



## **Important information**

### **Serious risk of injury**

When working on the engine, for example when adjusting drive belts and the clutch, or when changing the oil, it is important not to start the engine. The engine could be damaged, but more importantly there is a 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.



#### **WARNING!**

This warning symbol and text can be found next to those maintenance items where it is particularly important to bear in mind the risk of injury.

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## **Operator's manual**

### **DC16**

### **XPI**

### **Industrial engine**

### **en-GB 2 428 293**



Issue 4.0



#### **IMPORTANT!**

The owner is responsible for making sure that maintenance is carried out on time and in accordance with the instructions.

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The owner must entrust the maintenance, renewal and repair of emission-related components and systems to a qualified workshop or person.

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## Start-up Report – Warranty

The warranty starts when the start-up report has been filled in and sent to Scania. The normal warranty period is 1 year, but other conditions can apply.

Fill in the particulars in the start-up report below as well. This can make things easier if you need to contact a workshop, for example.

**Engine serial number**

**Date of entry into service**

**User's name and address**

**Signature**

**Engine type**

**Variant**

Engine type and variant are indicated on the engine data plate.

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## Introduction

This Operator's manual describes the operation and maintenance of Scania industrial engines.

The engines are direct-injection, liquid-cooled, four-stroke, turbocharged diesel engines. Certain engines are also equipped with an SCR system for emission control.

The engines are available with different output and engine speed settings. Engine power for the engine ordered is indicated on a plate located on the engine control unit.

### **Note:**

Only standard components are described in the operator's manual. Information about special equipment is contained in instructions from the various manufacturers.

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To ensure the maximum performance and the longest service life for the engine remember the following:

- Read through the Operator's manual before starting to use the engine. Even regular users of Scania engines will get new information from the Operator's manual.
- Always follow the maintenance instructions.
- Read the section on safety carefully.
- Get to know your engine so that you know what it can do and how it works.
- Always contact a workshop with qualified personnel for maintenance and repair.

The information in this manual was correct at the time of going to press. Scania reserves the right to make alterations without prior notice.

## Environment and safety

### Environmental responsibility

Scania develops and produces engines that are as environmentally-friendly as possible. Scania has made major investments in the reduction of harmful exhaust emissions in order to fulfil the environmental requirements in force in almost every market.

At the same time, we have been able to maintain a high level of performance and operating economy for Scania Industrial and Marine Engines. To maintain these throughout the entire service life of the engine, it is important for the user to follow the instructions on running, maintenance and fuel and lubricating oil as outlined in the Operator's manual.

Other green initiatives taken include ensuring that, following maintenance and repair, waste that is harmful to the environment (for example oil, fuel, coolant, filters and batteries) is disposed of accordance with the applicable environmental requirements.

### Safety

The following pages contain a summary of the safety precautions to be complied with when operating and maintaining Scania engines. The equivalent text can also be found under the relevant maintenance item.

To prevent damage to the engine and to ensure that it runs optimally, follow the instructions in the warnings and advisories.

If the instructions are not followed, the warranty can cease to apply.

### Different types of advisory

#### Warning!

All advisories preceded by Warning! are very important. They warn of serious faults and incorrect operation that could lead to personal injury. Example:



#### **WARNING!**

Block the starting device when working on the engine. If the engine starts unexpectedly, there is a serious risk of injury.

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#### Important!

Advisories preceded by Important! warn of faults and incorrect operation that could lead to equipment being damaged. Example:



#### **IMPORTANT!**

For Scania to guarantee that the engine corresponds to its certified configuration, and take responsibility for any damage and injuries that occur, maintenance must be carried out as above.

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**Note:**

Advisories preceded by Note: refer to information important to ensure the best possible operation and functionality. Example:

**Note:**

Leave the engine off for at least 1 minute before checking the oil level.

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**Environment**

This Operator's manual contains specially highlighted text with instructions to help protect the environment during maintenance. Example:

**Environment**

Use a container to avoid spillage.

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**Warnings and advisories****Smoking****WARNING!**

Smoking is prohibited

- in the vicinity of flammable or explosive material, e.g. fuel, oils, batteries, chemicals
  - when refuelling and in the vicinity of the filling station
  - when working on the fuel system
- 

**Safety precautions for running the engine****Daily maintenance**

Always carry out a visual inspection of the engine and engine compartment before starting the engine or when the engine has been switched off after operation.

This inspection should be done to detect fuel, oil or coolant leaks, or anything else that may require corrective action.

**Fuel**

Use only fuel recommended in the Workshop Manual.

**WARNING!**

The wrong fuel grade can cause breakdowns or stoppages by causing the injection system to malfunction. This can cause damage to the engine and, possibly, personal injury.

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**Refuelling**

Never overfill the fuel tank as the fuel needs space to expand. Also ensure that the filler cap is properly closed.

**WARNING!**

During refuelling there is a risk of fire and explosion. The engine must be switched off and smoking is prohibited.

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### Hazardous gases



#### WARNING!

Only start the engine in a well ventilated area. The exhaust gases 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.

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### Starter lock



#### IMPORTANT!

If the control panel is not fitted with a starter lock, the engine compartment should be locked to prevent unauthorised personnel from starting the engine. Alternatively, a lockable master switch or battery master switch can be used.

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### Starter gas



#### WARNING!

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

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### Running



#### WARNING!

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 be fitted with guards.

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### Safety precautions for handling materials

#### Fuel and lubricating oil



#### WARNING!

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

The work must be carried out on a cold engine. Fuel leaks and spillage on hot surfaces can cause fire.

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

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## Batteries



### WARNING!

The batteries contain and form oxyhydrogen gas, particularly during charging. Oxyhydrogen 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 can cause the battery to explode.

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## Reductant



### WARNING!

Reductant (AdBlue/DEF) is used in the reductant tank on engines equipped with an SCR system. Avoid contact with the skin.

If reductant comes in contact with the skin: Wash with soap and plenty of water. If reductant splashes in the eyes: Rinse immediately with plenty of water. Contact a doctor if it is ingested or causes skin irritations.

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## Chemicals



### WARNING!

Most chemicals such as glycol, anti-corrosive agents, preservative oils and degreasing agents, are hazardous to health.

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

Always follow the safety precautions on the relevant packaging.

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.

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## Environment

Always hand in leftover and used chemicals to an authorised waste disposal contractor.

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## Safety precautions for maintenance and repair

### Switch off the engine

Always switch off the engine before carrying out maintenance and repairs, unless otherwise indicated.

Make it impossible to start the engine: Remove any starter key, or cut the power using the main power switch or battery master switch and lock them.

Fix a warning plate somewhere appropriate, showing that work is being carried out on the engine.



### WARNING!

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.

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## Hot surfaces and fluids



### WARNING!

There is always a risk of sustaining burns when an engine is hot. Particularly hot parts are exhaust manifolds, turbochargers, oil sumps, hot coolant and oil in pipes and hoses.

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## Lifting the engine

Always use the engine lifting eyes. Always check that lifting accessories are in good condition and are designed to lift the weight.

Optional equipment on the engine can change the centre of gravity. This means that it may be necessary to use additional lifting devices to balance the engine correctly and lift it safely.



### WARNING!

Never work underneath a suspended engine!

---

## Batteries



### WARNING!

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

If sulphuric acid comes in contact with the skin: Wash with soap and plenty of water. If it gets in your eyes: Rinse immediately with plenty of water and seek medical attention.

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## Environment

Always hand in used batteries to an authorised waste disposal contractor.

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## Electrical system

The engine must be switched off 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.



### IMPORTANT!

Scania recommends that Scania spare parts are used for the fuel and electrical systems. Scania spare parts are designed to minimise the risk of fire and explosion.

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## Electric welding



### IMPORTANT!

When carrying out welding work on and near the engine, disconnect the battery and alternator leads. Pull out the multi-pin connector for the engine control unit as well.

Connect the welding clamp close to the component to be welded. The welding clamp must not be connected to the engine, or so that the current can cross a bearing.

When welding is finished:

1. Connect the alternator and control unit cables first.
2. Then connect the batteries.

## Lubrication system



### WARNING!

Hot oil can cause burns and skin irritation. Wear protective gloves and goggles when changing hot oil.

Make sure that there is no pressure in the lubrication system before starting work on it.

The oil filler cap must always be in place when starting and running the engine to prevent oil being ejected.



### Environment

Always hand in used oil to an authorised waste disposal contractor.

## Cooling system



### WARNING!

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

If the cap has to be opened do it slowly and carefully to release the pressure before removing the cap. Wear gloves as the coolant is still very hot.



### Environment

Always hand in used coolant to an authorised waste disposal contractor.

## Fuel system



### WARNING!

Always wear protective goggles when testing injectors. Fuel escaping at high pressure can penetrate tissues and cause serious injury.

Scania recommends that Scania spare parts are used for the fuel and electrical systems. Scania spare parts are designed to minimise the risk of fire and explosion.

## Before starting

Ensure that all guards are in place before starting the engine. Ensure that no tools or other objects have been left on the engine.



### WARNING!

The air filter must be fitted before starting the engine. Otherwise there is a risk of objects being sucked into the compressor impeller or of injury if you come into contact with the air filter.

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## Certification

An emissions certified engine fulfils the emissions requirements for a particular range of application.

On each emissions certified engine there is a label which shows which requirements the engine fulfils. Scania guarantees that each such engine fulfils the emissions requirements for the range of application for which it is certified.

The following are required for the certified engine to fulfil the emissions requirements once it has been taken into service:

- Maintenance is to be carried out in accordance with the instructions in this Operator's manual.
- The maintenance and repair of injection equipment are to be carried out by a qualified workshop or person.
- The engine may only be modified with equipment that has been approved by Scania.
- Seals may be broken and setting data edited only once approval has been granted by Scania. Modifications may be made by authorised personnel only.
- Modifications affecting the exhaust and intake systems must be approved by Scania.

Otherwise, the instructions in the Operator's manual for the running and maintenance of the engine shall apply. The safety precautions should be observed.



### IMPORTANT!

For Scania to guarantee that the engine corresponds to its certified configuration, and take responsibility for any damage and injuries that occur, maintenance must be carried out as above.

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# Scania engines 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 Engines ("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 ("You") 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, for their full useful life and designed, built and equipped so as to conform with all applicable regulations adopted by the California Air Resources Board pursuant to its authority under Chapters 1 and 2, Part 5, Division 26 of the California 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 or otherwise cause the failure of a warranted part to be identical in all material respects to the part as described

in the engine manufacturer's application for certification.

Where a warrantable condition exists, Scania will repair your heavy-duty off-road engine at no cost to You including diagnosis, parts, and labor.

### Warranty period

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

- 3,000 hours of operation as determined by a device to measure hours of use, or
- Five years

Each engine is equipped with a device to measure hours of use. If that device fails to account for hours of use due to defects in materials or workmanship, the engine shall be warranted for a period of five years. The warranty period shall begin on the date the engine is delivered to the first ultimate purchaser who, in good faith, purchases the engine for purposes other than imminent resale.

### The Warranty on emission-related parts shall be interpreted as follows:

1. Any warranted part which is not scheduled for replacement as required maintenance in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the warranty period defined above. If any such part fails during the period of warranty coverage, it shall be repaired or replaced by the engine manufacturer according to Subsection (4) below. Any such part repaired or replaced under the Warranty shall be warranted for the remaining warranty period.
2. Any warranted part which is scheduled only for regular inspection in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the warranty period defined above. A statement in such written instructions to the effect of "repair or replace as necessary" shall not reduce the period of warranty coverage. Any such part repaired or replaced under warranty shall be warranted for the remaining warranty period.

3. Any warranted part which is scheduled for replacement as required maintenance in Scania's written instructions for maintenance and use of the engine by owner shall be warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part shall be repaired or replaced by the engine manufacturer according to Subsection (4) below. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for the part.
4. Repair or replacement of any warranted part under the warranty provisions of this article shall be performed at no charge to the owner at a warranty station.
5. Notwithstanding the provisions of Subsection (4) above, warranty services or repairs shall be provided at all manufacturer distribution centers that are franchised to serve the subject engines.
6. The owner shall not be charged for diagnostic labor that leads to the determination that a warranted part is in fact defective, provided that such diagnostic work is performed at a warranty station.
7. The engine manufacturer shall be liable for damages to other engine components proximately caused by a failure under warranty of any warranted part.
8. Throughout the engine's warranty period defined above, the engine manufacturer shall maintain a supply of warranted parts sufficient to meet the expected demand for such parts.
9. Any replacement part, as defined in Section 1900(b), Title 13 of the California Code of Regulations, may be used in the performance of any maintenance or repairs and must be provided without charge to the owner. It is not necessary for replacement parts to be the same brand or by the same manufacturer as the original part sold with the engine. Such use shall not reduce the warranty obligations of the engine manufacturer.
10. Add-on or modified parts, as defined in Section 1900(b), Title 13 of the California Code of Regulations, that are not exempted by the California Air Resources Board may not be used. The use of any non-exempted add-on or modified parts shall be grounds for disallowing a warranty claim made in accordance with this article. The engine manufacturer

shall not be liable under this article to warrant failures of warranted parts caused by the use of a non-exempted add-on or modified part.

11. The Executive Officer of the California Air Resources Board may request, and in such case, the engine manufacturer shall provide, any documents which describe that manufacturer's warranty procedures or policies.

### 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 and California emission control regulations:

1. Fuel injection system.
2. Air induction system.
3. Exhaust manifold system.
4. Smoke puff limiter (included in ECU).
5. Oil filler cap.
6. EGR system (when applicable):
  - a) Cooler.
  - b) EGR valve.
7. Exhaust brake (when applicable).
8. NOx sensors:
  - a) NOx sensor, engine out.
  - b) NOx sensor, tail pipe.
9. DOC (when applicable).
10. SCR system:
  - a) DEF tank.
  - b) DEF tank level, temperature and quality sensors.
  - c) DEF hose.
  - d) DEF injector.
  - e) DEF injector pressure and temperature sensors.
  - f) Evaporator.
  - g) SCR catalyst inlet temperature sensor.
  - h) SCR catalyst including the ammonia-slip catalyst.
  - i) SCR control unit (EEC3).

11. Miscellaneous items used in the above system:

- a) Electronic control unit (ECU), sensors, wiring harnesses.
- b) Hoses, belts, connectors, assemblies, clamps, fittings tubing, sealing gaskets or devices and mounting hardware.
- c) Pulleys, belts and idlers.
- d) Emission control information label.



### 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.
- Emission related parts scheduled for inspection and replacement only as necessary are not considered expendable and if repaired or replaced under warranty shall be warranted for the remaining warranty period.

See Specific Warranty Exclusions below.

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### 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. Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with state or federal emissions requirements. The use of alternative fuels shall not void the warranties on any engine certified to use such fuel.

In addition, as the engine owner, You are responsible for the performance of all scheduled maintenance listed in your owner's manual, and all necessary repairs, on your new Scania industrial diesel engine. Scania may deny a warranty claim if the engine or part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

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. Scania cannot, however, deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

The Warranty covers the cost of diagnosis, 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.

