

Important information

Serious risk of injury

When working on the engine, e.g. when adjusting the drive belts and clutch, or when changing oil, it is important not to start the engine. The engine could be damaged, but more importantly there is a serious risk of injury.

Therefore, block the starting device and switch off the manual fuel cock when 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 maintenance items where it is particularly important to bear in mind the risk of injury.

Operator's manual

OC16 Gas Industrial engine

en-GB 3 449 187



Issue 9.0

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Start of warranty

The more we know about you, your company and your equipment, the more effectively we can adapt our services to you. If you have started to use a new Scania engine, it is very important that you send in the warranty start report to us immediately. Quite simply, we need to register all the details on engine ownership etc., so we can monitor it for you.

You can report the start of the warranty on the Scania website: www.scania.com.

Note:

If you do not send in the warranty report, the engine is not covered by the accompanying Scania warranty.

Also fill in below the details you enter in the warranty report. These details can facilitate contact with a workshop, for example. The engine serial number is on the engine data plate and is also engraved on the cylinder block.

Engine serial number (e.g. 1111111)

Ship ID (for example MMSI 111111111 or IMO 1111111)

Start date (yyyy-mm-dd)

Company name

Contact person

Phone number

Email address

Address

Postal code

Post town

State/County

Country

Introduction

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

The engines are liquid-cooled Otto gas engines with turbochargers.

The engines are available with different power 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.

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 an authorised Scania workshop for maintenance and repairs.

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

Note:

Always use spare parts that are approved by Scania for maintenance and repairs.

Certification



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 in accordance with the instructions in this Operator's manual.

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.
- Maintenance and repairs of injection equipment are to be carried out by an authorised Scania workshop.
- 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. Follow the safety precautions on the following pages.

Partly Completed Machinery



SCANIA

3310124

DECLARATION OF INCORPORATION OF PARTLY COMPLETED MACHINERY IN ACCORDANCE WITH EC DIRECTIVE 2006/42 EC

SCANIA declares that engines referenced below are manufactured as Partly completed machinery in accordance with Machinery directive 2006/42/EC.

This partly completed machinery shall not be put into service in the European Community until the final machinery, into which it is to be incorporated, has been declared in conformity with the provisions of Directive 2006/42/EC and all applicable EC Directives.

The engines within any of the following generic engine family names comply with this declaration.

DC09 A, DI09 M

DC13 A, DI13 M

DC16 A, DI16 M

OC16 A, DC11 A

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Södertälje, 5 March 2025
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Output classes

Scania supplies engines in 2 different output classes:

PRP, Prime Power: Intended for continual use and an unlimited number of operational hours with varying loads. For continuous operation and unlimited annual operating time with varying loads. Max. average load factor of 70% of rated power during 24 hours of operation. 1 hour/12 hour period over 100% load. Max. 25 hours accumulated service time over 100% load per year. This power class applies to single-speed engines.

COP, Continuous power: Intended for continual use with a non-varying load and an unlimited number of operational hours.

The engine serial numbers and output classes for the engines that are used in this installation should be listed below: You can find the power class of your engine in the engine type data sheet on the Scania website, www.scania.com.

Engine serial number:

Motor type:

Engine power:

_____ kW at _____ rpm

☐

PRP, Prime power

☐

COP, Continuous power

Environment and safety

Environmental liability

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 quality and operating economy for Scania engines. To maintain these throughout the entire service life of the engine, it is important for the user to follow the instructions on driving, maintenance and fuel, lubricating oil and coolant 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.

Information on parts with particularly hazardous substances

Note:

A number of component parts on the engine contain materials with particularly hazardous substances.

The substances have properties that can have a serious and lasting effect on human health and the environment.

If a part or component parts contain more than 0.1% by weight of a substance listed on the REACH candidate list, the supplier must provide information about the substance.

The requirement is defined in Article 33 of the REACH Regulation (EC 2006/1907) and applies within the EU, Liechtenstein, Norway and Iceland.

<https://echa.europa.eu/candidate-list-table>.

A list of engine parts containing substances in the candidate list is provided by Scania.

<https://sure.scania.com/reach>.

According to Article 9 of the EU Waste Framework Directive ((EU) 2018/851), manufacturers of parts containing more than 0.1% by weight of a particular hazardous substance must communicate this to the EU Chemicals Agency (ECHA).

Scania supplies individual notification numbers in SCIP for affected vehicles.

<https://sure.scania.com/>

The notification number can be used to search the ECHA SCIP database.

<https://echa.europa.eu/scip-database>

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 personal injury, 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.

Warnings and advisories

Use only fuel which fulfils the requirements in the section *Fuel quality requirements*.

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:

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



IMPORTANT!

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

An excessive coolant temperature can cause engine damage.

Note:

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

Leave the engine off for at least 7 minutes before you check the oil level.



Environment

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

Use a suitable container. The fuel collected must be disposed of as specified in national and international laws and regulations.



REQUIREMENT!

Advisories preceded by Requirements! indicate mandatory actions or conditions that must be fulfilled. If these are not followed, there is a risk of malfunctions, damage to equipment or that the terms of the warranty will not apply. **Example:**

Safety precautions for driving

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

The engine is designed and optimised to be run on either natural gas or pure biogas.



WARNING!

Fuel of the wrong quality can cause malfunctions or cause the engine to stop. This can cause damage to the engine and, possibly, personal injury.



WARNING!

Natural gas and pure biogas mainly consist of methane, and may have a methane content of up to 97%. Methane is flammable and must be handled with great care.



WARNING!

Methane is not toxic but in a mixture of 50% or more with air, the oxygen content will be so low that the risk of suffocation increases.



IMPORTANT!

Comply with applicable local laws and regulations when handling natural gas and pure biogas.



REQUIREMENT!

Use only fuel which fulfils the requirements in the [Fuel quality requirements](#) section.

Methane is a highly flammable gas which is flammable when present in a 5-16% mixture in the air.

Methane can even be ignited by static electricity from a person.

Methane ignites when in contact with hot surfaces at approx. 580°C.

Methane burns with an almost invisible flame. Therefore, take extra care.

Methane is lighter than air and therefore rises in the event of leakage. Bear this in mind if leaks do occur in enclosed spaces such as indoors or in a tunnel. In those cases the gas can cause suffocation and an explosive atmosphere.

Hazardous gases



WARNING!

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

When the engine is run in an enclosed space, there must be effective devices to extract gas and exhaust gases.

Starter lock



IMPORTANT!

If the instrument 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.

Driving



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 ro-

tating parts and hot surfaces must be fitted with guards.

Smoking



WARNING!

Smoking is prohibited:

- in the vicinity of gas engines.
 - 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 handling materials

Lubricating oil



WARNING!

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

The work must be carried out on a cold engine. Spillage on hot surfaces can cause fires.

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

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.

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 packaging.

Store chemicals and other materials which are hazardous to health in approved and clearly marked containers, where they are inaccessible to unauthorised persons.



Environment

Excess and used chemicals must be disposed of as specified in national and international laws and regulations.

Safety precautions for maintenance

Switch off the engine



WARNING!

Working on 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.

Always switch off the engine before carrying out maintenance, 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.

Hot surfaces and fluids



WARNING!

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

Lubrication system



WARNING!

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

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

Make sure that the oil filler cover is fitted when starting and driving in order to avoid oil escaping.



Environment

Used oil must be disposed of as specified in national and international laws and regulations.

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 cover has to be opened do it slowly to release the pressure before removing the cover. Wear protective gloves as the coolant is still very hot.

Avoid skin contact with coolant as this may cause irritation to the skin. Wear eye protection and gloves when handling coolant.

Ethylene glycol can be fatal if ingested.



Environment

Used coolant must be disposed of as specified in national and international laws and regulations.

Fuel system



WARNING!

Natural gas and pure biogas are extremely flammable and can even be ignited by static electricity from a person.

Natural gas and pure biogas are lighter than air and therefore rise in the event of leakage. Be aware of if there is a leak in a confined space. In those cases the gas can cause suffocation and an explosive atmosphere.

Always use Scania spare parts for the fuel and electrical systems. Scania spare parts are designed to minimise the risk of fire and explosion.



IMPORTANT!

Work on the engine may only be carried out by personnel who are aware of the risks and have sufficient knowledge of natural gas and pure biogas.

Comply with applicable local laws and regulations when handling natural gas and pure biogas.

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

Before working on the engine, ensure that the gas content of the air is below 10% of the lower explosive limit (LEL). Also check the permitted gas content with reference to local laws and regulations.

When working on the engine, use warning signs indicating that work with flammable fuel is in progress. The signs must be in the local language and comply with local regulations. The illustration shows an example of a warning sign design.

Inform all personnel of the basic risks of natural gas and pure biogas.

Check the earthing of the engine in instances of open handling of gas, i.e. handling which may give rise to an explosive atmosphere.

Never try to extinguish a burning gas flame. Try to stop the flow of gas instead. Move material that could be ignited by the flame.

Electrical system



WARNING!

Before working on the electrical system, ensure that the gas content of the air is below 10% of the lower explosive limit (LEL). Also check the permitted gas content with reference to local laws and regulations.

Switch off the engine and switch off the power by disconnecting the electrical cables to the battery. Also disconnect external electric power supply to auxiliary equipment on the engine.

Always use Scania spare parts for the fuel and electrical systems. They are designed to minimise the risk of fire and explosion.

Electric welding



WARNING!

Before welding, ensure that the gas content of the air is below 10% of the lower explosive limit (LEL). Also check the permitted gas content with reference to local laws and regulations.

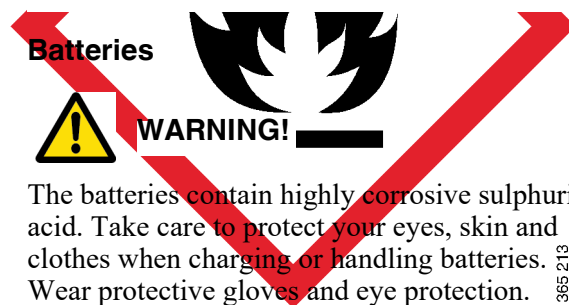
When carrying out welding work on and near the engine, disconnect the battery and alternator electrical cables. Pull out the multi-pin connector for the engine control unit as well.

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.
2. Connect the battery.



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 eye protection.

Disposal plan: Wash it off with soap and plenty of water. If it splashes in your eyes: Rinse immediately with plenty of water and seek medical attention.



WARNING!

Cut the power by disconnecting the electrical cables to the battery and not to the engine, as there is a risk of sparks building up.



Environment

Used batteries must be disposed of as specified in national and international laws and regulations.

Before starting



WARNING!

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

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.

Cybersecurity



IMPORTANT!

The machine manufacturer is responsible for ensuring that all engine management communication is protected against all forms of cyber attack.

The machine manufacturer is also responsible for ensuring the engine can be operated safely in all conditions, including the option of shutting off the engine in the event of disruption to communications with or without engine control.

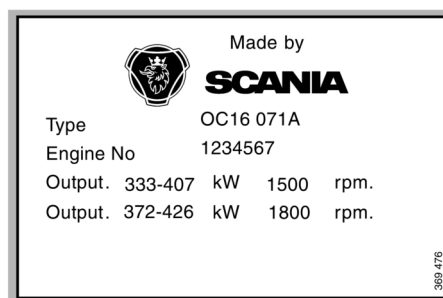
Engine data plate

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 the nominal engine speed.

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.

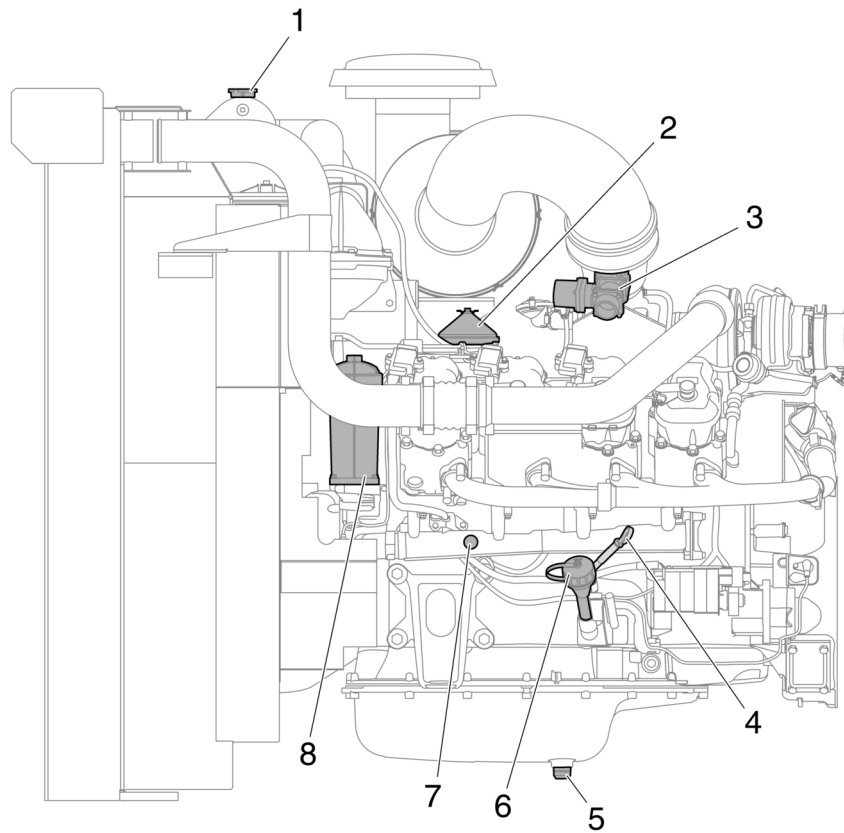
Example: OC16 071A

OC	turbocharged gas engine with air-cooled charge air cooler.
16	Displacement in whole dm ³ .
071	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.



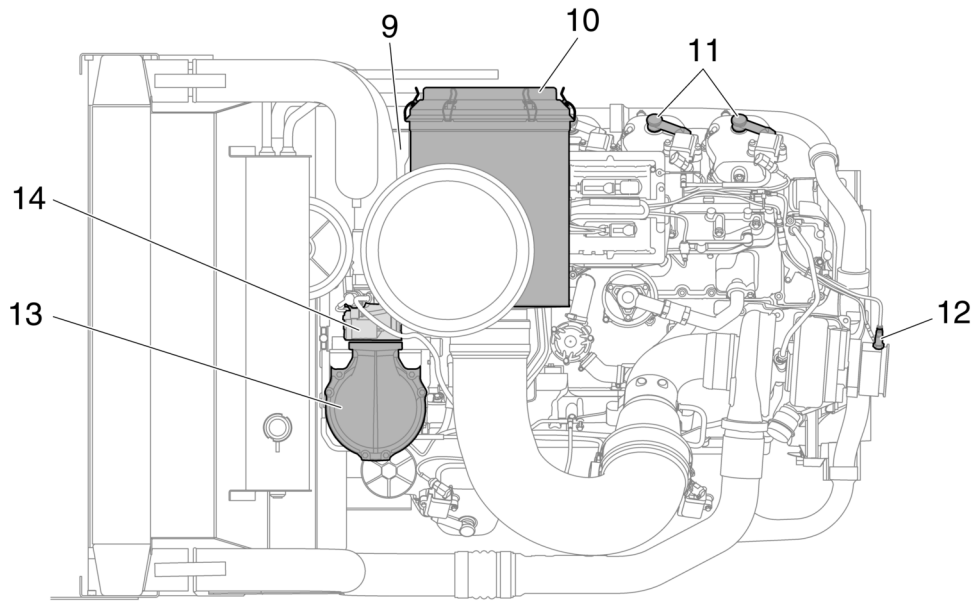
Example of an engine data plate.

