



SCANIA
Scania Engines

Important information

Serious risk of injury

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

For this reason, always secure the starting device or disconnect a battery cable before working on the engine. This is especially important if the engine has a remote starter or automatic starting.



WARNING!

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

Operator's manual

DI13

PDE

Marine engine

en-GB 2 291 901



Issue 1.0

Start-up Report – Warranty

When the start-up report has been filled in and sent to Scania, you have a 1-year warranty from the date of entry into service. Fill in the particulars below as well. This can make things easier if you need to contact a workshop for example.

Engine serial number

Date of entry into service

User's name and address

Signature

Engine type

Variant

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

Introduction	3	Diesel	68
Power classes	4	Composition of the fuel	68
Environment and safety	5	Sulphur content of fuel	68
Environmental responsibility	5	Using DMX and DMA fuels in marine engines.	68
Safety	5	Temperature dependency of the fuel	69
Warnings and advisories	7	Preparing the engine for storage	70
Certification	16	Handling the engine	70
Engine data plate	17	Preservative coolant	70
Component identification	18	Preservative fuel	71
Starting and running	19	Preservative oil	71
Checks before running	19	Preparations for storage	72
Starting the engine	20	Technical data	75
Running	21	General data	75
Engine shutdown	24	Lubrication system	75
Checks after running	25	Injection system	77
Inspection	26	Cooling system	77
Engines with few hours of operation	27	Intake system	77
Inspection interval	28	Electrical system	77
Lubrication system	29	Scania Assistance	78
Oil grade	29		
Oil analysis	30		
Checking oil level	30		
Changing the oil	31		
Renewing the oil filter	32		
Labels for top-up engine oil grade	33		
Parts	33		
Cleaning the centrifugal oil cleaner	34		
Operational testing	39		
Cooling system	40		
Coolant	40		
Checking coolant level	44		
Checking the sacrificial anodes	45		
Checking the sea water pump impeller	45		
Checking antifreeze and corrosion inhibitor	46		
Antifreeze and corrosion inhibitor	47		
Changing coolant	48		
Cleaning the cooling system	50		
Air cleaner	56		
Reading the vacuum indicator	56		
Renewing the filter element	56		
Filter with a non-renewable element	57		
Renewing the safety cartridge	57		
Fuel system	58		
Checking fuel level	58		
Renewing the fuel filter	58		
Renewing and bleeding double, commutative fuel filters	59		
Renewing the water separating fuel filter	60		
Bleeding the fuel system	61		
Miscellaneous	62		
Checking the drive belt	62		
Checking for leaks	64		
Checking and adjusting the valve clearance	64		

Introduction

This Operator's Manual describes the operation and inspection of Scania marine engines.

The engines are direct-injection, liquid-cooled, four-stroke, turbocharged diesel engines.

The engines are available with different output and speed settings. The normal output setting of the engine (performance code) is indicated on the engine data plate.

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 inspection 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.

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

Note:

Always use Scania spare parts for inspection and repair.

Power classes

Scania supplies engines in 4 different power classes:

ICFN – continuous operation: Intended for unlimited number of operational hours per year at a total load factor of 100%.

IFN – periodic operation: Intended for periodic operation, where full power is available 1 h/3 h. The accumulated load factor must not exceed 80% of the calculated load. Unlimited number of hours per year.

Patrol craft – long: Intended for periodic operation, where full power is available 1 h/6 h. In between periods of operation at full load, the engine speed must be reduced by at least 10% of the maximum engine speed attained. The maximum accumulated operating time must be 2,000 hours per year.

Patrol craft – short: Intended for periodic operation where the calculated power is available 1h/12h. In between periods of operation at full load, the engine speed must be reduced by at least 10% of the maximum engine speed attained. The maximum accumulated operating time must be 1,200 hours per year.

The engine serial numbers and power classes for the engines that are used in this installation should be listed below:

Engine serial number: _____

Engine type: _____

Engine power: _____ kW at _____ rpm

Indicate below the type of operation, and enter it on page 1.

☐ **ICFN – continuous operation**

☐ **IFN – periodic operation**

☐ **Patrol craft – long**

☐ **Patrol craft – short**

Environment and safety

Environmental responsibility

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

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

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

Safety

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

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

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

Different types of advisory

Warning!

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



WARNING!

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

Important!

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



IMPORTANT!

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

Note:

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

Note:

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

Environment

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



Environment

Use a container to avoid spillage.

Warnings and advisories

Smoking



WARNING!

Smoking is prohibited

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

Safety precautions for running the engine

Daily inspection

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

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

Fuel

Use only fuel recommended in the workshop manual.



WARNING!

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

Refuelling

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



WARNING!

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

Hazardous gases



WARNING!

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

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

Starter lock



IMPORTANT!

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

Starter gas



WARNING!

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

Running



WARNING!

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

Approaching a running engine always poses a safety risk. Parts of the body, clothes or dropped tools can get caught in rotating parts such as the fan and cause injury. For personal safety all rotating parts and hot surfaces must be fitted with guards.

Safety precautions for handling materials

Fuel and lubricating oil



WARNING!

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

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

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

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 relevant packaging.

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



Environment

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

Safety precautions for inspection and repair

Switch off the engine

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

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

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



WARNING!

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

Hot surfaces and fluids



WARNING!

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

Lift the engine out

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

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



WARNING!

Never work underneath a suspended engine!

Batteries



WARNING!

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

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



Environment

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

Electrical system

The engine must be switched off and the power disconnected using the master switch or battery master switch before working on the electrical system. External power supplies to extra equipment on the engine must also be disconnected.



IMPORTANT!

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

Electric welding



IMPORTANT!

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

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

When welding is finished:

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

Lubrication system



WARNING!

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

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

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



Environment

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

Cooling system



WARNING!

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

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



Environment

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

Fuel system



WARNING!

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

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

Before starting

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



WARNING!

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

Certification

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

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

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

- Inspection is to be carried out in accordance with the instructions in this Operator's Manual.
- The inspection and repair 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 inspection of the engine shall apply. The safety precautions on the following pages must be observed.



IMPORTANT!