You are responsible for initiating the warranty process. The California Air Resources Board suggests that You present your heavy-duty off-road engine to an authorized Scania dealer as soon as a problem exists. The warranty repairs should be completed by the dealer as expeditiously as possible.



### 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.

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## 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 due to a failure of the device to track hours of use unrelated to defects in materials or workmanship.
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 1002, 78216, San Antonio, Texas

**Mailing address:** 121 Interpark Blvd, suite 1002, 78216, San Antonio, Texas

**Telephone:** +1 210 403 0007

**Fax:** +1 210 403 0211

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

California customers shall also be furnished a copy of the California Emission Control Warranty Statement applicable to each new Scania engine purchased.

## California emission control warranty statement

### Your warranty rights and obligations

The California Air Resources Board is pleased to explain the emission control system warranty on your 2016 engine. In California, new heavy-duty off-road engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Scania CV AB must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Scania CV AB will repair your heavy-duty off-road engine at no cost to you including diagnosis, parts and labor.

### Manufacturer's warranty coverage

The 2016 heavy-duty off-road engines are warranted for a period of five years or 3,000 hours, whichever occurs first. If any emission-related part on your engine is defective, the part will be repaired or replaced by Scania CV AB.

### Owner's warranty responsibilities

- As the off-road engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Scania CV AB recommends that you retain all receipts covering maintenance on your off-road engine, but Scania CV AB cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.
- As the off-road engine owner, you should however be aware that Scania CV AB may deny you warranty coverage if your off-road engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.
- Your engine is designed to operate on ultra low-sulfur diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.
- You are responsible for initiating the warranty process. The ARB suggests that you present your off-road engine to a Scania CV AB dealer as soon as a problem exists. The warranty repairs should be completed by the dealer as expeditiously as possible.

If you have any questions regarding your warranty rights and responsibilities, you should contact Scania U.S.A. Inc +1-210-403-0007.



## SCR catalytic converter



### WARNING!

The SCR catalytic converter contains vanadium pentoxide, a chemical known to the State of California to cause cancer.

The SCR catalytic converter is fitted in the silencer and does not constitute a health hazard during normal use and handling.

When carrying out work on the SCR catalytic converter which may result in exposure to dust, safety precautions must be taken. Such work includes, for example, opening the silencer machining and scrapping the SCR catalytic converter.

Safety precautions when working on the SCR system.

- Inhalation: If dust is inhaled, the person should be provided with fresh air immediately. Seek medical attention
- Eye contact: Rinse eyes with water immediately. If irritation persists, seek medical attention.
- Skin contact: Wash with water and soap. Remove contaminated clothes.
- Ingestion: If large amounts have been ingested, drink plenty of water and induce vomiting. Seek medical attention

Environmental hazards

- Vanadium pentoxide is toxic to water organisms and can cause detrimental long term effects to water environment.

Environmental protection measures

- The SCR catalytic converter is a manufactured article that contains vanadium pentoxide, a hazardous substance. Before disposing of, or scrapping, a spent SCR catalytic converter, it should be tested for any hazardous characteristics (ignitability, corrosivity, reactivity, acute hazardousness, and toxicity), as those categories are described in 22 CCR § 66261.30. If the spent SCR catalytic converter exhibits hazardous characteristics and is being disposed of, it will be considered by the State of California to be a hazardous waste subject to Title 22, California Code of Regulations. Before disposing of hazardous waste, review and follow all pertinent federal and California requirements.
- Vanadium pentoxide is a listed commercial chemical product - P120 - pursuant to 22 CCR § 66261.33(e). According to the State of California, commercial chemical products that are discarded or intended to be discarded are hazardous wastes and are subject to all provisions of Title 22, California Code of Regulations. Before disposing of vanadium pentoxide, review and follow all pertinent federal and California requirements.
- If the SCR catalytic converter is opened for maintenance, any dust spillages from the catalyst should be collected and tested for the presence of vanadium pentoxide prior to proper disposal. Dust spillages should also be tested for any hazardous characteristics (ignitability, corrosivity, reactivity, acute hazardousness, and toxicity), as those categories are described in 22 CCR § 66261.30, prior to proper disposal. If the dust contains either vanadium pentoxide or exhibits hazardous characteristics and is being disposed of, it will be considered by the State of California to be a hazardous waste subject to Title 22, California Code of Regulations. Before disposing of hazardous waste, review and follow all pertinent federal and California requirements.

- Do not dispose of the spent SCR catalytic converter or its constituent parts into any waterways, storm drains or sanitary sewers.

**WARNING!**

The SCR catalytic converter contains vanadium pentoxide, a chemical known to the State of California to cause cancer.

---

#### Additional considerations when working on the SCR system

- Carry out work on the SCR catalytic converter in all well ventilated area. Use protective goggles and gloves if there is any risk of splashing or spraying of reductant or coolant.
  - When engine is running, the exhaust system parts can reach such high temperatures that there is a risk of personal injury. Make sure that the exhaust system temperature has decreased to a suitable level before starting to work.
  - The SCR system is heated by water from the engine cooling system. The cooling system runs at overpressure and when the engine is hot the coolant is hot. Do not open any hoses without first stopping the coolant flow in the hose.
  - A P3 type respirator/filter mask or a type FFP3 fine dust mask, protective goggles and gloves should be used for any work where there is a risk of exposure to dust from the SCR catalytic converter.
  - Use a disposable overall and dispose of it properly after machining.
  - Eating, drinking or smoking while working is not permitted.
- Any dust from the SCR catalytic converter should be removed using a vacuum cleaner with microfilter to minimize exposure.
  - Make sure that the work surface is cleaned after completed work; Vacuum first then swab.
  - Make sure you clean your hands after working with SCR catalytic converter to avoid ingestion.
  - Work done on the SCR catalytic converter may generate waste considered by the State of California to be a hazardous waste subject to Title 22, California Code of Regulations. Before disposing of hazardous waste, review and follow all pertinent federal and California requirements.

## Engine data plate

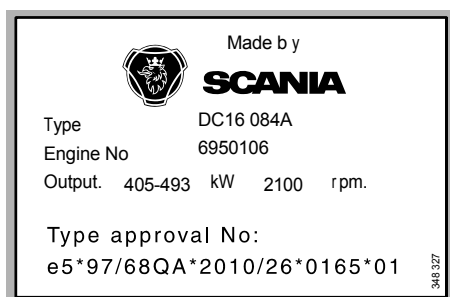
The engine data plate indicates, in the form of a code, the engine type, its size and applications. It also indicates the engine type power range and operating speed. The engine EU type approval for exhaust emissions is indicated under *Output*, where applicable.

The engine power is stated on a plate which is located on the engine control unit.

The engine serial number is stamped onto the top of the cylinder block at the front right.

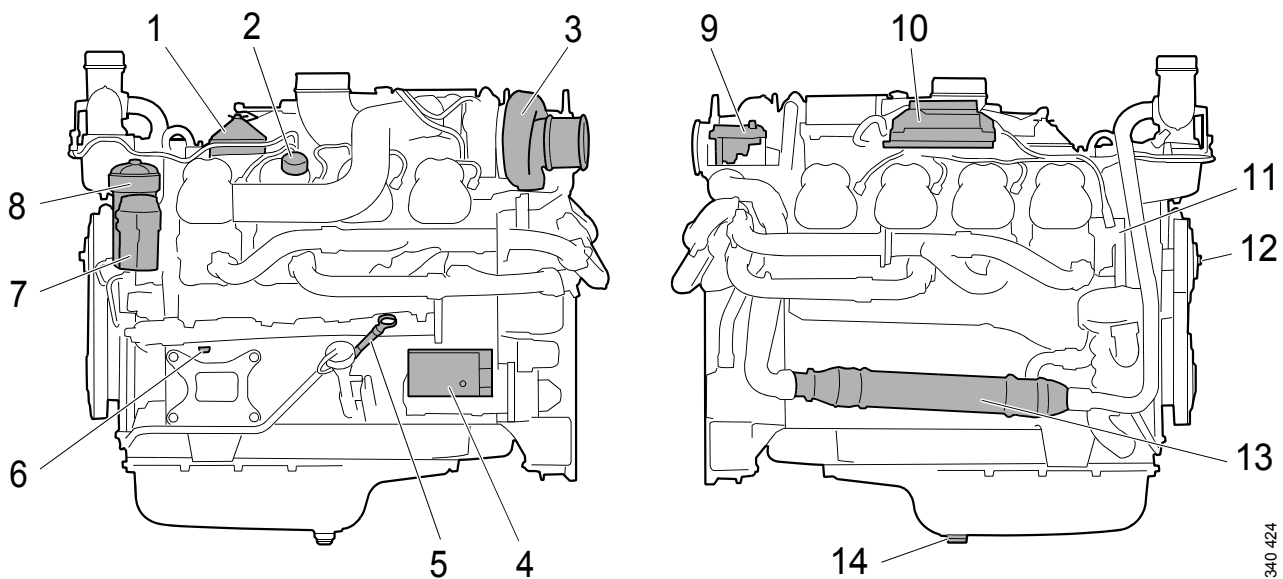
### Example: DC16 084A

DC	Supercharged diesel engine with air-cooled charge air cooler.
16	Displacement in whole dm <sup>3</sup>
084	Performance and certification code. The code indicates, together with the application code, the normal gross engine output.
A	Code for application. A means for general industrial use.



*Example of an engine data plate*

## Component identification



The illustration shows a normal version of a DC16 engine. The engine ordered may have different equipment.

### Note:

The oil cooler is located on the top of the engine between the cylinder banks.

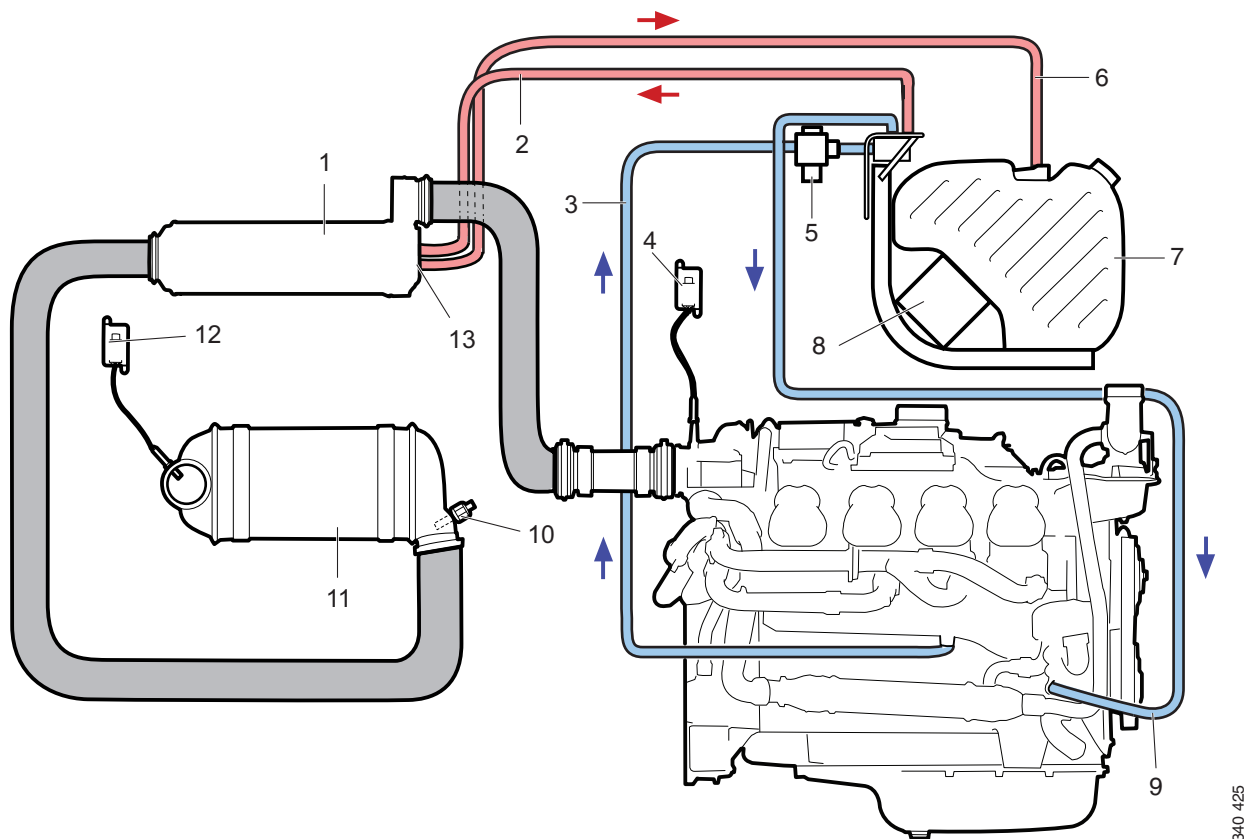
The water separating prefilter for the fuel is located between the fuel tank and engine.

- |                               |                         |
|-------------------------------|-------------------------|
| 1. Centrifugal oil cleaner    | 8. Oil filter           |
| 2. Oil filler                 | 9. EGR valve            |
| 3. Turbocharger <sup>1</sup>  | 10. Engine control unit |
| 4. Starter motor              | 11. Engine data plate   |
| 5. Oil dipstick               | 12. Coolant pump        |
| 6. Valve for draining coolant | 13. EGR cooler          |
| 7. Fuel filter                | 14. Oil plug            |

1. The DC16 084A/384A may be equipped with an exhaust brake which is connected to the turbocharger.

## SCR system

The illustration provides an overview of SCR system components.



340 425

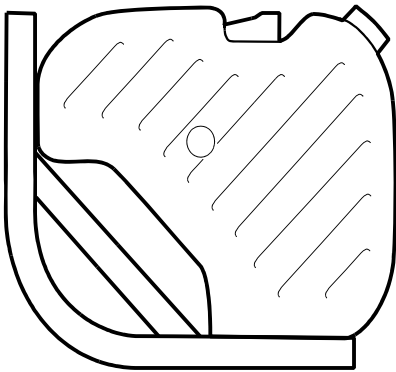
- |   |  |
|---|--|
| 1. Evaporator or hydrolysis catalytic converter | 8. Reductant pump and control unit                 |
| 2. Pressure line for reductant                  | 9. Coolant hose, return from tank and pump heating |
| 3. Coolant hose for tank and pump heating       | 10. Exhaust gas temperature sensor                 |
| 4. NOx sensor with control unit <sup>1</sup>    | 11. SCR catalytic converter                        |
| 5. Coolant valve                                | 12. NOx sensor with control unit                   |
| 6. Reductant return line                        |  |
| 7. Reductant tank                               |  |

1. DC16 084A/384A/085A/385A only.

## Reductant tank

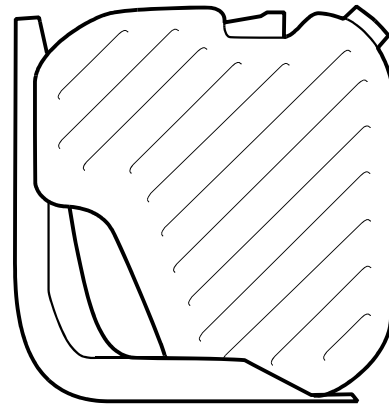
Reductant tanks come in 5 different sizes. The volumes indicated for each tank are filling volumes.