Component identification



1. *Filling coolant*
2. *Centrifugal oil cleaner*
3. *Throttle at gas mixer*
4. *Oil dipstick*
5. *Oil plug*
6. *Oil filler*
7. *Nipple to drain and fill coolant (behind the coolant manifold, 1 on each side).*
8. *Oil filter*

368 360



368 361

- 9. Engine data plate and engine serial number*
- 10. Air cleaner*
- 11. Spark plugs*
- 12. Lambda sensor*
- 13. Flame arrestor*
- 14. Throttle at flame arrestor*

Starting and running

Checks before first start

Before the engine is started for the first time, carry out the maintenance items listed under First start in the maintenance schedule. Check the following:

- Oil level.
- Coolant.
- Fluid level in batteries.
- Battery state of charge.
- Condition of the drive belt.

See also [Maintenance intervals](#).

Checks before running



WARNING!

Block the starting device and switch off the manual fuel cock when working on the engine. If the engine starts unexpectedly, there is a serious risk of injury.

Carry out daily maintenance as described in the maintenance schedule prior to operation. See [Maintenance intervals](#).

Starting the engine



WARNING!

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 gas and exhaust 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.

1. Open the manual fuel cock.
2. Disconnect the engine from any load.
3. If the engine has a battery master switch:
Connect the power using the battery master switch.
4. Start the motor.
5. The engine will rev up. Let the engine run without load for 2 minutes.

Starting at low temperatures

Take the local environmental requirements into account. Use the engine heater to avoid starting difficulties. Scania recommends that an engine heater should be used if the engine will be used at temperatures below -10°C.

A low engine speed and moderate load on a cold engine gives better combustion and faster heating than warming up with no load.

Avoid running it longer than necessary at idling speed.

Driving

Check instruments and warning lamps at regular intervals.

Engine speed range

The engine operating speed range is between low idling and the nominal engine speed. The nominal engine speed is 1,500 or 1,800 rpm. Low idling is normally 1,000 rpm.

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 height higher than 2,000 metres above sea level is only permitted if it has first been approved by Scania.

The engine is designed and optimised for continuous operation at 100% load. To ensure operational reliability and to extend the maintenance intervals, the following limitations for load and operating time apply:

Power	Max. operating time
0-150 kW	30 minutes
150-200 kW	120 minutes
200 kW – COP	Unlimited operating time
> COP	Max. average load factor of 70% of rated power during 24 hours of operation. 1 hour/12 hour period over 100% load. Max. 25 hours accumulated service time over 100% load per year.

Coolant temperature



IMPORTANT!

An excessive coolant temperature can cause engine damage.

Normal coolant temperature during operation is 90-95°C (194-203°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 98°C (208°F) and 105°C (221°F) respectively.

The high coolant temperature alarm has the following functions:

- Alarm at the lowest limit value.
- Alarm at the lowest limit value and engine shutdown at the highest limit value.

The accumulated total engine operating time at < 150 kW should be < = 10%.

The accumulated total engine operating time at < 200 kW should be < = 15 %.

Oil pressure

For information on the normal oil pressure and lowest permitted oil pressure, see the [Technical data](#) section.

The engine management system activates an alarm for high or low oil pressure at engine speeds above 650 rpm. The values below are for overpressure, not absolute pressure.

- An alarm for high oil pressure is activated when the pressure exceeds 7.9 bar (115 psi).
- An alarm for low oil pressure is activated when the oil pressure drops below 0.65 bar (9 psi).

The incorrect oil pressure alarm has the following functions:

- Alarm only.
- Alarm and engine shutdown.

Note:

High oil pressure (above 6 bar/87 psi) is normal if the engine is cold when started.

Charge air temperature

The engine management system has the following alarm levels for high charge air temperature.

- Alarm at 70 °C (158°F).
- Alarm or engine shutdown at 80°C (176°F).

Charging indicator lamp

If the lamp comes on during operation: Check and adjust the alternator drive belt according to the section [Checking the drive belt](#).

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. This noise is normal and disappears after 50-100 hours of operation. The noise does not affect the service life of the belt transmission.

Engine shutdown



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.

1. Run the engine without load for 3 minutes at the nominal engine speed.
2. Switch off the engine via the coordinator and allow the engine to run until the gas has run out and the engine stops.
3. Close the manual fuel cock.

Checks after running



WARNING!

Block the starting device and switch off the manual fuel cock 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 include turbochargers, oil sumps, hot coolant and oil in pipes and hoses.



IMPORTANT!

Check the coolant level following the first start. Top up with coolant as necessary.

1. Check that the manual fuel cock is turned off.
2. Check that the power supply has been cut.
3. Check that the cooling system contains enough glycol according to the Scania instructions. See the section [Coolant](#).
4. If the temperature is below 0°C (32°F): Prepare for the next start by connecting the engine heater, if fitted.

Maintenance

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

- Lubrication system.
- Air cleaner.
- Cooling system.
- Fuel system.
- Electrical system.
- Other.



WARNING!

Block the starting device and switch off the manual fuel cock 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 include turbochargers, oil sumps, hot coolant and oil in pipes and hoses.



IMPORTANT!

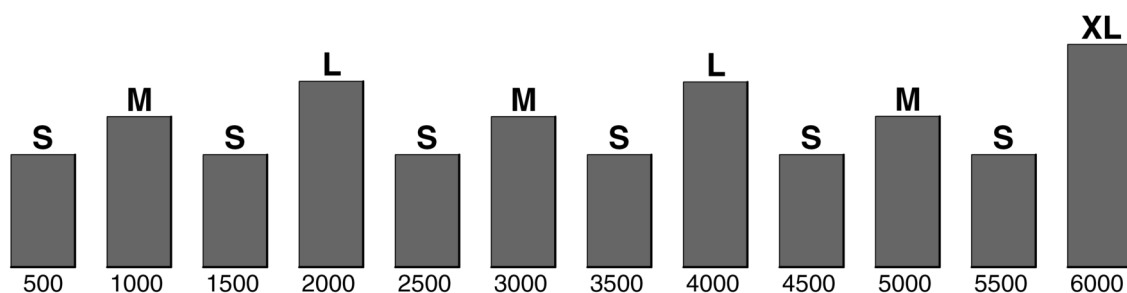
On delivery a Scania engine is optimised for its application. However, regular maintenance is necessary to

- 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.

The maintenance programme includes the following:

- Maintenance R: One event when taken into service.
- Maintenance S: Minimum basic maintenance.
- Maintenance M: More extensive maintenance.
- Maintenance L: Includes nearly all maintenance items in the form.
- Maintenance XL: Includes all maintenance items in the form.

During a period, the sequence is S-M-S-L-S-M-S-L-S-M-S-XL.



Maintenance intervals

	Daily	First time at		Interval (hours)					Minimum	
		first start	500	500	1,000	1,500	2,000	6,000	an- nual- ly	every 5 years
			R	S	M	SP	L	XL		
Lubrication system										
Checking the oil level	X	X								
Changing the oil			X	X	X	X	X	X	X	
Cleaning the centrifugal oil cleaner			X		X		X	X	X	
Renewing the oil filter			X	X	X	X	X	X	X	
Air cleaner										
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
Cooling system										
Checking the coolant level	X	X	X	X	X	X	X	X		
Checking the coolant's anti-freeze and corrosion protection		X					X	X	X	
Changing the coolant and cleaning the cooling system								X		X
Fuel system, only when using pure biogas										
Cleaning the flame arrestor and throttle at the flame arrestor								X		
Cleaning the throttle at the gas mixer								X		
Leak testing after maintenance of the fuel circuit								X		
Checking deposits in the combustion chamber						X		X		
Electrical system										
Renewing the spark plugs						X		X		
Other										
Checking the drive belt		X			X		X	X	X	
Checking for leakage	X			X	X	X	X	X		
Checking and adjusting the valve clearance			X				X	X		

Lubrication system

Oil grade

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

Recommended oil: Scania Oil LDF-4.

The engine oil must satisfy the following quality requirements:

- ACEA E6.
- ACEA E9
- API CJ4.

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

If Scania Oil LDF-4 is not used, the oil must be of a viscosity class suitable for the outdoor temperature in the area where the engine is used.

Viscosity class	Outdoor temperature in °C		
SAE 20W-30	-15°C	-	+30°C
SAE 30	-10°C	-	+30°C
SAE 40	-5°C	-	+45°C
SAE 50	0°C	-	+45°C
SAE 5W-30	< -40°C	-	+30°C
SAE 10W-30	-25°C	-	+30°C
SAE 15W-40	-20°C	-	+45°C

Viscosity class	Outdoor temperature in °F		
SAE 20W-30	5°F	-	86°F
SAE 30	14°F	-	86°F
SAE 40	23°F	-	113°F
SAE 50	32°F	-	113°F
SAE 5W-30	< -40°F	-	86°F
SAE 10W-30	-13°F	-	86°F
SAE 15W-40	-4°F	-	113°F

In case of very low surface temperatures: Consult your nearest Scania workshop on how to avoid starting difficulties.

If the engine is used in areas of the world where engine 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.

Filled engine oil grade label

When changing the oil it is important to use the correct engine oil grade. Therefore, the oil filler cover must be clearly marked with a label indicating the oil grade used. However, there are only labels for oils from Scania and oil grade ACEA E9.

Stick on a new label if the oil type or oil grade is changed in favour of any of the oil types above. Replace the label if it is missing.

If the oil grades below are used, it is possible to order labels for the oil filler cover from Scania.

Product	Colour	Part no.
Scania Oil LDF-4	Blue	2 602 886
ACEA E9	-	2 132 429



Oil filler label.

389 686

Oil analysis

To be able to extend the oil change intervals using an oil analysis, Scania LDF-4 oils must be used.

The following requirements must remain satisfied when the oil is changed:

- Viscosity at 100°C (212°F): max. $\pm 20\%$ of the 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).
- Oil oxidation (in accordance with DIN 51453) > 15 A/cm.

Such analysis measures the oil's total base number, TBN (Total Base Number), total acidic number, TAN (Total Acid Number), fuel dilution, water content, viscosity and the quantity of particles 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 oil change intervals. Work out the new oil change interval for the engine in conjunction with the workshop.

Note:

Only Scania LDF-4 oils may be used in conjunction with oil analysis and a possible extended oil change interval.

Depending on the market, the warranty conditions may also change if the oil change intervals differ from the recommended Scania timetable.

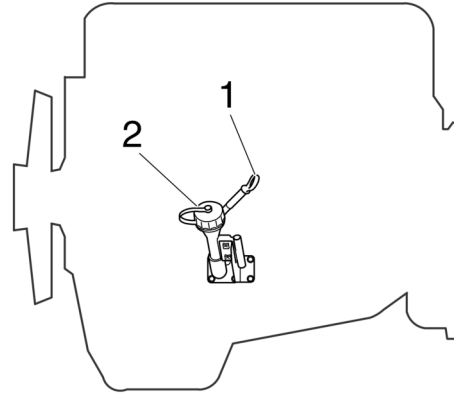
Checking the oil level

Note:

Leave the engine off for at least 7 minutes before you check the oil level.

1. Pull out the oil dipstick 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 via the oil filler if the oil level is at or below the minimum mark.

For information on the correct oil grade, see the section [Oil grade](#).

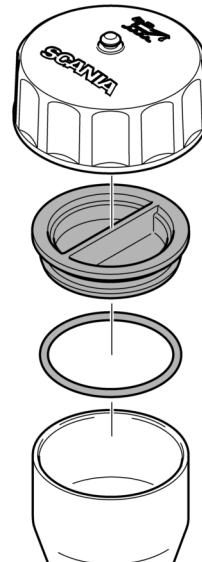


375 553

1. Oil dipstick
2. Oil filler

Note:

Some engines are fitted with a protection plug which prevents dust from entering the lubrication system. Make sure that the plug and O-ring are fitted before the oil filler cap.

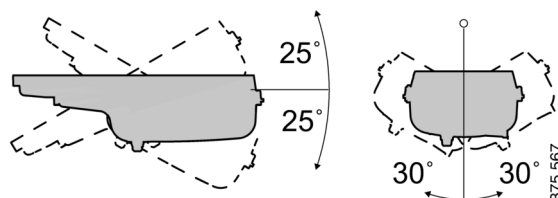


458 553

Protection plug with O-ring

Maximum angles of inclination during operation

The illustration shows the maximum angles of inclination allowed during operation.



375 567

Changing the oil



WARNING!

Hot oil can cause burns and skin irritation. Use protective gloves and eye protection when renewing hot oil. Make sure that there is no pressure in the lubrication system before changing the oil. The oil filler cover must always be in place when starting and running the engine to prevent oil being ejected.

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).

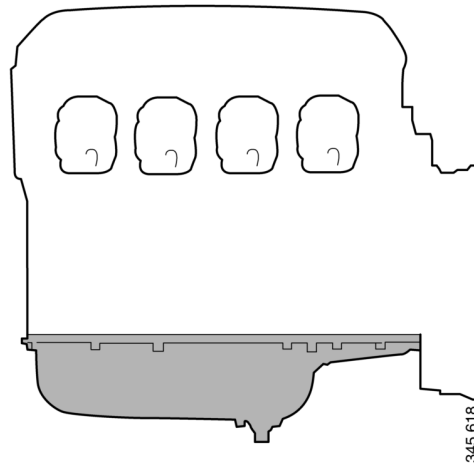
Renew the oil filter and clean the centrifugal oil cleaner when changing the oil.



Environment

Use a suitable container. Used oil must be disposed of as specified in national and international laws and regulations.

1. Unscrew the oil plug and drain the oil when the engine is hot. In certain engine types the oil is pumped out by means of a bilge pump. If the engine is drained via the valve, the oil should be hot. Alternatively, use a pump. This is so that draining occurs more quickly.
2. Wipe off the magnet on the oil plug.
3. Renew the gasket on the oil plug.
4. Refit the oil plug.
5. Fill with the amount of oil specified for the oil sump.
6. Wait at least 7 minutes.
7. Check the level on the oil dipstick.



345 618

Oil volume:

Min. 40 litres (10.5 US gallons).

Max. 48 litres (12.6 US gallons).

Cleaning the centrifugal oil cleaner



WARNING!

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

Wear eye protection and protective gloves when working on the centrifugal oil cleaner.

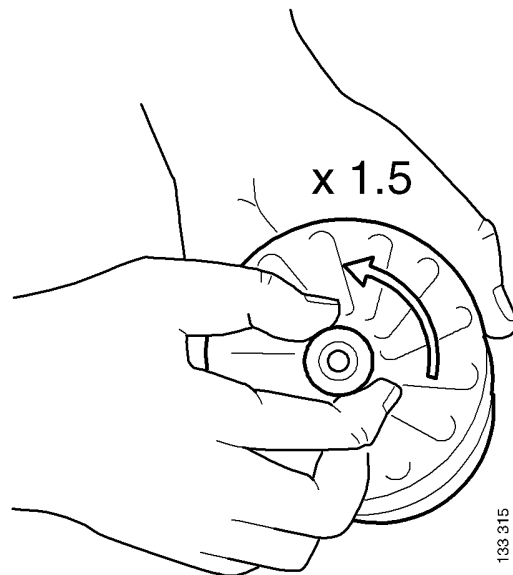
When the centrifugal oil cleaner is cleaned, there should be some dirt deposits on the paper in the rotor cover. If the paper is clean, the equipment is not working as it should. If this is the case, investigate the cause of this.

Renew the paper more frequently if the dirt deposits are thicker than 28 mm (1.1 inches) during a scheduled oil change.

1. Clean the cover.
2. Unscrew the nut securing the outer cover.
3. Let the oil run out from the rotor.
4. Lift out the rotor. Wipe off the outside.
5. Loosen the rotor nut and unscrew it about 1.5 turns.

Note:

Take care not to damage the rotor shaft.