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

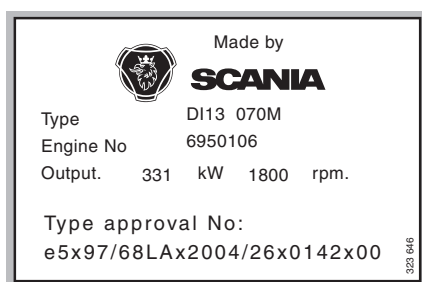
Engine data plate

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

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

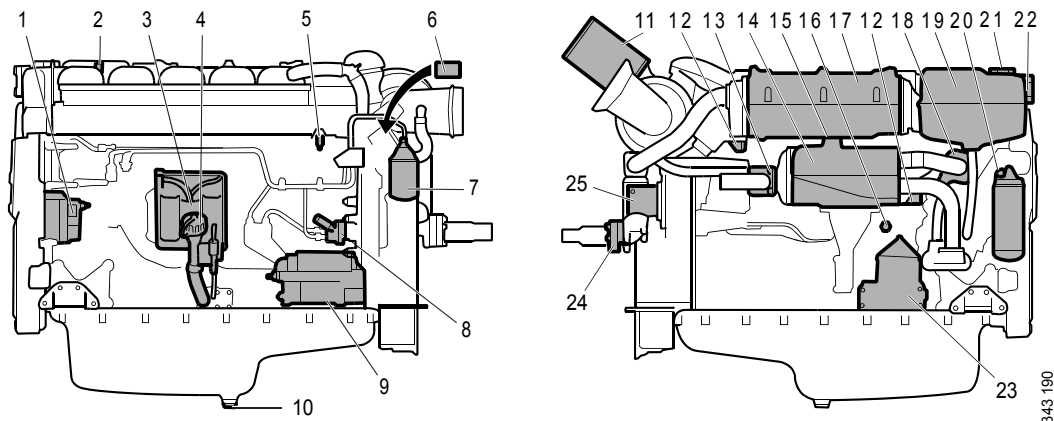
Example: DI13 070M

- DI Supercharged diesel engine with water-cooled charge air cooler.
- 13 Displacement in whole dm³.
- 070 Performance and certification code. The code indicates, together with the application code, the normal gross engine output.
- M Code for application. M means for marine use.



Example of an engine data plate

Component identification



The illustration shows a normal version of a DI13 engine with heat exchanger. The engine ordered may have different equipment

- | | |
|-------------------------------|--|
| 1. Alternator | 14. Heat exchanger |
| 2. Oil filler cap | 15. Holes for draining condensation in charge air cooler |
| 3. Engine control unit | 16. Coolant drain tap |
| 4. Oil dipstick | 17. Charge air cooler |
| 5. Fuel manifold bleed nipple | 18. Thermostat |
| 6. Engine data plate | 19. Expansion tank |
| 7. Fuel filter | 20. Oil filter |
| 8. Fuel pump with hand pump | 21. Filling coolant |
| 9. Starter motor | 22. Level glass for checking coolant level |
| 10. Oil plug | 23. Centrifugal oil cleaner |
| 11. Air filter | 24. Sea water intake |
| 12. Sacrificial anodes (2) | 25. Sea water pump |
| 13. Sea water outlet | |

Starting and running

Note:

When the engine is started for the first time, carry out the inspection points listed under First start-up in the inspection schedule. See the Inspection section.

Always check the following before running:

- oil level
- coolant
- fuel level
- electrolyte level in batteries
- state of charge of the batteries
- condition of the drive belt.

Checks before running

Carry out a daily inspection as described in the inspection schedule prior to operation. See the Inspection section.



WARNING!

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

Starting the engine

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

- Open the fuel cock if fitted.
- Disengage the engine.
- If the engine has a battery master switch:
Switch on the power by means of the battery master switch.
- Start the engine.

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



WARNING!

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

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



IMPORTANT!

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

Starting at low temperatures

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

Scania recommends that an engine heater should be used if the engine will be used at temperatures below -10°C.

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

Avoid running it longer than necessary at idling speed.

Running

Check instruments and warning lamps at regular intervals.

Engine speed range

600-750 rpm	Low idling. Engine idling is controlled by the engine management system.
Low idling up to 2,300 rpm	The engine operating speed range, depending on power class.
2,300-2,600 rpm	Unsuitable operating speed, but a slightly higher engine speed than the normal maximum operating speed may occur when load is low or negative.
2,600-3,000 rpm	Prohibited engine speed.

Limp home mode

If there is a fault in the normal throttle opening or if CAN communication is interrupted, the following emergency operation option is provided:

A CAN fault or throttle opening fault in an all-speed engine (both signal and idling switch):

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

Throttle opening fault, but the idling switch is working:

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

CAN fault:

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

Coolant temperature

Normal coolant temperature during operation is 90-95°C/194-203°F for engines with a heat exchanger and 83-88°C/181-190°F for engines with keel cooling.

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

The high coolant temperature alarm has the following functions:

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

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



IMPORTANT!

An excessively high coolant temperature can damage the engine.

Oil pressure

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

The engine management system has the following alarm levels:

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

The incorrect oil pressure alarm has the following functions:

- Alarm only.
- Alarm and torque reduction by 30%.
- Alarm and engine shutdown.
- Alarm and engine shutdown override control.

Note:

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

Charging indicator lamp

If the lamp comes on during operation:

- Check and adjust the alternator drive belts as described under the corresponding inspection point. See the Inspection section.

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

Belt transmission

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

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

Engine shutdown

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

Note:

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

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



IMPORTANT!

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

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

Checks after running



WARNING!

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

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

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



IMPORTANT!

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

Inspection

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

- Lubrication system
- Cooling system
- Air cleaner
- Miscellaneous



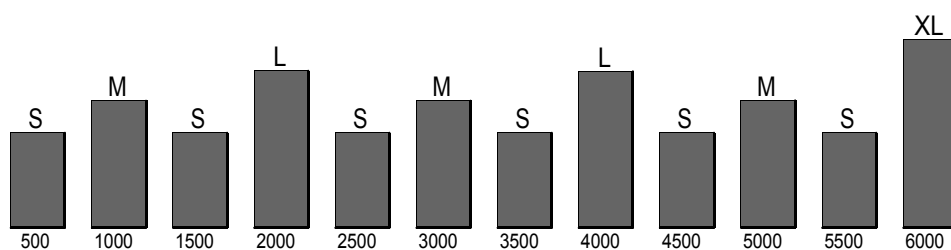
WARNING!