A filler filter with magnet is fitted in the reductant tank to prevent the reductant from becoming contaminated when topping up. It is used when refuelling at a filling station. A filler filter without a magnet is also supplied for use when manually topping up reductant.



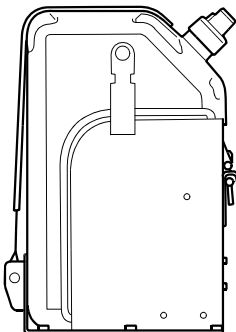
348 425

*38 litres (10 US gallons)*



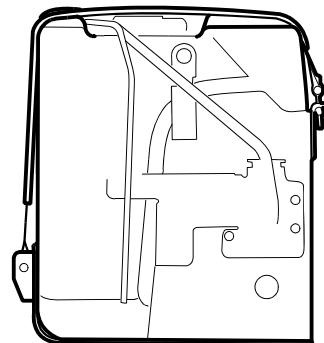
348 422

*60 litres (15.8 US gallons)*



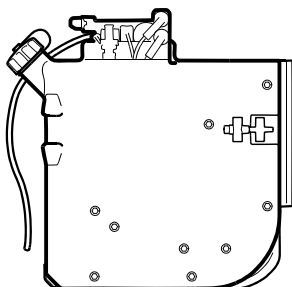
353 442

*45 litres (11.9 US gallons)*



348 421

*69 litres (18.2 US gallons)*



348 426

*70 litres (18.5 US gallons)*

## Starting and running

### Note:

When the engine is started for the first time, carry out the maintenance items listed under First start in the maintenance schedule. See the Maintenance section.

---

Always check the following before running:

- oil level
- coolant
- fuel level
- electrolyte level in batteries
- state of charge of the batteries
- condition of the drive belt
- the level in the reductant tank, if the engine is equipped with an SCR system.



### WARNING!

Running the engine without reductant in the reductant tank violates emissions legislation and will damage the SCR system.

---

## Checks before running

Carry out daily maintenance as described in the maintenance schedule prior to operation. See the Maintenance section.



### WARNING!

Block the starting device when working on the engine. If the engine starts unexpectedly, there is a serious risk of injury.

---

## Reductant pump

When the reductant pump is new, the check valves may need to be slackened.

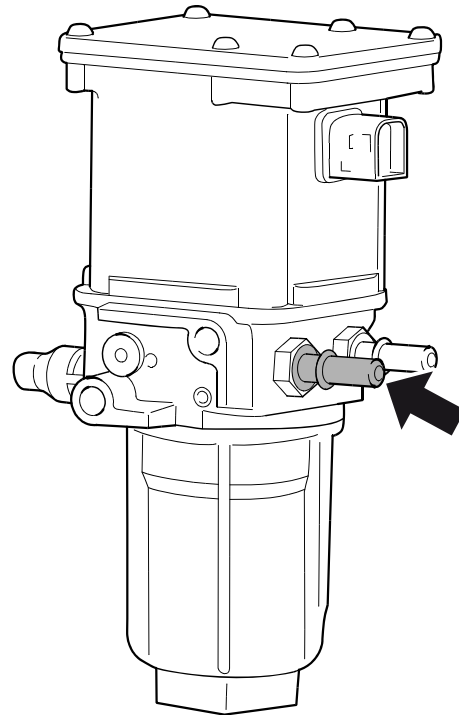


### IMPORTANT!

Blow the reductant pump suction nipple with compressed air (approx. 6 bar) for at least 3 seconds before starting the engine for the first time.

Start the reductant pump immediately after the reductant tank has been filled for the first time.

---



336 838

*Reductant pump*



## Starting the engine

For environmental reasons the Scania engine has been developed to be started with a low fuel feed. Using unnecessarily large amounts of fuel when starting the engine always results in emissions of unburnt fuel.

1. Open the fuel cock if fitted.
2. Disengage the engine.
3. If the engine has a battery master switch:  
Connect the power using the battery master switch.
4. Start 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.



### **WARNING!**

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

Only start the engine in a well ventilated area. When the engine is run in an enclosed space, there must be effective devices to extract exhaust gases and crankcase gases.



### **IMPORTANT!**

The starter motor must only be cranked twice for 30 seconds at a time. After that, it must rest for at least 5 minutes before the next attempt to start it.

**Starting at low temperatures and at high altitudes**

Take the local environmental requirements into account. Use a fuel heater and engine heater to avoid starting problems and white smoke.

Scania recommends that an engine heater should be used if the engine will be used at temperatures below -10°C or at an altitude of more than 2,000 metres.

A low engine speed and a moderate load on a cold engine limits white smoke, gives better combustion and warms up the engine more quickly than warming it up with no load.

Avoid running it longer than necessary at idling speed.

## Running

Check instruments and warning lamps at regular intervals.

### Engine speed range

600-750 rpm	Low idling. Engine idling is controlled by the engine management system.
Low idling up to 2,100 rpm	Engine operating speed range. Controlled by the engine management system.
2,100-2,600 rpm	Unsuitable operating speed, but a slightly higher engine speed than the normal maximum operating speed may occur when load is low or negative.
2,600-3,000 rpm	Prohibited engine speed.

### Emission control

The system provides a warning if there are faults on the SCR system or if the level of reductant in the reductant tank is too low. In the case of some faults, for example if doser cooling is not working, the torque is reduced.

### Reaction at low reductant level

Reductant level	Warning lamp	Torque reduction <sup>1</sup>
20%	Constant light	
10%	Flashing	Torque is reduced by 1% per minute to 70% of the highest torque
0%	Flashing rapidly	Torque is reduced to 0% (low idling) within 2-10 minutes

1. Applies only to engines that are certified according to Tier 4.

The engine resumes normal torque after reductant has been filled to a level of at least 20%.



*Symbol for low reductant level*

## Reaction to fault in SCR system

Time	Warning lamp	Torque reduction <sup>1</sup>
Fault detected	Constant light	
After 30 minutes	Flashing	Torque is reduced by 1% per minute to 70% of the highest torque
After 4 hours	Flashing rapidly	Torque is reduced to 0% (low idling) within 2-10 minutes

1. Applies only to engines that are certified according to Tier 4.

Once the fault has been remedied and the engine control unit has received an indication that it is working, torque returns to the normal level.

If a new fault occurs within 40 hours of operation since the first fault, the warning lamp will come on. After 30 minutes of operation, the warning lamp will flash rapidly and torque will be reduced to 0% (low idling) within 30 minutes.

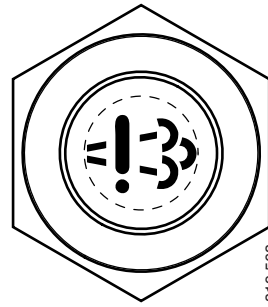


### IMPORTANT!

If the torque has been reduced to 0% (low idling), the engine control unit does not detect that the SCR system is functioning again. A service technician must then reset the system so that the torque returns to the normal level.

### Note:

The torque reduction applies only to engines that are certified according to Tier 4.



*Symbol for fault in SCR system*

## Coolant temperature

Normal coolant temperature during operation is 80-90°C/176-194°F.

Alarm levels are set in the engine control unit. The default setting for the lowest and highest limit values for high coolant temperature are 95°C/203°F and 105°C/221°F respectively.

The following function is standard as alarm for high coolant temperature:

- Alarm and torque reduction at the lowest limit value.

Depending on the engine configuration, the following alarm functions may also be available:

- Alarm only.
- Alarm and engine shutdown at the highest limit value.
- Alarm, torque reduction at the lowest limit value and engine shutdown at the highest limit value.
- Alarm and engine shutdown at the highest limit value with the possibility of engine shutdown override control.
- Alarm, torque reduction at the lowest limit value and engine shutdown at the highest limit value, with the possibility of engine shutdown override control.

If run for extended periods under an extremely light load, the engine may have difficulty in maintaining the coolant temperature. At an increased load the coolant temperature rises to the normal value.



### IMPORTANT!

An excessively high coolant temperature can damage the engine.

---

## Oil pressure

Information about the normal oil pressure and lowest permitted oil pressure is contained in the section headed Technical Data.

The engine management system has the following alarm levels:

- At an engine speed below 1,000 rpm and an oil pressure below 0.7 bar/10.2 psi.
- At an engine speed above 1,000 rpm and an oil pressure below 2.5 bar/36.3 psi for longer than 3 seconds.

The following function is standard as alarm for incorrect oil pressure:

- Alarm and torque reduction by 30%.

Depending on the engine configuration, the following alarm functions may also be available:

- Alarm only.
- Alarm and engine shutdown.
- Alarm and engine shutdown override control.

### Note:

High oil pressure (above 6 bar/87 psi) is normal when starting a cold engine.

---

## Charging indicator lamp

If the lamp comes on during operation:

- Check and adjust the alternator drive belts as described under the corresponding maintenance item. See the Maintenance section.

If the charging indicator lamp is still on, this could be due to an alternator fault or a fault in the electrical system.

## Belt transmission

When the belt transmission is new, it may make a squeaking noise when running. The noise is normal and disappears after 50-100 hours of operation.

The noise does not affect the service life of the belt transmission.

## Driving at high altitude

When driving at high altitudes engine power is reduced automatically due to the lower oxygen content in the air. It is then not possible to run the engine at maximum power.

### Note:

Driving at a higher height than 4,000 metres above sea level is only permitted if it has first been approved by Scania.

---

## Engine shutdown

1. Run the engine without a load for a few minutes if it has been run continuously with a heavy load.
2. Switch off the engine.

### Note:

The battery voltage must remain on for a few seconds after the 15 voltage is switched off so that the control units can store the values and switch to standby mode.

10 prohibited engine shutdowns will cause a torque reduction (70% of fuel quantity). Reset the engine by switching it off correctly once.

---



### IMPORTANT!

There is risk of post boiling and of damage to the turbocharger if the engine is switched off without cooling.

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

If the engine is equipped with a battery master switch and an SCR system, the SCR system must run for a while after the ignition has been switched off to allow it to cool down. During this period the power must not be cut using the battery master switch.

---

## Checks after running



### **WARNING!**

Block the starting device when working on the engine. If the engine starts unexpectedly, there is a serious risk of injury.

There is always a risk of sustaining burns when an engine is hot. Particularly hot parts are exhaust manifolds, turbochargers, oil sumps, hot coolant and oil in pipes and hoses.

---

1. Check that the power supply has been cut.
2. Top up the fuel tank. Make sure that the filler cap and the area round the filler opening are clean to avoid contamination of the fuel.
3. Top up the reductant tank. Make sure that the filler cap and the area round the filler opening are clean to avoid contamination of the reductant.
4. If there is a risk of freezing, the cooling system must contain enough glycol.
5. If the temperature is below 0°C/32°F: Prepare for the next start by connecting the engine heater (if fitted).



### **IMPORTANT!**

Check the coolant level following the first start. Top up if necessary.

---

## Maintenance

The maintenance programme covers a number of points that are divided into the following sections:

- Lubrication system
- Cooling system
- Air cleaner
- Fuel system
- Miscellaneous

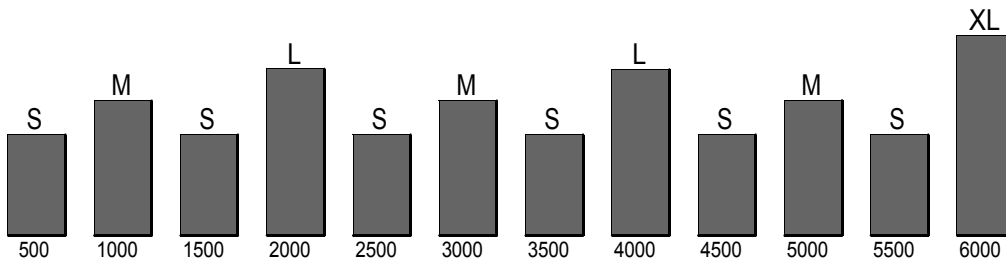


### WARNING!

Block the starting device when working on the engine. If the engine starts unexpectedly, there is a serious risk of injury.

The maintenance programme includes the following:

- S maintenance: Minimum basic maintenance.
- M maintenance: More extensive maintenance.
- L maintenance: Includes nearly all maintenance items.
- XL maintenance: Includes all maintenance items.



313 153



### IMPORTANT!

On delivery a Scania engine is optimised for its application. However, regular maintenance is necessary to:

- prevent unplanned stops
- extend the service life of the engine
- maximise the long-term emission performance of the engine
- give the best possible operating economy.



## Engines with few hours of operation



### IMPORTANT!

On engines with few hours of operation, maintenance must be carried out annually or every 5 years.

Stand-by generator sets and the like that are not used regularly should be test run and checked in accordance with the manufacturer's instructions.

The following maintenance items must be carried out once the engine has been warmed up to operating temperature.

1. Checking oil level.
2. Checking coolant level.
3. Checking the vacuum indicator.
4. Checking fuel level.
5. Check for engine leaks.

## Cleaning the engine



### WARNING!

Beware of hot water! Use suitable protective equipment.

The engine must be cleaned before starting work.

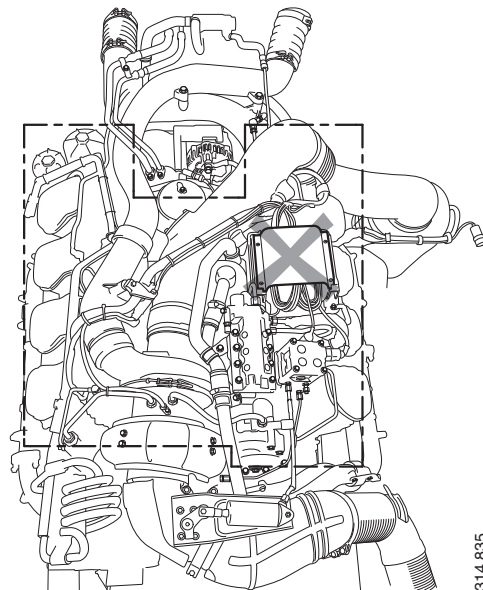
Clean the engine with hot water. Also use a degreasing agent, if necessary.

Avoid spraying water on the engine control unit, see illustration.



### Environment

The washing water must be disposed of in compliance with the relevant national and international regulations.