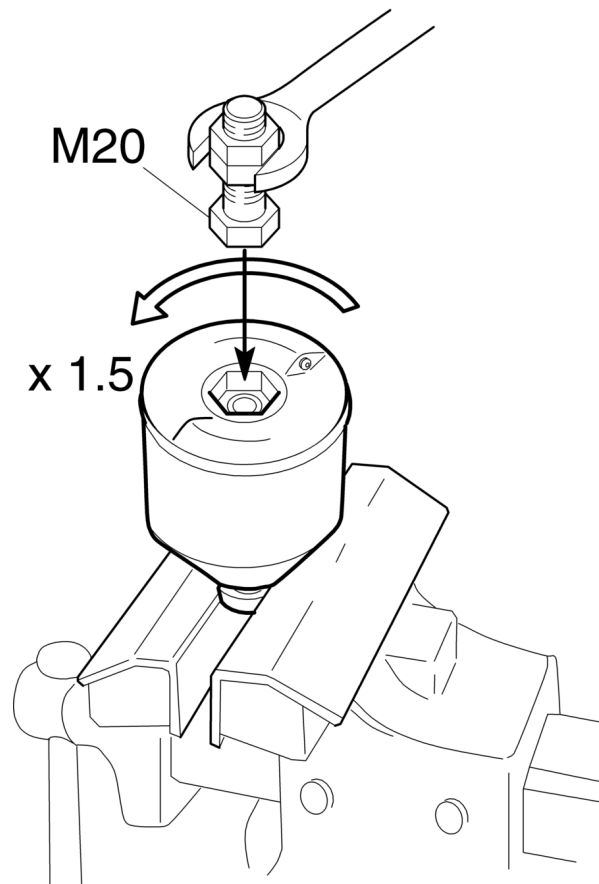
133 315

6. If the rotor nut is too tight: Turn the rotor upside down and secure the rotor nut in a vice. See illustration.
7. Use protective jaws so as not to damage the grooves of the rotor nut.
8. Turn the rotor 1.5 turns anti-clockwise by hand.
9. If this does not work: Screw 2 nuts together with an M20 screw.
10. Position the screw head at the bottom of the rotor.
11. Position a ring spanner on the lower nut and turn the rotor 1.5 turns anti-clockwise.

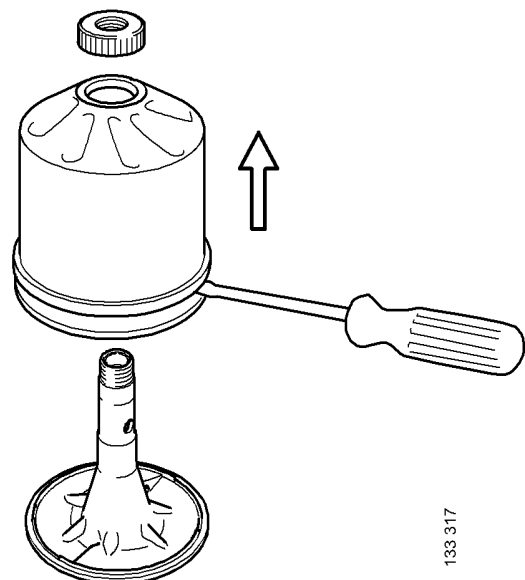


IMPORTANT!

Do not attach the rotor directly to the vice. Never strike the rotor cover.

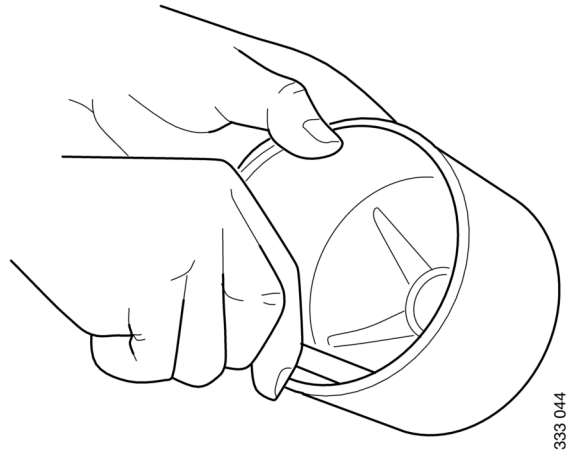


12. Remove the rotor cover by holding the rotor in both hands and tapping the rotor nut against the table. Never strike the rotor directly as this may damage its bearings.
13. Remove the strainer from the rotor cover. If the strainer is stuck, insert a screwdriver between the rotor cover and strainer and carefully prise them apart.

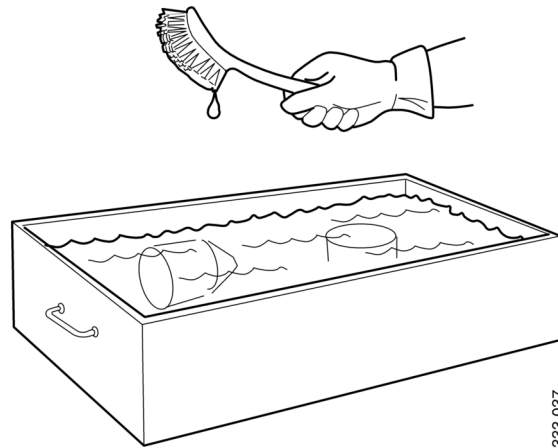


133 317

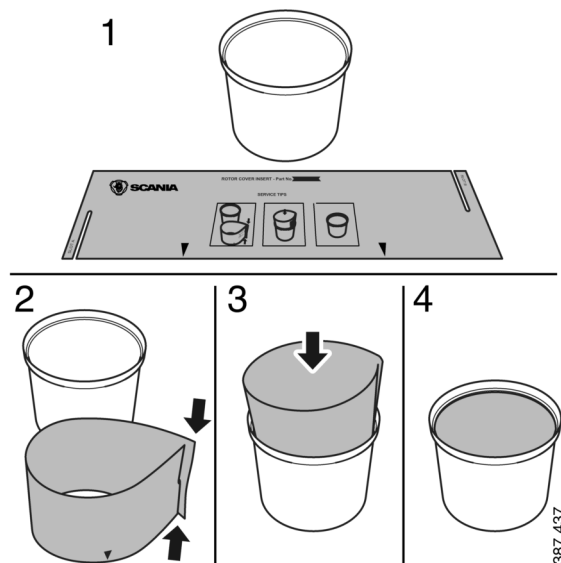
14. Remove the paper insert.
15. Scrape off any remaining dirt deposits from the inside of the rotor cover. If the deposits on the paper are thicker than 28 mm (1.1 in), the centrifugal oil cleaner must be cleaned more often.



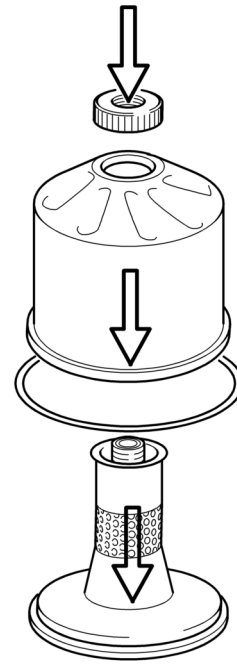
16. Wash the parts according to the applicable industrial method.
17. Check the 2 nozzles on the rotor. Ensure that they are not blocked or damaged.
Renew any damaged nozzles.
18. Check that the bearings are undamaged.
Renew damaged bearings.



19. Fold and fit a new paper insert on the inside of the rotor cover as illustrated.



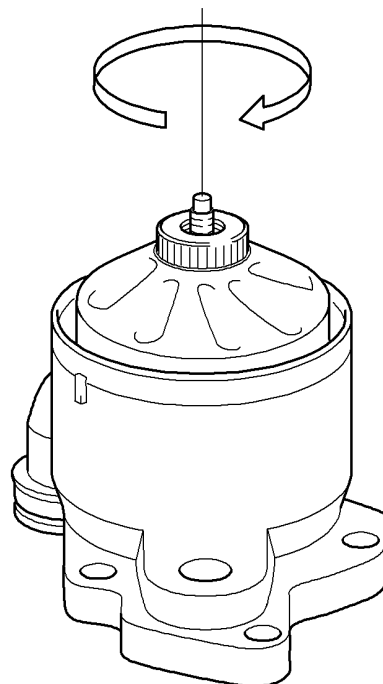
20. Fit the strainer onto the rotor.
21. Fit a new O-ring to the foot of the centrifugal oil cleaner.
22. Refit the rotor cover. Ensure that the O-ring is not outside the edges, but is in the groove.
23. Screw the rotor nut back on by hand.
24. Check that the shaft is not damaged or loose.
Contact a Scania workshop if the rotor shaft needs renewing.



Note:

Take care not to damage the rotor shaft.

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



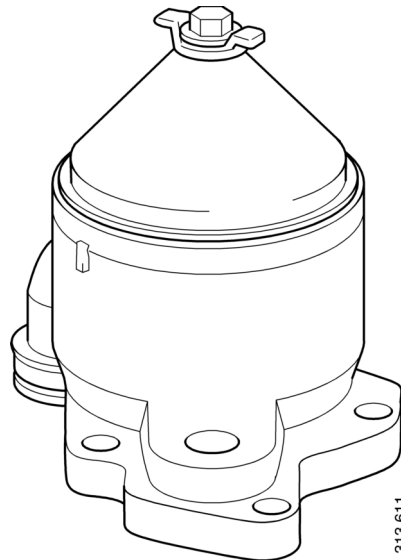
313 612

26. Fit a new O-ring in the cover.
27. Refit the cover and tighten the lock nut.
Tightening torque 20 Nm (15 lb-ft).



IMPORTANT!

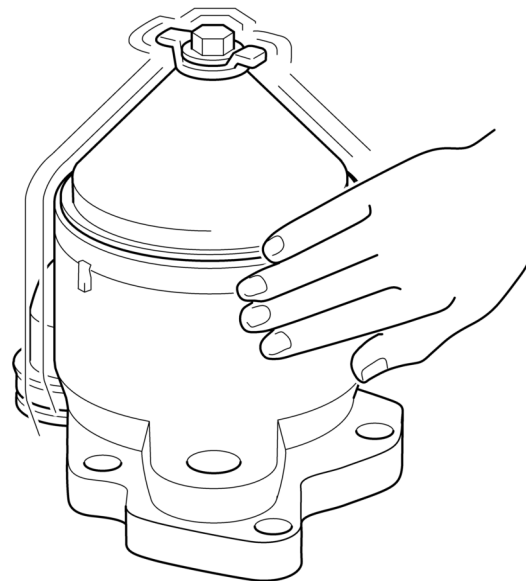
To reduce the risk of oil leakage it is important to tighten the cover to the correct tightening torque.



Operational testing of the centrifugal oil cleaner

Operational testing need only be carried out if it is suspected that the centrifugal oil cleaner is malfunctioning. For example, if there are unusually few deposits given the distance driven.

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine and listen for the sound from the rotor. It should continue rotating for a time, even when the engine has stopped.
3. Use your hand to feel if the filter housing is vibrating.
4. If the filter housing is not vibrating, dismantle and check the centrifugal oil cleaner.



Renewing the oil filter

Tool

Designation	Illustration
Hexagon socket, 1/2", 36 mm	



IMPORTANT!

The engine must not be run without a filter element in the oil filter. There is a risk of engine damage caused by particles and by the oil pressure being too low.

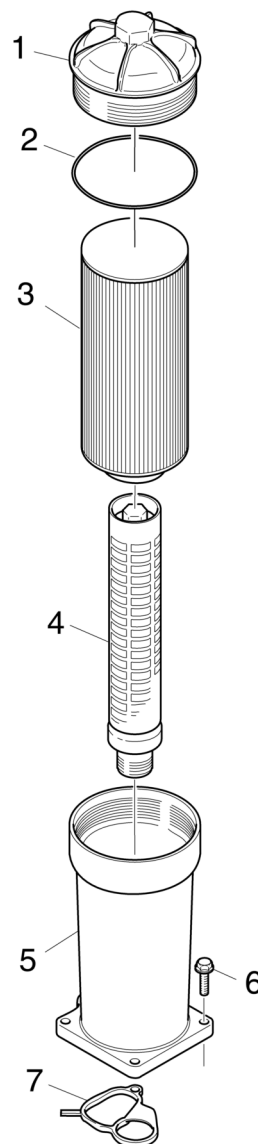
1. Unscrew the filter cover using the socket.



IMPORTANT!

Do not use an adjustable spanner or other open tool, as there is a 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. Undo the old filter from the cover by carefully bending it to one side.
4. Fit a new O-ring on the cover. Lubricate the O-ring with engine oil.
5. Press a new filter into the snap fastener in the cover and tighten the filter cover to 25 Nm (18 lb/ft).
6. Make sure the oil filter drain has emptied the oil from the filter housing. Screw on the filter cover firmly with the socket.
7. Start the engine and inspect the filter housing for leaks.



1. Cover
2. O-ring
3. Filter element
4. Pipe
5. Filter housing
6. Flange screw
7. Gasket

381 921

Air cleaner



WARNING!

Never start the engine without the air filter in position. Without the air filter, there is a risk of dirt being sucked into the engine.

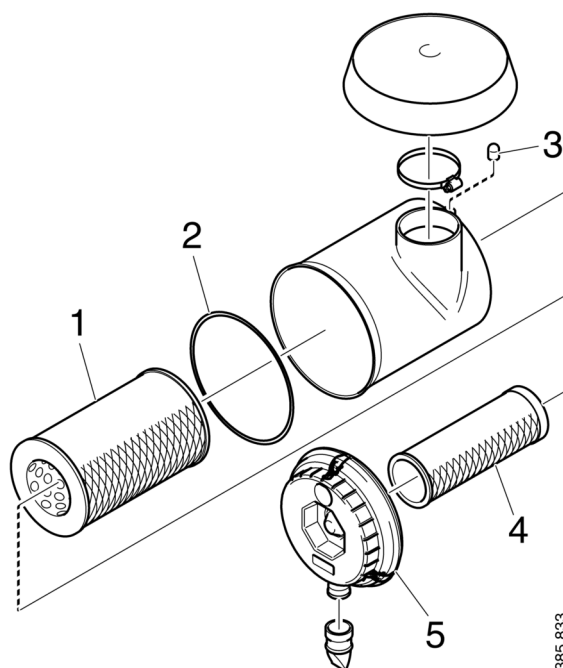
The engine turbocharger will continue to rotate and take in air for a time, even after the engine has stopped. Therefore, wait for a few minutes before opening the air cleaner.



IMPORTANT!

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

The filter element must not be cleaned in water or be blown clean with compressed air. There is always a risk that the filter element will be damaged when it is cleaned.



385 833

Air cleaner with safety cartridge

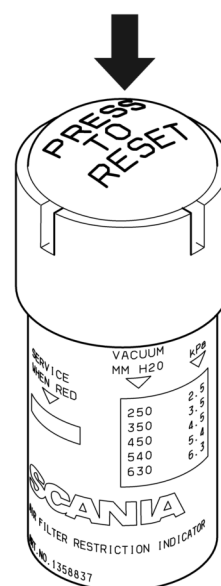
1. Filter element
2. O-ring
3. Vacuum indicator
4. Safety cartridge
5. Cover

Reading the vacuum indicator

If the vacuum indicator's red plunger is fully visible, renew the air cleaner filter element in accordance with the following section.

Renewing the filter element and safety cartridge

1. Remove the cover from the air cleaner.
2. Renew the filter element.
3. Remove the safety cartridge and fit a new one.
4. Insert a torch into the filter element and check that the filter paper is free of holes and cracks.
5. Renew the O-ring if it is damaged or hard.
6. Assemble the air cleaner.
7. Ensure that the O-ring is not outside the edges.
8. Reset the vacuum indicator by pressing in the button marked in the illustration.



326 671

Cooling system

Coolant

Only the product Scania coolant, or other products tested as antifreeze and corrosion protection for Scania, may be used in Scania engines.

Products that do not satisfy the requirements for use in a Scania engine may result in faults in and damage to the cooling system. This may lead to the invalidation of Scania's warranty for faults and damage caused by the use of unsuitable coolant.

