incorrect.                                      |
| <b>27</b>              | The signals from the RCB (Remote Control Box) switches are implausible.        |
| <b>28</b>              | Incorrect signals from the droop setting switches.                             |
| <b>29</b>              | Faulty remote start switch or short circuit.                                   |
| <b>31</b>              | No communication from the slave coordinator or the master coordinator.         |
| <b>32</b>              | Short circuit in the signal cable to the coolant temperature warning lamp.     |
| <b>33</b>              | Short circuit in the signal cable to the charge warning lamp.                  |
| <b>34</b>              | Incorrect signal from the <i>Fixed speed</i> switches.                         |
| <b>35</b>              | Fault in CAN communication.                                                    |

1) Single speed engine

2) All-speed engine

# Starting and running

## First start

When the engine is started for the first time, carry out the maintenance points listed under "First start" in the maintenance schedule; see page 29.

Since the points are important for satisfactory operation of the engine right from the outset, they are also listed below.

1. Checking the oil level; see page 31.
6. Checking the coolant; see page 36.

The coolant must contain corrosion inhibitor to protect the cooling system from corrosion.

### If there is a danger of freezing:

- Only antifreeze glycol should be used in the coolant as protection against corrosion. We recommend only nitrite-free antifreeze glycols with the following supplier designations:

**BASF G48 or BASF D542**

- The concentration of glycol should be 30-60% by volume depending on the ambient temperature. 30% glycol by volume provides anti-freeze protection down to -16°C. See page 37.
- Never top up with water alone or glycol alone! Fluid losses must always be replaced with pre-mixed coolant having the same glycol concentration as that in the engine. If the glycol content drops, both anti-freeze protection and protection against corrosion are impaired.

**Note:** A glycol concentration below 30% by volume will not provide sufficient protection against corrosion. Glycol concentrations higher than 60% do not improve anti-freeze protection and have an adverse effect on engine cooling capacity.

### If there is no danger of freezing:

- Only Scania Corrosion Inhibitor should be used in the coolant as protection against corrosion. The correct concentration of corrosion inhibitor is 8-12% by volume, and this must never drop below 8% by volume. The inhibitor in Scania Corrosion Inhibitor is free of nitrites.
- First filling: Fill up the system with water + 10% by volume Scania Corrosion Inhibitor. Use drinking water with a pH of 6-9.
- Never top up with water alone or corrosion inhibitor alone! Fluid losses must always be replaced with ready-mixed coolant: water + 10% by volume Scania Corrosion Inhibitor.

### Coolant filter (not standard equipment)

Only coolant filters without inhibitor may be used. The use of coolant filters increases the life of the coolant and reduces the risk of deposition corrosion.

#### *Coolant composition:*

#### **If there is a danger of freezing:**

**min 30% glycol by volume**

**max 60% glycol by volume**

#### **If there is no danger of freezing:**

**8-12% by volume**

**Scania Corrosion Inhibitor**

**(no glycol)**



#### **Important**

**Ethylene glycol and corrosion inhibitor can be fatal if imbibed.**

**Avoid contact with the skin.**



#### **Important**

**The recommended glycols must not be mixed with glycol containing nitrite-based corrosion inhibitor.**



#### **Important**

**Overdosing with *Scania Corrosion Inhibitor* and mixing with glycol can cause sludge to be formed.**



#### **Important**

**If a coolant filter has been fitted it must not contain inhibitor.**

- 12. Checking the fuel level; see page 44.
- 14. Checking the electrolyte level in batteries; see page 46.
- 15. Checking the state of charge in batteries; see page 46.
- 18. Checking the drive belt tension; see page 48.

**WARNING**

**Block the starting device when working on the engine. If the engine starts accidentally, there is a SERIOUS RISK OF INJURY.**

## Checks before running

Before running, "Daily maintenance" as described in the maintenance schedule should be carried out; see page 29.

## Starting the engine

If the fuel tank has been run dry or if the engine has not been used for a long time, bleed the fuel system, see page 45.

Out of consideration for our common environment, your Scania engine has been designed to use less fuel when starting. Using unnecessarily large amounts of fuel when starting the engine always results in emissions of unburnt fuel.

- Open any fuel valve.
- Disengage the engine.
- Engines with battery master switch: Switch on the power by means of the battery master switch.
- Start the engine with the key in the control panel (SCP) or the start button (only from RCB).
- **S6**: The diagnostics lamp should go out after approximately 2 seconds when starting.

**WARNING**

**Only start the engine in a well ventilated area. If it is run in a enclosed space, there should be an effective device to draw off exhaust gases and crankcase gases.**

**WARNING**

**Never use starter spray or similar agents to help start the engine. An explosion may occur in the intake manifold with a risk of personal injury.**

## Starting at low temperatures

Local environmental requirements must be complied with. Starting aids, engine heaters should be used to avoid starting problems and white smoke.

To limit white smoke, the engine should be run at low speed and under moderate load. A moderate load on a cold engine gives better combustion and faster heating than warming up with no load.

Avoid running it longer than necessary at idling speed.

### At temperatures below 0°C:

**Note:** Only use starting aids recommended by Scania.

- The starter motor must only be cranked for 30 seconds at a time. After that it must rest for 30 seconds before the next start attempt. Maximum of 5 start attempts are permitted, after which the starter motor must rest for 15 minutes before the next start attempt.

**Note:** If the engine is equipped with an INTERLOCK switch, this switch should be depressed and held down until the oil pressure has reached a sufficiently high level.

!

### Important

The starter motor may only be cranked for a maximum of 30 seconds. There is risk of overheating. Let the starter motor rest for 30 seconds between each start attempt.

## Running

Check instruments and warning lamps at regular intervals.

### Engine speed

The Scania tachometer is divided into different coloured sectors, as follows:

|                 |                       |                                                                                                                       |
|-----------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------|
| 0-500 rpm       | red area:             | prohibited engine speed, passed through when stopping and starting.                                                   |
| 500-700 rpm     | yellow area:          | slow idle. Engine idling is controlled by the S6 control system. Raised idling speed with a cold engine. See page 24. |
| 700-2,200 rpm   | green area:           | normal operating speed. The engine operating speed range is controlled by the S6 control system.                      |
| 2,200-2,600 rpm | yellow/green striped: | unsuitable operating speed. May occur when switching off.                                                             |
| 2,600-3,000 rpm | red area:             | prohibited engine speed.                                                                                              |



## **Limp-home mode**

If there is a fault on the normal accelerator pedal or if CAN communication is interrupted, the following limp-home option is available:

CAN outage or accelerator pedal malfunction (both signal and idling switch):

- The accelerator pedal value is 0% and the engine is running at normal idling speed.
- The accelerator pedal value is 0% and the engine is running at raised idling speed (750 rpm) if this function is activated.

Accelerator pedal malfunction but the idling switch is working:

- The accelerator pedal value can be increased slowly between 0% and 50% by using the idling switch.

CAN outage:

- The engine is switched off if the shutdown function is activated.

## **Coolant temperature**

Normal coolant temperature when the engine is running should be 70-90°C.

The S6 control system has the following alarm levels:

- If the temperature is high, 98°C-103°C, for a certain period (1 second), S6 will send a CAN message which switches on the warning lamp and diagnostics lamp via the coordinator.
- If the temperature exceeds 103°C, the warning lamp and diagnostics lamp will come on. If torque reduction is activated, the control system will reduce the fuel quantity to 70%. A fault code is generated in the control unit.
- At temperatures exceeding 103°C and with engine shutdown activated, the warning lamp and diagnostics lamp come on and the engine is switched off. If the override function is activated, only torque reduction takes place when this function is activated. A fault code is generated in the control unit.

After an alarm, approved values should be registered for more than 2 seconds to reset the alarm.

Excessively high coolant temperature can damage the engine.

If run for extended periods under an extremely light load, the engine may have difficulty in maintaining normal operating temperature. However, the temperature will rise to a normal level again when the load on the engine is increased.

## Oil pressure

### *Maximum oil pressure:*

warm engine running at a speed above 800 rpm      6 bar

### *Normal oil pressure:*

warm engine at operating speed      3-6 bar

### *Minimum oil pressure:*

warm engine running at a speed of 1,000 rpm      2.3 bar

**High lubricating oil pressure  
(above 6 bar) is normal when  
starting a cold engine.**

The control system has the following alarm levels:

- at a speed of less than 1,000 rpm and an oil pressure of less than 1.0 bar
- at a speed of more than 1,000 rpm and an oil pressure of less than 2.3 bar for longer than 5 seconds.

The following functions are available if there is an alarm:

- Alarm which only switches on the warning lamp and diagnostics lamp.
- Alarm which switches on the warning lamp and diagnostics lamp as well as torque reduction if this function is activated (70% of fuel quantity).  
A fault code is generated in the control unit.
- Alarm which switches on the warning lamp and diagnostics lamp. The engine is switched off if engine shutdown is activated. If the override function is activated, only torque reduction takes place when this function is activated.  
A fault code is generated in the control unit.

After an alarm, approved values should be registered for more than 1 second to reset the alarm.

## Charging indicator lamp

If the lamp comes on during operation:

- Check/adjust the alternator drive belt as described under the maintenance point. See page 48.
- If the charging indicator lamp is still on, this could be due to an alternator fault or a fault in the electrical system.

## Stopping the engine

1. Run the engine without a load for a few minutes if it has been run continuously with a heavy load.
2. Stop the engine with the stop button or the ignition key (depending on the model). Keep the stop button depressed until the engine is completely stationary.
3. Set the control switch to the "0" position.
4. Engines with battery master switch: switch the power off with the battery master switch.

**Note:** If the engine is stopped improperly 10 times, torque reduction will be activated (70% fuel volume). To reset the engine, switch off the engine once in the prescribed manner.



### **Important**

**There is danger of turbocharger damage and post boiling if the engine is stopped without cooling.**



### **Important**

**The power must not be switched off before the engine has stopped.**



### **WARNING**

**Block the starting device when working on the engine.  
If the engine starts accidentally, there is a  
SERIOUS RISK OF INJURY.**

## Checks after running

- Check that the power is cut from the battery master switch and that the control switch is in the "0" position.
- Fill the fuel tank. Make sure that the filler cap and the area round the filler opening are clean to avoid contamination of the fuel.
- If there is a risk of freezing, the cooling system must contain enough glycol. See pages 22 and 39.
- At temperatures below 0°C: Prepare for the next start by connecting the engine heater (if fitted).