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

The inspection programme includes the following inspections:

- S inspection: Minimum basic inspection.
- M inspection: More extensive inspection.
- L inspection: Includes nearly all inspection points.
- XL inspection: Includes all inspection points.

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



313 153

Engines with few hours of operation



IMPORTANT!

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

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

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

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

Inspection interval

	Daily	First time at		Interval (hours)				At least	
		first start	500	500	1,000	2,000	6,000	annually	every 5 years
				S	M	L	XL		
Lubrication system	X	X							
Checking oil level									
Changing the oil				X ¹	X ¹	X ¹	X ¹	X	
Cleaning the centrifugal oil cleaner				X ¹	X ¹	X ¹	X ¹	X	
Renewing the oil filter				X ¹	X ¹	X ¹	X ¹	X	
Cooling system	X								
Checking coolant level									
Checking sacrificial anodes				X	X	X	X	X	
Checking the sea water pump impeller				X	X	X	X	X	
Checking coolant antifreeze or corrosion protection		X				X	X	X	
Cleaning the cooling system and changing coolant							X		X
Air cleaner	X								
Reading the vacuum indicator									
Renewing the filter element						X ¹	X		X
Renewing the safety cartridge						X	X		X
Fuel system	X	X							
Checking the fuel level									
Renewing the fuel filter					X ¹	X ¹	X ¹		X
Miscellaneous	X	X			X	X	X	X	
Checking the drive belt									
Checking for leaks						X	X		
Checking and adjusting valve clearances and injectors			X			X	X		

¹ More often if required.

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 quality engine oils available on the market.

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

The engine oil must fulfil the following quality requirements:

- ACEA E5/API CI-4
- ACEA E7/API CI-4+
- For engines not run on low-sulphur fuel, the TBN (Total Base Number) should be at least 12 (ASTM 2 896).
- Oils with a low ash content (ACEA E9/API CJ4) are not recommended.

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

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

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

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

Oil analysis

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

Oil companies can offer analysis of the engine oil.

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

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

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

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

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

Checking oil level

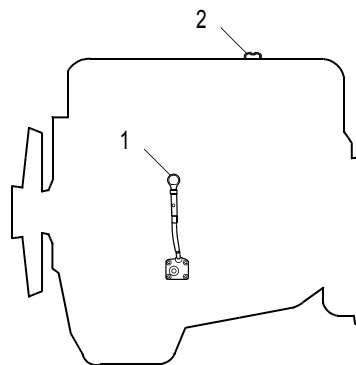
Checking the oil level with the engine switched off

Note:

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

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

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



312 506

Changing the oil

Note:

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



WARNING!

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

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

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



Environment

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

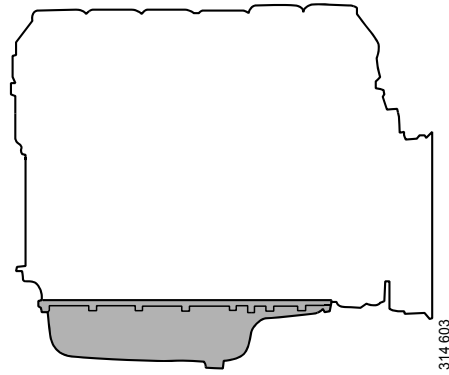
Note:

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

1. Unscrew the oil plug and drain the oil when the engine is hot.

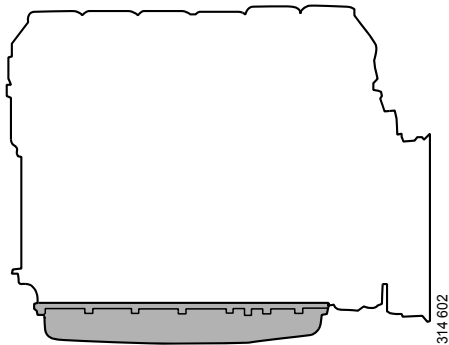
In certain engines the oil is pumped out by means of a bilge pump.

2. Clean the magnet on the oil plug.
3. Refit the oil plug.
4. Top up with oil.
5. Check the level on the oil dipstick.



Min. 40 litres (10.5 US gallons)

Max. 48 litres (12.6 US gallons)



Max. 34 litres (9 US gallons)

Min. 28 litres (7.4 US gallons)

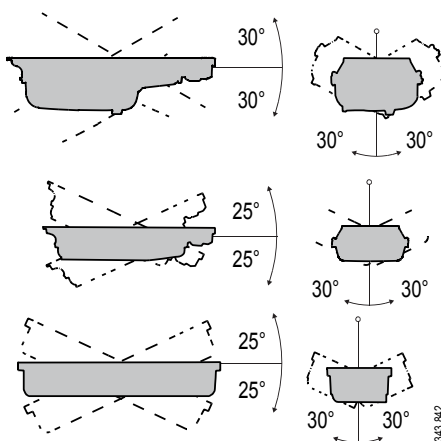


Max. 30 litres (7.9 US gallons)

Min. 25 litres (6.6 US gallons)

Maximum angles of inclination during operation

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



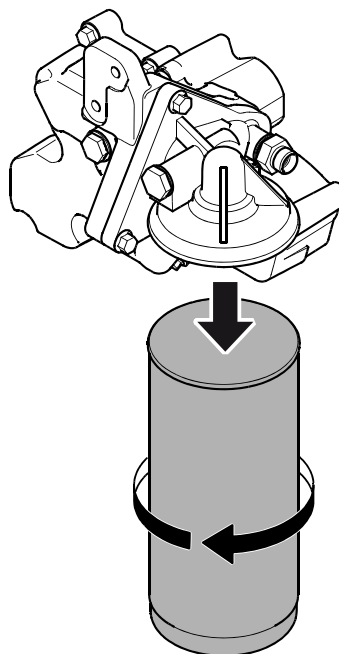
Renewing the oil filter



IMPORTANT!

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

1. Remove the old filter.
2. Oil the rubber gasket on the new filter.
3. Tighten the filter by hand. Never use tools, the filter could sustain damage, obstructing circulation.
4. Start the engine and check for leaks.