Note:

The coolant should be changed when the cooling system is cleaned: every 6,000 hours or at least every five years. See [Changing the coolant and cleaning the cooling system](#).

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

- Corrosion protection.
- Antifreeze.
- Increases the boiling point.

Water

Use only pure fresh water that is free from particles, sludge and other impurities. If there is uncertainty about the quality of the water, Scania recommends use of Scania ready-mixed coolants. See the section [Recommended Scania products](#).

Antifreeze and corrosion protection

The antifreeze and corrosion protection used in Scania engines should be antifreeze (ethylene glycol) and corrosion protection.

Scania Ready Mix coolant is a pre-mixed coolant consisting of water, antifreeze (ethylene glycol) and corrosion protection.

Addition of antifreeze and corrosion protection to water

The coolant should contain 35-55% by volume antifreeze (ethylene glycol) and corrosion protection. The percentage varies depending on the need for antifreeze.

A minimum of 35% by volume of Scania antifreeze and corrosion protection is needed to provide sufficient corrosion protection.

Note:

Too high a dose of antifreeze and corrosion protection will increase the amount of sludge and blockages accumulating in the radiator. Too low a concentration can lead to corrosion of the cooling system and ice formation at low temperatures.

Measure the ethylene glycol content (antifreeze and corrosion protection) with a refractometer following the instructions in the [Checking the coolant's antifreeze and corrosion protection](#) section.

Risk of freezing



IMPORTANT!

The engine should not be subjected to heavy loads when ice starts to build up in the cooling system.

As the coolant starts to freeze, the water in the coolant starts to crystallise and the percentage of ethylene glycol in the coolant therefore rises. If freezing produces a great increase in the amount of ice, circulation problems could arise. There is no risk of damage by freezing if the content of Scania antifreeze and corrosion protection, or an equivalent mixture of a similar product, is at least 35% by volume.

Minimal ice formation in the coolant sometimes causes disruptions without any risk of damage. For example, the auxiliary heater may not work for up to 1 hour after the engine has been started.

The chart depicts coolant properties at different percentages of antifreeze and corrosion protection concentration by volume.

Curve A: Ice formation starts (ice slush)

Curve B: Damage by freezing

Zone 1: Safe zone

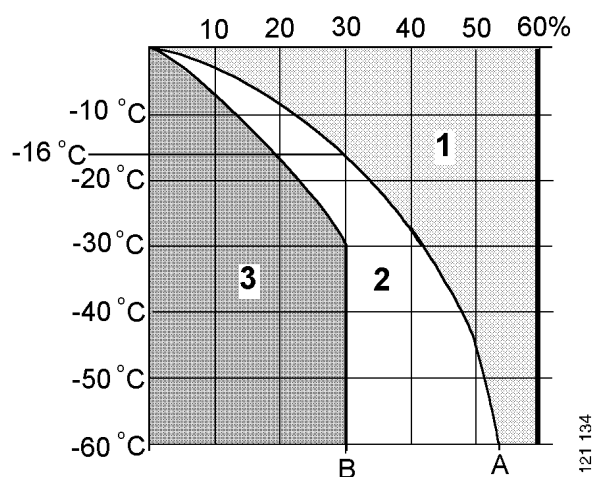
Zone 2: Disruptions may occur (ice slush)

Zone 3: Risk of damage by freezing

The following example shows coolant properties with 30% by volume of antifreeze and corrosion protection:

- Ice slush starts to form at -16°C (3°F).
- At -30°C (-22°F), there is a risk of disruptions in the cooling system.
- There is no risk of damage by freezing with a minimum antifreeze and corrosion protection content of 35% by volume.

Example: If the temperature is -16°C (3°F), there is a risk of damage by freezing if the percentage of antifreeze and corrosion protection is 20% by volume. At 30% antifreeze and corrosion protection by volume the coolant will not contain any ice.



Hot climates

In order to retain the corrosion protection and the higher boiling point, it is essential to use coolant consisting of water mixed with antifreeze and corrosion protection (ethylene glycol). This also applies in countries where the temperature never drops below 0°C (32°C).

The coolant should always contain 35-55% anti-freeze and corrosion protection by volume so that the coolant properties ensure that the coolant works correctly.

Topping up

Coolant must only be topped up with pre-mixed coolant. The pre-mixed coolant can either be concentrate mixed with clean freshwater or pre-mixed coolant from the factory. Use only pure fresh water that is free from particles, sludge and other impurities.



IMPORTANT!

Containers used for mixing coolant must be intended for the purpose and free from any dirt or contaminants. When the containers not in use they must be kept closed to avoid collecting dirt and dust.

Note:

Within the coolant change interval, coolant may only be reused if it has been cleaned of dirt, sludge and particles. If the coolant is contaminated with oil or fuel, it must not be reused.

Recommended Scania products

Scania Ready Mix 50/50

Scania Ready Mix 50/50 is a ready-mixed coolant containing 50% antifreeze (ethylene glycol) and corrosion protection and 50% water. It should be used in cold countries where there is a risk of freezing in the cooling system.

Part no.	Volume litres	Volume US gallons
1 921 955	5	1.3
1 921 956	20	5.3
1 921 957	210	55
1 896 695	1,000	264

Scania concentrate

Scania also produces coolant with antifreeze and corrosion protection in the form of a concentrate.

Part no.	Volume litres	Volume US gallons
1 894 323	5	1.3
1 894 324	20	5.3
1 894 325	210	55
1 894 326	1,000	264

Antifreeze and corrosion protection dosing

35% by volume of Scania antifreeze provides sufficient corrosion protection. The lower the temperature, the higher the anti-freeze content required. In the tables below, you can see how much antifreeze is required in litres and US gallons at different temperatures.

Example, litres:

- The total volume of the cooling system is 68 litres.
- The measured concentration of ethylene glycol is 35% by volume (freezing point -21°C). According to the table, there are 25 litres of ethylene glycol in the cooling system.
- The required concentration of ethylene glycol is 45 per cent by volume (freezing point -30°C). According to the table, 32 litres of ethylene glycol are required in the cooling system.
- Since there are already 25 litres in the cooling system, fill another 7 litres of ethylene glycol ($32 - 25 = 7$ litres).

Ethylene glycol content (%)	35	40	45	50	60
Ice slush forms (°C)	-21	-24	-30	-38	-50
Volume of ethylene glycol (litres)	25	28	32	35	42

Example, US gallons:

- The total volume of the cooling system is 18 US gallons.
- The measured concentration of ethylene glycol is 35% by volume (freezing point -6°F). According to the table, there are 6.6 US gallons of ethylene glycol in the cooling system.
- The required concentration of ethylene glycol is 45 per cent by volume (freezing point -22°F). According to the table, 8.5 US gallons of ethylene glycol are required in the cooling system.
- Since the cooling system already contains 6.6 US gallons, fill with another 1.9 US gallons of ethylene glycol ($8.5 - 6.6 = 1.9$ US gallons).

Ethylene glycol content (%)	35	40	45	50	60
Ice slush forms (°F)	-6	-11	-22	-36	-58
Volume of ethylene glycol (US gallons)	6.6	7.4	8.5	9.2	11.1

Checking the coolant level



WARNING!

Do not open the coolant filler cover in the expansion tank if the engine is hot. Hot coolant and steam may spray out and cause burns. If the cover has to be opened do it slowly to release the pressure before removing the cover.

Use protective gloves as coolant can cause irritation if it comes in contact with the skin.



IMPORTANT!

It is not permissible to top up large amounts of coolant via the expansion tank. Filling via the expansion tank leads to air locks in the cooling system which can lead to e.g. cavitation damage to the coolant pump shaft seal. If a large amount of coolant needs to be added, follow the instructions in the section [Filling coolant](#).

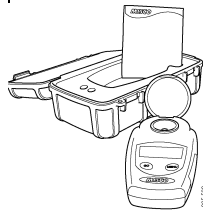
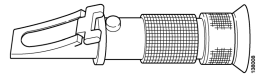
Only pour pre-mixed coolant into the cooling system.

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

1. Open the expansion tank cover and check the coolant level.
 - The right coolant level on a cold engine is at the height of 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.

Checking the coolant's anti-freeze and corrosion protection

Tool

Designation	Illustration
Refractometer	
	



WARNING!

Avoid skin contact with coolant as this may cause irritation to the skin. Wear eye protection and gloves when handling coolant.



IMPORTANT!

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 protection content with the refractometer.

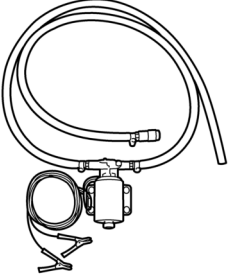
The following rules apply to ethylene glycol-based coolant:

- The antifreeze and corrosion protection content must be a minimum of 35 per cent by volume for corrosion protection to be sufficient.
- An antifreeze and corrosion protection 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.

Changing the coolant and cleaning the cooling system

Draining coolant

Special tools

Number, designation	Illustration
2 443 679, coolant pump	 360 625



WARNING!

Do not open the coolant filler cover in the expansion tank if the engine is hot. Hot coolant and steam may spray out and cause burns. If the cover has to be opened do it slowly to release the pressure before removing the cover.

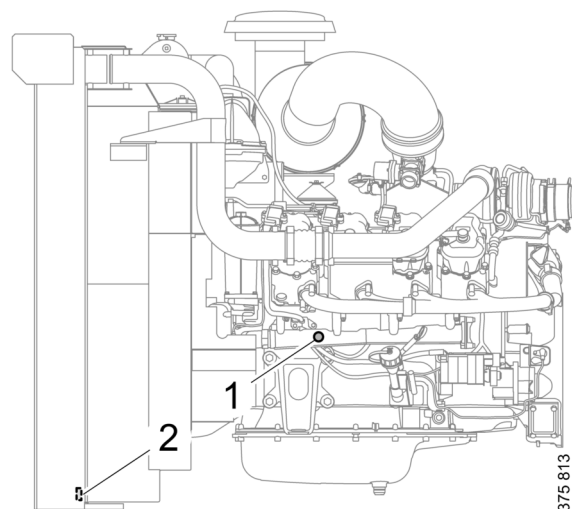
Use protective gloves as coolant can cause irritation if it comes in contact with the skin.



Environment

Use a suitable container. Used coolant must be disposed of as specified in national and international laws and regulations.

1. Open the expansion tank cover.
2. Place the hose from the coolant pump in an empty container.
3. Connect the pump to the draining nipple in the cylinder block (1).
4. Connect the pump's 2 cable terminals to the battery's negative and positive terminal. Make sure that the drainage starts. If draining does not start: Change the position of the cable terminals.
5. Repeat the procedure on the lowest draining point of the cooling system (2).



Cleaning the cooling system

Note:

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

External cleaning: Cleaning the radiator and the charge air cooler



IMPORTANT!

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

Read the warning text on the detergent packaging.

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

Internal cleaning: Removing oil and grease in the cooling system



Environment

Use a suitable container. Used coolant must be disposed of as specified in national and international laws and regulations.

Always fit a new thermostat and a new cover to the expansion tank after cleaning, as the oil in the cooling system destroys the seals. If the engine is fitted with a coolant filter, also renew this filter.

It may be necessary to wash it multiple times if the cooling system is very dirty. One cause of contamination can be that oil is lying on top of the coolant and collecting high up in the cooling system. If several rinses are needed, this is not necessarily because work has been carried out incorrectly. Oil residues often need to be rinsed repeatedly from the expansion tank and the external heating system to be completely clean.

Repeated washing is more effective and preferable to using higher concentrations of detergent (max. 10%) or cleaning for a longer period (max 30 minutes).

If only a small amount of dirt has collected in the expansion tank after cleaning, one extra rinse and clean of the expansion tank only is usually sufficient. There is no need to clean the whole cooling system again.

1. Run the engine until it has reached operating temperature if possible and then drain the cooling system following the previous description.
2. Remove the thermostat.

3. Fill the cooling system with clean hot water mixed with detergent 2 479 017. Detergent 2 479 017 must make up 5-10% (depending on the degree of dirt) of the total coolant volume.

If detergent 2 479 017 is not available, use a dishwashing detergent for domestic appliances that does not foam. Concentration 1%.

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 cooling system with clean, hot water and run the engine for about 20-30 minutes.
7. Repeat steps 3-6 if the cooling system is not clean.
8. Drain the water from the cooling system.
9. If necessary, clean the expansion tank by detaching all hoses and rinsing and cleaning with a degreasing agent and a dish brush.
Alternatively, dismantle the expansion tank and clean it with water with 10% of detergent 2 479 017. Fill the expansion tank with the mixture, shake it and drain it. Renew the cover of the expansion tank.
10. Fit a new thermostat.
11. Fill the cooling system with new coolant as described in the next section.
12. Check again whether further dirt or oil has collected in the expansion tank. Decide whether it is necessary to carry out another full cleaning or whether only rinsing or cleaning of the expansion tank will suffice.

Internal cleaning: Removing deposits in the cooling system



Environment

Use a suitable container. Used coolant must be disposed of as specified in national and international laws and regulations.

1. Run the engine until it has reached operating temperature if possible and then drain the cooling system following the previous description.
2. Remove the thermostat.
3. Fill the cooling system with clean hot water mixed with a radiator detergent that is based on sulfamic 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. Reinstall the thermostat.
9. Fill the cooling system with new coolant as described in the next section.

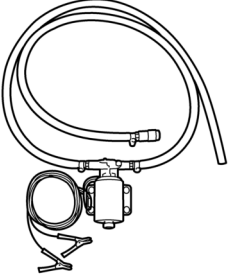
External cleaning: Cleaning the radiator and the charge air cooler

1. Check that neither the radiator nor the charge air cooler are 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 discs using a steel brush or the like.

Filling coolant

This procedure applies when the cooling system has been drained and needs to be filled with a large amount of coolant.

Special tools

Number, designation	Illustration
2 443 679, coolant pump	 360 625



WARNING!

Use protective gloves as coolant can cause irritation if it comes in contact with the skin. Hot coolant can also cause scalding.



IMPORTANT!

Mix the coolant as specified in the section headed [Coolant](#).

It is not permissible to top up large amounts of coolant via the expansion tank. Filling via the expansion tank leads to air pockets in the cooling system which can lead to e.g. damage to the coolant pump shaft seal.

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

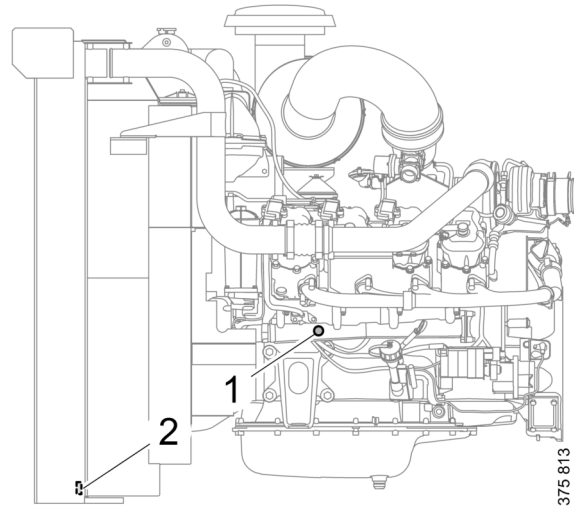
Do not start the engine until the correct coolant level has been obtained. If the engine is started with engine coolant level low, it can damage the coolant pump shaft seal, which leads to coolant leakage.

1. Open the expansion tank cover.
2. Connect the coolant pump to the filler nipple in the cylinder block (1).
3. Connect the pump's 2 cable terminals to the battery's negative and positive terminal. Make sure that the filling starts. If the filling does not start: Change the position of the cable terminals.
4. Start the engine and run it at idling for 15 minutes.



IMPORTANT!

It is very important that the engine is idling. Engine overspeed could damage the coolant pump shaft seal, which leads to coolant leakage.