### **Important**

**Coolant should be topped up when the engine is stopped after the first start.**

# Maintenance

The maintenance programme covers 20 points, divided into the following main groups:

|                                            |         |
|--------------------------------------------|---------|
| Lubricating oil system . . . . .           | page 30 |
| Coolant system . . . . .                   | page 36 |
| Air cleaner . . . . .                      | page 42 |
| Fuel system. . . . .                       | page 44 |
| Electrical system, batteries, etc. . . . . | page 46 |
| Miscellaneous . . . . .                    | page 48 |

The maintenance points are divided into intervals as follows:

Daily maintenance

Maintenance before the first start

Maintenance after the first 400 hours of operation

Periodic maintenance every 200 hours of operation (carried out after 200, 400, 600, 800, etc. hours)

Periodic maintenance every 400 hours of operation (carried out at 400, 800, 1,200, 1,600, etc. hours)

Periodic maintenance every 1,200 hours of operation (carried out at 1,200, 2,400, 3,600, etc. hours)

Periodic maintenance every 2,400 hours of operation (carried out at 2,400, 4,800, etc. hours)

Periodic maintenance every 4,800 hours of operation (carried out at 4,800, 9,600, etc. hours)

Annual maintenance

Maintenance every 5 years



**Block the starting device when working on the engine. If the engine starts accidentally, there is a SERIOUS RISK OF INJURY.**

## Engines with few hours of operation

Emergency generator sets etc., that are not used regularly should be test run and checked in accordance with the generator set manufacturer's instructions.

Run the engine until it reaches operating temperature and then carry out the maintenance points below:

1. Checking the oil level.
5. Checking the coolant level.
8. Checking the vacuum indicator.
12. Checking the fuel level.
14. Checking the electrolyte level in batteries.
15. Checking the state of charge in batteries.
16. Cleaning the batteries.
19. Check for leaks, rectify as necessary.



**For engines with few operating hours that do not receive periodic maintenance according to the maintenance schedule on page 29, maintenance should be carried out in accordance with the schedule:  
"Annually"  
"Every 5th year"**

# Maintenance schedule

|                                                                    | <i>Daily</i> | <i>First time at</i> |              | <i>Interval</i> |              |                |                |                | <i>At least</i> |                      |
|--------------------------------------------------------------------|--------------|----------------------|--------------|-----------------|--------------|----------------|----------------|----------------|-----------------|----------------------|
|                                                                    |              | <i>First start</i>   | <i>400 h</i> | <i>200 h</i>    | <i>400 h</i> | <i>1,200 h</i> | <i>2,400 h</i> | <i>4,800 h</i> | <i>Annually</i> | <i>Every 5 years</i> |
| <b>Lubricating oil system, page 30</b>                             | ●            | ●                    |              |                 |              |                |                |                |                 |                      |
| 1. Checking the oil level                                          | ●            | ●                    |              |                 |              |                |                |                |                 |                      |
| 2. Oil change                                                      |              |                      |              |                 | ●1           |                |                |                | ●               |                      |
| 3. Cleaning the lubricating oil cleaner                            |              |                      |              |                 | ●1           |                |                |                | ●               |                      |
| 4. Renewing the oil filter and closed crankcase ventilation filter |              |                      |              |                 | ●1           |                |                |                | ●               |                      |
| <b>Coolant system, page 36</b>                                     | ●            |                      |              |                 |              |                |                |                |                 |                      |
| 5. Checking the coolant level                                      | ●            |                      |              |                 |              |                |                |                |                 |                      |
| 6. Checking the coolant                                            |              | ●                    |              |                 |              |                | ●3             |                | ●               |                      |
| 7. Cleaning the cooling system                                     |              |                      |              |                 |              |                |                | ●1             |                 | ●                    |
| <b>Air cleaner, page 42</b>                                        | ●            |                      |              |                 |              |                |                |                |                 |                      |
| 8. Checking the read out from the vacuum indicator                 | ●            |                      |              |                 |              |                |                |                |                 |                      |
| 9. Cleaning the coarse cleaner                                     |              |                      |              | ●1              |              |                |                |                |                 | ●                    |
| 10. Cleaning or renewing the filter element                        |              |                      |              |                 |              | ●2             |                |                |                 | ●                    |
| 11. Renewing the safety cartridge                                  |              |                      |              |                 |              |                | ●              |                |                 | ●                    |
| <b>Fuel system, page 44</b>                                        | ●            | ●                    |              |                 |              |                |                |                |                 |                      |
| 12. Checking the fuel level                                        | ●            | ●                    |              |                 |              |                |                |                |                 |                      |
| 13. Renewing the main filter and water separating filter           |              |                      |              |                 |              | ●1             |                |                |                 | ●                    |
| <b>Electrical system, page 46</b>                                  |              | ●                    |              | ●               |              |                |                |                | ●               |                      |
| 14. Checking the electrolyte level in batteries                    |              | ●                    |              | ●               |              |                |                |                | ●               |                      |
| 15. Checking the state of charge in batteries                      |              | ●                    |              |                 |              | ●              |                |                | ●               |                      |
| 16. Cleaning the batteries                                         |              |                      |              |                 |              | ●              |                |                | ●               |                      |
| 17. Checking the coolant level monitor                             |              |                      |              |                 |              | ●              |                |                | ●               |                      |
| <b>Miscellaneous, page 48</b>                                      |              | ●                    |              |                 |              | ●              |                |                | ●               |                      |
| 18. Checking the drive belt                                        |              | ●                    |              |                 |              | ●              |                |                | ●               |                      |
| 19. Check for leaks, rectify as necessary                          | ●            |                      |              |                 |              |                |                |                |                 |                      |
| 20. Checking/adjusting valve clearances                            |              |                      | ●            |                 |              |                | ●              |                |                 |                      |
| 21. Checking/adjusting PDE injector rocker arms                    |              |                      | ●            |                 |              |                | ●              |                |                 |                      |

1. More often if required
2. Earlier if vacuum indicator shows red.
3. If inhibitor has not been topped up for five years, the coolant should be changed.

# Lubricating oil system

## Oil grade

The engine oil must **at least** meet the requirements for one of the following oil classifications:

### -ACEA E3, E4 or E5

- The Total Base Number (TBN) should be *at least 12-13* (ASTM 2896).
- Check with your oil supplier that the oil meets these requirements.
- Specified oil change intervals apply provided that the sulphur content of the fuel does not exceed 0.3% by weight. If the sulphur content is greater than 0.3% but no more than 1.0%, the oil change interval must be halved (200 h).
- Viscosities are shown in the figure below.
- For operation at extremely low ambient temperature: Consult your nearest Scania representative on how to avoid starting difficulties.

!

### **Important**

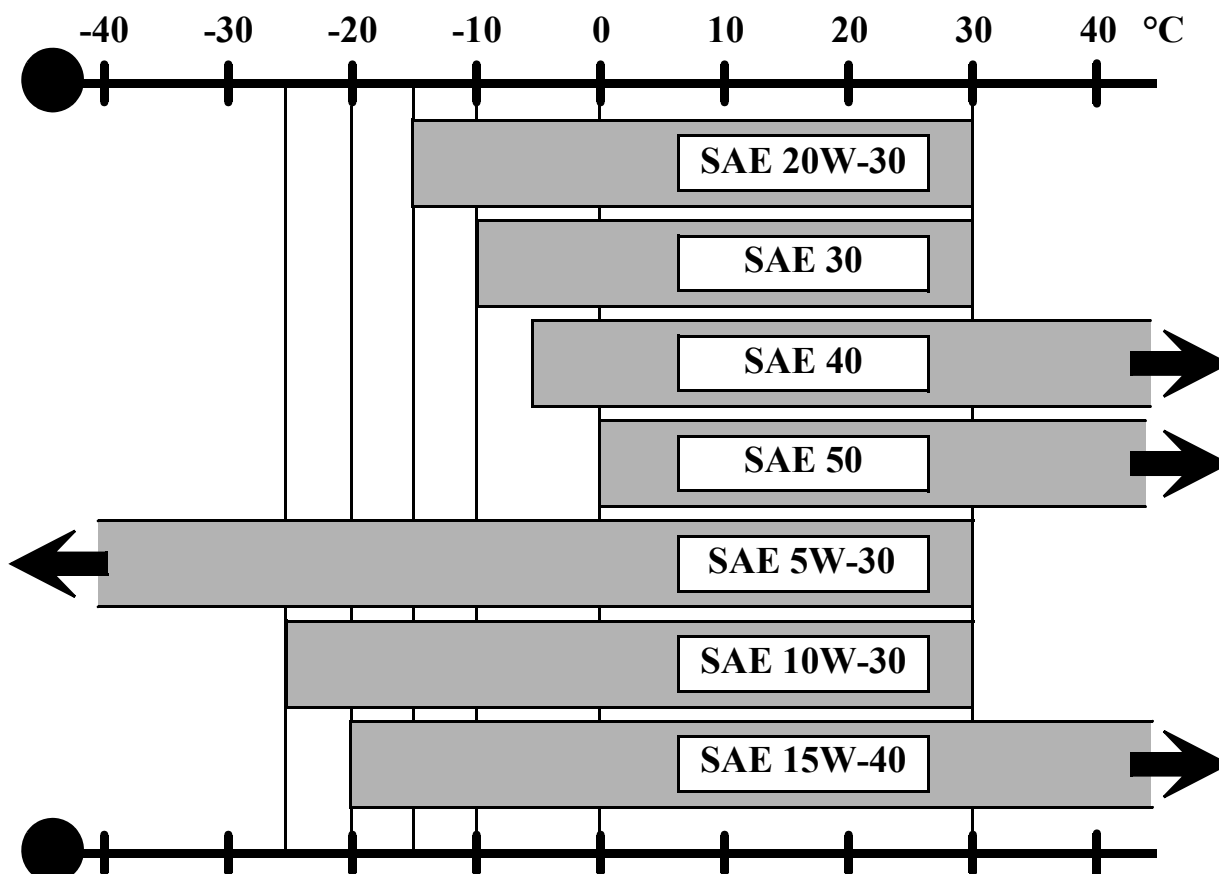
**Additives must not be used.**  
**The oil should be suitable for all temperature variations until the next oil change.**

## Oil analysis

Some oil companies can offer analysis of the engine oil. Such analysis measures the oil's TBN (Total Base Number), TAN (Total Acid Number), fuel dilution, water content, viscosity and the quantity of wear particles and soot in the oil.

The result of a series of analyses is used as the basis for establishing a suitable oil change interval.