314 835

*Clean within the marked area.*

## Maintenance intervals

	Daily	First time at		Interval (hours)					At least	
		first start	500 R	500 S	1,000 M	2,000 L	6,000 XL	annu- ally	every 5 years	
<b>Lubrication system</b>										
Checking oil level	X	X								
Changing the oil			X	X	X	X	X	X		
Cleaning the centrifugal oil cleaner			X	X	X	X	X	X		
Renewing the oil filter			X	X	X	X	X	X		
<b>Cooling system</b>										
Checking coolant level	X	X	X	X	X	X	X	X		
Checking antifreeze and corrosion inhibitor		X					X	X	X	
Cleaning the cooling system and changing coolant								X		X
<b>Air cleaner</b>										
Reading the vacuum indicator	X		X	X	X	X	X	X		
Renewing the filter element							X	X		X
Renewing the safety cartridge							X	X		X
<b>Fuel system</b>										
Checking fuel level	X	X								
Renewing the fuel filter				X <sup>2</sup>	X	X	X	X		X
<b>Miscellaneous</b>										
Checking the drive belt		X			X	X	X	X	X	
Checking for leaks	X			X	X	X	X	X		
Checking and adjusting the valve clearance			X			X	X	X		
Renewing the reductant filter					X	X	X	X	X	
Cleaning the reductant tank filler filter				X	X	X	X	X		
Cleaning the reductant tank ventilation filter					X	X	X	X		

2 Applies to DC16 072.

## Lubrication system

### Oil grade

Scania LDF stands for the Scania Long Drain Field test standard. Approved Scania LDF oils have been carefully selected after extensive testing. The approval is only granted to the highest quality engine oils available on the market.

Recommended oil
Scania Oil LDF
Scania Oil LDF-2
Scania Oil LDF-3
Scania Oil E7

The engine oil must fulfil the following quality requirements:

- ACEA E5/API CI-4
- ACEA E7/API CI-4+
- For engines not run on low-sulphur fuel, the TBN (Total Base Number) should be at least 12 (ASTM D2896).
- Oils with a low ash content (ACEA E9/API CJ4) are not recommended.

Check with your oil supplier that the oil meets these requirements.

If the engine is used in areas of the world where lubricating oil with ACEA or API classification is not available, the oil grade must be measured in actual operation. In this case contact the nearest Scania workshop.

For operation at extremely low outdoor temperatures: Consult your nearest Scania representative on how to avoid starting difficulties.

Viscosity class	Outdoor temperature	
SAE 20W-30	-15 °C (5 °F)	- +30 °C (86 °F)
SAE 30	-10 °C (14 °F)	- +30 °C (86 °F)
SAE 40	-5 °C (23 °F)	- > +45°C (113°F)
SAE 50	0 °C (32 °F)	- > +45°C (113°F)
SAE 5W-30	< -40°C (-40°F)	- +30 °C (86 °F)
SAE 10W-30	-25 °C (-13 °F)	- +30 °C (86 °F)
SAE 15W-40	-20 °C (-4 °F)	- > +45°C (113°F)

## Oil analysis

To be able to extend the oil change intervals using an oil analysis, Scania LDF-2 and LDF-3 oils must be used.

Oil companies can offer analysis of the engine oil.

The following conditions must remain fulfilled when the oil is changed.

- Viscosity at 100°C (212°F): max.  $\pm 20\%$  of original value of the fresh oil.
- TBN (in accordance with ASTM D4739): > 3.5
- TBN (in accordance with ASTM D4739): > TAN (in accordance with ASTM D664)
- Soot (DIN 51452): < 3%

Such analysis measures the oil's TBN (Total Base Number), TAN (Total Acid Number), fuel dilution, water content, viscosity and the quantity of 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 new change intervals.

## Checking oil level

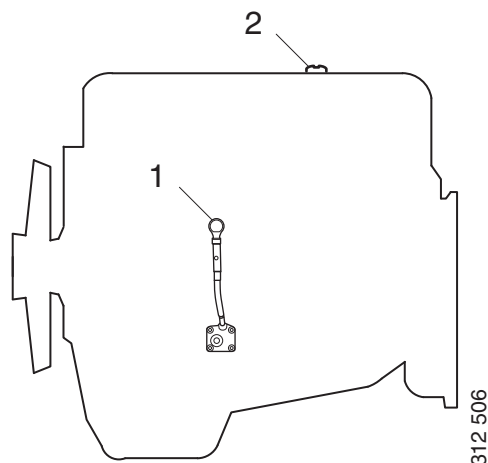
### Checking the oil level with the engine switched off

#### Note:

Leave the engine off for at least 1 minute before checking the oil level.

1. Remove the oil dipstick (1) and check the oil level. The correct level is between the minimum and maximum marks on the oil dipstick.
2. Top up with more oil (2) when the oil level is at or below the lower mark.

Information on the correct oil type is found under the heading Oil grade.



## Changing the oil

### Note:

Renew the oil filter and clean the centrifugal oil cleaner when changing oil.



### WARNING!

Hot oil can cause burns and skin irritation. Wear protective gloves and goggles when changing hot oil. Make sure that there is no pressure in the lubrication system before starting work on it. The oil filler cap must always be in place when starting and running the engine to prevent oil being ejected.



### Environment

Use a container to avoid spillage. Used oil must be disposed of as specified in national and international law.

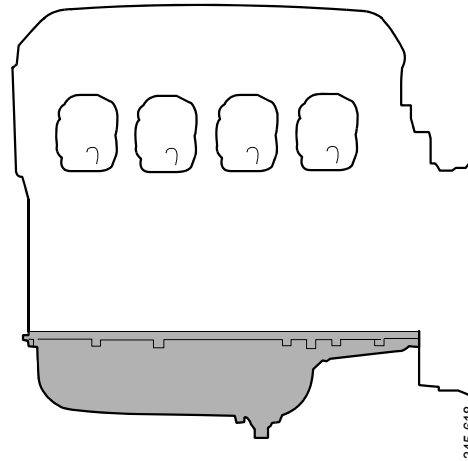
### Note:

Change oil more often if the engine is subjected to particularly demanding operation, such as a dusty environment, or if deposits in the centrifugal oil cleaner are thicker than 28 mm (1.1 in).

1. 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. When draining with the valve, the oil should be hot. Alternatively, use a pump. This so that draining occurs more quickly.
2. Clean the magnet on the oil plug.
3. Refit the oil plug.
4. Top up with oil.
5. Check the level on the oil dipstick.

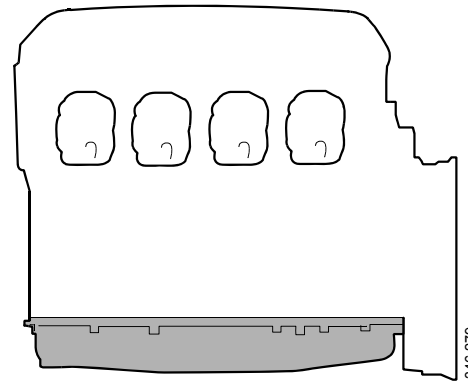
### Maximum angles of inclination during operation

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



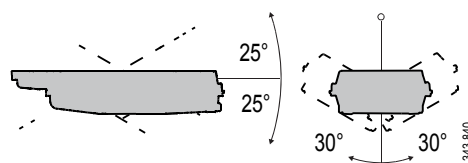
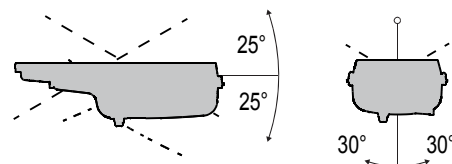
*Min. 40 litres (10.5 US gallons).*

*Max. 48 litres (12.6 US gallons).*



*Min. 29 litres (7.6 US gallons).*

*Max. 37 litres (9.7 US gallons).*



## Labels for top-up engine oil grade

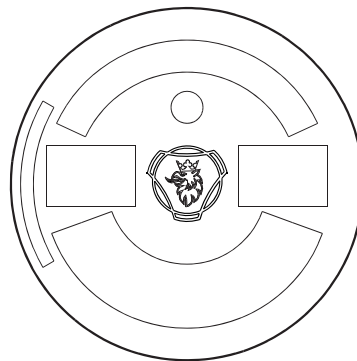
When changing oil it is important to use the correct engine oil grade.

The oil filler cap must be clearly marked with a label showing the top-up oil grade.

If the label is missing or if the engine oil grade is changed, a new label must be fitted.



*Filling label in the cylinder block.*



*Filling label in the rocker cover.*

## Parts

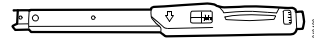
Oil grade	Colour	Part No.	
		Filling in the cylinder block	Filling in the rocker cover
Scania LDF-2	Blue	2 132 424	2 296 064
Scania LDF-3	Red	2 132 426	2 296 066
Scania LDF	Grey	2 269 345	2 296 071
ACEA E7	White	2 132 425	2 296 065
Scania Low Ash	Green	2 132 427	2 296 067
Scania Bioethanol	Black	2 132 428	2 296 068
Scania BEO-2	Orange	2 258 841	2 296 070
ACEA E9	-	2 132 429	2 296 069

## Cleaning the centrifugal oil cleaner

### Designation

Torque wrench 2-20 Nm with exchangeable ratchet head

### Illustration



When cleaning the centrifugal oil cleaner there will be some dirt deposits in the rotor cover. If this is the case, this indicates that the rotor is working. If it is clean and not working, the cause must be established immediately.

If the dirt deposit exceeds 28 mm at the recommended intervals, the rotor cover should be cleaned more often.



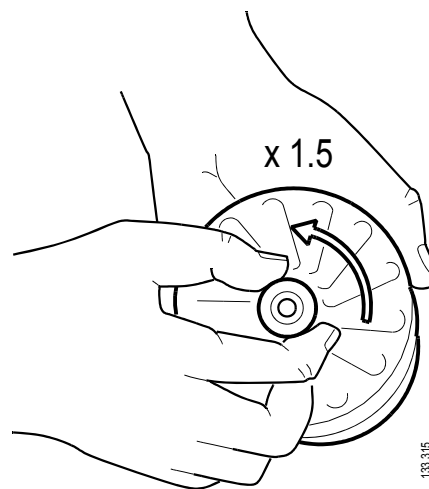
### WARNING!

The oil may be hot. Carefully remove the cover from the centrifugal oil cleaner.

1. Clean the cover. Unscrew the nut securing the outer cover.
2. Let the oil run out from the rotor.
3. Lift out the rotor. Wipe off the outside. Undo the rotor nut and unscrew it about 1.5 turns to protect the bearing.

### Note:

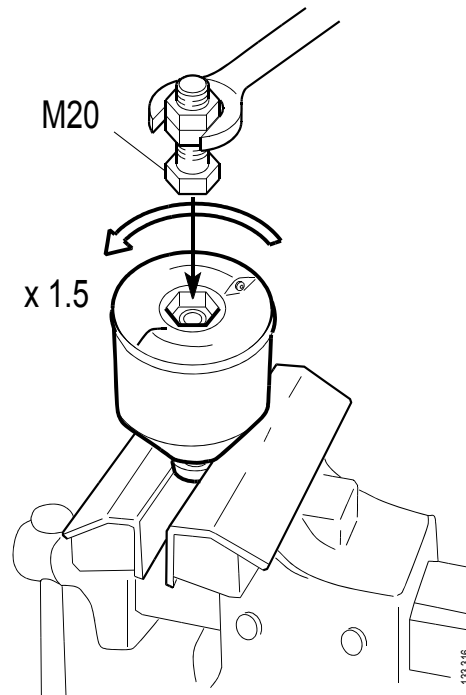
Take care not to damage the rotor shaft.



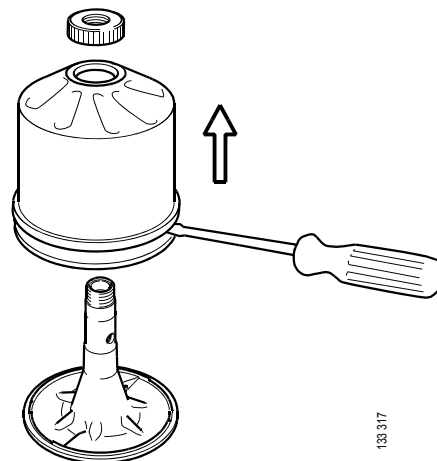
- If the rotor nut is difficult to get loose, turn the rotor upside down and fasten the rotor nut in a vice. Turn the rotor anti-clockwise 1.5 turns by hand or use an M20 nut, see illustration.

**IMPORTANT!**

The rotor must not be put in a vice. Never strike the rotor cover. This may cause damage resulting in imbalance.

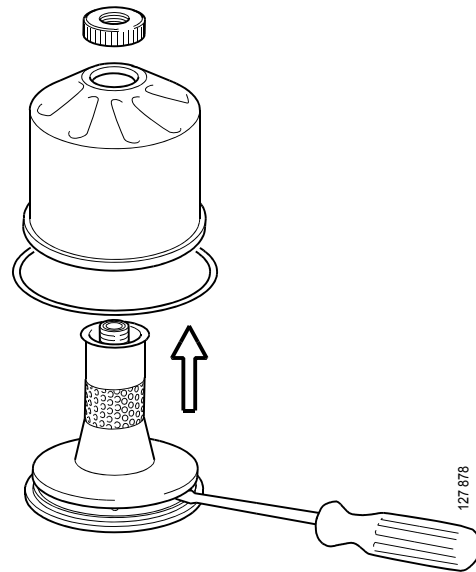


- Remove the rotor cover by holding the rotor in both hands and tapping the rotor nut against the table. Never strike the rotor directly as this may damage its bearings.

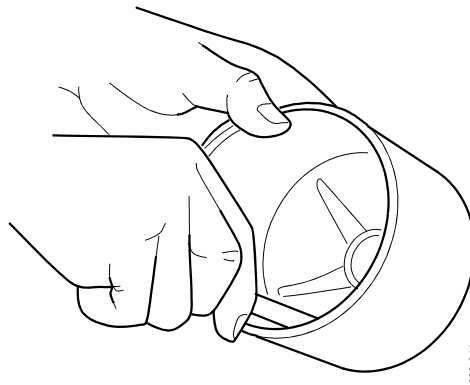




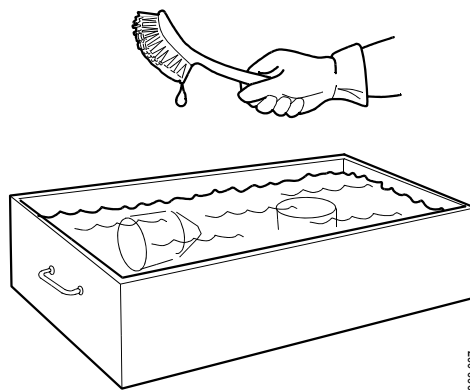
6. Remove the strainer from the rotor cover. If the strainer is stuck, insert a screwdriver between the rotor cover and strainer and carefully prise them apart.



7. Remove the paper insert and scrape away any remaining dirt deposits inside the rotor cover. If the deposits are thicker than 28 mm, the centrifugal oil cleaner must be cleaned more often.

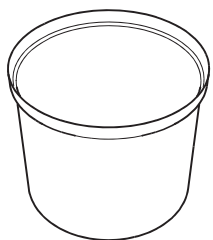


8. Wash the parts.
9. Inspect the 2 nozzles on the rotor. Ensure that they are not blocked or damaged. Renew any damaged nozzles.
10. Check that the bearings are undamaged.