5. Switch off the engine and fill with coolant to the maximum level through the expansion tank.

Air pockets may still be left in the cooling system. These will disappear after the engine has been operated for a period of time. Therefore, the coolant may need topping up at a later stage.

Fuel system

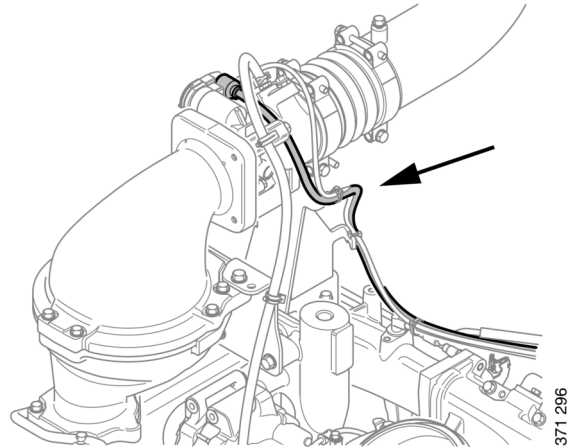
Cleaning the flame arrestor and throttle at the flame arrestor

This procedure applies only if pure biogas is used as a fuel.

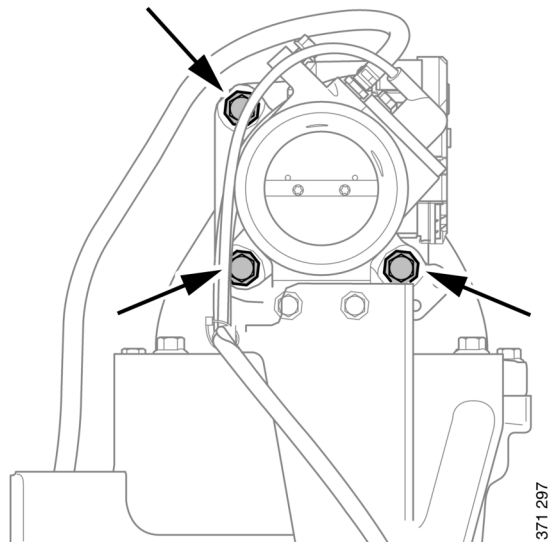


Read the safety precautions before starting work.

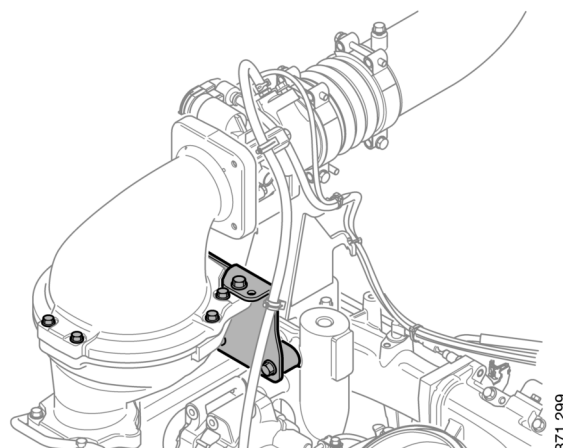
1. Detach the harness-to-component connector from the throttle.



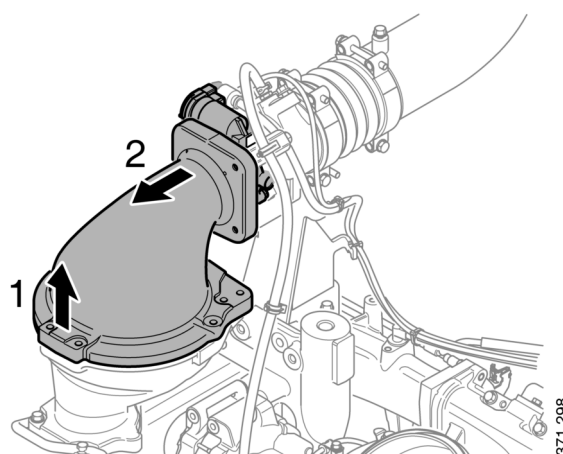
2. Remove the screws securing the throttle bracket to the flame arrestor.



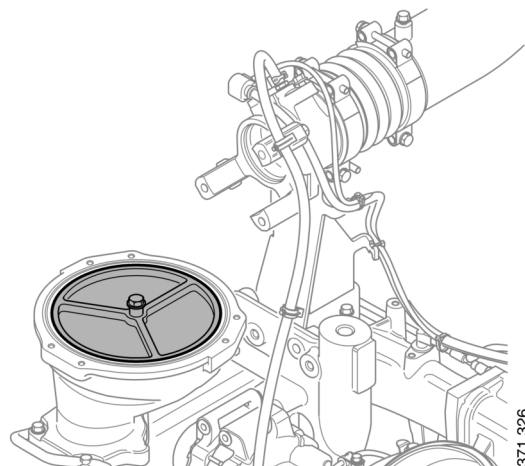
3. Remove the flame arrestor housing bracket and the screws.



4. Remove the upper part of the flame arrestor housing and the throttle.

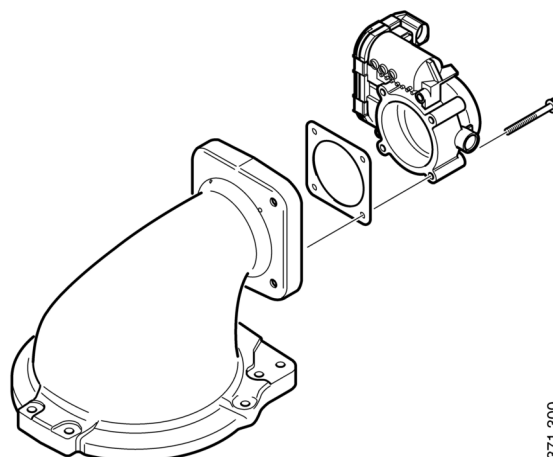


5. Remove the flame arrestor.



6. Clean the insert with degreasing agent. Remove dirt with a soft brush.
7. Rinse the insert with hot water.
8. Blow out any remaining water with compressed air.

9. Remove the throttle.



371 300

10. Protect the throttle electrical connection from moisture.

11. Clean the throttle with soap and water. Use a soft brush to remove stubborn dirt.



IMPORTANT!

Only use soap and water. Solvents and degreasing agents can damage the throttle.

12. Rinse the throttle with hot water.

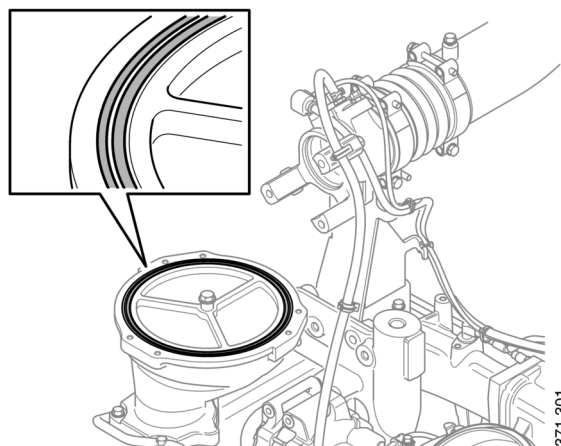
13. Dry off the water.

14. Spray the outside of the throttle with water-repellent anti-corrosive oil, for example LPS1 or equivalent. Make sure that the oil reaches the holes for the throttle shaft in the throttle housing.

15. Renew the gasket.

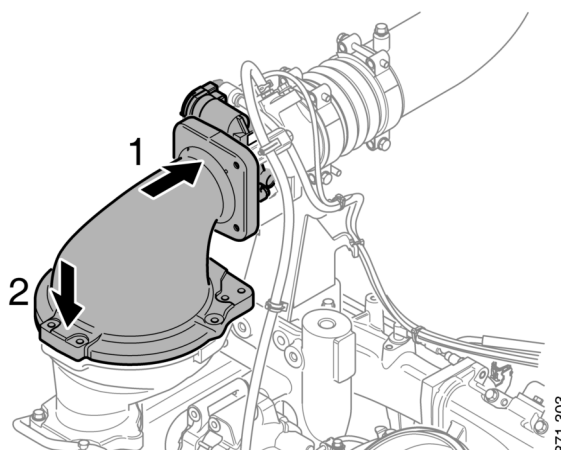
16. Fit the throttle to the flame arrestor housing.

17. Check the O-rings. Renew them if necessary.



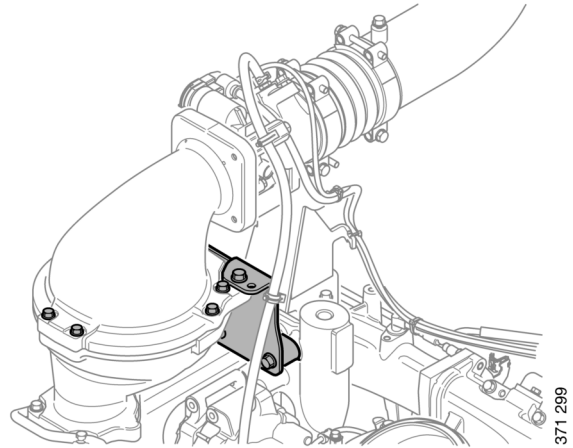
371 301

18. Fit the flame arrestor housing and the throttle.

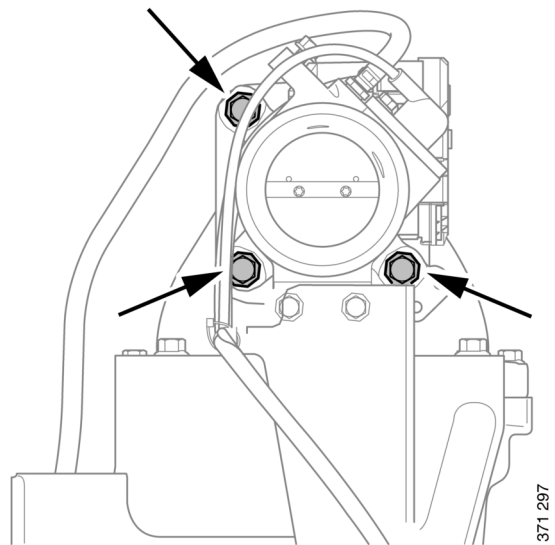


371 303

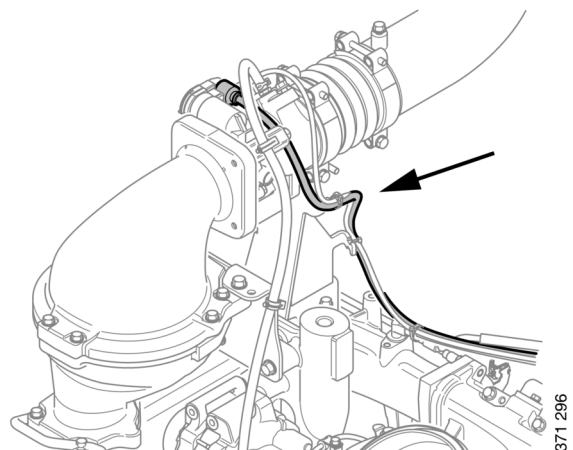
19. Fit the screws and the bracket.



20. Fit the screws securing the throttle bracket.



21. Fit the throttle harness-to-component connector.



22. Make sure the fuel system is not leaking. See [Leak testing after maintenance of the fuel circuit](#).

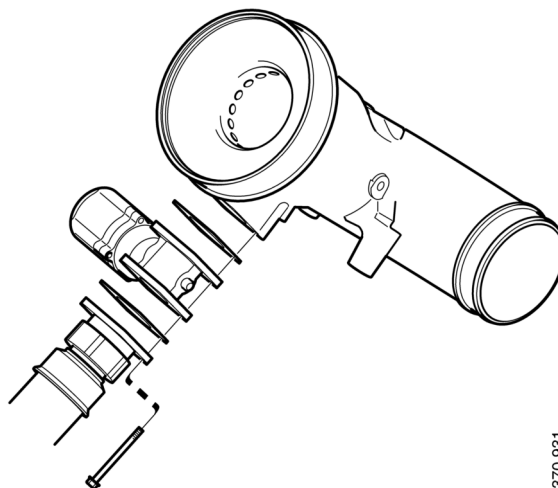
Cleaning the throttle at the gas mixer

This procedure applies only if pure biogas is used as a fuel.

IMPORTANT!

Read the safety precautions before starting work.

1. Detach the harness-to-component connector from the throttle.
2. Remove the screws and detach the fuel hose and the throttle.

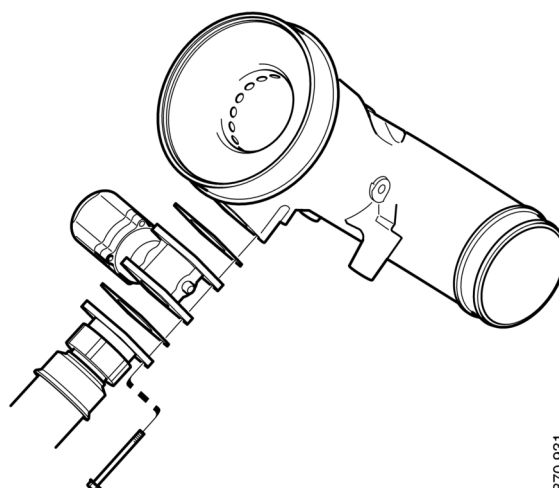


3. Protect the throttle electrical connection from moisture.
4. Clean the throttle with soap and water. Use a soft brush to remove stubborn dirt.

IMPORTANT!

Only use soap and water. Solvents and degreasing agents can damage the throttle.

5. Rinse the throttle with hot water.
6. Dry off the water.
7. Spray the outside of the throttle with water-repellent anti-corrosive oil, for example LPS1 or equivalent. Make sure that the oil reaches the holes for the throttle shaft in the throttle housing.
8. Fit the gas mixer housing.
9. Renew the gaskets.
10. Fit the throttle and gas connection.
11. Make sure the fuel system is not leaking. See the following section.



Leak testing after maintenance of the fuel circuit

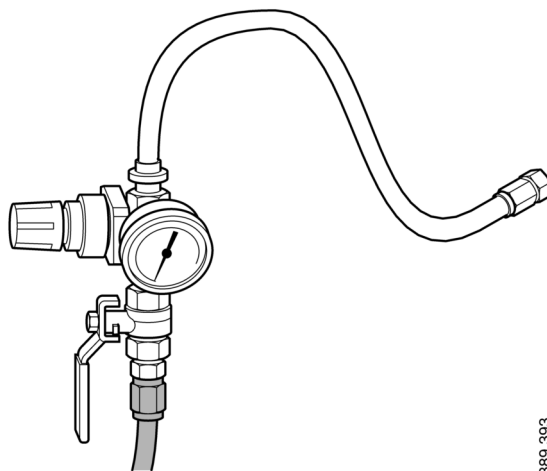
This procedure applies only if pure biogas is used as a fuel.