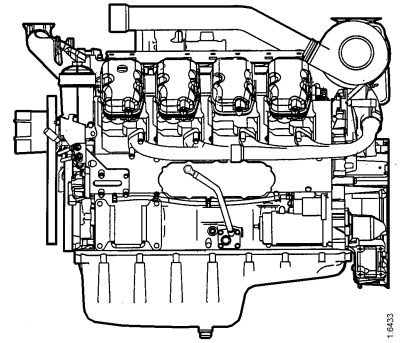
If the conditions are changed, a new oil analysis programme must be carried out to establish the new change interval.



# 1. Daily: CHECKING THE OIL LEVEL

**Note:** Before checking the oil level: Leave the engine switched off for at least 1 minute.

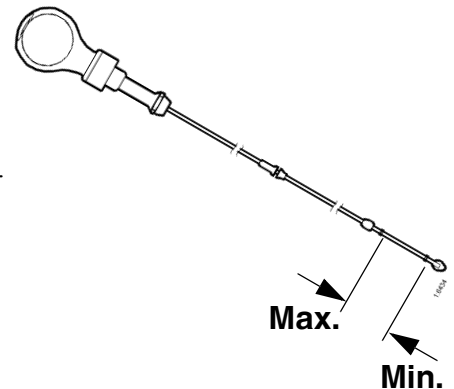
- The oil is at the correct level when it comes to between the marks on the dipstick. Top up when the oil level is at the lower mark on the dipstick.
- Refer to page 30 for correct oil grade.



## Checking the oil level during operation

On some engines the oil level can be checked during operation.

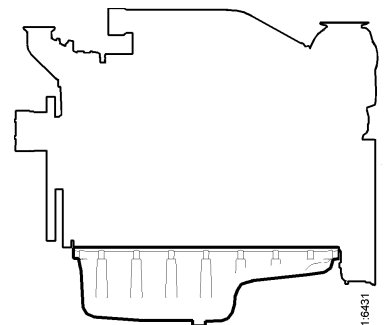
- Remove the oil filler cap to release the pressure in the crankcase.
- Check the level on the dipstick. Correct oil level: 10 mm below the Min. or Max. mark.



# 2. Every 400 hours: Oil change

**Note:** If the engine is used for especially demanding operations, particularly in a dusty environment or if the deposits in the centrifugal cleaner are thicker than 20 mm: change the oil more frequently.

- Unscrew the oil plug and drain the oil when the engine is hot.
- In certain engines the oil is pumped out by means of a bilge pump.
- Clean the magnet on the plug.
- Refit the oil plug.
- Fill up with oil.
- Check the level on the oil dipstick.



**Max. 40 dm<sup>3</sup>**  
**Min. 35 dm<sup>3</sup>**

**1 dm<sup>3</sup> = 1 litre**



**WARNING**

**The oil may be hot.**  
**Wear protective gloves and goggles.**



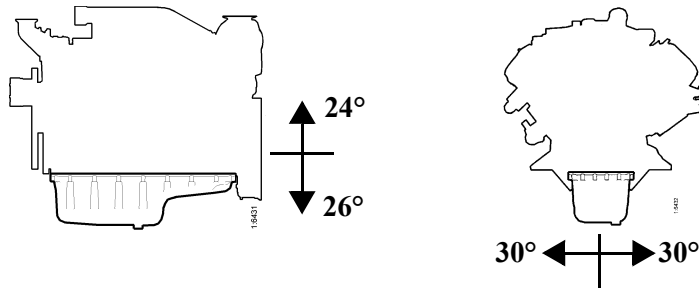
**Help protect our environment!**

**Use a container to avoid spillage when changing the oil. Dispose of used oil through an authorised waste disposal contractor.**

## Maximum angles of inclination during operation

Maximum permissible angles during operation vary, depending on the type of oil sump, see illustration.

**Note:** The specified angles may only occur intermittently.





## 3. Every 400 hours: Cleaning the oil filter unit (in connection with oil change)

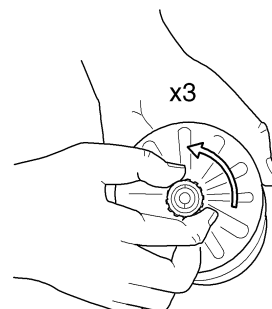
- Clean the cover. Unscrew the nut and remove the cover.



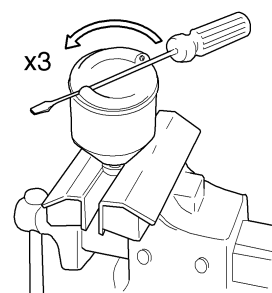
### WARNING

Open the cover carefully. The oil may be hot.

- Lift out the rotor and loosen the nut on the rotor cover three turns.



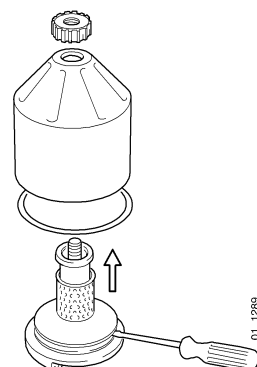
- If the nut is jammed:  
Clamp the nut, **but never the rotor**, in a vice and turn the rotor three turns by hand or with a screwdriver.



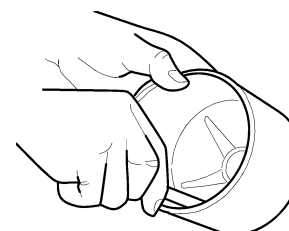
- Tap the nut lightly with your hand or a plastic hammer, to detach the rotor cover from the bottom plate.



- Unscrew the nut and remove the rotor cover.
- Remove the strainer located on the rotor. If the strainer is stuck, you can prise its bottom edge carefully until it comes loose from the bottom plate.



- Scrape off the deposits from the inside of the rotor cover. If there are no deposits, this indicates that the cleaner is not working properly.
- If the deposits are thicker than 20 mm: clean more often.



- Wash all parts in diesel.
- Make sure the nozzles on the rotor are not blocked or damaged.
- Check that the bearings are undamaged.
- Fit the O-ring in the rotor cover. The O-ring must not be damaged. Renew if necessary.
- Reassemble the rotor.
- Tighten the rotor nut firmly by hand.
- Check that the shaft is not loose. If it is loose, use locking compound 561 200 and torque tighten to 34 Nm.

- Refit the rotor.
- Check that it rotates easily by rotating it manually.

- Check that the O-ring in the bowl is not damaged. Renew hardened or damaged O-rings.
- Screw on the cover and tighten the lock nut to 15 Nm.

Tighten the nut carefully so as not to damage the rotor shaft, nut or cover.

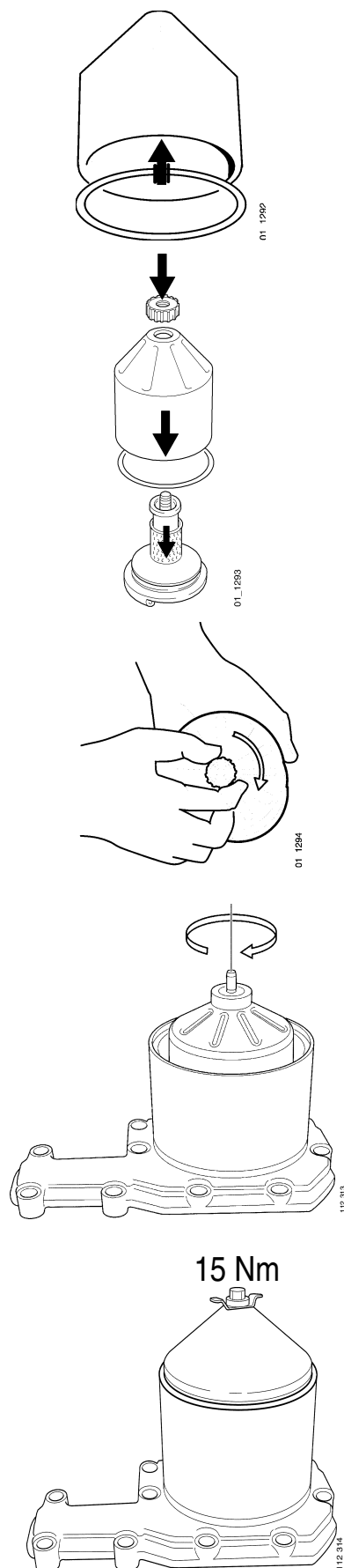
## Functional inspection

The rotor rotates very fast and should continue to rotate when the engine has stopped.

- Stop the engine when it is warm.
- Listen for a whirring sound from the rotor or feel whether the cleaner housing is vibrating.

The rotor normally continues spinning for 30-60 seconds after the engine has stopped.

If not: dismantle and check.

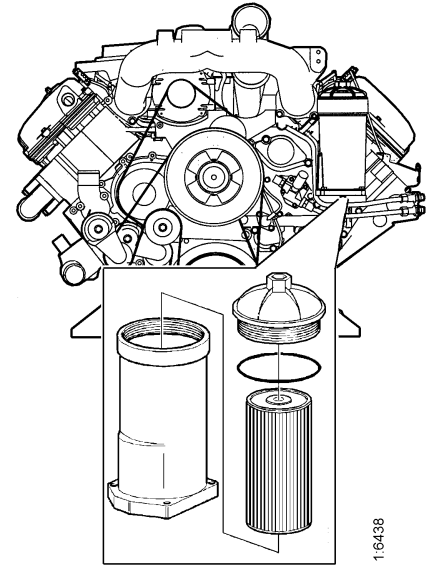


## 4. Every 400 hours:

### Renewing the oil filter

#### (At the same time as an oil change)

- Unscrew the filter cover with a closed tool with hexagon driver, for example, socket 587 637, so as not to damage the filter cover.
- Lift out the filter housing lid with filter element. The filter housing will drain automatically once the filter has been removed.
- Undo the old filter from the cover by carefully bending it to one side.
- Lubricate a new O-ring with engine oil and place it in the cover.
- Press a new filter element into the snap fastener in the lid.
- Make sure the oil filter drain has emptied the oil from the filter housing.
- Screw on the filter lid with a closed tool with hexagon driver, for example, socket 587 637. Tightening torque 25 Nm.
- Start the engine and check for leaks.



**Important!** *If the deposits in the centrifugal cleaner are more than 20 mm thick, the oil filter must be renewed more often. The same is true for cleaning the centrifugal filter and changing the oil.*



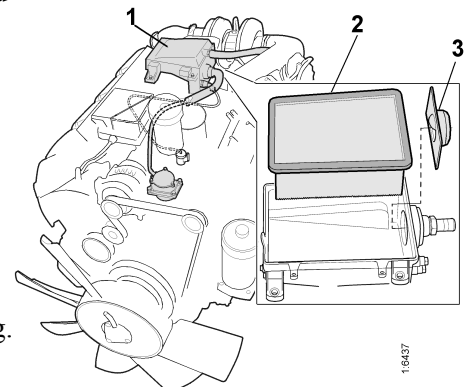
**Help protect our environment!**

Use a container to avoid spillage when renewing the filter. Dispose of used filters through an authorised waste disposal contractor.