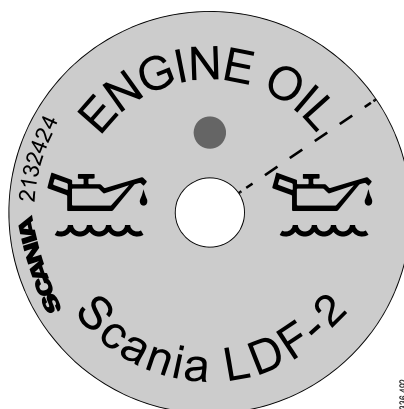
325 164

Labels for top-up engine oil grade

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

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

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



The illustration shows the label for oil grade Scania LDF-2.

Parts

Oil grade	Colour	Part No.
Scania LDF-2	Blue	2 132 424
Scania LDF-3	Red	2 132 426
Scania LDF	Grey	2 269 345
ACEA E7	White	2 132 425

Cleaning the centrifugal oil cleaner

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

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



WARNING!

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

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

Note:

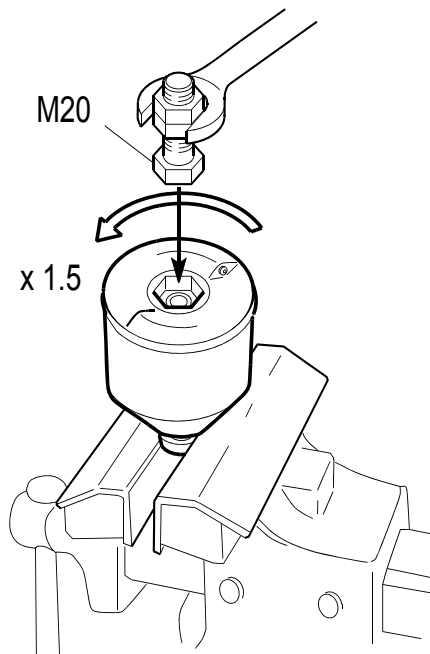
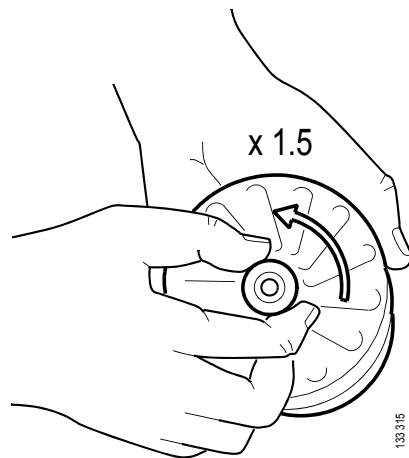
Take care not to damage the rotor shaft.

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

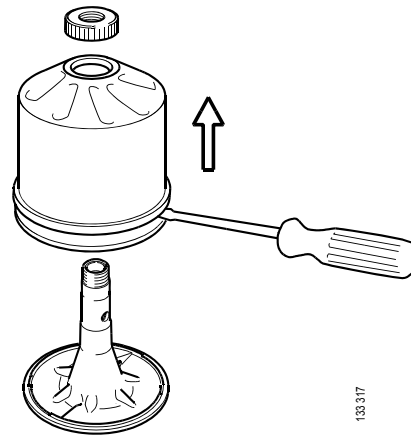


IMPORTANT!

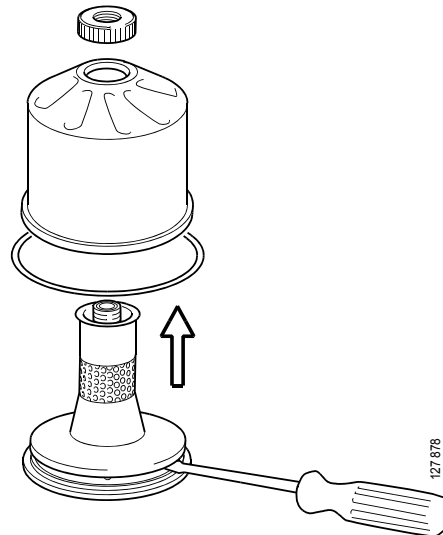
The rotor must not be put in a vice. Never strike the rotor cover. This may cause damage resulting in imbalance.



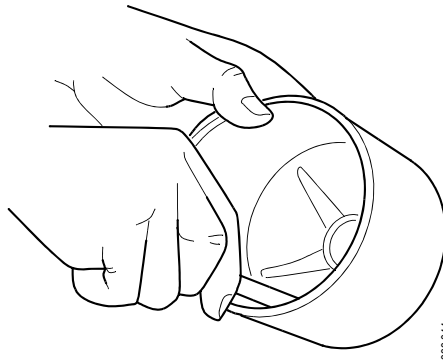
5. Remove the rotor cover by holding the rotor in both hands and tapping the rotor nut against the table. Never strike the rotor directly as this may damage its bearings.



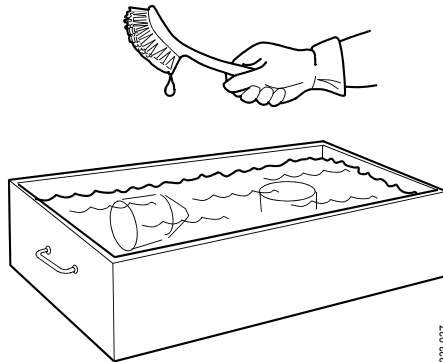
6. Remove the strainer from the rotor cover. If the strainer is stuck, insert a screwdriver between the rotor cover and strainer and carefully prise them apart.