Special tools

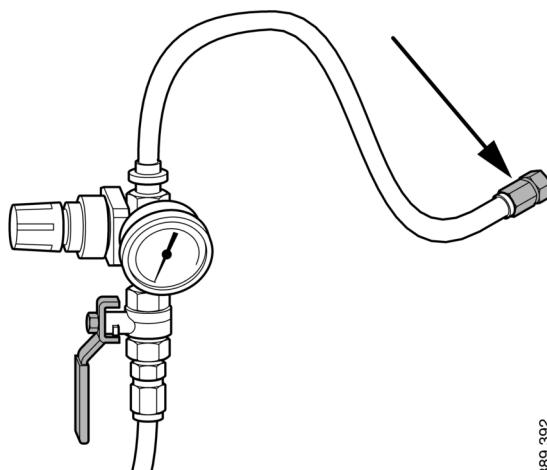
Number	Designation
2,541,520	Pressure testing kit

Calibration of the pressure testing equipment

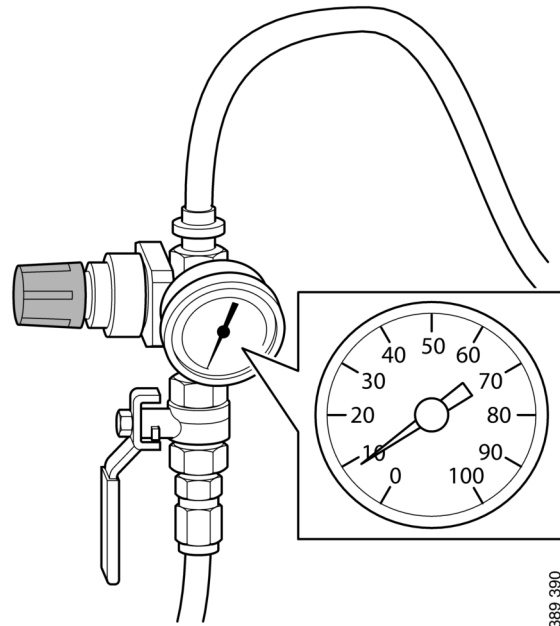
1. Connect pressure regulator 2 301 551 to the compressed air.



2. Block the connection nipple and open the pressure regulator valve.



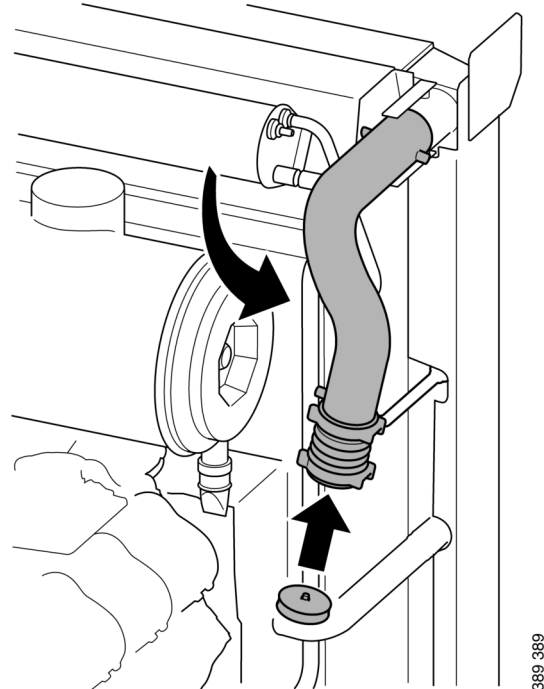
3. Adjust the pressure regulator so that the manometer shows 7 psi.



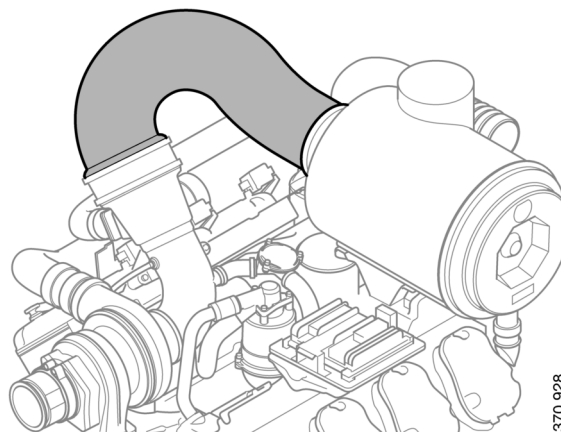
4. Lock the pressure regulator adjustment rotary control and close the valve.

Leak testing the intake system upstream of the throttle

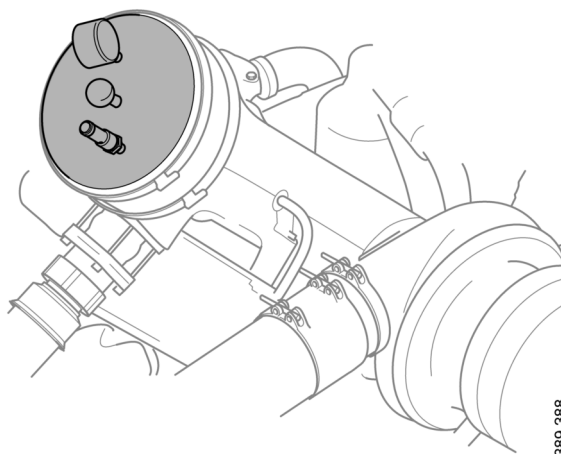
1. Undo the hose clamps.
2. Turn the charge air pipe downwards.
3. Close the nipple on pressure cover 2 655 714 and fit the cover to the hose spigot.
4. Tighten the hose clamps.



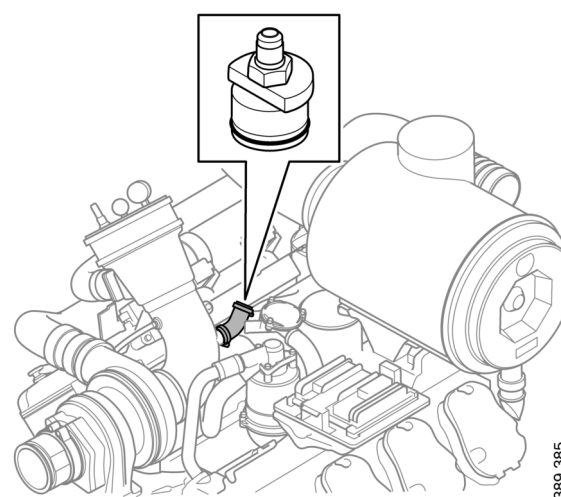
5. Remove the air pipe between the air cleaner and the gas mixer.



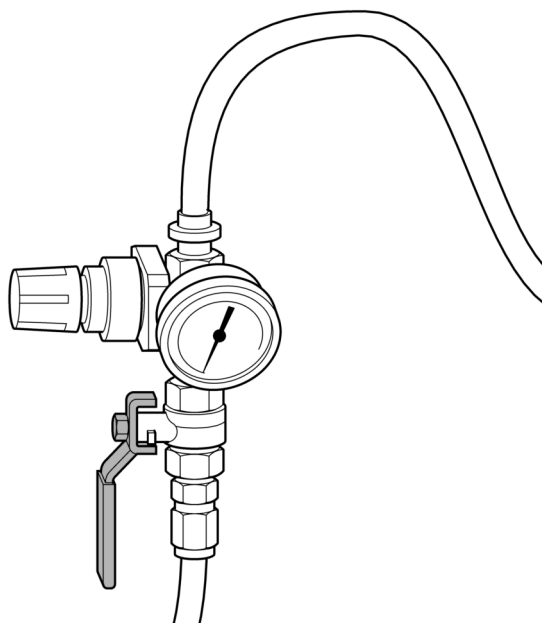
6. Fit pressure cover 2 541 521 in the hose spigot on the gas mixer.



7. Detach the crankcase ventilation connection.
8. Fit cover 2 655 695.
9. Connect pressure regulator 2 301 851 to cover 2 655 695.

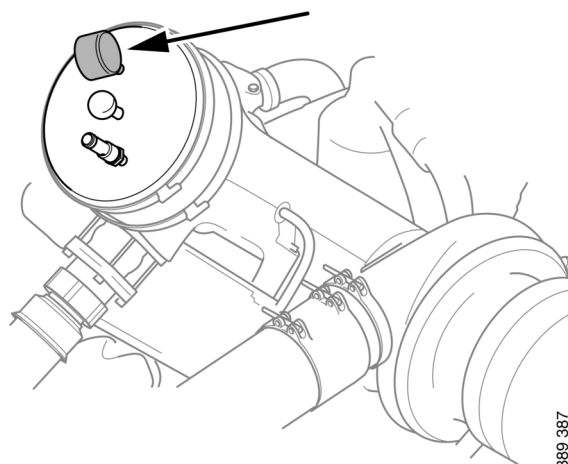


10. Open the valve on pressure regulator
2 301 851.



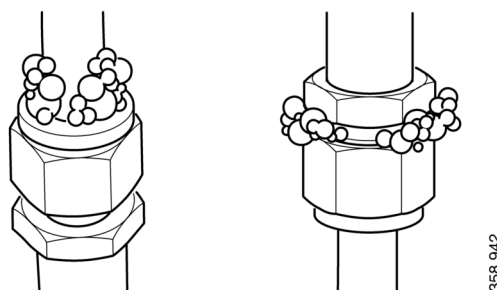
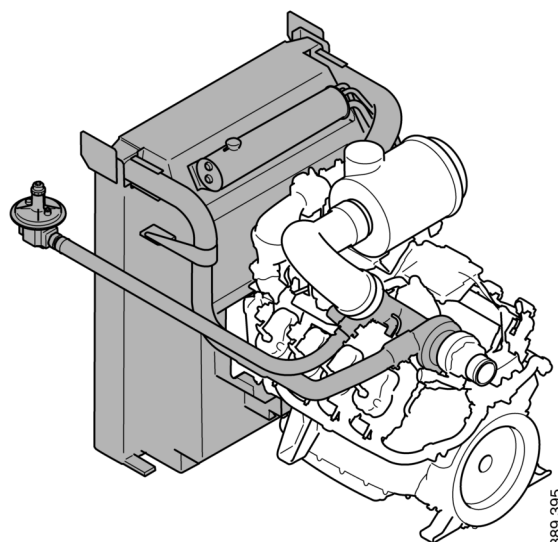
389 391

11. Monitor the pressure on pressure cover
2 541 521. The manometer should indicate a
pressure below 0.3 bar. Greater pressure may
damage the engine.



389 387

12. Use leak detection spray to locate any gas leaks. If there is a gas leak, bubbles form upon application of leak detection spray. Be careful in areas where work has been carried out or where a joint has been cut.

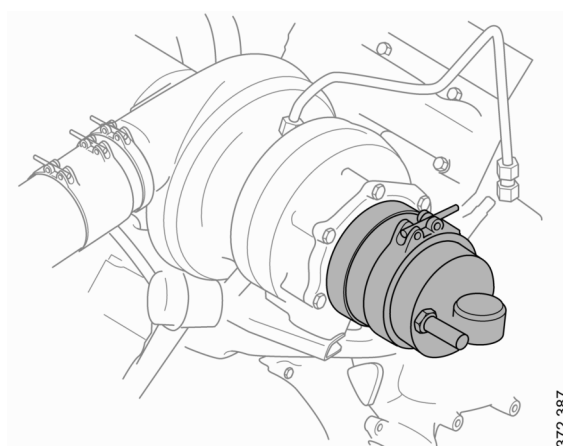


13. If there is a leak, rectify the leakage and repeat the leak tracing.

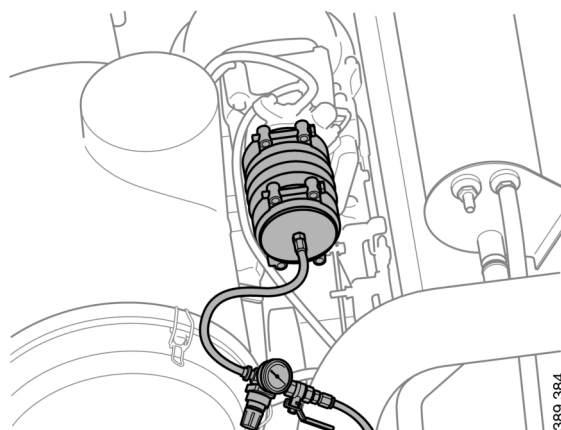
Leak testing the intake system downstream of the throttle

1. Remove the V-clamp and move the exhaust pipe to one side.
2. Remove the O-ring from pressure testing equipment 2 284 630. Fit adapter 2 541 522 and the pressure testing equipment and plug the pneumatic connection with cover 2 655 696.

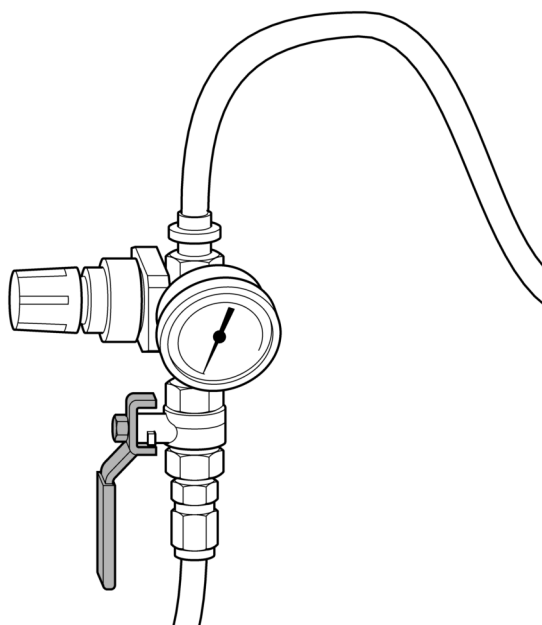
Fit the pressure testing equipment with adapter.



3. Remove the hose spigot and pressure cover 2 655 714 from the charge air pipe.
4. Open the nipple on pressure cover 2 655 714.
5. Fit adapter connection 2 655 697 to the pressure regulator and connect it to pressure cover 2 655 714.
6. Fit the hose spigot and pressure cover 2 655 714 at the throttle housing.



7. Open the valve on pressure regulator 2 301 851.

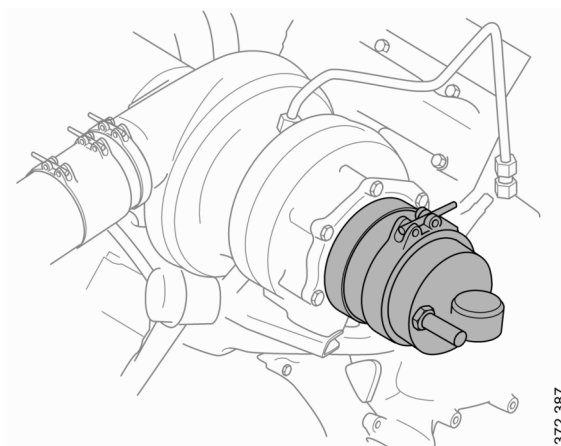


8. Monitor the pressure on pressure testing equipment 2 284 630. The manometer should indicate a pressure below 0.3 bar. Greater pressure may damage the engine.



IMPORTANT!

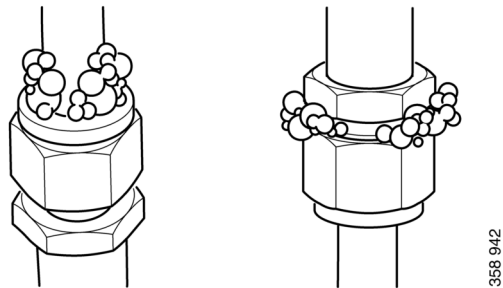
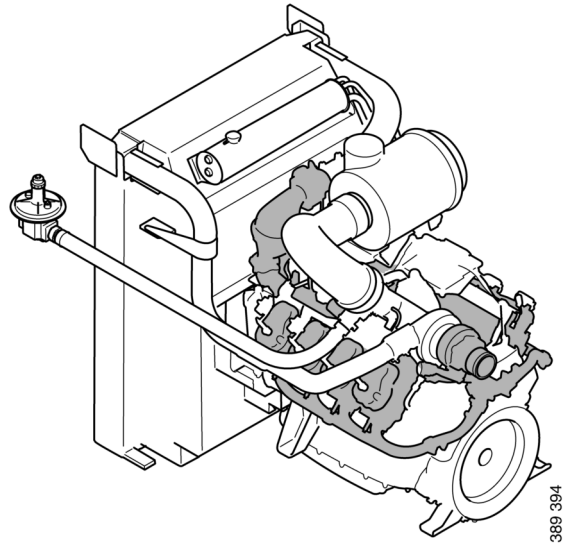
The pressure must not exceed 0.3 bar. A higher pressure can damage the turbocharger.