### Renewing the closed crankcase ventilation filter

In the case of engines with closed crankcase ventilation, the filter element and prefilter must be renewed at the same time as the main oil filter as described below:

- Remove the filter housing cover (1) and remove the filter element (2).
- Remove the prefilter (3) from the filter housing inlet.
- Clean the filter housing and insert a new prefilter.
- Pour approximately 1 dl of oil into the filter housing oil outlet so as to ensure that there is sufficient oil in the liquid seal.
- Insert a new filter element and place the cover back on the filter housing.



# Cooling system

## 5. Daily:

### Checking the coolant level

- Open the expansion tank filler cap and check the coolant level.
- *Correct level: (Scania plastic expansion tank)*
  - Cold engine: Coolant level must be approximately 50 mm below the full line.
  - Hot engine: Coolant level must be approximately 25 mm below the full line.
- Other types of expansion tank according to the instructions of the fitter.
- Top up the coolant as necessary, see point 6.

**Note:** When filling large amounts of coolant:  
 Never pour cold coolant into a hot engine.  
 This could crack the cylinder block and cylinder head.



#### **WARNING**

**Open the cover carefully.  
 Water and steam can spray out.**



#### **Important**

**Always top up with ready mixed  
 coolant.**

## 6. Every 2,400 hours: Checking the coolant

Coolant should be checked as follows:

- a) Check the appearance of the coolant.
- b) Coolant with glycol only: Check the glycol content.
- c) Coolant containing only Scania Corrosion Inhibitor:  
Check the corrosion inhibitor content.

The composition of the coolant is described in more detail under "Starting and running".

a)

### Checking the appearance of the coolant

- Pour a small amount of coolant in a container, and check that the coolant is pure and clear.
- If the coolant is contaminated or cloudy: consider changing the coolant.
- Water for the coolant must be clean and free from contamination.
- Use drinking water with a pH of 6-9.

b)

### Checking the glycol content

If there is a danger of freezing, use only glycol as an anti-corrosive in the coolant.

- Cooling systems with glycol should contain at least 30% glycol by volume to provide acceptable protection against corrosion.
- 30% glycol by volume provides protection against freezing to -16°C. If additional protection against freezing is required, see the table on the next page to help you calculate how much glycol you need.

We recommend only nitrite-free antifreeze glycols with the following supplier designations:

#### **BASF G48 or BASF D542**

- Always add glycol if the glycol content drops below 30% by volume. A glycol content above 60% by volume will not provide greater protection against freezing.
- The table shows the temperature at which ice starts to form. The engine will freeze and break at appreciably lower temperatures, see diagram.
- Ice forming in the coolant often causes malfunctioning without any risk of damage. The engine should not be subjected to heavy loads when ice starts to form.

**Note:** The coolant should be changed when the cooling system is cleaned: every 4,800 hours or at least every 5 years.

**Important!** *If a coolant filter is used in the cooling system it must not contain an inhibitor.*

#### ***Coolant composition:***

##### **If there is a danger of freezing:**

**min 30% glycol by volume  
max 60% glycol by volume**

##### **If there is no danger of freezing:**

**8-12% by volume  
Scania Corrosion Inhibitor**



#### **WARNING**

**Ethylene glycol is highly dangerous if imbibed and can prove fatal.  
Avoid skin contact with glycol.**

**The coolant should be ready mixed when it is poured into the cooling system.  
Never top up with only water or only glycol.**



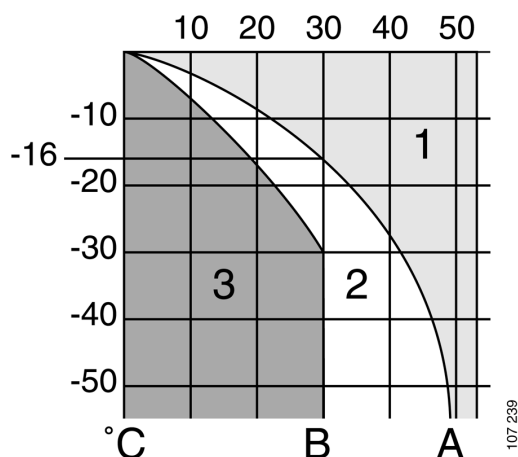
#### **Important**

**The recommended glycols must not be mixed with glycol containing nitrite-based corrosion inhibitor.  
Risk of build up of sludge and reduced cooling capacity.**

Antifreeze glycol, % by volume

## Characteristics of glycol at low temperatures:

- Example with 30% glycol by volume
- Ice slush starts to form at -16°C.
- There is risk of malfunctions at -30°C
- No risk of damage by freezing with a minimum content of 30% glycol by volume



Curve A: Ice formation starts (ice slush)

Curve B: Temperature at which there is a risk of damage by freezing

1. Safe range
2. Malfunctions may occur (ice slush)
3. Risk of damage by freezing

## A

| % by volume glycol                       | 15 | 20 | 25  | 30  | 35  | 40  | 45  | 50  | Cooling system volume, dm <sup>3</sup> |
|------------------------------------------|----|----|-----|-----|-----|-----|-----|-----|----------------------------------------|
| Ice slush starts to form at °C           | -6 | -9 | -12 | -16 | -21 | -24 | -30 | -37 |                                        |
| Ethylene glycol dm <sup>3</sup> (litres) | 5  | 6  | 8   | 9   | 11  | 12  | 14  | 15  | 30                                     |
|                                          | 6  | 8  | 10  | 12  | 14  | 16  | 18  | 20  | 40                                     |
|                                          | 8  | 10 | 13  | 15  | 18  | 20  | 23  | 25  | 50                                     |
|                                          | 9  | 12 | 15  | 18  | 21  | 24  | 27  | 30  | 60                                     |
|                                          | 11 | 14 | 18  | 21  | 25  | 28  | 32  | 35  | 70                                     |
|                                          | 12 | 16 | 20  | 24  | 28  | 32  | 36  | 40  | 80                                     |
|                                          | 14 | 18 | 23  | 27  | 32  | 36  | 41  | 45  | 90                                     |
|                                          | 15 | 20 | 25  | 30  | 35  | 40  | 45  | 50  | 100                                    |
|                                          | 17 | 22 | 28  | 33  | 39  | 44  | 50  | 55  | 110                                    |
|                                          | 18 | 24 | 30  | 36  | 42  | 48  | 54  | 60  | 120                                    |
|                                          | 20 | 26 | 33  | 39  | 46  | 52  | 59  | 65  | 130                                    |
|                                          | 21 | 28 | 35  | 42  | 49  | 56  | 63  | 70  | 140                                    |
|                                          | 23 | 30 | 38  | 45  | 53  | 60  | 68  | 75  | 150                                    |
|                                          | 24 | 32 | 40  | 48  | 56  | 64  | 72  | 80  | 160                                    |
|                                          | 26 | 34 | 43  | 51  | 60  | 68  | 77  | 85  | 170                                    |
|                                          | 27 | 36 | 45  | 54  | 63  | 72  | 81  | 90  | 180                                    |
|                                          | 29 | 38 | 48  | 57  | 67  | 76  | 86  | 95  | 190                                    |
|                                          | 30 | 40 | 50  | 60  | 70  | 80  | 90  | 100 | 200                                    |

A = Area to be avoided. Only for calculating glycol mix.

Coolant freezing temperature, when ice starts to form, for different glycol mixes.

c)

## Checking the corrosion inhibitor

There must always be sufficient corrosion protection (inhibitor) in the coolant to protect the cooling system against corrosion.

If there is no danger of freezing, only Scania Corrosion Inhibitor should be used in the coolant.

The inhibitor in Scania Corrosion Inhibitor is free of nitrites.

The correct proportion of anti-corrosive is 8-12% by volume.

- Topping up with 1.0% Scania Corrosion Inhibitor by volume should be done after every 2,400 hours of operation.
- Never top up with water alone or corrosion inhibitor alone!  
Fluid losses must always be replaced with pre-mixed coolant:  
water + 10% Scania Corrosion Inhibitor by volume.

**Note:** The coolant should be changed when the cooling system is cleaned: every 4,800 hours or at least every 5 years.



### WARNING

**Corrosion protection is highly dangerous if ingested and can prove fatal.**

**Avoid contact with the skin.**



### Important

**Mixing with glycol or the use of too much corrosion protection can lead to build up of sludge and reduced cooling capacity.**

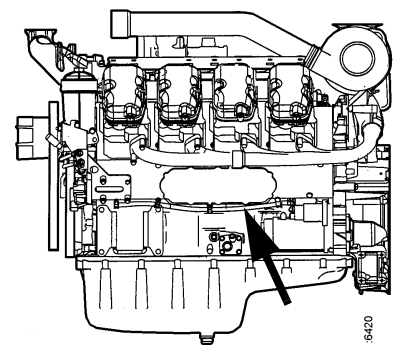
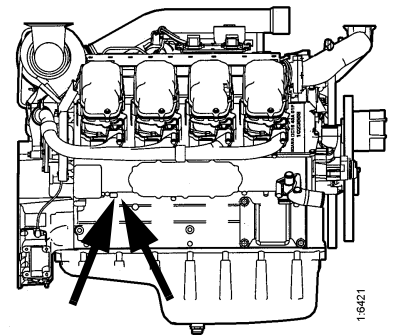


### Important

**If a coolant filter has been fitted it must not contain inhibitor.**

## Changing the coolant

1. Remove the filler cap from the expansion tank.
2. The coolant is drained at three points:
  - 2 drain taps on the lower right side of the block, see illustration
  - drain tap on the lower left side of the block (see illustration) and at the coolant system's lowest point outside the engine.
3. Close the cocks.
4. Top up with coolant through the expansion tank's filler hole.  
Mix coolant as described on page 37.



### Help protect our environment!

**Use a container to avoid spills when changing the coolant.  
Dispose of used coolant through an authorised waste disposal contractor.**

## 7. Every 4,800 hours: Cleaning the cooling system

**Note:** If necessary, the cooling system should be cleaned more often.

### External cleaning

#### Radiator

- Check that the radiator is not clogged on the air side and that the cooling fins are not damaged.
- Carefully scrape the deposit off the radiator's cooling fins. If necessary, a paraffin-based engine cleaner can be used.
- Bent fins can be straightened using a wire brush, for example, and exercising care.