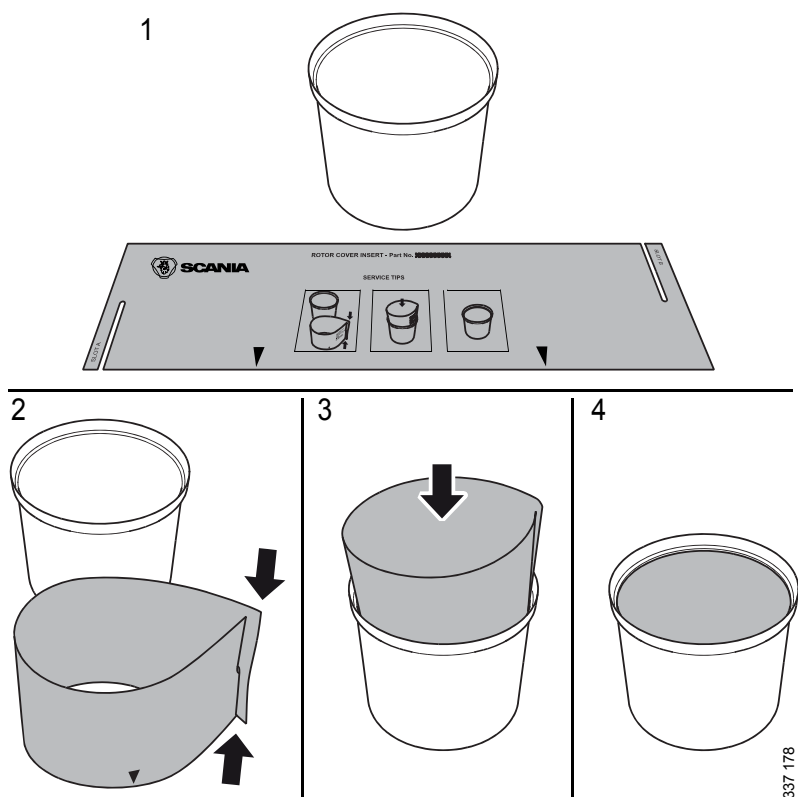
7. Remove the paper insert and scrape away any remaining dirt deposits inside the rotor cover. If the deposits are thicker than 28 mm, the centrifugal oil cleaner must be cleaned more often.



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



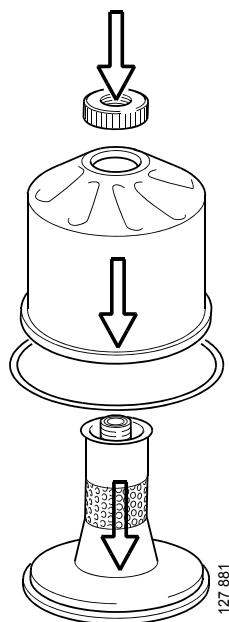
11. Fit a new paper insert on the inside of the rotor cover. Fit the strainer onto the rotor.



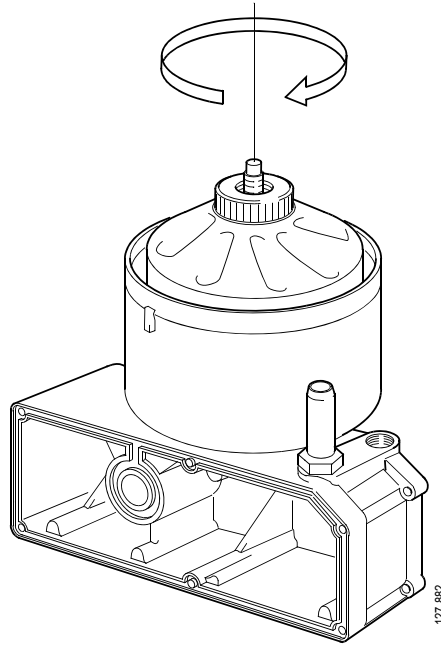
12. Fit the strainer onto the rotor.
 13. Fit a new O-ring by sliding it over the strainer.
 14. Refit the rotor cover. Make sure that the O-ring is seated correctly on the inside.
 15. Screw the rotor nut back on by hand.
 16. Check that the shaft is not loose. Secure with thread-locking fluid 561 200 if it is loose. First clean thoroughly using a suitable solvent. Tighten the rotor shaft using socket wrench 99 520. Tightening torque 27 Nm.

Note:

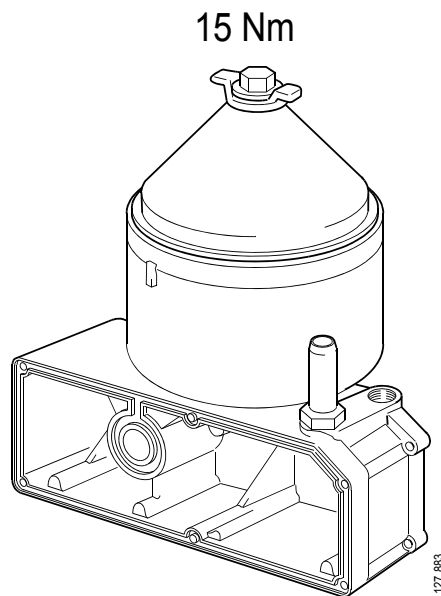
Take care not to damage the rotor shaft.



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



18. Renew the O-ring on the cover of the oil cleaner housing and fit the cover. Tighten the lock nut to 15 Nm.

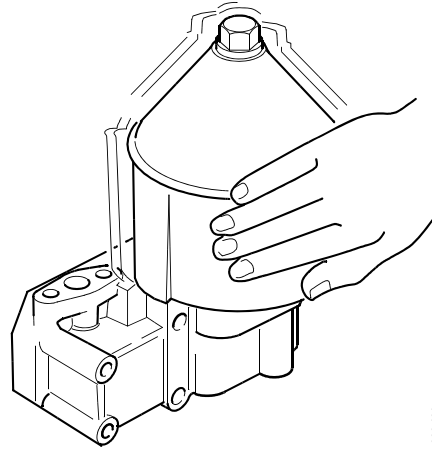


Operational testing

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

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

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



333 009

Cooling system

Coolant



WARNING!

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

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

- Corrosion inhibitor
- Antifreeze
- Increases the boiling point

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

Note:

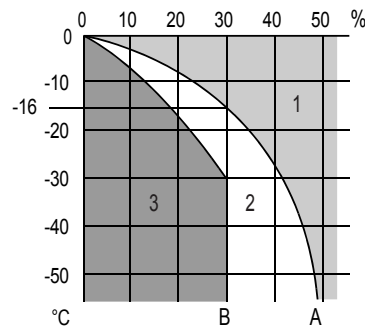
The coolant should be changed when the cooling system is cleaned: every 6,000 hours or at least every 5 years. Refer to Changing coolant.

Coolant resistance to cold

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

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

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



Curve A: Ice formation starts (ice slush)

Curve B: Damage by freezing occurs

Area 1: Safe area

Area 2: Malfunctions may occur (ice slush)

Area 3: Risk of damage by freezing

Antifreeze and corrosion inhibitor concentration table

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

Example:

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

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

Antifreeze and corrosion inhibitor concentration table

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

Example:

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

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

Checking coolant level

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



WARNING!