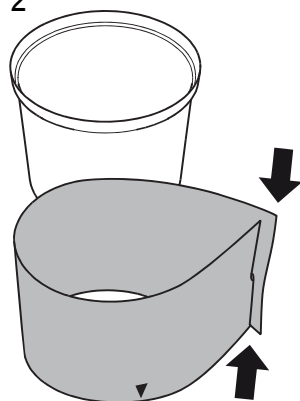


11. Fit a new paper insert on the inside of the rotor cover.

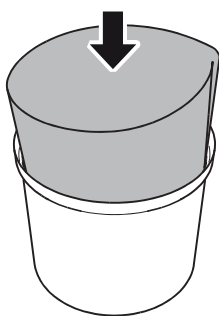
1



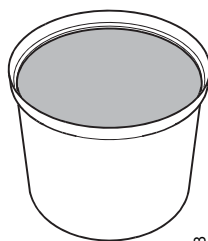
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3

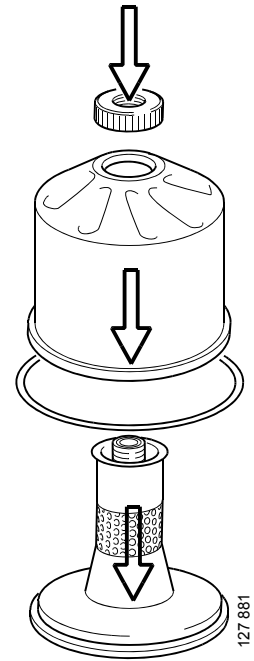


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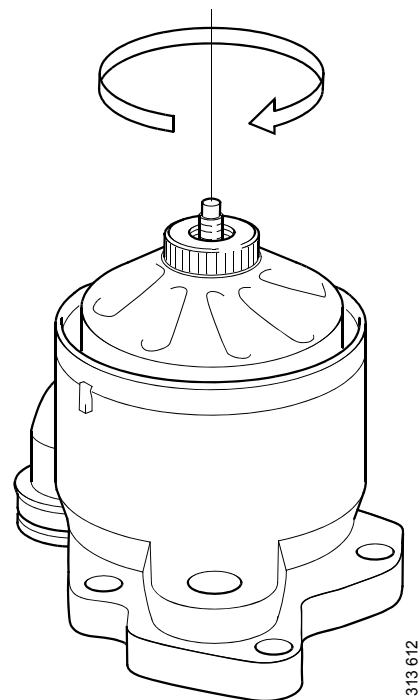
337 178

12. Fit the strainer onto the rotor.
13. Fit a new O-ring by sliding it over the strainer.
14. Refit the rotor cover. Ensure that the O-ring is not outside the cover.
15. Screw the rotor nut back on by hand.
16. Check that the shaft is not damaged or loose.

**Note:**

Take care not to damage the rotor shaft.

17. Refit the rotor and rotate it by hand to make sure it rotates easily.



18. Fit a new O-ring in the cover. Refit the cover and tighten the lock nut. Tightening torque 15 Nm.

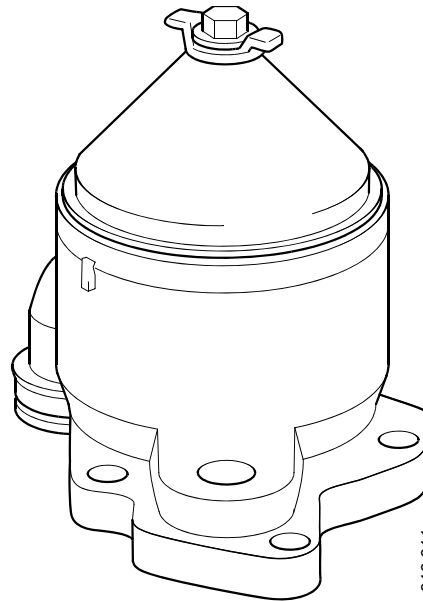


### IMPORTANT!

To reduce the risk of oil leakage it is important to tighten the cover to the correct tightening torque.

### Note:

A torque wrench together with a ratchet head is suitable for use during maintenance of the centrifugal oil cleaner.

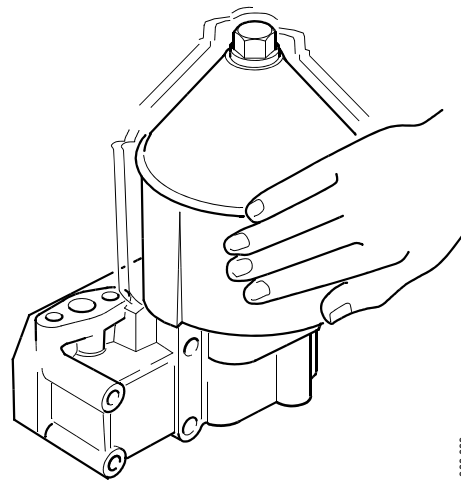


## Operational testing

Operational testing need only be carried out if it is suspected that the centrifugal oil cleaner is not working properly. For example, if there is an abnormally small amount of deposit in the centrifugal oil cleaner in relation to the distance driven.

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

1. Run the engine until it is warm.
2. Turn off the engine and listen for the sound from the rotor. Use your hand to feel if the filter housing is vibrating.
3. If the filter housing is not vibrating, dismantle and check the centrifugal oil cleaner.

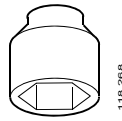


## Renewing the oil filter

### Designation

Hexagon socket, 1/2" drive, 36 mm

### Illustration



### IMPORTANT!

Clean the centrifugal oil cleaner when renewing the oil filter.

Otherwise, the oil filter will be blocked and resistance in the filter will increase. If this happens, an overflow valve in the filter retainer opens and lets the oil pass without being filtered.

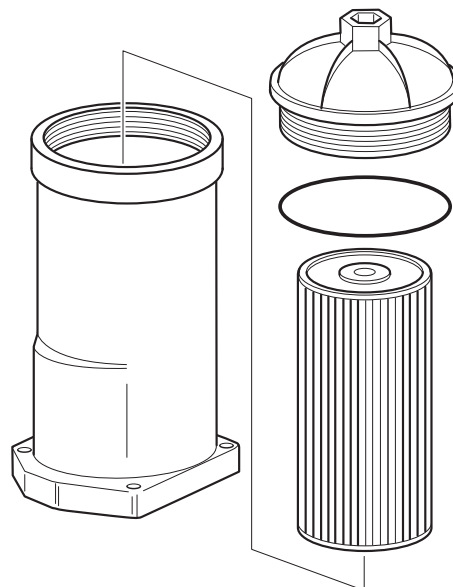
1. Unscrew the filter cover with the socket.



### IMPORTANT!

Do not use an adjustable spanner or other open tool as there is risk of damaging the filter cover.

2. Lift out the filter housing cover with filter element. The filter housing will drain automatically once the filter has been removed.
3. Renew the O-ring in the cover. Lubricate the O-ring with engine oil.
4. Press a new filter into the snap fastener in the cover and tighten the filter cover to 25 Nm (18 lbf/ft).



## Cooling system

### Coolant



#### WARNING!

Ethylene glycol can be fatal if ingested and can cause skin irritation and eye damage.

The coolant recommended by Scania is a mixture of water with antifreeze and corrosion inhibitor (ethylene glycol). The coolant has several characteristics which are important for the operation of the cooling system:

- Corrosion inhibitor
- Antifreeze
- Increases the boiling point

The coolant should always contain 35-55% by volume of antifreeze and corrosion inhibitor so that the coolant properties ensure that the coolant works correctly.

#### Note:

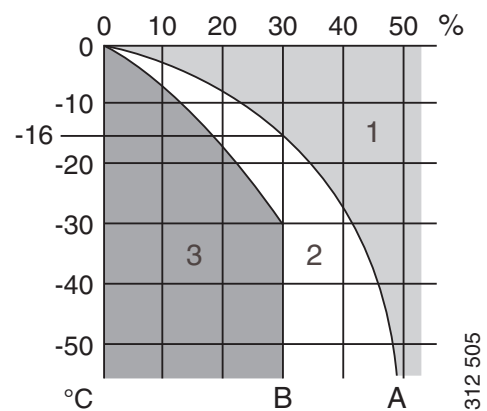
The coolant should be changed when the cooling system is cleaned: every 6,000 hours or at least every 5 years. Refer to Changing coolant.

### Coolant resistance to cold

The following example shows coolant properties with 30 percent by volume of antifreeze and corrosion inhibitor:

- Ice slush starts to form at  $-16^{\circ}\text{C}$  ( $3^{\circ}\text{F}$ ).
- At  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ), there is a risk of cooling system malfunction.
- There is no risk of damage by freezing with a minimum antifreeze and corrosion inhibitor content of 35 percent by volume.

The chart depicts coolant properties at different percents of antifreeze and corrosion inhibitor concentration by volume.



Curve A: Ice formation starts (ice slush)

Curve B: Damage by freezing occurs

Area 1: Safe area

Area 2: Malfunctions may occur (ice slush)

Area 3: Risk of damage by freezing

## Antifreeze and corrosion inhibitor concentration table

35% by volume of Scania antifreeze provides sufficient protection against corrosion.

### Example:

1. The total volume of the cooling system is 40 litres in this example.
2. The measured concentration of ethylene glycol is 35% by volume (freezing point -21 °C). According to the table there are 14 litres of ethylene glycol in the cooling system.
3. The required concentration of ethylene glycol is 45% by volume (freezing point -30 °C). According to the table, 18 litres of ethylene glycol are required in the cooling system.
4. Since there are already 14 litres in the cooling system, 4 litres of ethylene glycol must be added to the cooling system (18 - 14 = 4 litres).

Volume of ethylene glycol (%)	For calculation			Adequate protection against corrosion					Cooling system volume (litres)
	20	25	30	35	40	45	50	60	
Ice slush forms (°C)	-6	-9	-12	-21	-24	-30	-38	-50	
Volume of ethylene glycol (litres)	5	6	8	11	12	14	15	18	30
	6	8	10	14	16	18	20	24	40
	8	10	13	18	20	23	25	30	50
	9	12	15	21	24	27	30	36	60
	11	14	18	25	28	32	35	42	70
	12	16	20	28	32	36	40	48	80
	14	18	23	32	36	41	45	54	90
	15	20	25	35	40	45	50	60	100
	17	22	28	39	44	50	55	66	110
	18	24	30	42	48	54	60	72	120
	20	26	33	46	52	59	65	78	130
	21	28	35	49	56	63	70	84	140
	23	30	38	53	60	68	75	90	150
	24	32	40	56	64	72	80	96	160
	26	34	43	60	68	77	85	102	170
27	36	45	63	72	81	90	108	180	
29	38	48	67	76	86	95	114	190	
30	40	50	70	80	90	100	120	200	

## Antifreeze and corrosion inhibitor concentration table

35% by volume of Scania antifreeze provides sufficient protection against corrosion.

### Example:

1. The total volume of the cooling system is 10.6 US gallons in this example.
2. The measured concentration of ethylene glycol is 35% by volume (freezing point  $-6^{\circ}\text{F}$ ). According to the table there are 3.7 US gallons of ethylene glycol in the cooling system.
3. The required concentration of ethylene glycol is 45% by volume (freezing point  $-22^{\circ}\text{F}$ ). According to the table, 4.8 US gallons of ethylene glycol are required in the cooling system.
4. Since the cooling system already contains 3.7 US gallons, fill another 1.1 US gallons of ethylene glycol in the cooling system ( $4.8 - 3.7 = 1.1$  US gallons).

Volume of ethylene glycol (%)	For calculation			Adequate protection against corrosion					Cooling system volume (US gallons)
	20	25	30	35	40	45	50	60	
Ice slush forms ( $^{\circ}\text{F}$ )	21	16	10	-6	-11	-22	-36	-58	
Volume of ethylene glycol (US gallons)	1.3	1.6	2.1	2.9	3.2	3.7	4	4.8	7.9
	1.6	2.1	2.6	3.7	4.2	4.8	5.3	6.3	10.6
	2.1	2.6	3.4	4.8	5.3	6.1	6.6	7.9	13.2
	2.4	3.2	4	5.5	6.3	7.1	7.9	9.5	15.9
	2.9	3.7	4.8	6.6	7.4	8.5	9.2	11.1	18.5
	3.2	4.2	5.3	7.4	8.5	9.5	10.6	12.7	21.1
	3.7	4.8	6.1	8.5	9.5	10.8	11.9	14.3	23.8
	4	5.3	6.6	9.2	10.6	11.9	13.2	15.9	26.4
	4.5	5.8	7.4	10.3	11.6	13.2	14.5	17.4	29.1
	4.8	6.3	7.9	11.1	12.7	14.3	15.9	19	31.7
	5.3	6.9	8.7	12.2	13.7	15.6	17.2	20.6	34.3
	5.5	7.4	9.2	12.9	14.8	16.6	18.5	22.2	37
	6.1	7.9	10	14	15.9	18	19.8	23.8	39.6
	6.3	8.5	10.6	14.8	16.9	19	21.1	25.4	42.3
	6.9	9	11.4	15.9	18	20.3	22.5	26.9	44.9
7.1	9.5	11.9	16.6	19	21.4	23.8	28.5	47.6	
7.7	10	12.7	17.7	20.1	22.7	25.1	30.1	50.2	
7.9	10.6	13.2	18.5	21.1	23.8	26.4	31.7	52.8	



## Checking coolant level

The following instructions apply to Scania expansion tanks. For other types of expansion tanks, follow the manufacturer's instructions.



### WARNING!

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

If the cap has to be opened do it slowly and carefully to release the pressure before removing the cap. Wear gloves as the coolant is still very hot.

1. Open the expansion tank cap and check the coolant level.
  - The right coolant level on a cold engine is even with the lower edge of the filler neck.
  - The right coolant level on a hot engine is approximately 25 mm (1 in) over the lower edge of the filler neck.
2. Top up with coolant as necessary.



### IMPORTANT!

Do not top up large quantities of coolant through the expansion tank. Top up in accordance with the instructions in the section headed Changing coolant instead.



### IMPORTANT!

Never fill a large amount of cold coolant in a hot engine. There is great risk of cracks forming in the cylinder block and cylinder heads.



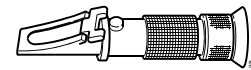
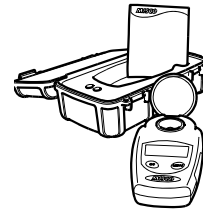
### IMPORTANT!

Only pour pre-mixed coolant into the cooling system.

## Checking antifreeze and corrosion inhibitor

**Designation**  
Refractometer

**Illustration**



### Note:

Use only pure fresh water that is free from particles, sludge and other impurities.

1. Pour a small amount of coolant into a container and check that the coolant is pure and clear.
2. Change the coolant if it is contaminated or cloudy.
3. Measure the antifreeze and corrosion inhibitor content with a refractometer.

The following rules apply to ethylene glycol-based coolant:

- The antifreeze and corrosion inhibitor content must be minimum 35 percent by volume for corrosion protection to be sufficient.
- An antifreeze and corrosion inhibitor content greater than 55 percent by volume impairs the ability to protect against frost.
- If ice forms in the coolant, there are disruptions initially, but there is no immediate risk of damage. The engine should not be subjected to heavy loads when ice starts to form.