9. Use leak detection spray to locate any gas leaks. If there is a gas leak, bubbles form upon application of leak detection spray.

Be careful with areas where work has been carried out or where a joint has been cut.

The exhaust system up to the turbocharger outlet is pressurised, but does not need to be checked.

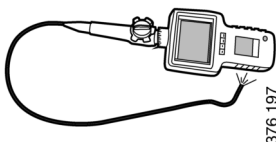


10. If there is a leak, rectify the leakage and repeat the leak tracing.

Checking deposits in the combustion chamber

The procedure only applies if pure biogas is used as a fuel, and after cleaning the flame arrestors and throttles in accordance with the 2 previous sections.

Tool

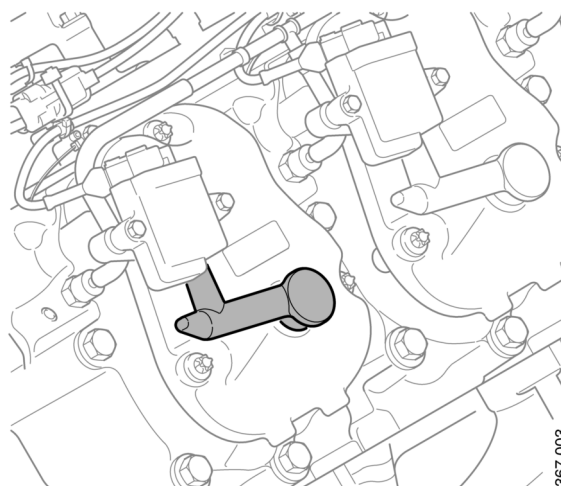
Designation	Illustration
Endoscope	



IMPORTANT!

Read the safety precautions before starting work.

1. Remove the spark plug connection and the spark plug. See the section [Renewing the spark plugs](#).



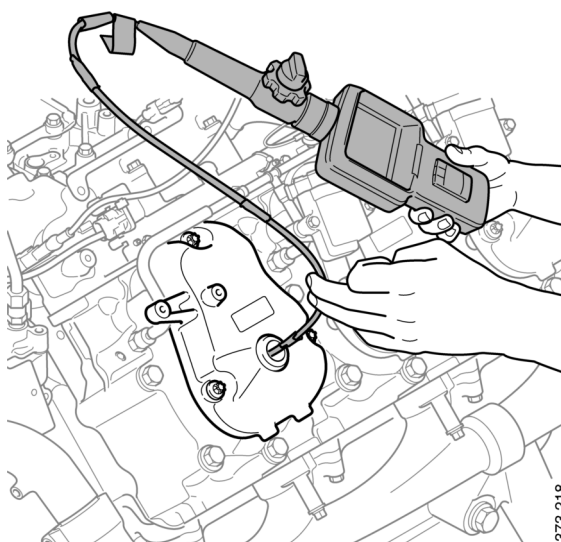
2. Check if there are any deposits in the combustion chamber using an endoscope.
3. Check the amount of deposits on the top of the piston.

The cylinder, piston and the valve head must be cleaned if

- deposits on the top of the piston are flaking,
- or if
- the deposit protrudes at least 5 mm from the valves.

The cleaning procedure is described in the Workshop Manual, which can be ordered from a Scania dealer or directly from Scania.

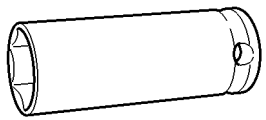
4. Repeat steps 1-3 on the other cylinders.



Electrical system

Renewing the spark plugs

Tool

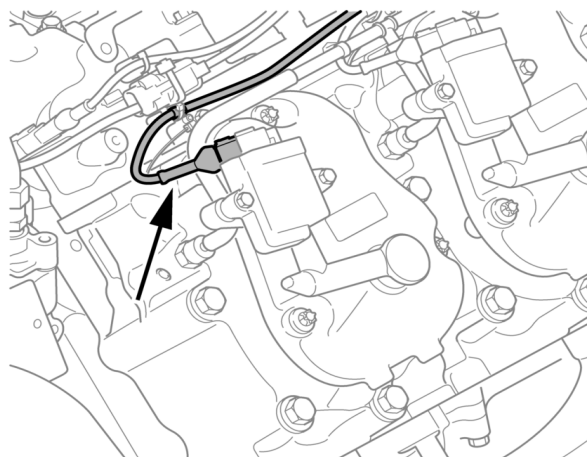
Designation	Illustration
Spark plug socket	



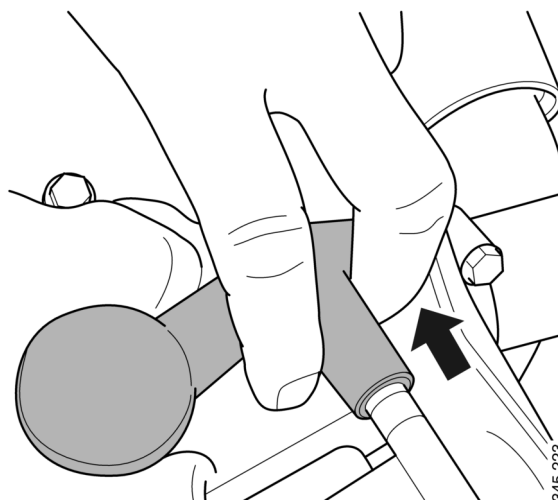
IMPORTANT!

Read the safety precautions before starting work.

1. Disconnect the ignition coil harness-to-component connector.



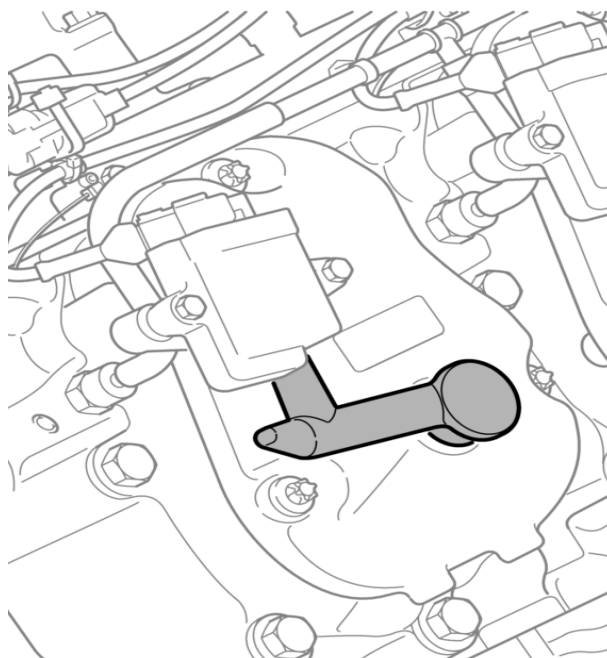
2. Twist off the spark plug connector arm laterally.



3. Remove the spark plug connector by pulling it straight upwards.

**IMPORTANT!**

Do not pull on the arm as this could damage the spark plug connector.



4. Check that the spark plug connector does not have any visible damage.
5. Unscrew the spark plug using the spark plug socket.

**IMPORTANT!**

Do not touch the spark plug insulator with your fingers. If this occurs, clean the insulator with alcohol.

6. Place the new spark plug in the spark plug socket and tighten the spark plug. Tightening torque 30 Nm (22 lb-ft).

**IMPORTANT!**

Do not lower the spark plug through the rocker cover since this could cause the gap between the spark plug electrodes to be incorrect. Always position the spark plug in the spark plug socket before fitting. The correct gap between the spark plug electrodes is 0.25 mm.

7. Fit the spark plug connector.

Other

Checking the drive belt



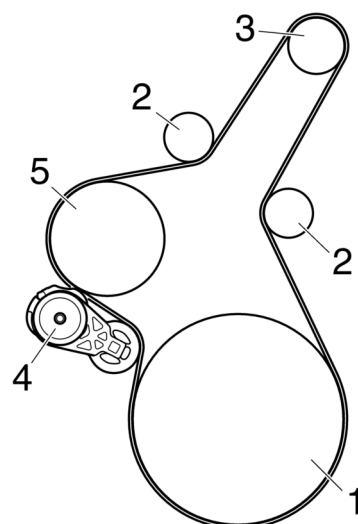
IMPORTANT!

Before starting, make a note of how the drive belt is fitted. Refit the drive belt with the same direction of rotation as it had before removal.

1. Check the drive belt thoroughly, particularly at the idler rollers.
2. Check the drive belt for cracks. Renew the drive belt if deep cracks have formed.

Note:

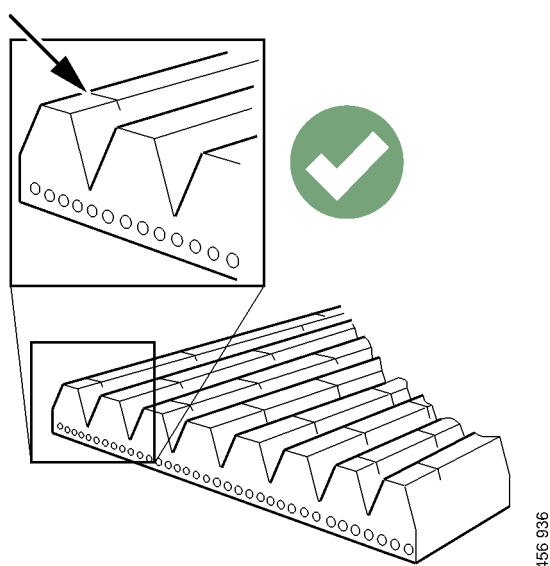
Small and shallow cracks are normal and form after only a few hours of operation. They do not mean that the drive belt needs to be renewed. If there are many deep cracks, or if parts of the drive belt have started to come off, the drive belt must then be renewed.



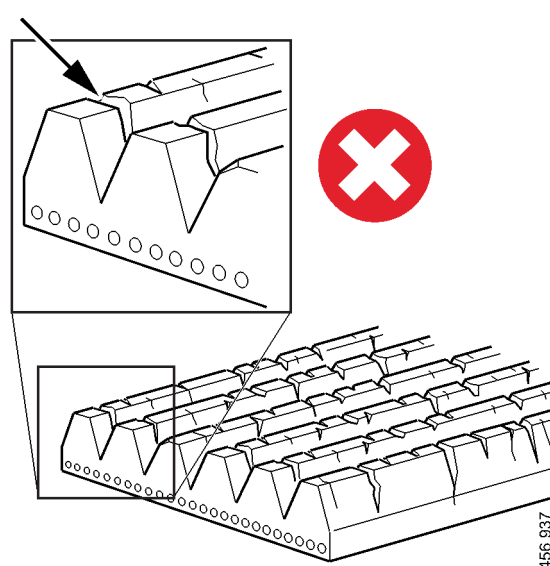
389 001

Example of a drive belt.

1. Crankshaft
2. Idler roller
3. Alternator
4. Belt tensioner
5. Coolant pump

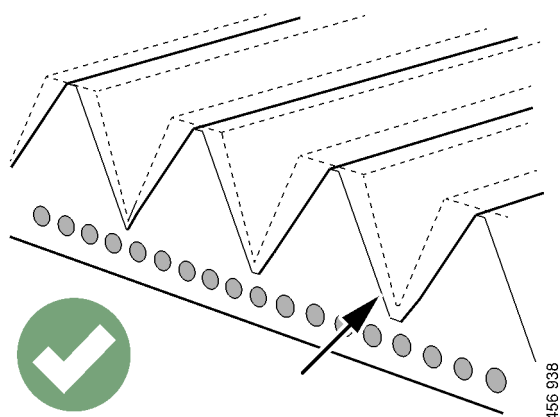


Example of a minor crack in the drive belt. The drive belt can be refitted.

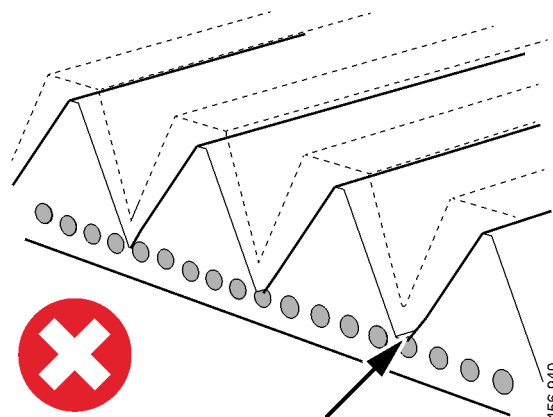


The drive belt has deep cracks and must be renewed.

3. Check drive belt wear. Renew the drive belt if it is too worn.



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 leakage



WARNING!

If there is leakage in the fuel system, contact your nearest Scania workshop immediately.



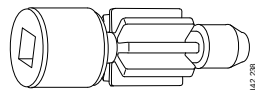
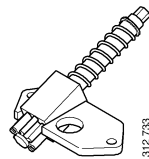
IMPORTANT!

If there is a major oil or coolant leak, contact your nearest Scania workshop.

1. Start the motor.
2. Check for oil, coolant, fuel, air or exhaust leakage.
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 complete coolant pump assembly.

Checking and adjusting the valve clearance

Special tools

Number	Designation	Illustration
99 309	Turning tool for rotating the flywheel from below.	
2 402 509	Turning tool for rotating the flywheel from above	

Other tools
Torque wrench, 0-50 Nm
Waterproof felt-tip pen
0.45 and 0.80 mm feeler gauges
Flash light
Mirror



WARNING!

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



IMPORTANT!

The engine must be cold when the work is carried out.

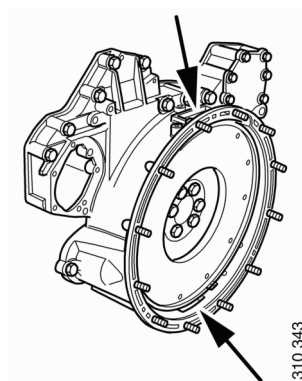
Remember to remove the turning tool from the flywheel following adjustment.

Note:

Carry out the working without pausing, so that no step is overlooked.

Carry out a check and adjustment of the valve clearances one more time after the first 500 hours of operation. After this, adjustment according to the regular interval takes place, which is every 2,000 operational hours.

The reference information UP TDC,DOWN TDC and the angle indications listed in the table below are engraved on the flywheel. Depending on the engine installation, this information is visible in one of the windows, either furthest up or furthest down on the flywheel. See illustration.



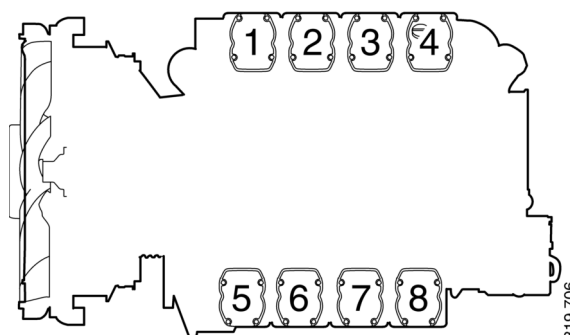
Upper and lower window to read the engraving on the flywheel.

Valve clearance, specifications	
Intake valve	0.45 mm (0.018 in)
Exhaust valve	0.80 mm (0.032 in)

Tightening torque	
Lock nut for valves	35 Nm (26 lb/ft)

Adjust the valves according to the table below. Follow the respective column depending on whether you are reading the engraving on the flywheel in the lower or the upper window. Start adjustment at the top of the table.

Reading in the lower window	Valve transition on cylinder	Adjust intake valve on cylinder	Adjust exhaust valve on cylinder	Reading in the upper window
DOWN TDC (0°)	6	7 and 8	4 and 5	UP TDC (180°)
UP TDC (180°)	7	1 and 5	2 and 6	DOWN TDC (0°)
DOWN TDC (360°)	1	2 and 4	3 and 7	UP TDC (540°)
UP TDC (540°)	4	3 and 6	1 and 8	DOWN TDC (360°)



Order of cylinders.