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

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

1. Check the coolant level through the sight glass.
2. Top up with coolant as necessary.



IMPORTANT!

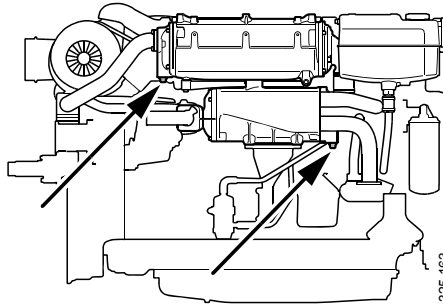
Do not top up large quantities of coolant through the expansion tank. Top up in accordance with the instructions in the section headed Changing coolant instead.

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

Only pour pre-mixed coolant into the cooling system.

Checking the sacrificial anodes

- Empty the sea water circuit and check the sacrificial anodes.
- Scrape off all loose material from the anode.
- Renew if less than half the anode is left. A new anode is 60 mm long with a diameter of 17 mm.
- If the sacrificial anodes are very corroded, the inspection interval must be reduced

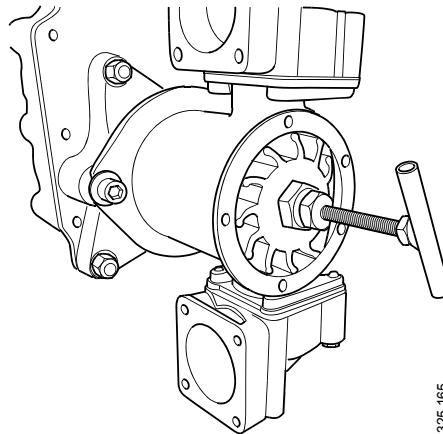


Checking the sea water pump impeller

- Close the bottom valve if the sea water pump is below water level.
- Drain the sea water circuit.
- Take off the sea water pump cap.
- Check that the vanes of the impeller are not heavily splintered or damaged.

Note:

If the impeller must be renewed frequently, the cleaning of the sea water must be improved.



Renewing the impeller

- Pull out the impeller using puller 98 482.
- Fit a new impeller and cap. Check that the cap seal is not hard or damaged.

Note:

There should be a spare impeller on board.

The impeller can be deformed during extended periods of inactivity. Renew the impeller before starting or remove the impeller before longer periods of stoppage. See also "Preparations for storage".

Checking antifreeze and corrosion inhibitor

Note:

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

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

Part No.	Designation
588 805	Refractometer
588 226	Refractometer

The following rules apply to ethylene glycol-based coolant:

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

Antifreeze and corrosion inhibitor

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

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

Scania concentrate

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

Scania Ready Mix

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

Changing coolant

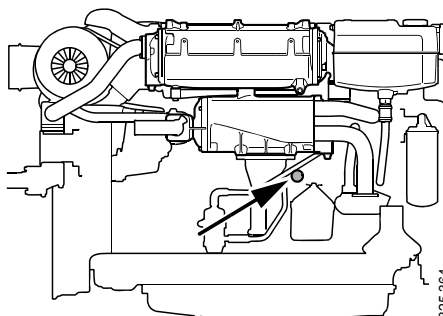


Environment

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

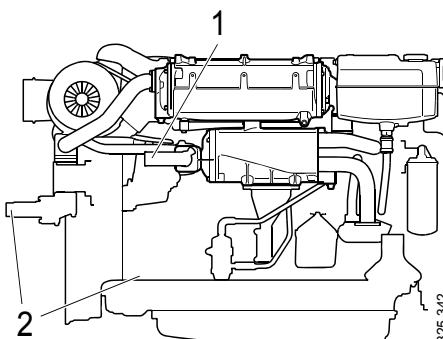
Draining coolant

- Drain coolant from the engine by opening the expansion tank filler cap. Detach the drain tap located on the right-hand side below the heat exchanger.
- It is also possible to drain the coolant from the lowest point in the engine and the cooling system.



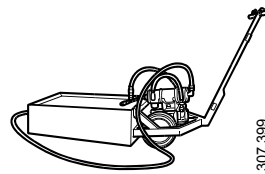
Draining the sea water circuit

- Drain the sea water circuit by first closing the sea cock of the vessel and then removing the connection pipe from the heat exchanger outlet (1).
- Also remove the cover from the sea water pump (2) to completely drain the pump.



Filling coolant

1. Connect the hose from unit 588 540 to the engine's drain valve.
2. Open the expansion tank cap.
3. Pump in coolant using coolant unit 588 540. Fill with coolant to the max. level of the expansion tank.
4. Disconnect the hose
5. Set the heating control to maximum heating and start the engine. Idling speed must not exceed 600 rpm. Leave the engine idling for 15 minutes.
6. Stop the engine and top up with coolant to the maximum level through the expansion tank.
7. Air pockets may still be left in the cooling system, which will disappear after the engine has been operated for a period of time. It may, therefore, need some topping up to start with.



Unit 588 540



IMPORTANT!

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

Cleaning the cooling system

Note:

Clean the cooling system more often than the inspection interval if necessary.

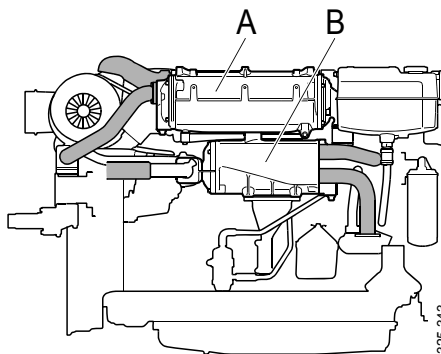


IMPORTANT!

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

Removing heat exchanger and charge air cooler

1. Make sure that the system is empty as described earlier.
2. Remove the protective plate that sits on the charge air cooler.
3. Detach the inlet pipe from the turbocharger.
4. Remove the front charge air pipe by loosening the screws on the bracket, protection cover and inlet pipe.
5. Remove the water pipe from the sea water pump to the charge air cooler.
6. Detach the upper clamp on the rubber bellows between the charge air cooler and the heat exchanger.
7. Undo the screws securing the charge air cooler to the engine.
8. Remove the charge air cooler and the bracket.
9. Remove the pipe between the heat exchanger and the exhaust pipe.
10. Remove the coolant pipes, both intake and outlet, from the heat exchanger.
11. Detach the heat exchanger from the bracket.