## Antifreeze and corrosion inhibitor

Only the product Scania coolant, or other products that are tested to provide proper antifreeze and protection against corrosion for Scania, may be used in Scania engines. Products that do not satisfy the requirements for use in a Scania engine can result in faults in and damage to the cooling system. This can lead to the invalidation of Scania's warranty for faults and damage caused by the use of inappropriate coolant.

The antifreeze and corrosion inhibitor used in Scania engines should be of the ethylene glycol type.

### Scania concentrate

Designation	Contents	Part No.	Volume litre	Volume US gallons
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 323	5	1.3
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 324	20	5.3
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 325	210	55
Coolant	Antifreeze and corrosion inhibitor (concentrate)	1 894 326	1,000	264

### Scania Ready Mix

Designation	Contents	Part No.	Volume litre	Volume US gallons
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 921 955	5	1.3
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 921 956	20	5.3
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 921 957	210	55
Coolant	Scania antifreeze and corrosion inhibitor Ready Mix 50/50	1 896 695	1,000	264

## Changing coolant



### IMPORTANT!

Mix the coolant as specified in the section headed Coolant.

### Draining coolant

1. Remove the expansion tank cap.
2. Drain the coolant at the following two points:
  - Lowest point of the cylinder block.
  - The lowest point of the cooling system.
3. Close the drain taps.



### Environment

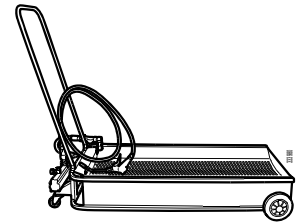
Avoid spillage and use a suitable container. Used coolant must be disposed of as specified in national and international law.

## Filling coolant

### Designation

Coolant trolley

### Illustration



### IMPORTANT!

When it is necessary to fill a large quantity of coolant, it must be pumped in from underneath. This is to ensure that air does not get into the cooling system, which can cause the coolant pump to overheat.

1. Use a Scania coolant trolley, or other suitable equipment, to fill with coolant through the drain valve on the cylinder block. This facilitates the venting of the engine.
2. Start the engine when the cooling system has been filled. Allow the engine to run for a while. Then check the coolant level and top up with coolant as necessary.
3. Air pockets may still be left in the cooling system, which will disappear after the engine has been operated for a period of time. It may, therefore, need some topping up to start with.

## Cleaning the cooling system



### WARNING!

When handling cooling system detergent: Read the warning text on the package concerned.

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### IMPORTANT!

Do not use caustic soda or other alkaline detergent as this could damage the aluminium.

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### Note:

Clean the cooling system more often than specified in the maintenance interval if necessary.

---

### External: Cleaning the radiator and charge air cooler

1. Check that the radiator and the charge air cooler are not clogged on the air side and that the cooling fins are not damaged.
2. Carefully scrape away any deposits from the radiator cooling fins. Use a paraffin-based engine cleaner if necessary.
3. Carefully straighten bent cooling fins using a steel brush or the like.

**Internal: Removing oil and grease**

1. Run the engine until it has reached operating temperature and then drain the cooling system.
2. Remove the thermostats.
3. Fill the system with clean, hot water mixed with liquid dishwasher detergent intended for household machines. Concentration 1% (0.1/10 l).
4. Warm up the engine for approximately 20-30 minutes. Remember to switch on the cab heating system, if one is installed.
5. Drain the cooling system.
6. Fill the system with clean, hot water and run the engine for about 20-30 minutes.
7. Drain the water from the cooling system.
8. Refit the thermostats.
9. Fill the cooling system with new coolant following the specification under Coolants earlier in the document.

**Environment**

Avoid spillage and use a suitable container. Used coolant must be disposed of as specified in national and international law.

---

**Internal: Removing deposits**

1. Run the engine until it has reached operating temperature and then drain the cooling system.
2. Remove the thermostats.
3. Fill the system with clean, hot water mixed with some commercially available radiator detergent which is based on sulphamic acid and contains dispersing agents. Follow the manufacturer's instructions for the concentration and cleaning period.
4. Run the engine for the specified time. Remember to switch on the cab heating system, if one is installed.
5. Drain the cooling system.
6. Fill the cooling system with clean, hot water and run the engine for about 20-30 minutes.
7. Drain the water from the cooling system.
8. Refit the thermostats.
9. Fill the system with new coolant following the specification under Coolants earlier in the document.

**Environment**

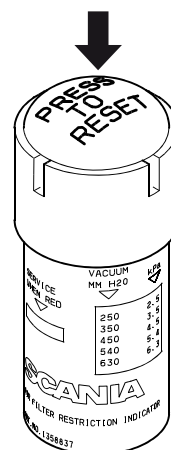
Avoid spillage and use a suitable container. Used coolant must be disposed of as specified in national and international law.

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## Air cleaner

### Reading the vacuum indicator

If the indicator's red plunger is fully visible, renew or clean the air cleaner filter element following the instructions.



328 671

### Renewing the filter element

#### Note:

Renew the filter element earlier than the maintenance interval if the indicator shows red.

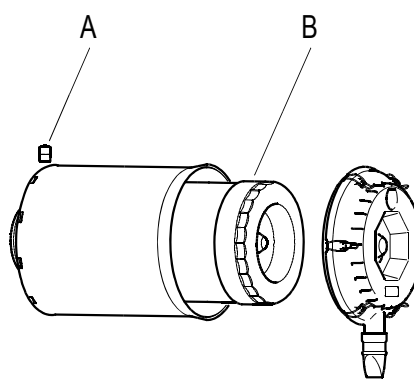
There is always a risk that the filter element will be damaged when it is cleaned.

The filter element must not be cleaned in water or be blown clean with compressed air.



#### WARNING!

Never start the engine without the air filter as this could cause injury and severe engine damage.



336 100

*A Vacuum indicator.*

*B Filter element.*

1. Remove the cover from the air cleaner.
2. Renew the filter element.
3. Carry out a check by inserting an inspection lamp into the element and checking from the outside that there are no holes or cracks in the filter paper.
4. Assemble the air cleaner.
5. Reset the vacuum indicator by pressing the button.

## Renewing the safety cartridge



### IMPORTANT!

When renewing the safety cartridge, take great care to ensure that no dirt or other impurities get into the engine. Do not remove the safety cartridge unnecessarily.

---

1. Remove the cover from the air cleaner.
2. Remove the filter element.
3. Remove the safety cartridge.
4. Fit a new safety cartridge.
5. Renew or clean the filter element.
6. Assemble the air cleaner.

## Fuel system



### IMPORTANT!

The whole fuel system is very sensitive to dirt and even very small particles. Foreign particles in the system can cause serious malfunctions. It is therefore very important that everything is as clean as possible when work is carried out on the fuel system. Before starting work on the fuel system, the engine must be washed. If possible, a hot water wash should be used.

It is strictly forbidden to carry out any machining work or work with compressed air near an open fuel system.

Be extra careful and always use clean, lint-free and dust-free clothes and gloves when working on the fuel system. Scania recommends using Tegera 848 gloves.

Clean tools before they are used and do not use any worn or chrome-plated tools. Material and flakes of chrome may come off.

Clean connections and the surrounding area before removal. When cleaning, cloths or paper which shed fibres must not be used. Use clean and lint-free cloths.

Plug or cover the connections during removal. Also clean the connections before fitting the components. Removed components should be placed on a thoroughly cleaned, dust-free surface. Cover with a lint-free cloth.

---

## Checking fuel level

- Check the fuel level and top up with fuel as necessary.

### Note:

The fuel system must be bled if the tank has been run dry. Refer to the Bleeding the fuel system section.

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## Renewing the fuel filter using a bleeding tool

Engines with XPI have dual fuel filters in the form of a water separating suction filter and a pressure filter.

### Removal

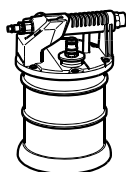
#### Designation

Hexagon socket, 1/2" drive, 36 mm

#### Illustration



#### Bleeding tool



#### Environment

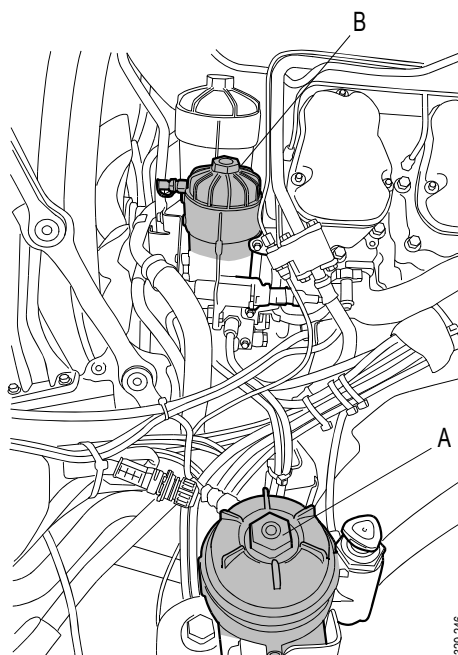
Avoid spillage and use a suitable container. Used fuel must be disposed of as specified in national and international law.

To ensure that the filter housings are drained properly, the filter covers must be removed as follows:



#### IMPORTANT!

Start with the water separating suction filter (A). Do not open the pressure filter cover (B) until the filter housing for the water separating filter (A) is completely drained.



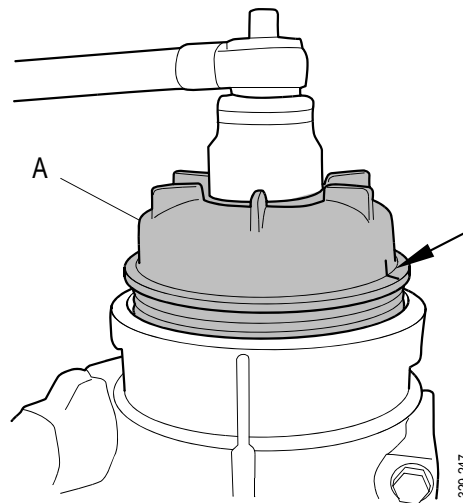
**IMPORTANT!**

Do not use an adjustable spanner or other open tool to undo the filter covers, as this risks damaging the filter covers.

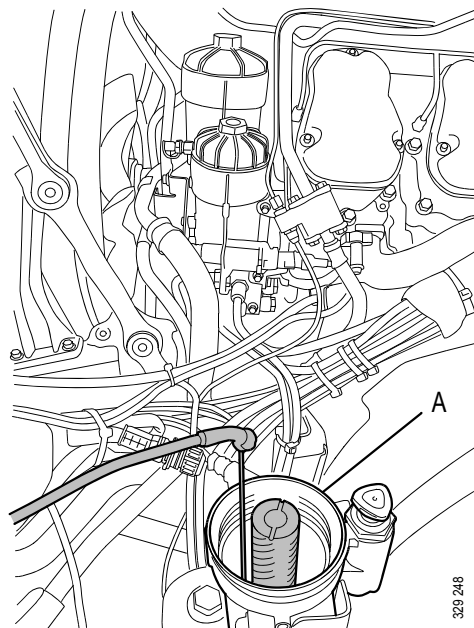
1. Make a mark on the water separating suction filter cover (A). Unscrew the cover 3 to 4 turns, use the socket.

**IMPORTANT!**

Wait a minimum of 2 minutes to allow as much of the fuel as possible to drain out of the filter housing.



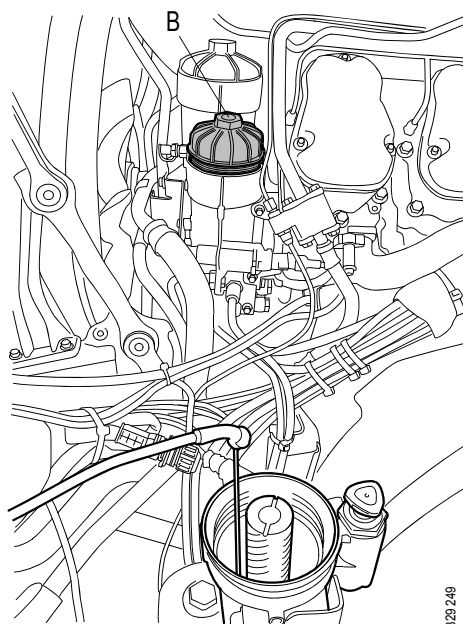
2. Unscrew the filter cover (A) and lift it up slowly with the filter element.
3. Make sure the bleeding tool is completely drained before starting work. Draw out any remaining fuel and any particles using the bleeding tool.
4. Keep the bleeding tool hose in the filter housing for the water separating suction filter (A).



5. Make a mark on the pressure filter cover (B). Unscrew the cover 3 to 4 turns, use the socket. Draw out fuel which may drain into the water separating suction filter housing when the pressure filter is detached.

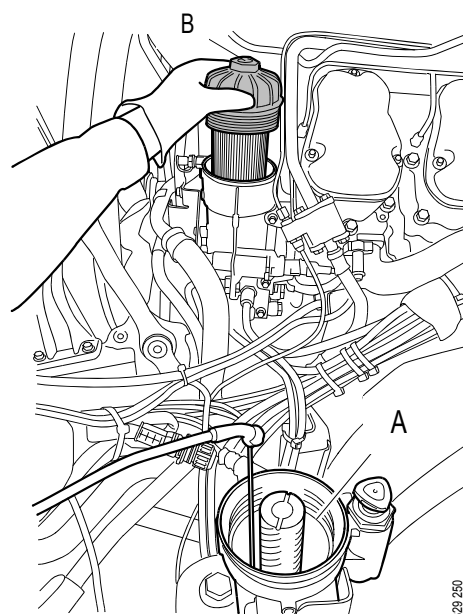
**IMPORTANT!**

Wait a minimum of 2 minutes to allow as much of the fuel as possible to drain out of the filter housing.



329 249

6. Unscrew the pressure filter cover (B) and lift it up slowly with the filter element.
7. Fuel from the pressure filter housing (B) will flow into the water separating suction filter housing (A). Leave the bleeding tool in the water separating suction filter housing (A) until it is completely drained of fuel.



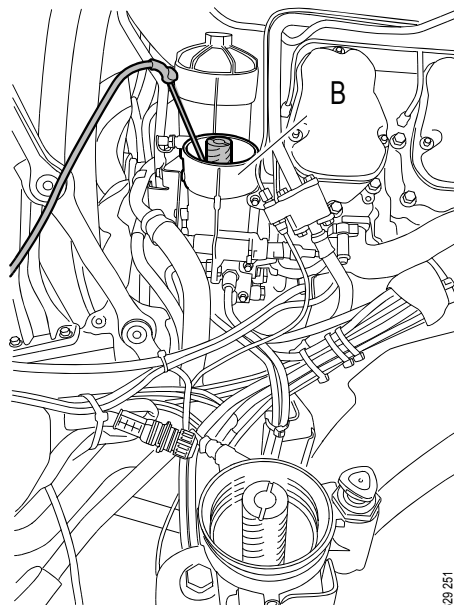
329 250

8. Move the bleeding tool to the pressure filter housing (B). Draw out remaining fuel and particles.

**IMPORTANT!**

It is important to remove remaining fuel and particles from the filter housings to prevent fuel system contamination.