**!**

#### ***Important***

**The cooling system must never  
be cleaned with caustic soda.  
There is a risk of damage to  
aluminium parts.**



## Internal cleaning

### Removing oil and grease

- If possible, run the engine until it has reached operating temperature and then drain the cooling system.
- Remove the thermostats.
- Fill the system with clean, hot water mixed with liquid dishwasher detergent designed for household use.  
Concentration 1% (0.1/10 l).
- Run the engine for approximately 20-30 minutes. Do not forget the cab heating system (if fitted).
- Drain the cooling system.
- Refill the system with clean hot water and run the engine for about 20-30 minutes.
- Drain the water from the system.
- Refit the thermostats.
- Top up the system with coolant according to the specification on page 37.



#### **WARNING**

**When handling cooling system detergent:  
read the warning text on the containers.**

### Removing deposits

- If possible, run the engine until it has reached operating temperature and then drain the cooling system.
- Remove the thermostats.
- Fill the system with clean, hot water mixed with some of the radiator cleaning agent available on the market which is based on sulphamic acid and contains dispersing agents. Follow the manufacturer's instructions for the concentration and cleaning period.
- Run the engine for the specified time and then drain the cooling system.
- Refill the system with hot water and run the engine for about 20-30 minutes.
- Drain the water from the system.
- Refit the thermostats.
- Top up the system with coolant according to the specification on page 37.



#### **Help protect our environment!**

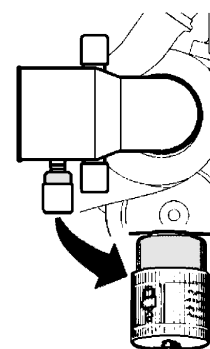
**Use a container to avoid spills  
when changing the coolant.  
Dispose of used coolant through  
an authorised waste disposal  
contractor.**

# Air cleaner

## 8. Daily:

### Test reading low pressure indicator

If the red indicator bar is entirely visible, change or clean the air cleaner filter element, see point 10. This is particularly important if the engine is run at high loads and high speed.



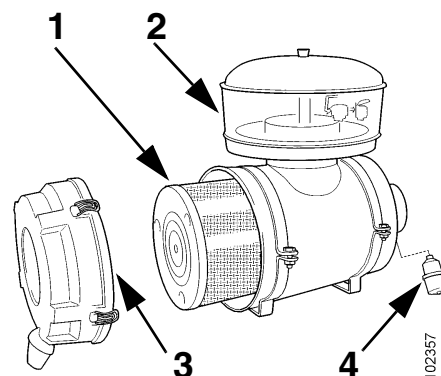
### Important

The coarse cleaner must always be fitted in an upright position.

## 9. Every 200 hours:

### Cleaning the air cleaner coarse cleaner

1. Remove the cover from the coarse cleaner (2).
2. Remove the conical coarse separator. Empty out the particles of dirt and clean it.
3. Fit the coarse cleaner as shown in the figure and screw the cover into place.



1. Filter element
2. Coarse cleaner
3. Cover
4. Vacuum indicator

## 10. Every 1,200 hours:

### Cleaning or renewing the filter element

**Note:** Earlier if the low pressure indicator shows red

#### Dismantling

1. Remove the side cover from the air cleaner.
2. Renew or clean the element.

**Note:** Cleaning the element always entails a risk of damaging it. The element can only be cleaned a maximum of four times. After cleaning, it has poorer dust capacity than a new element.

3. Mark the filter when it has been cleaned.

#### Cleaning the element

- Carefully blow the filter element clean using dry compressed air from the inside.

**Note:** This filter element must not be washed with water.



### Important

Only use genuine Scania air filters.

Renew the filter element if it is damaged.

**Danger of engine damage if the filter element is damaged.**



### WARNING

Never start the engine without the air filter.

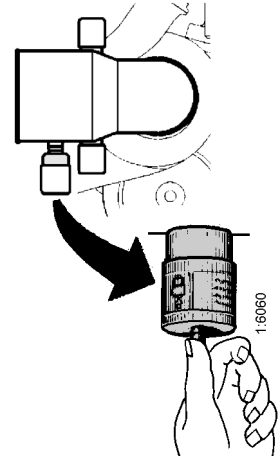
There is a risk of injury or serious engine damage.

## Check

- Insert a torch into the element and check from the outside that there are no holes or cracks in the filter paper.
- Renew the filter element if it has the slightest damage. Danger of engine damage.

## Assembly

1. Assemble the air cleaner in reverse order.
2. Reset the vacuum indicator by pressing the button.



## 11. Every 2,400 hours: RENEWING THE SAFETY CARTRIDGE

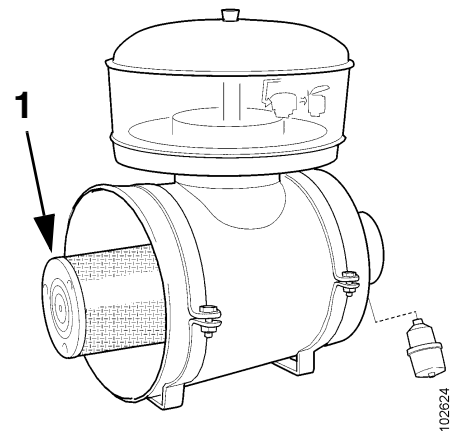
**Note:** Not all filters are equipped with a safety cartridge. When changing the safety cartridge, take great care to ensure that no dirt or other impurities can get into the engine.

1. Remove the side cover from the air cleaner.
2. Remove the filter element.
3. Remove the safety cartridge.
4. Fit a new genuine Scania safety cartridge.
5. Renew or clean the filter element, see point 10.
6. Assemble the air cleaner.

!

### **Important**

**Do not remove the safety cartridge unnecessarily.**



1. Safety cartridge

*Air cleaner with safety cartridge*

!

### **Important**

**Never clean the safety cartridge.**

# Fuel system

## 12. Daily:

### Checking fuel level

- Top up with fuel if necessary. At the same time, drain the water separating filter.
- If the tank has been run dry, bleed the fuel system, see point 13.

!

#### **Important**

Observe the utmost cleanliness when working on the fuel system.

There is a risk of engine malfunction and damage to the injection equipment.

## 13. Every 1,200 hours:

### Renewing the fuel filter

#### Fuel tanks

- Drain any water from the fuel tanks.

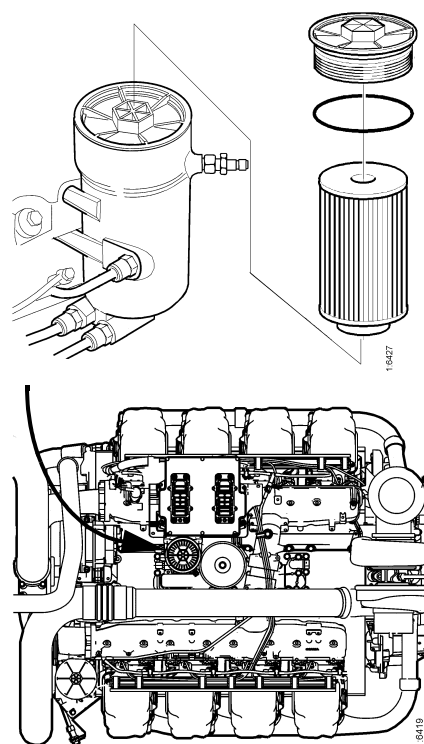
#### Main filter

- Unscrew the filter cover with a closed tool with hexagon driver, for example, socket 587 637, so as not to damage the filter cover.
- Lift out the filter cover and filter element. At the same time, the filter housing will drain automatically.
- Remove the filter element from the lid by carefully prying it to one side. Discard the filter according to environmental requirements.
- Renew the O-ring in the cover. Lubricate the new O-ring with a suitable grease.
- Check that the filter housing is drained of fuel. Contaminated fuel may enter the injectors if the drainage does not work.
- Press a new filter element into the snap fastener in the lid.
- Fit the cover with the filter element in the housing. Tighten the lid to 25 +/-5 Nm. Use a closed tool with hexagon driver.
- Bleed the fuel system after changing the water separating filter as instructed on the next page.

!

#### **Important**

Use only genuine Scania fuel filters.

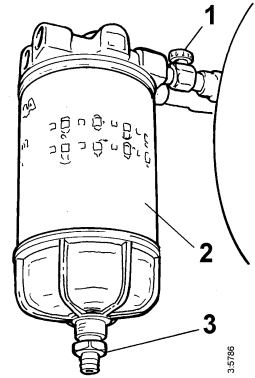


#### **Help protect our environment!**

Use a container to avoid spillage when bleeding and renewing components.

## Water separating filter

- Drainage must be carried out when filling fuel.
- The filter must be renewed at the same renewal interval as the main filter.
- Close the cock (1) before the filter.
- Unscrew the container and drain valve (3).
- Unscrew and renew the filter (2). Lubricate the seal before tightening the new filter by hand.
- Screw the container and drain valve into position.
- Open the cock (1).
- Bleed the fuel system after renewing both filters.



1. Shut-off cock
2. Filter
3. Drain valve

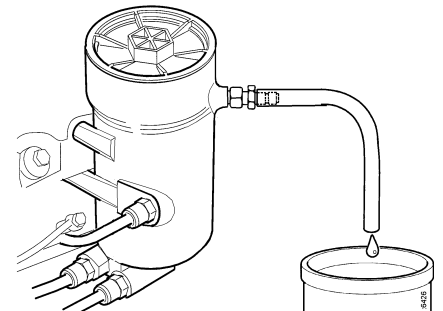


**Help protect our environment!**

**Use a container to avoid spillage when bleeding and renewing components.**

## Bleeding the fuel system

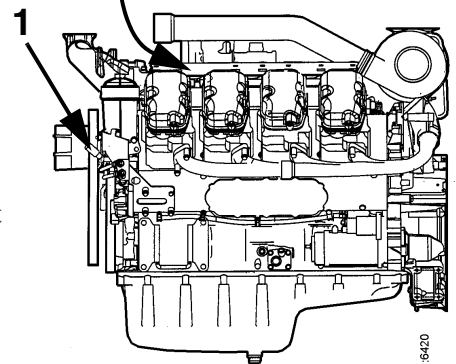
- Attach a clear plastic hose to the bleed nipple on the fuel filter housing to channel fuel into a container.
- Open the bleed nipple and pump the hand pump (1) until the fuel flowing out of the opened bleed nipple is free of air bubbles.
- Close the bleed nipple and remove the hose.
- Continue hand pumping until it feels tight.
- After renewing the fuel filter, it will take approximately 20 strokes.
- Approximately 50 pump strokes after renewing a unit injector.
- Start the engine and check for leaks.