A Charge air cooler

B Heat exchanger



WARNING!

To ensure proper handling of cooling system detergent, study the warning text on the package.

Cleaning the heat exchanger

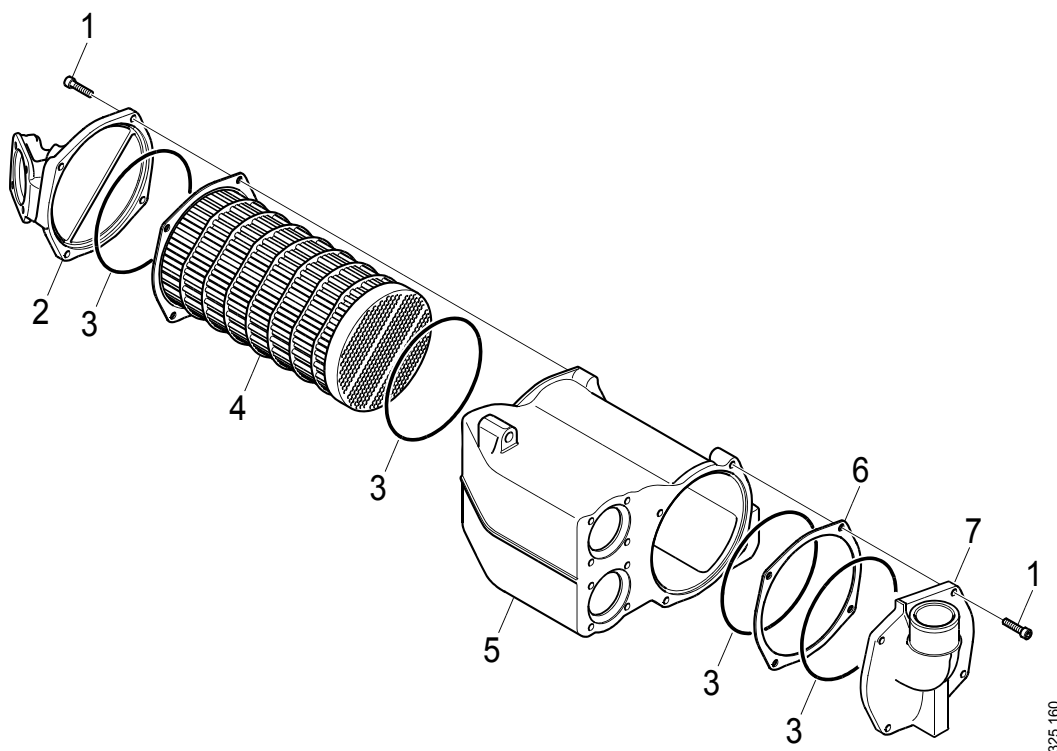
1. Remove the cover and pull out the cooler core.
2. Clean the outside of the cooler core.



IMPORTANT!

Use a paraffin-based engine cleaning agent.

3. Remove any internal deposits using a round rod.
4. Replace damaged and hard O-rings.
5. Assemble the heat exchanger.
6. Tighten the screws to 15-18 Nm.
7. Fit the heat exchanger according to the description.



1. Screw
2. Rear cover
3. O-ring
4. Cooler core

5. Housing
6. Flange
7. Front cover

Cleaning the charge air cooler

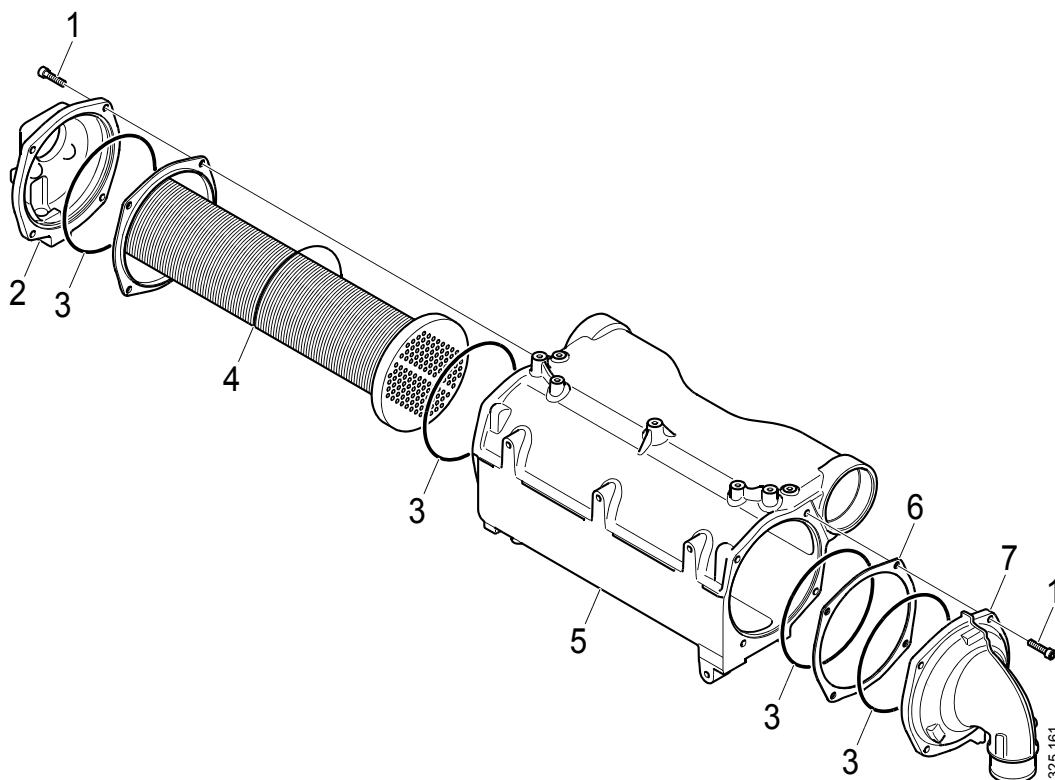
1. Remove the charge air cooler cover and pull out the cooler core.
2. Clean the outside of the cooler core.



IMPORTANT!

Use a paraffin-based engine cleaning agent.