9. Undo the old filter elements from the covers by carefully bending them to one side.



329 251

## Fitting

### Designation

Hexagon socket, 1/2" drive, 36 mm

### Illustration



1. Unpack the new filter elements and the supplied O-rings.



### IMPORTANT!

Check that there is no remaining packaging material stuck to the new filter elements.

2. Fit the new O-rings to the covers. Lubricate the O-rings with O-ring grease.
3. Press the filter elements into the snap fasteners on the covers.
4. Check that the filter housings are clean before fitting.



### IMPORTANT!

- Fit the filter elements in the filter covers before placing them in the fuel filter housings or the filter elements may be damaged.
- Open the bleed nipple to prevent back pressure in the filter housings when the filter elements are screwed on.

5. Press down the filter elements into the fuel filter housings with the filter covers.
6. Screw on the filter covers. Use the socket.
7. Check that there is no gap between the filter cover and the filter housing. If there is a gap, repeat the procedure and make sure that the bleed nipple is open.

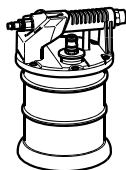
## Bleeding the fuel system using a bleeding tool

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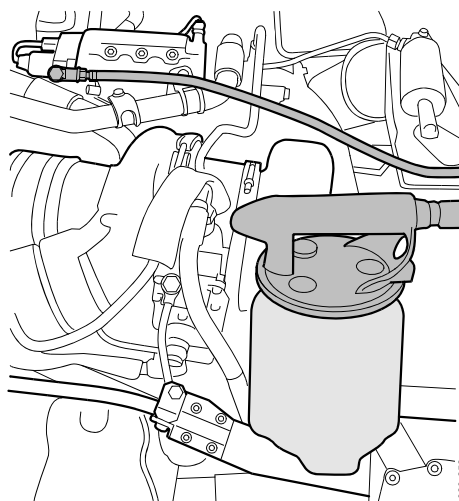
### Designation

Bleeding tool

### Illustration



1. Open the bleed nipple at the high pressure pump and connect a clear plastic hose from the bleeding tool.
2. Drain the bleeding tool. Hold the bleeding tool straight and draw out a full container of fuel. Bleeding is now complete.
3. Start the engine.



## Miscellaneous

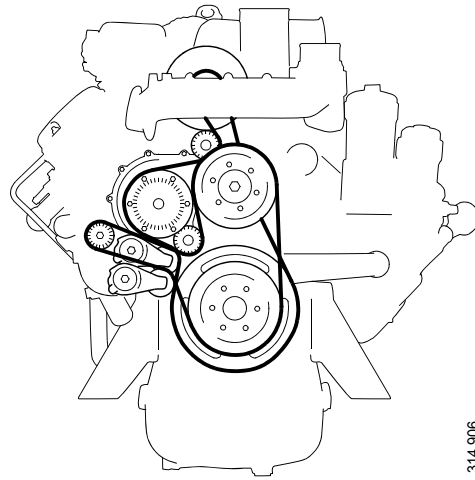
### Checking the drive belt



#### IMPORTANT!

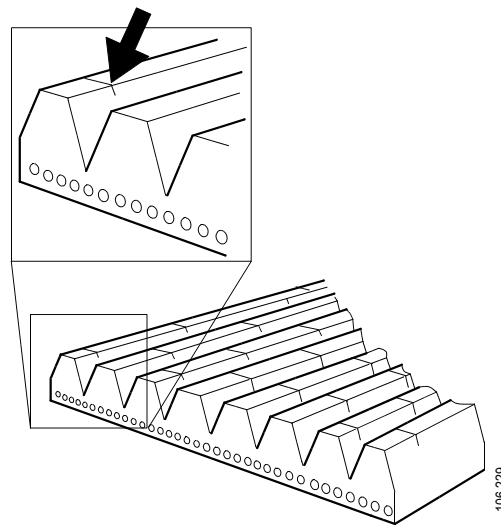
Refit the drive belt with the same direction of rotation as it had before removal.

Check the drive belt thoroughly, particularly at the idler rollers.



314 906

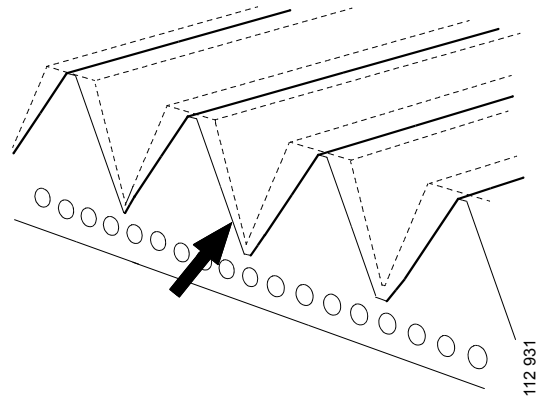
Check the drive belt for cracks.



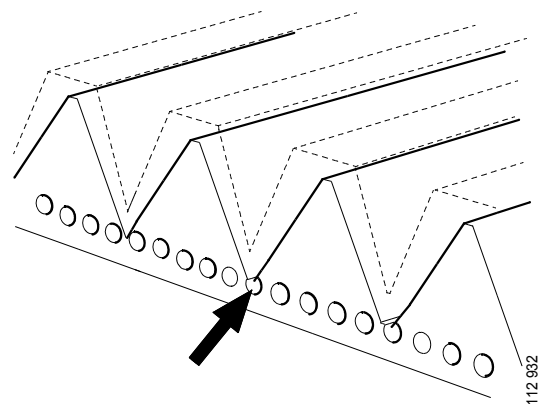
106 229

*The drive belt must be renewed if it has cracks.*

Check drive belt wear.



*The drive belt is starting to become worn, but can be refitted.*



*The belt is worn down to the cord. The drive belt must be renewed.*

## Checking for leaks



### IMPORTANT!

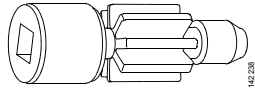
If serious leakage occurs, contact your nearest workshop.

1. Start the engine.
2. Check for oil, coolant, fuel, air or exhaust leaks.
3. Tighten or renew leaking connections.  
Check the overflow holes which show whether the O-rings between the cylinder liners and crankcase are leaking.
4. Check whether the drain hole on the coolant pump is blocked. If there is leakage: Renew the seal in the pump or the entire coolant pump.



## Checking and adjusting the valve clearance

### Special tools

Number	Designation	Illustration
99 309	Turning tool for rotating the flywheel from below.	



### WARNING!

Block the starting device when working on the engine. If the engine starts unexpectedly, there is a serious risk of injury.

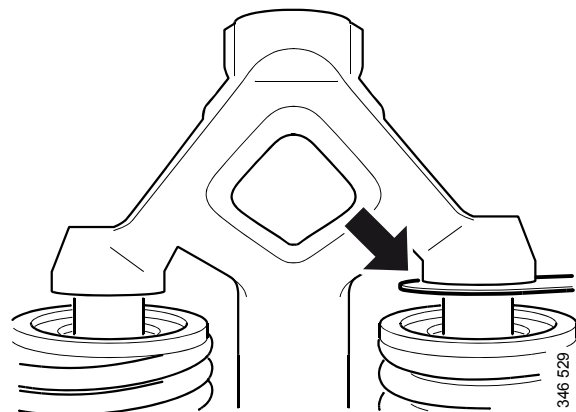
### Note:

Checking and adjusting valve clearances should also be done one more time after the first 500 hours of operation. Then the normal interval will follow (every 2,000 hours).

Check and adjust the valve clearance with the engine cold.

Intake valve clearance	0.45 mm (0.018 in)
Exhaust valve clearance	0.70 mm (0.028 in)

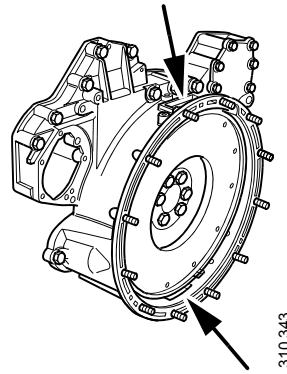
Max. clearance between two valves under the same valve bridge is 0.2 mm.



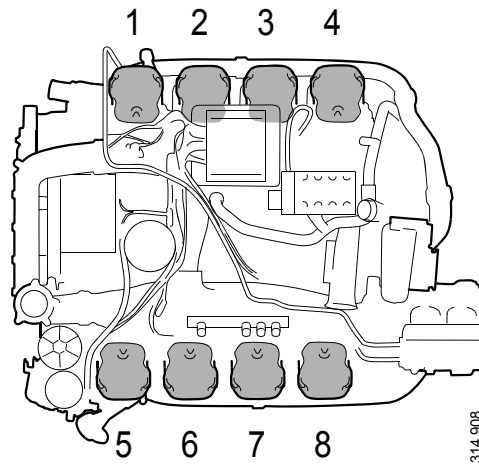
Turn the flywheel in the direction of rotation of the engine using the turning tool. Read the mark on the flywheel in the lower window of the flywheel housing.

**Note:**

Valve transition occurs when the cylinder switches from exhaust stroke to intake stroke. The exhaust valve is closing while the intake valve is opening.



*Openings for taking readings on the flywheel housing.*



*Cylinder location.*

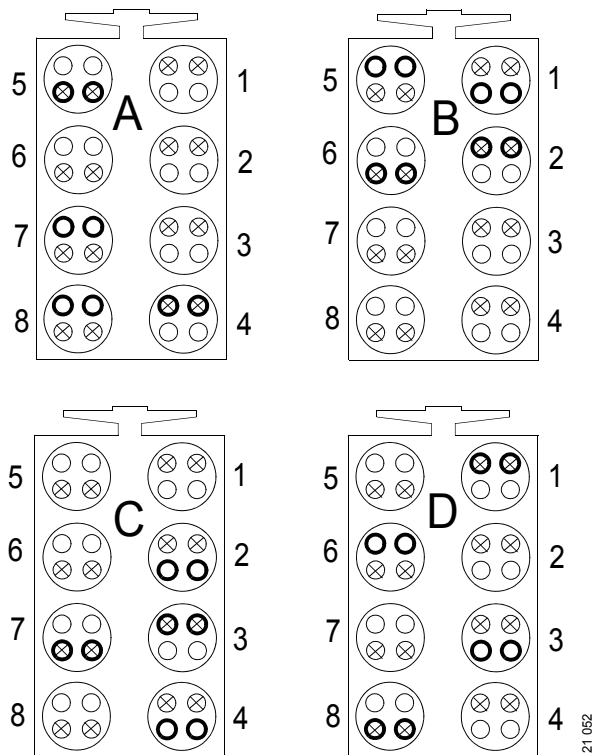
**! IMPORTANT!**

Remember to remove the flywheel rotation tool after adjustment.

Reading in the lower window	Valve transition on cylinder	Adjust intake valve on cylinder	Adjust exhaust valve 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

It is a good idea to mark the rocker arm with a pen after adjustment to keep track of what has already been adjusted.

**Alternate adjustment table**



121 052

## Renewing the reductant filter

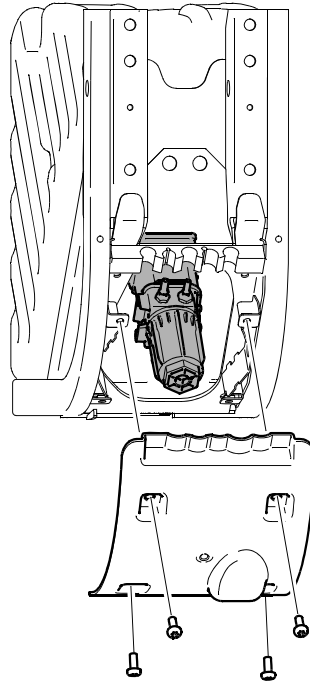
### Designation

Hexagon socket, 1/2" drive, 46 mm

### Illustration

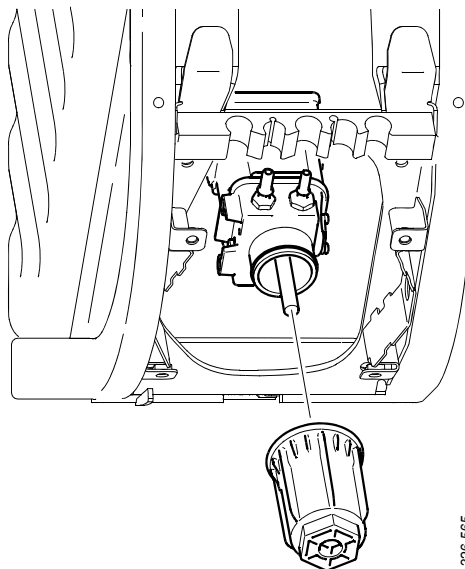


1. Remove the cover on the rear of the reductant tank.



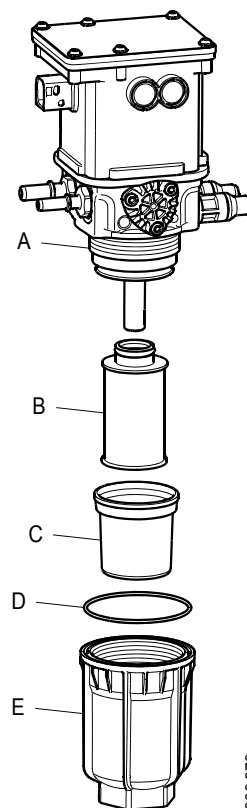
316 163

2. Place a suitable container underneath.
3. Unscrew the filter cover. Use the socket.
4. Remove the filter cover and O-ring.



326 565

5. Remove the frost protection device (C) and the filter (B).
6. Wipe the pump clean (A).
7. Fit the new filter (B).
8. Fit the new frost protection device (C).
9. Lubricate the threads with the spray.
10. Fit the new O-ring (D) in the new cover (E).
11. Check that the frost protection device and valve ring are correctly fitted in the new cover.
12. Fit the new cover and tighten to 80 Nm (59 lbf/ft).



336879

*A Pump.*

*B Filter.*

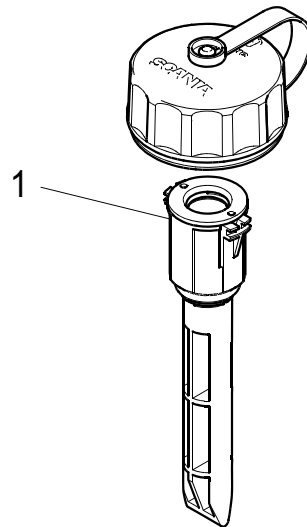
*C Frost protection device.*

*D O-ring.*

*E Cover.*

## Cleaning the reductant tank filler filter

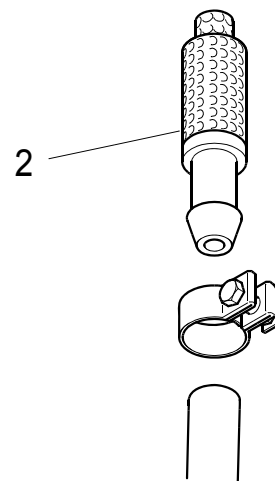
Make sure that the filler filter (1) is clean. If it is dirty: Clean the filler filter with clean water and refit it.