**Important!** *The starter motor may only be used for 30 seconds at a time. After that time it must rest for 2 minutes.*

If the engine fails to start after bleeding:

- Open the bleed nipple again and pump the hand pump until fuel without air bubbles flows out.
- Tighten the bleed nipple. Start the engine and check for leaks.



# Electrical system

## 14. Every 200 hours:

### Checking the electrolyte level in batteries

1. Unscrew the plugs and check the electrolyte level in all cells.
2. Top up with distilled water until the level is 10-15 mm above the plates.

## 15. Every 1,200 hours:

### Checking the state of charge in batteries

- Check the density with an acid tester.

In a fully-charged battery it should be:

- 1.280 at +20°C
- 1.294 at 0°C
- 1.308 at -20°C

- If the density is below 1.20, the battery must be charged. A discharged battery will freeze at -5°C.

Do not boost charge the battery. This will damage the battery in the long run.

## 16. Every 1,200 hours:

### Cleaning batteries

1. Clean batteries, cables and cable terminals.
2. Check that all cable terminals are firmly tightened.
3. Grease battery terminal posts and cable terminals with vaseline.



#### **WARNING**

**Avoid naked flames or sparks near the batteries.**

**When the batteries are charged, oxyhydrogen gas is formed which is flammable and explosive.**



#### **WARNING**

**Wear gloves and protective goggles when charging and handling batteries.**

**The batteries contain a highly corrosive acid.**



#### **WARNING**

**Do not connect the terminals incorrectly.**

**This can cause serious damage to the electrical system.**

**If the terminals are shorted, sparking will occur.**

# Renewing the battery

## Removal

1. Disconnect the negative cable (-) from the battery (cable connected to earth).
2. Disconnect the positive cable (+) from the battery (cable connected to starter motor).

## Fitting

1. Connect the positive cable (+) to the battery (cable connected to starter motor).
2. Connect the negative cable (-) to the battery (cable connected to earth).



### **WARNING**

**Do not connect the terminals incorrectly.**  
**This can cause serious damage to the electrical system.**  
**If the terminals are shorted, sparking will occur.**



### **Help protect our environment!**

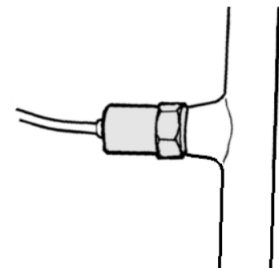
**Dispose of used batteries through an authorised waste disposal contractor.**

## 17. Every 1,200 hours:

## Checking the coolant level monitor

### (Optional equipment)

1. Start the engine.
2. Reduce the coolant level in the expansion tank to below the level monitor.
3. Automatic stop in the event of a fault: The engine stops, the indicator lamp comes on and the buzzer (if fitted) sounds if there is no fault in the level monitor. If the function is connected via the coordinator, the emergency stop fault code will be generated and can be read off on the diagnostics lamp.
4. No automatic stop in the event of a fault: The indicator lamp comes on and the buzzer (if fitted) sounds if there is no fault in the level monitor.
5. Top up coolant to the correct level, see page 36.



2:5454

*16 litre engines:  
 Level indicator in static line*



### **Help protect our environment!**

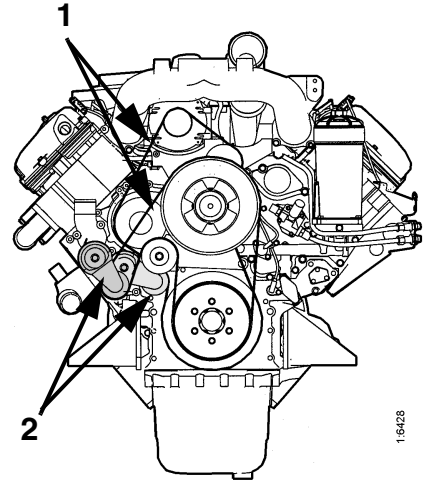
**Use a container to avoid spills when draining the coolant.**  
**Dispose of used coolant through an authorised waste disposal contractor.**

## Other

### 18. Every 1,200 hours:

#### Checking the drive belts

- If the drive belts (1), which are poly-V belts, are worn or damaged they must be changed.
- Also check that the automatic belt tensioners (2) are in proper working order and keep the drive belts correctly tensioned.





## 19. Daily:

### Check for leaks, rectify as necessary

- Start the engine.
- Check for oil, coolant, fuel, air and exhaust leaks.
- Tighten or renew leaking connections. Check the overflow holes (1) in the block which show whether the O-rings between the cylinder liners and crankcase are leaking, see figure.
  - a) If coolant is running out, the O-ring is leaking.
  - b) If lubricating oil is running out, the liner shelf is leaking.
- Check that there are no leaks from the coolant pump (2). If there is leakage, change the pump seal or the complete coolant pump.
- A small amount of leakage from the overflow holes during the engine running-in period is normal. (Sealing rings and O-rings are lubricated with soap or oil when fitted.)
- This leakage normally stops after a time.



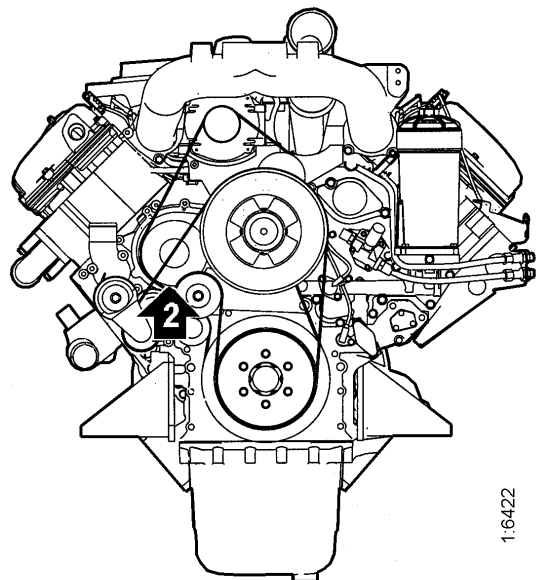
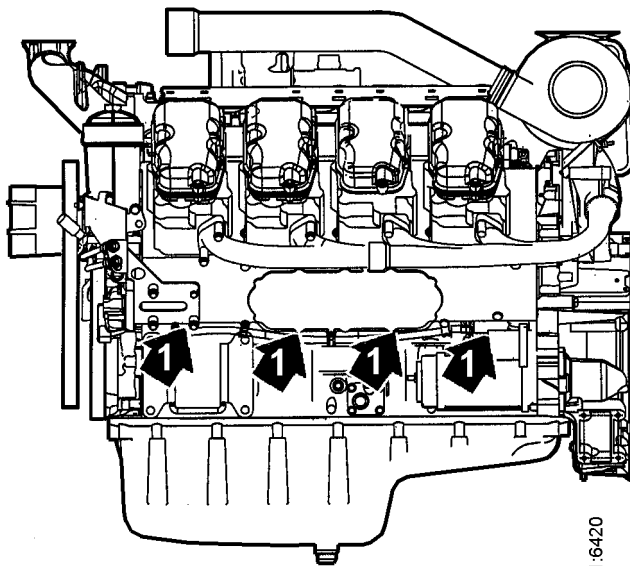
***Help protect our environment!***

**Take care to ensure that any leaks do not cause pollution.**



***Important***

**If serious leakage occurs, contact your nearest Scania workshop.**



## 20. Every 2,400 hours: Check and adjust valve clearance

**Note:** Checking and adjusting valve clearances should also be done after the first 400 hours of operation.

Valve clearances should be adjusted when the engine is cold, at least 30 minutes after running.

The rocker cover gaskets should be renewed as necessary. Tightening torque: 26 Nm.

Intake valve clearance: 0.45 mm.

Exhaust valve clearance: 0.70 mm.

Tightening torque for lock nut: 35 Nm.

### Order of adjustment

- Turn the flywheel so that the marks on the flywheel can be seen in the lower opening in the flywheel casing.
- Measure the valve clearance with a feeler gauge and adjust the valves as per the order of adjustment in the table below. Correct valve clearances are also given on the instruction plate on one of the rocker covers.

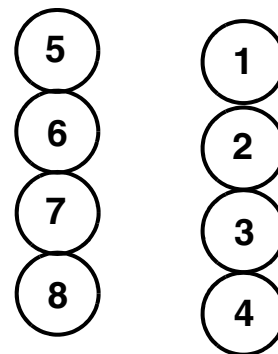
| Mark on flywheel | Valve overlap on cylinder | Adjust intake valves on cylinder | Adjust exhaust valves on cylinder |
|------------------|---------------------------|----------------------------------|-----------------------------------|
| TDC Down (0°)    | 6                         | 7 and 8                          | 4 and 5                           |
| TDC Up (180°)    | 7                         | 1 and 5                          | 2 and 6                           |
| TDC Down (360°)  | 1                         | 2 and 4                          | 3 and 7                           |
| TDC Up (540°)    | 4                         | 3 and 6                          | 1 and 8                           |



### WARNING

**Block the starting device when working on the engine.**

**If the engine starts out of control, there is a SERIOUS RISK OF INJURY.**

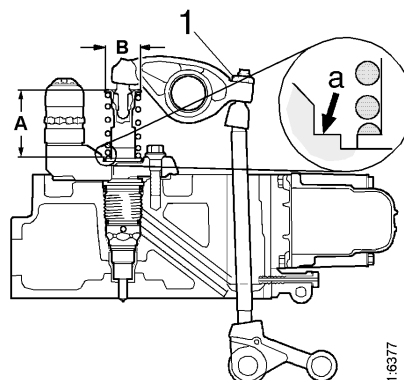


FLYWHEEL

Cylinder numbering

## 21. Every 2,400 hours Checking and adjusting the unit injector rocker arms

**Note:** Checking and adjusting of the unit injector rocker arms should also be done together with the valve clearance check and adjustment after the first 400 hours of operation.



Measurement A =  
PDE31: 66.9 ±0.1 mm  
PDE32: 69.9 ±0.1 mm

Measurement B =  
PDE31: 36.5 mm  
PDE32: 38.8 mm

## PDE31:

1. First, measure the distance (A) between plane (a) and the top edge of the valve spring collar on the unit injector using a digital sliding caliper. See figure.
2. Dimension (A) should be 66.9 mm for PDE31 (dimension B=36.5 mm).
3. The dimension is adjusted by undoing the lock nut and screwing the rocker arm adjusting screw (1) to the correct measurement.