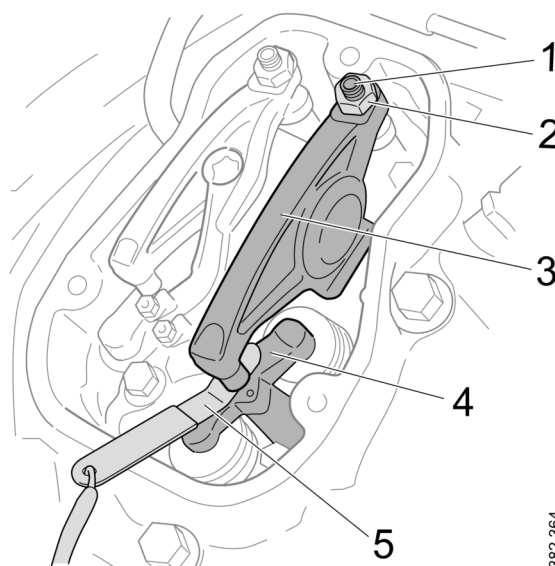
1. Clean the rocker covers and the area around them.
2. Remove the rocker covers.
3. Use the turning tool appropriate to the installation of the engine. Tool 99 309 is used to rotate the flywheel from the underside of the engine and tool 2 402 509 is used from the top side.
4. Start adjusting one cylinder according to the table. Rotate the flywheel until the correct engraving can be read on the flywheel. It may be necessary to rotate it more than 1 revolution.

Rotate the flywheel in the rotational direction of the engine, which is clockwise viewed from the front of the engine and anti-clockwise viewed from the back of the engine.

During a valve transition, the exhaust valve (the long arm) is closing at the same time as the intake valve is opening.

The UP TDC engraving on the flywheel is now visible in the window furthest up on the flywheel. The DOWN TDC engraving is visible in the lower window.

5. Read the table on the previous page to see which valve to adjust.
6. Stick the feeler gauge under the pressure pad of the rocker arm and check the valve clearance.
7. If necessary, adjust the valve clearance by
 - a) loosening the lock nut on the end of the rocker arm
 - b) adjusting the valve clearance with the adjusting screw
 - c) tighten the lock nut.
8. Mark the rocker arm with the felt-tip pen and then continue with the next cylinder according to the table.



1. *Adjusting screw*
2. *Lock nut*
3. *Rocker arm*
4. *Valve bridge*
5. *Feler gauge*

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Fuel quality requirements



IMPORTANT!

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

Methane amount and calorific value per power level

The requirements for the lowest permitted methane amount and calorific value vary depending on the engine power as shown in the table below.

The methane number is calculated according to the MWN method in EN 16726:2015. Use the calculator on the Euromot website.

The calorific value is calculated according to standard ISO 6976. Use *Natural gas calorific value calculator* available on Unitrove's website. This calculator can also be used for biogas.

Engine power 1,500/1,800 rpm	Power class	Type of fuel	Lowest methane number	Lowest calorific value (MJ/m ³) ¹
333/372 kW	PRP	Natural gas	70	23.5
372/411 kW	PRP	Natural gas	72	24.5
407/426 kW	PRP	Natural gas	75	26.5
360/360 kW	PRP	Pure biogas	70	21.5
330/350 kW	COP	Natural gas	70	23.5
320/320	COP	Pure biogas	70	21.5

1. Lower calorific value at the reference state of 15°C (59°F) and 101.325 kPa.

Other quality requirements

Requirements	Value	
	Natural gas	Biogas
Supply pressure to gas regulator ¹	20–35 mbar (0.3–0.5 psi)	20–35 mbar (0.3–0.5 psi)
Fuel temperature	10-40°C (50-104°F)	
Max. water content	A maximum of 60 per cent relative humidity at the lowest fuel temperature. There is no free water, other visible impurities or condensation.	
Max. sulphur content (H ₂ S)	40 mg/Nm ³	
Max. sulphur content (total)	150 mg/Nm ³	
Max. ammonia content	20 mg/Nm ³	
Max. content of halogen compounds	65 mg/Nm ³	
Max. hydrogen gas content	12% (v/v)	
Max. siloxane content	1 mg/Nm ³	5 mg/Nm ³
Max. particulate matter content	10 mg/Nm ³	
Max. particle size	5 µ (filtration with 99% cleaning above 5 µ is recommended)	
Max. fluctuation speed in gas pressure	5 mbar/30 s (0.07 psi/30 s)	
Max fluctuation speed in calorific value	1% Ch ₄ /30 s	0.5 % Ch ₄ /30 s

1. The values apply even at full load. Lower values may be permitted if they have first been approved by Scania. If a lower value is used, the maximum output is reduced.

Normal cubic metres (Nm³) refers to gas at the following temperature and pressure:

T = 273.15 K, p = 101.325 kPa.

Engine preservation

Note:

The engine should be stored indoors, in a temperature-controlled room with constant (or near constant) temperature, protected from dirt and dust.

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.

On delivery, the engine is protected by so-called VCI plastic. Provided that the VCI bag is intact and has not been removed, the engine can be stored for 3 years without any action required. After 3 years, the engine must be preserved again and the battery must be renewed.

The interval between each new Preparing for storage is then 24 months and the bag is renewed.

The VCI bag must be inspected at least once a year. If the plastic is missing or broken, it must be replaced with a new one immediately.

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

Preparation means that the following measures are taken:

- The engine is cleaned thoroughly.
- Run the engine for a specific period using special preservative fuel, oil and coolant.
- Otherwise prepare the engine for storage (filter renewal, lubrication, etc.).

Preservative products

Preservative engine oil

Use a normal engine oil that meets the requirements in the [Oil grade](#) section.

Preservative oil for combustion chambers

Suitable preservative oils are supplied by most oil companies. Use a preservative oil based on mineral oil and propellant which must be completely ventilated away.

The oil should have as few other additives as possible and must not contain PTFE or silicone. An example of a good product to use is CRC Motor Protect.

Preservative coolant

Use coolant containing 50% by volume of glycol. Example: BASF MPG Glyscorr P113 and Valvoline Zerex P113 FP.



WARNING!

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

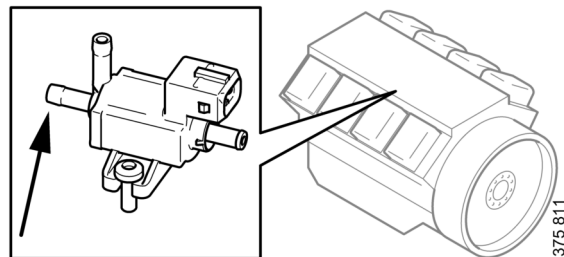
Preparations for storage



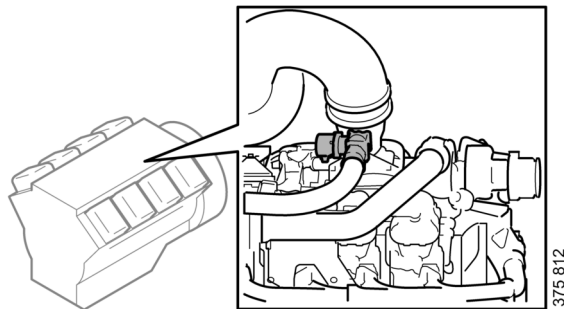
Environment

Use a suitable container. Used oil and coolant must be disposed of as specified in national and international laws and regulations.

1. Remove plugs and tape from the coolant connections, air intake and exhaust pipe.
2. Drain the oil.
3. Renew the oil filter and fuel filter in the gas supply installation.
4. Clean the centrifugal oil cleaner.
5. Fill with engine oil to the minimum level on the oil dipstick.
6. Drain and flush the cooling system of any old coolant.
7. Top up with preservative coolant.
8. Start the engine and run it at low idling for approximately 20-25 minutes if the coordinator allows it. If it is not possible to run at idling, run the engine at approx. 1,500 rpm without load.
9. Detach the hose to the solenoid valve return connection. Continuously spray preservative oil into the inlet pipe until white smoke is observed in the exhaust gases for at least 8 seconds.
10. Switch off the engine and refit the hose to the magnet valve return connection.
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 coolant in the cooling system.
12. Renew the filter elements in the air cleaner.
13. Cover the air intake and exhaust pipe.
14. Spray the alternator and starter motor with water-repellent anti-corrosive oil: CRC 226, LPS1 or the equivalent.
15. Spray the outside of smooth engine parts, first with penetrating preservative oil such as Dinitrol 25B and then with Dinitrol 112 or equivalent.



Solenoid valve return connection.



Throttle at the gas mixer.

16. Detach the fuel hose from the throttle at the gas mixer.
17. Spray the outside of the throttle with water-repellent anti-corrosive oil, for example LPS1 or equivalent. Make sure that the oil reaches the holes for the throttle shaft in the throttle housing.
18. Clearly mark the engine with the storage preparation date, and state that the engine must not be started or cranked.

Batteries



WARNING!

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

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.

Storage

After the preparation, the engine should be stored indoors in a dry location at room temperature. The engine must be packed in packaging made of VCI plastic to protect against dust, dirt and moisture.

When the engine is to be taken into operation again

1. Remove plugs and tape from the coolant connections, air intake and exhaust pipe.
2. Fill the cooling system with coolant.
3. Drain the preservative oil.
4. Renew the oil filter and fuel filter.
5. Fill with new engine oil.
6. Remove the rocker covers and lubricate the valve mechanisms with pushrods and the valve tappets, as well as the injector mechanism, using a liberal amount of oil. Refit the rocker covers.
7. Carry out a visual inspection of the engine and the engine compartment.
8. Wash off any preservative oil on the outside using white spirit.
9. Renew the spark plugs.

Technical data

General data

Number of cylinders and configuration	90° V8
Working principle	4-stroke engine
Cylinder diameter (mm/in)	130/5.118
Piston stroke (mm/in)	154/6.06
Displacement (l/in ³)	16.4/1,001
Firing order	1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Compression ratio	12.2:1
Engine direction of rotation viewed from rear	Anticlockwise
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)	0.80/0.031
Number of teeth on the flywheel	158
Low idling (rpm)	1,000
Operating speed (rpm)	1,500/1,800
Fuel	Natural gas or pure biogas
Approximate weight, without coolant and oil (kg/lb)	1,352/2,981

Lubrication system

Oil volume (l/in ³)	40–48/2.4–2.9
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/psi)	
Normal with the engine at operating temperature, operating speed	3-6/44-87
Minimum permitted at idling speed	0.65/9
Crankcase pressure with closed crankcase ventilation (mbar)	-5.4 to 2.0

Fuel system

Type	Zero pressure gas supply system with venturi function
Engine management system	OCE1

Cooling system

Coolant volume including 1.5 m ² radiator (dm ³ /US gallons)	68/18
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 filter (mbar/psi)	30/0.4
Permissible pressure drop in the intake system with blocked (dirty) filter (mbar/psi)	65/0.9

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

Tightening torque for screw joints

Screws and nuts

Hexagon screws, hexagon socket screws, Torx screws, hexagon nuts

Metric thread. Strength class 8.8/8.

Thread	Tightening torque	
	Nm	Lb-ft
M4	2.9	21
M5	6	4
M6	9.5	7
M8	24	18
M10	47	35
M12	84	62
M14	135	100
M16	210	155
M18	290	214
M20	420	310
M22	580	428
M24	730	538

Flange screws with hexagonal head and hexagonal flange nuts

Metric thread. Strength class 8.8/8.

Thread	Tightening torque	
	Nm	Lb-ft
M5	6.7	5
M6	10.2	8
M8	26	19
M10	50	37
M12	92	38
M14	149	110
M16	184	136

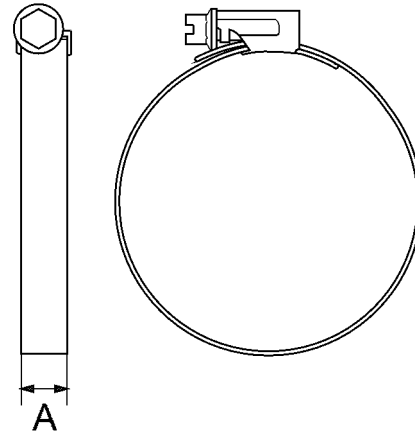
Hose clamps

Specifications in the tables show tightening torque when tightening by hand.

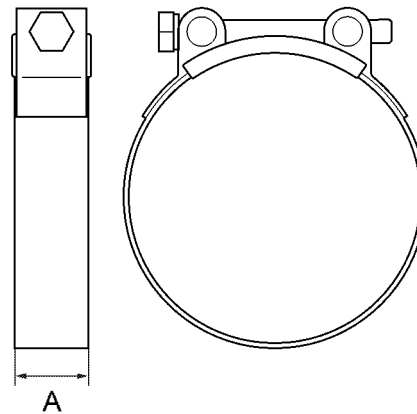
Note:

The maximum tightening torque for a new unfitted hose clamp is 1 Nm (0.7 lb-ft).

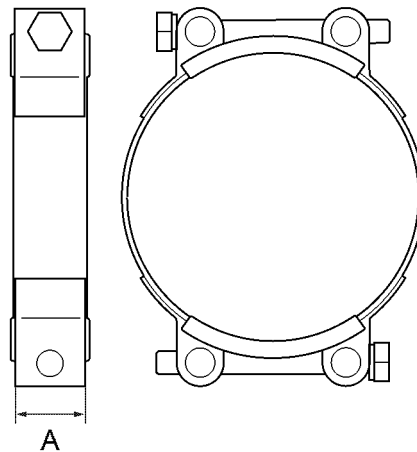
A = width (mm)	Tightening torque	
	Nm	Lb-ft
7.5-9	1.5	1
12	5	4
20	10	7
25	20	15



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Scania Assistance

Wherever you are, you can always get assistance from Scania's service organisation, Scania Assistance, 24 hours a day, every day of the year.

Always call the contact for your country.

Country	Tel.	Country	Tel.
Austria	+43 1 256 44 11	Latvia	+371 29 44 24 24
America	+1 (0) 800 272 2642	Lithuania	+46 8 52 24 24 24
America	1 800 272 2642	Luxembourg	+32 2 264 00 00
Argentina	800,999,722,642	Malaysia	1800 08 8500
Australia	611300722642	Malaysia	6035590907
Belgium	+32 2 264 00 00	Mexico	543327451092
Botswana	+267 72 102 591	Morocco	3222640000
Brazil	8000194224	Namibia	264634461352
Bulgaria	+359 88 666 0001	Netherlands	+31 76 52 54 111
Chile	188,800,722,642	Norway	+47 223 217 00
Colombia	1800184548	Peru	0800-51-727
Czech Republic	+420 225 020 225	Peru	(01)512-1877
Denmark	+45 333 270 44	Poland	+48 22 331 22 33
Estonia	Tallinn: +372 5153 388	Portugal	+34 91 678 9247
Estonia	Tartu: +372 5126 333	Romania	+40 723 27 27 26
Estonia	Pämu: +372 5071 477	Russia	+7(495) 925 77 75
Estonia	Rakvere: +372 5074 655	Singapore	6565917180
Finland	+358 10 555 24	Slovakia	+421,903,722,048
France	+33 2 414 132 32	South Africa	0 800 005 798
Germany	+49 261 887 8888	South Africa	+27 11 226 5005
Great Britain	0 800 800 660	Spain	+34 91 678 80 58
Great Britain	441274301260	Sweden	+46 42 100 100
Hungary	+36,209,727,197	Switzerland	+41 800 55 24 00
Ireland	+353 71 963 4000	Thailand	66819397525
Italy	+39046 1996222	Thailand	+1800 019 88
Latvia	+46 8 52 24 24 24	Uruguay	0 800 835 1

Other countries: +46 8 52 24 24 24

Calls will be recorded for training purposes.