350 114

## Cleaning the reductant tank ventilation filter

Make sure that the ventilation filter (2) is clean. If it is dirty: Clean the ventilation filter with clean water and refit it.



352 009

## Diesel

### Composition of the fuel

The composition of the fuel is extremely important for the operation and service life of the engine and injection system. The engine output and exhaust gases are also dependent on the fuel grade.

The requirements and testing standards for the most important characteristics are described in the Workshop Manual which can be ordered from Scania dealers or directly from Scania.

The table shows some of the key properties.

Property	Requirement
Viscosity at 40°C (104°F)	2.0-4.5 cSt
Density at 15°C (59°F)	0.82-0.86 cSt
Ignitability (CET rating)	minimum 49
Flashpoint	56°C (132°F)
Particulate contamination level	ISO 11500, class 22/20/17

### Sulphur content of fuel

#### It is important to use low-sulphur fuel

It is important for sulphur-free or ultra-low sulphur fuel to be used on engines with SCR systems certified in accordance with Stage III B/Tier 4i and Stage IV/Tier 4f to ensure that the engine operates correctly. Use of the wrong fuel grade can cause damage to the engine and the exhaust gas aftertreatment system.

From January 2011 legislation in the USA and Europe requires all diesel engines not used on the road to be run on sulphur-free or ultra-low sulphur fuel.



#### REQUIREMENT!

In Europe, the fuel should be sulphur-free according to standard EN 590. This means that the sulphur content must not exceed 10 ppm.

In the USA the fuel must be an ultra-low sulphur fuel in accordance with standard ASTM D975. This means that the sulphur content must not exceed 15 ppm.

#### Responsibility



#### IMPORTANT!

The machine operator is responsible for using the correct type of fuel to ensure that local laws are complied with.

## Permitted sulphur content in fuel

Engine type	Max. sulphur content in fuel for unaffected oil change intervals	Note
Engines without EGR and SCR	Up to 2,000 ppm (0.2%)	If the sulphur content is higher than 2,000 ppm, the oil change intervals must be halved. A higher sulphur content than 4,000 ppm is not permitted, since this will result in engine damage.
Engines with SCR only	Up to 500 ppm (0.05 %)	A higher sulphur content than 15 ppm may only be used where Stage III A/Tier 3 or less restrictive emission laws apply.
Engines with both EGR and SCR	Up to 350 ppm (0.035%)	A higher sulphur content than 15 ppm may only be used where Stage III A/Tier 3 or less restrictive emission laws apply. A higher sulphur content than 350 ppm is not permitted, since this will result in engine damage.

### Fuel with a higher sulphur content than 15 ppm for engines with SCR systems

If fuel with a higher sulphur content than that specified in the standard is used on a short-term basis, this will not cause permanent damage to a catalytic converter. The catalytic converter may, however, require fuel with a low sulphur content for some time after this to regain its normal efficiency.

If fuel with too high a sulphur content is used for a prolonged period, there is a risk that the catalytic converter will not operate correctly, which will result in a reduction in engine torque.



## Temperature dependency of the fuel

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

The fuel 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 a temperature lower than normal, first identify the temperature properties of that particular fuel.

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

- Install an electric fuel heater if this particular fuel is not suitable for the expected temperature and no fuel is available with the correct temperature properties.
- Add 0.5-2% alcohol (isopropanol) to prevent any water in the fuel from freezing and forming plugs of ice. Drain fuel tanks and drain or renew fuel filters regularly.



### IMPORTANT!

Mixing kerosene or other paraffins with the fuel is prohibited. The injectors may be damaged.

Mixing petrol with the fuel is prohibited. In the long term petrol can cause wear in the injectors and engine.

## Biodiesel (FAME)

Scania uses the term biodiesel according to the EN 14214 standard to refer to renewable diesel which is made from greases or oils and methanol. The biodiesel should conform to the requirements of European standard EN 14214. For biodiesel in accordance with EN 14214 the generic term FAME is frequently used.

Scania XPI engines are approved for diesel according to the EN 590 standard. EN 590 contains up to 7% biodiesel in accordance with EN 14214.

## Use of fuel oil in stand-by generator sets

Long-term storage of diesel, where the diesel comes into contact with water, may lead to the growth of micro organisms (bacteria and fungus). To avoid this in fuel used in stand-by generator sets, i.e. ESP engines, Scania permits the use of fuel oil according to DIN 51603-1 and ÖNORM C 1109.

Use of fuel oil is only permitted for ESP engines and under the following conditions:

- The fuel must not be stored or used in temperatures under  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- The engine must not be equipped with an SCR system.

## Definition of ESP

ESP is an output class for stand-by generator sets in accordance with ISO 8528, which states that stand-by generator sets may be used under varying loads for a maximum of 200 hours/year.

ESP engines are intended for use as stand-by power supplies in the efficient electrical networks in Europe, North and South America, Australia, New Zealand, Japan and Taiwan.

## Reductant for SCR

Reductant is a urea solution normally known as AdBlue, DEF or ARLA 32 depending on the market. With SCR, the reductant is added to the exhaust gases before the catalytic converter. This reduces nitrogen oxide emissions.

## Responsibility and quality requirements



### IMPORTANT!

The machine operator is responsible for using the correct type of reductant to ensure that local laws are complied with.



### REQUIREMENT!

In order for the emission control to meet the emission requirements set by the public authorities, the reductant should be specified in accordance with ISO 22241.

## Properties

Reductant in accordance with ISO 22241 is a solution consisting of urea and water containing 32.5% by weight of urea. The solution freezes at approximately -11°C. When the solution freezes, ice and urea always maintain the same concentration. Always store reductant at a temperature between -11°C and 30°C.

Rec. % by weight of urea	Limit value according to ISO 22241
32.5%	31.8-33.2%

Reductant is normally colourless if no dye has been added. It is not harmful to the skin. Nor is it toxic in small quantities, but it tastes very unpleasant.

Reductant has a low surface tension and rapidly spreads over large areas, which then become very slippery. Reductant is extremely corrosive, especially to aluminium and copper. Therefore, wash off any spillages on metal and electrical connections as soon as possible. Water works very well for cleaning purposes. Please use hot water.

Reductant can dry out and form white or greyish brown crystals or deposits. Dense deposits which have been formed as a result of heat may need to be scraped off or heated to more than 500°C.

## Preparing the engine for storage

If the engine is not being used for an extended period its cooling system, fuel system and combustion chamber and outside must be protected against rust.

An alternative to preparing the engine for long-term storage is to start the engine and warm it up every 6 months.

## Handling the engine

The engine can normally stand idle for up to 6 months without preparation. For longer periods of downtime, the following measures should be taken. These measures provide protection for approximately 4 years.

Preparations for storage:

1. Thoroughly clean the engine.
2. Run the engine for a specific period using special preservative fuel, oil and coolant.
3. Otherwise prepare the engine for storage (filter renewal, lubrication, etc.).

If the engine is equipped with an SCR system: The reductant in the SCR system is perishable. If it is not used, its quality can deteriorate over time. The reductant tank and the SCR system should therefore be drained and cleaned after longer stationary periods.



### IMPORTANT!

Reductant is a highly corrosive fluid which must not come into contact with materials which are sensitive to corrosion.

Rinse off reductant spillages with plenty of water.

If reductant seeps into electrical connections or electrical cables, these must be renewed.

## Preservative coolant

If the engine is to be stored with a full cooling system, use coolant containing 50 percent glycol by volume. Glycol without nitrite-based inhibitor should be used. Example: BASF G48 or BASF D542.



### WARNING!

Ethylene glycol can be fatal if ingested. Avoid contact with the skin.

## Preservative fuel

Use diesel mixed with Lubrizol 560H or the equivalent. Mix 1 cm<sup>3</sup> (ml)/0.06 in<sup>3</sup> Lubrizol 560H in 10 dm<sup>3</sup>/2.3 US gallons of fuel.



### WARNING!

Lubrizol 560H contains aromatic hydrocarbons which are hazardous to health.

- Use spot extractors where there is a danger of vapour build-up.
- Wear protective goggles and gloves when handling the fuel.
- Do not use contaminated clothing.
- If it gets in your eyes: Flush with a gentle jet of water for at least 15 minutes and contact a doctor.
- If it gets on your skin: Wash with soap and water.
- If you inhale it: Fresh air, rest and warmth.
- Store in well-sealed containers in a dry, cool, place out of the reach of children.

Lubrizol is flammable and has a 2A fire rating. The flashpoint is 27 °C/81°F. In case of fire: Extinguish with carbon dioxide, powder or foam.

## Preservative oil

Suitable preservative oils are supplied by most oil companies. Example: Dinitrol 40 or equivalent.

## Preparations for storage



### Environment

Use a container to avoid spillage when draining the oil, coolant and reductant. Dispose of used fluids through an authorised waste disposal contractor.

1. Drain and flush the cooling system. Top up with preservative coolant.
2. Warm up the engine on normal fuel. Stop the engine and drain the oil.
3. Renew the fuel filter.
4. Fill the engine with preservative oil up to the minimum level on the oil dipstick.
5. Mix preservative fuel in a can. Detach the fuel pipe at the feed pump suction line and connect a hose from the can.
6. Detach the fuel pipe at the overflow valve and connect a return hose to the can.
7. Start the engine and run it at about 1,000 rpm for 20-25 minutes.
8. Stop the engine, remove the hoses and connect the normal fuel pipes.
9. Remove the rocker covers and lubricate the valve mechanisms with plenty of preservative oil. Refit the rocker covers.

### Note:

Do not remove the injectors.

10. Drain the preservative oil from the engine. Fill with new engine oil immediately or when the engine is to be reused.
11. Drain the coolant if the engine is not to be stored with coolant in the system. Plug and tape all coolant connections if the engine is to be stored without a cooling system.
12. Air cleaner: Clean or renew the filter element.
13. Cover air intakes and exhaust pipes.
14. Alternator and starter motor: Spray with water-repellent anti-corrosive oil, CRC 226, LPS1 or the equivalent.
15. Spray the outside of bright engine parts, first with penetrating preservative oil such as Dinitrol 25B and then with Dinitrol 112 or the equivalent.

Clearly mark the engine with the storage preparation date, and state that the engine must not be started or cranked.

If the engine is to stand idle for more than a year:

16. Drain the reductant from the reductant tank.

## Batteries

Remove the batteries and trickle charge them at the battery charging station. This does not apply to batteries specified as maintenance-free by the manufacturer.

The same applies to short-term storage, even if the engine has not been prepared for storage as above.



### WARNING!

Wear gloves and protective goggles when charging and handling batteries. The batteries contain a highly corrosive acid.

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## Storage

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

## When the engine is to be taken into operation again

1. Remove plugs and tape from coolant connections, air intakes and exhaust pipes.
2. Fill the cooling system with coolant. For more information refer to Maintenance.
3. Check the oil level in the engine or top up with fresh engine oil.
4. Lubricate the valve mechanisms and their pushrods and valve tappets as well as the injector mechanisms with plenty of oil.
5. Drain the preservative fuel from the fuel manifold and fuel filter.
6. Connect and bleed the fuel system. For more information refer to Maintenance.
7. Wash off any preservative oil on the outside using white spirit.

If the engine is equipped with an SCR system which has been drained and cleaned:

8. Fill the reductant tank with reductant.

## Technical data

### General data

Number of cylinders and configuration	V 8
Working principle	4-stroke engine
Cylinder diameter (mm/in)	130/5.118
Piston stroke (mm/in)	154/6.06
Displacement (dm <sup>3</sup> /in <sup>3</sup> )	16.4/1,001
Firing sequence	1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Compression ratio	
DC16 084A/384A	17.4:1
Other engine types	16.7:1
Engine direction of rotation viewed from rear	Anti-clockwise
Fan direction of rotation viewed from front	Clockwise
Cooling	Coolant
Valve clearances, cold engine	
Intake valve (mm/in)	0.45/0.017
Outlet valve (mm/in)	0.70/0.027
Number of teeth on the flywheel	158
Low idling (rpm)	600-750
Maximum full-load speed (rpm)	2,100
Fuel	Diesel
Approximate weight, without coolant and oil (kg/lb)	
DC16 084A/384A	1,375/3,031
Other engine types	1,340/2,954

### Lubrication system

Oil volume	See Maintenance
Oil cleaning	Centrifugal oil cleaning
Oil cooler	Coolant cooled, full flow
Oil filter	Paper filter from Scania
Interval between oil changes (h)	500
Oil pressure (bar)	
Normal with the engine at operating temperature, operating speed	3-6
Minimum permitted at idling speed	0.7
Crankcase pressure with closed crankcase ventilation (mbar)	-5.4 to 2.0

## Injection system

Type	XPI (Extra High Pressure Injection)
Engine management system	EMS
Fuel filter	Paper filter from Scania
Fuel filter with water separator	Paper filter from Scania

## Cooling system

Coolant volume, excluding radiator (dm <sup>3</sup> /US gallons)	
DC16 084/384A	26/6.9
Other engine types	24/6.3
Coolant volume including 1.5 m <sup>2</sup> radiator (dm <sup>3</sup> /US gallons)	68/18.0
Coolant temperature (°C/°F)	90-95/194-203
Number of thermostats	1
Thermostat opening temperature (°C/°F)	80/176 and 87/189

## Intake system

Permissible pressure drop in the intake system with cleaned or new filter (mbar)	30
Permissible pressure drop in the intake system with blocked (dirty) filter (mbar)	65

## Electrical system

Type	1-pin, 24 V, DC
Starter motor, standard equipment	1-pin, 24 V, 7.0 kW
Alternator, standard equipment	1-pin, 28 V, 100 A

## Scania Assistance

Wherever you are, you can always get assistance from the Scania service organisation, Scania Assistance, all day, every day of the year.

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 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>CA</b>	+1-800-2-SCANIA	<b>NL</b>	+31 70 4182666
<b>CH</b>	+41 800 55 24 00	<b>NO</b>	+47 223 217 00
<b>CL</b>	188 800 722 642	<b>PL</b>	+48 602 622 465
<b>CZ</b>	+420 225 020 225	<b>PT</b>	+48 91 678 9247
<b>DE</b>	+49 261 887 8888	<b>RO</b>	+40 723 27 27 26
<b>DK</b>	+45 333 270 44	<b>SE</b>	+46 42 100 100
<b>ES</b>	+34 91 678 80 58	<b>SK</b>	+421 903 722 048
<b>FI</b>	+358 10 555 24	<b>TR</b>	+90 212 335 04 40
<b>FR</b>	+33 2 414 132 32	<b>TZ</b>	+255 78 472 2642
<b>GB</b>	0 800 800 660 +44 1274 301260	<b>US</b>	1-800-2-SCANIA
<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 +27 11 661 9823

Other countries: +46 8 52 24 24 24

### Note:

Calls will be recorded for training purposes.