**WARNING! Take care when carrying out the adjustment if the dimension is well outside the adjustment dimension. The spring is pre-tensioned and can cause personal injury if it is released.**

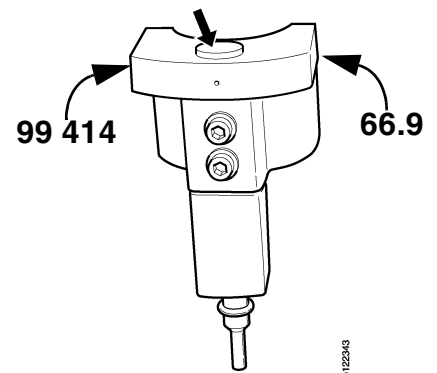
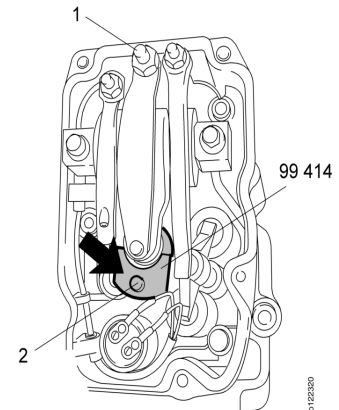
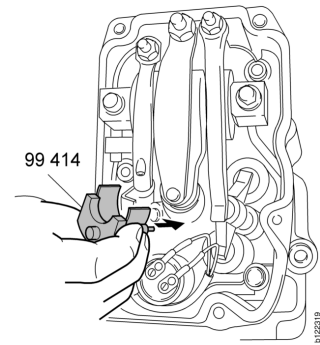
4. Position setting tool 99 414 with the metal plate around the injector spring.
5. Finely adjust dimension (A) by simultaneously using a finger to sense that the small piston (2) is level with the flat upper surface of the tool. It is possible to feel differences of less than a tenth of a millimetre.
6. If the setting tool is not available, a digital sliding calliper can also be used for fine adjustment. The rocker arm position is adjusted using the adjusting screw to 66.9 +/-0.1 mm as stated above.
7. Tighten the adjusting screw lock nut to 39 Nm and remove the tool.
8. The order in which the injector rockers are to be checked and adjusted is shown in the table below.

**Note:** No further checking and adjustment of the unit injector, such as checking the opening pressure, must be done. Faulty injectors must always be replaced completely.

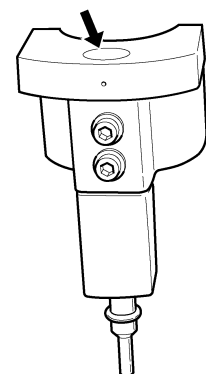
### Order of adjustment:

- Turn the flywheel so that the marks on the flywheel can be seen in the lower opening in the flywheel casing.

| Mark on flywheel | Valve overlap on cylinder | Adjust injector rocker arm on cylinder |
|------------------|---------------------------|----------------------------------------|
| TDC Down (0°)    | 6                         | 4 and 5                                |
| TDC Up (180°)    | 7                         | 2 and 6                                |
| TDC Down (360°)  | 1                         | 3 and 7                                |
| TDC Up (540°)    | 4                         | 1 and 8                                |



*Piston above or below the flat surface. Adjustment necessary*



*Piston level with the flat surface. The adjustment is correct*

## PDE32:

1. First, measure the distance (A) between plane (a) and the top edge of the valve spring collar on the unit injector using a digital sliding caliper. See figure.
2. Dimension (A) should be 69.9 mm for PDE32 (dimension B=38.8 mm).
3. The dimension is adjusted by undoing the lock nut and screwing the rocker arm adjusting screw (1) to the correct measurement.

**WARNING! Take care when carrying out the adjustment if the dimension is well outside the adjustment dimension. The spring is pre-tensioned and can cause personal injury if it is released.**

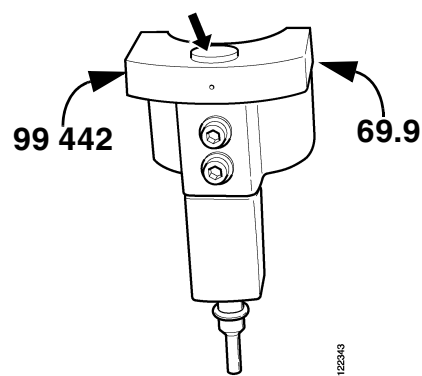
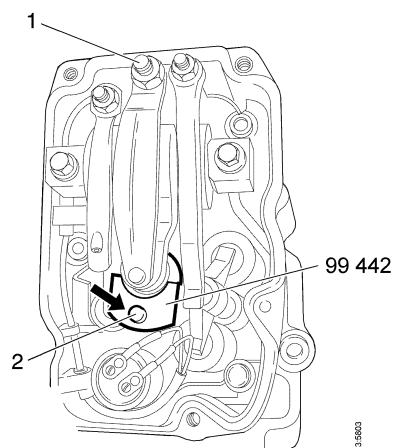
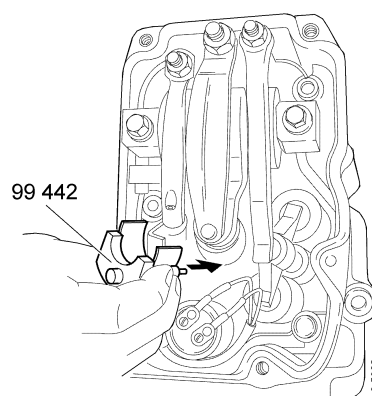
4. Position setting tool 99 442 with the metal plate around the injector spring.
5. Finely adjust dimension (A) by simultaneously using a finger to sense that the small piston (2) is level with the flat upper surface of the tool. It is possible to feel differences of less than a tenth of a millimetre.
6. If the setting tool is not available, a digital sliding calliper can also be used for fine adjustment. The rocker arm position is adjusted using the adjusting screw to 69.9 +/-0.1 mm as stated above.
7. Tighten the adjusting screw lock nut to 39 Nm and remove the tool.
8. The order in which the injector rockers are to be checked/adjusted is shown in the table below.

**Note:** No further checking and adjustment of the unit injector, such as checking the opening pressure, must be done. Faulty injectors must always be replaced completely.

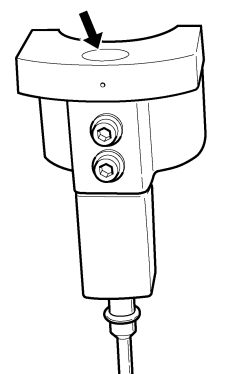
### Order of adjustment:

- Turn the flywheel so that the marks on the flywheel can be seen in the lower opening in the flywheel casing.

| Mark on flywheel | Valve overlap on cylinder | Adjust injector rocker arm on cylinder |
|------------------|---------------------------|----------------------------------------|
| TDC Down (0°)    | 6                         | 4 and 5                                |
| TDC Up (180°)    | 7                         | 2 and 6                                |
| TDC Down (360°)  | 1                         | 3 and 7                                |
| TDC Up (540°)    | 4                         | 1 and 8                                |



*Piston above or below the flat surface. Adjustment necessary*



*Piston level with the flat surface. The adjustment is correct*

# Long-term storage

If the engine is not to be used for a lengthy period of time, special measures should be taken to protect the cooling system, fuel system and combustion chamber from corrosion and the exterior from rusting.

The engine can normally stand idle for up to six months. If it remains unused for longer than this the following measures, which provide protection for about four years, should be adopted. An alternative to preparing the engine for long-term storage is to start the engine and warm it up every 6 months.

Preparing for storage means:

- Thoroughly cleaning the engine.
- Running the engine for a certain time using special preservative fuel, oil and coolant.
- Otherwise preparing the engine for storage (filter renewal, lubrication, etc.).

## Preservative coolant

If the engine is stored with coolant in the system, the coolant should contain 50% glycol by volume. Use glycol without nitrite-based inhibitors, such as BASF G48 or BASF D542.



### WARNING

**Ethylene glycol is highly dangerous if imbibed and can prove fatal.**  
**Avoid contact with the skin.**

## Preservative fuel

- Use diesel mixed with Lubrizol 560H or equivalent.
- Mix 1 cm<sup>3</sup> (ml) Lubrizol 560H in 10 dm<sup>3</sup> (l) of fuel.



## HANDLING LUBRIZOL 560H

### Hazardous!

### Contains aromatic hydrocarbons

Use spot extractors where there is a danger of vapour build-up.

Wear protective gloves and goggles when handling Lubrizol. Do not use contaminated clothing.

|                                 |                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------|
| <i>If it gets in your eyes:</i> | Rinse with a gentle stream of water (at least 15 minutes). Seek medical attention.  |
| <i>If it gets on your skin:</i> | Wash the affected area with soap and water.                                         |
| <i>If inhaled:</i>              | Fresh air, rest and warmth.                                                         |
| <i>Flammable:</i>               | Fire class 2A. Flashpoint +27°.                                                     |
|                                 | <b><i>In the event of fire:</i></b> Extinguish with carbon dioxide, powder or foam. |
| <i>Storage:</i>                 | In well-sealed receptacle in a dry, cool place. Keep out of reach of children.      |

## Preservative oil

Suitable preservative oils are supplied by most oil suppliers.

For example, Dinitrol 40 or equivalent.

## Preparations for storage

- Drain and flush the cooling system. Top up with preservative coolant.
- Warm up the engine on normal fuel. Stop the engine and drain the oil.
- Renew the fuel filter.
- Fill the engine with preservative oil up to the minimum level on the dipstick.
- Mix preservative fuel in a can. Detach the fuel pipe at the feed pump suction line and connect a hose from the can.
- Detach the fuel pipe at the overflow valve and connect a return hose to the can.
- Start the engine and run it at about 1,000 rpm (not single-speed engines) for 20-25 minutes.
- Stop the engine, remove the hoses and connect the normal fuel lines.
- Remove the rocker covers and lubricate the valve mechanisms and unit injector mechanisms with preservative oil. Refit the rocker covers.



***Help protect our environment!***

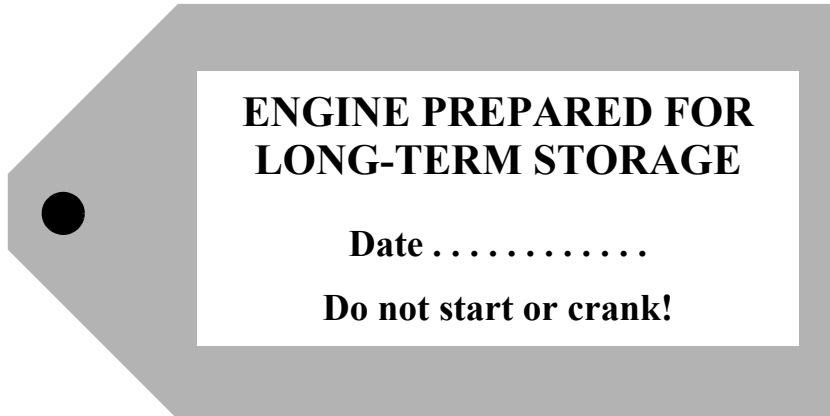
**Use a container to avoid spills when draining the oil and coolant.**

**Dispose of used oil and coolant through an authorised waste disposal contractor.**

### **Note: The unit injectors must not be removed.**

- Drain the preservative oil from the engine. Fresh engine oil can be filled directly or when the engine is taken out of storage.
- Drain the coolant if the engine is not to be stored with coolant in the system. Plug and tape over all coolant connections (if the cooling system is not completely assembled).
- Air cleaner: Clean or renew the filter element.
- Cover air intakes and exhaust pipes.
- Alternator and starter motor:
  - Spray with water-repellent anti-corrosive oil, CRC 226, LPS1 or the equivalent.
- Spray the outside of bright engine parts with penetrating preservative oil, for example Dinitrol 25B, and then with Dinitrol 112 or equivalent.

- *Attach a label to the engine, clearly stating the storage preparation date and that the engine must not be started or cranked.*



## **Batteries**

Remove the batteries for trickle charging at the battery charging station. (Does not apply to batteries which according to the manufacturer do not require any maintenance.) The same applies to short-term storage, even if the engine has not been prepared for storage as above.

## **Storage**

After the preparations, the engine should be stored in a dry and warm place (room temperature).

## **Taking out of storage**

### **(Procedure for taking the engine into operation)**

- Remove plugs and tape from coolant connections, air intakes and exhaust pipes.
- Fill the system with coolant, see page 22.
- Check the oil level in the engine or fill up with fresh engine oil.
- Lubricate the valve mechanisms and their pushrods and valve tappets as well as the PDE injector mechanisms.
- Drain the preservative fuel from the fuel manifolds and fuel filter.
- Connect and bleed the fuel system, see page 45.
- Wash off any externally applied preservative oil, using white spirit.



### **WARNING**

**Wear gloves and protective goggles when charging and handling batteries.**

**The batteries contain a highly corrosive acid.**

# Technical data

| General                                              |                           | DC16                          |
|------------------------------------------------------|---------------------------|-------------------------------|
| Number of cylinders                                  |                           | 8 (V8, 90°)                   |
| Cylinder diameter                                    | mm                        | 127                           |
| Piston stroke                                        | mm                        | 154                           |
| Displacement                                         | dm <sup>3</sup> (litres)  | 15.60                         |
| No. of main bearings                                 |                           | 5                             |
| Firing order                                         |                           | 1 - 5 - 4 - 2 - 6 - 3 - 7 - 8 |
| Compression ratio                                    |                           | 18:1 DC16 44:16:1             |
| Engine direction of rotation viewed from rear        |                           | Counterclockwise              |
| Fan direction of rotation viewed from front          |                           | Clockwise                     |
| Cooling                                              |                           | Liquid                        |
| Valve clearances, cold engine                        |                           |                               |
| intake valve                                         | mm                        | 0.45                          |
| outlet valve                                         | mm                        | 0.70                          |
| Weight with fan, without coolant or oil              | kg                        | 1,346                         |
| Power                                                |                           | see "Engine record card"      |
| Lubrication system                                   |                           |                               |
| Max. oil pressure                                    |                           |                               |
| hot engine at a speed above 1,000 rpm                | bar (kp/cm <sup>2</sup> ) | 6                             |
| Normal oil pressure                                  |                           |                               |
| hot engine at operating speed                        | bar (kp/cm <sup>2</sup> ) | 3-6                           |
| Min. oil pressure                                    |                           |                               |
| hot engine 1,000 rpm                                 | bar (kp/cm <sup>2</sup> ) | 3.0                           |
| Min. oil pressure                                    |                           |                               |
| hot engine, idling                                   | bar (kp/cm <sup>2</sup> ) | 1.4                           |
| Oil capacity, see page 31                            |                           |                               |
| Crankcase pressure with closed crankcase ventilation | mm VP                     | -55 - +20                     |



| <b>Fuel system</b>                                      |                           | <b>DC16</b>                          |
|---------------------------------------------------------|---------------------------|--------------------------------------|
| Low idling                                              | rpm                       | 700 (adjustable 500-800)             |
| Maximum full-load speed                                 |                           | See engine card                      |
| Fuel                                                    |                           | Diesel <sup>1</sup>                  |
| <sup>1</sup> see page 58                                |                           |                                      |
| <b>Cooling system</b>                                   |                           |                                      |
| Number of thermostats                                   |                           | 1 (dual thermostat)                  |
| Thermostat, opening temperature                         | °C                        | 79                                   |
| Coolant temperature:                                    |                           |                                      |
| system at atmospheric pressure                          | °C                        | 70-93                                |
| system at overpressure                                  | °C                        | 70 - approximately 100               |
| Capacity, including radiator, engine and expansion tank |                           |                                      |
| with 0.8 m <sup>2</sup> radiator                        | dm <sup>3</sup> (litres)  | 85                                   |
| with 1.3 m <sup>2</sup> radiator                        | dm <sup>3</sup> (litres)  | 95                                   |
| <b>Electrical systems</b>                               |                           |                                      |
| System voltage                                          | V                         | 24                                   |
| Alternator, current                                     | A                         | 65 or 90                             |
| Starter motor output                                    | kW (hp)                   | 6.7 (9.1)                            |
| Monitors, threshold values:                             |                           |                                      |
| oil pressure monitor                                    | bar (kp/cm <sup>2</sup> ) | 1.0 ± 0.15                           |
| temperature monitor                                     | °C                        | Stamped on hexagonal part of monitor |

# Fuel

## Diesel

The composition of the diesel has a great influence on the functioning and the service life of the engine and the injection system. The engine output and exhaust emissions are also dependent on the fuel quality. The requirements and testing standards for the most important properties are described in the workshop manual in sections which can be ordered from Scania dealers or directly from Scania. Scania's address is printed on the cover.

Diesel must comply with the following standard: EN 590 (European standard).

The table below shows the requirements for some of the most important properties.

| Property                        | Requirements                     |
|---------------------------------|----------------------------------|
| Viscosity at 40°C               | 2.0-4.5 mm <sup>2</sup> /s (cSt) |
| Density at 15°C                 | 0.82-0.86 kg/dm <sup>3</sup>     |
| Sulphur (concentration by mass) | max. 0.3%                        |
| Ignitability (CET rating)       | min. 49                          |
| Flashpoint                      | 56°C                             |

## Environmentally friendly fuels (low sulphur fuels)

There are three classes of environmentally friendly fuels (SS15 54 35). Class 1 is sulphur-free and class 2 is low in sulphur. Compared with class 3 (normal fuel), these fuels are less dense and this reduces engine power output. Only class 1 fuel should be used with a catalytic converter.

Short term use of fuel with a higher sulphur content than 0.05% by weight will not cause permanent damage to the catalytic converter.

The catalytic converter may, however, require fuel with low sulphur content for some time after this to regain its normal efficiency.

## Temperature dependence of diesel

At temperatures lower than those specified for the diesel, paraffin wax may precipitate from the fuel and block filters and pipes. The engine can then lose power or stop.

The diesel is adapted for use in the specific climate of each country. If a vehicle or an engine is to be operated in a temperature zone with lower temperature than normal, first identify the temperature properties of the fuel concerned.

The properties of the fuel when cold can be improved by adopting one of the following measures before the temperature drops:

- If the fuel concerned cannot cope with the expected temperatures, and diesel is not available with the correct temperature properties, we recommend that an electric fuel heater is installed as a preventative measure.
- The low temperature properties of diesel may be improved by adding kerosene as a preventive measure. A maximum of 20% may be added. When refuelling, the kerosene should be added first, so that it mixes thoroughly with the diesel.

**Note:** It is prohibited to use kerosene in engine fuel in some countries.

- To prevent water in the fuel from freezing and forming ice, a maximum of 0.5-2% alcohol (isopropanol) may be added.

Drain fuel tanks and drain or renew fuel filters regularly.



### **WARNING**

**It is not permitted to mix kerosene with diesel fuel that is already adapted for the climate concerned, it can damage the unit injectors. All use of paraffin other than kerosene is forbidden, as it causes engine damage.**



### **Important**

**It is not permissible to mix petrol with diesel. Petrol may cause wear to the unit injectors and it may also cause damage to the engine.**

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# Scania Assistance

Always call the contact for your country.

|           |                                  |           |                                 |
|-----------|----------------------------------|-----------|---------------------------------|
| <b>AR</b> | 0800 999 722 642                 | <b>IE</b> | +353 71 9634000                 |
| <b>AT</b> | +43 1 256 44 11                  | <b>IT</b> | +39 0461 996 222                |
| <b>AU</b> | 1300 SCANIA<br>1300 722642       | <b>KR</b> | +82 1588 6575                   |
| <b>BE</b> | +32 2 264 00 00                  | <b>LU</b> | +32 226 400 000                 |
| <b>BG</b> | +359 886 660001                  | <b>MA</b> | +34 91 678 92 13                |
| <b>BR</b> | 0800 019 42 24                   | <b>MX</b> | 01 800 4SCANIA                  |
| <b>CH</b> | +41 800 55 24 00                 | <b>NL</b> | +31 70 4182666                  |
| <b>CL</b> | 188 800 722 642                  | <b>NO</b> | +47 223 217 00                  |
| <b>CZ</b> | +420 225 020 225                 | <b>PL</b> | +48 602 622 465                 |
| <b>DE</b> | +49 261 887 8888                 | <b>PT</b> | +351 91 678 9247                |
| <b>DK</b> | +45 333 270 44                   | <b>RO</b> | +40 723 27 27 26                |
| <b>ES</b> | +34 91 678 80 58                 | <b>SE</b> | +46 42 100 100                  |
| <b>FI</b> | +358 10 555 24                   | <b>SK</b> | +421 903 722 048                |
| <b>FR</b> | +33 2 414 132 32                 | <b>TR</b> | +90 212 335 04 40               |
| <b>GB</b> | 0 800 800 660<br>+44 1274 301260 | <b>TZ</b> | +255 78 472 2642                |
| <b>GR</b> | +30 6944 420 410                 | <b>UY</b> | 0800 8351                       |
| <b>HU</b> | +36 209 727 197                  | <b>ZA</b> | 0800 005 798<br>+27 11 661 9823 |

Other countries: +46 8 52 24 24 24

**Note:** Calls will be recorded for training purposes.