3. Remove any internal deposits using a round rod.
4. Renew damaged and hard O-rings and assemble the charge air cooler.
5. Tighten the screws to 15-18 Nm.
6. Fit the charge air cooler according to the description.



1. Screw
2. Rear cover
3. O-ring
4. Cooler core

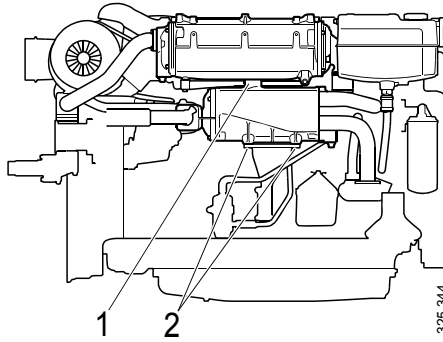
5. Charge air cooler
6. Flange
7. Front cover

Fitting heat exchanger and charge air cooler

1. Fit the heat exchanger on the bracket.
2. Fit the charge air cooler bracket and tighten the screws as illustrated.

Note:

When the heat exchanger is re-fitted, the screw (26 Nm) on the upper side must be fitted first. Then fit the lower screws (50 Nm). Otherwise there is a risk of serious damage.



Tightening torques for screws.

M6: 10 Nm

M8: 26 Nm

M10: 50 Nm

3. Fit the coolant pipes to the heat exchanger.
4. Fit the heat exchanger outlet pipe for sea water.
5. Fit the charge air cooler, inlet pipe from the turbocharger and the outlet pipe. Check O-rings, apply vaseline and push the pipes into position. Torque tighten the screws.
6. Fill the system with coolant according to specification.
7. Start the engine and check that no leakage occurs. Check the coolant level and top up as necessary.



IMPORTANT!

Use silicone or teflon-based grease to lubricate the O-rings. Only lubricate the O-rings, too much grease can cause leakage.

Internal: Removing oil and grease

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

**Environment**

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

Internal: Removing deposits

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



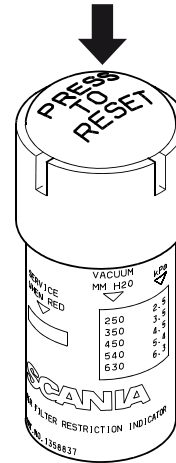
Environment

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

Air cleaner

Reading the vacuum indicator

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



326 671

Renewing the filter element

Note:

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

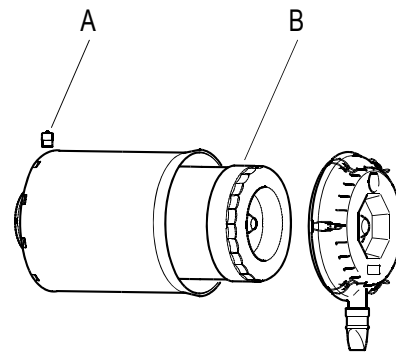
There is always a risk that the filter element will be damaged when it is cleaned.

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



WARNING!

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



326 100

A Vacuum gauge

B Filter element

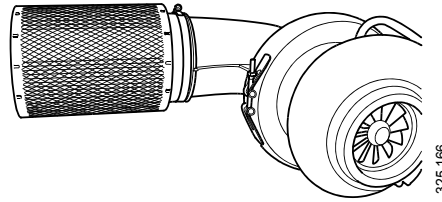
1. Remove the cover from the air cleaner.
2. Renew the filter element.
3. Carry out a check by inserting an inspection lamp into the element and checking from the outside that there are no holes or cracks in the filter paper.
4. Assemble the air cleaner.
5. Reset the vacuum indicator by pressing the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

Filter with a non-renewable element

Note:

Scania recommends that the filter should be renewed rather than cleaned.

- The filter may be cleaned a maximum of 3 times. Mark the filter after each time it has been cleaned.
- Use a cleaning solution consisting of water mixed with approx. 1% mild detergent.



1. Pour the cleaning solution into the filter outlet at the same time as turning the filter so that the cleaning solution pours through the filter against the direction of the air flow.
2. Leave the filter in the cleaning solution for 5 minutes and then take it out so that all the cleaning solution drains away.
3. Rinse the filter with 30 litres of clean water at a temperature of 30 to 40°C.
4. Take out the element and allow the rinsing water to drain off.
5. Repeat this procedure until the rinsing water is clean.
6. Leave the element to dry in a warm place for a few days.

Note:

The filter must not be dried with compressed air.

Renewing the safety cartridge



IMPORTANT!

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

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

Fuel system

Sulphur content in fuel and its effect on oil change interval

- A sulphur content of 0-2,000 ppm in the fuel gives an oil change interval of up to 500 hours.
- With a sulphur content of 2,000-4,000 ppm in the fuel, the oil change interval is halved to max. 250 hours.

Checking fuel level

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

Note:

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

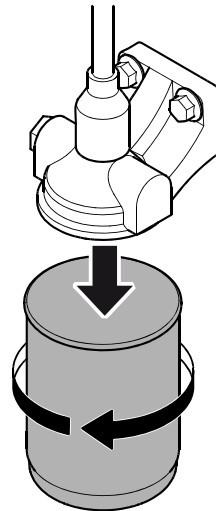
Renewing the fuel filter



Environment

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

1. Clean the exterior of the filter with a damp cloth.
2. Unscrew the filter.
3. Apply oil to the gasket on the new filter.
4. Screw the filter into place by hand until it makes contact.
5. Turn screw a further half turn by hand.
6. Then bleed the fuel system as per instructions.



325 167

Renewing and bleeding double, commutative fuel filters

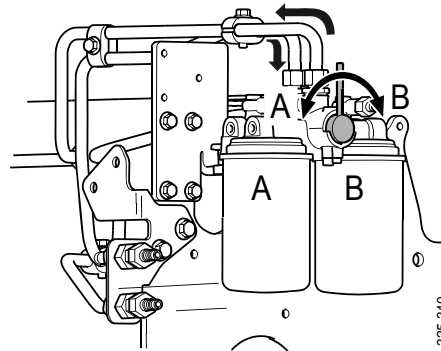


Environment

Since the engine may be running during filter renewal, fuel may spill. Use a suitable container. Used fuel must be disposed of as specified in national and international law.

While running, the rotary control should point 90° towards the filter used.

1. Turn the rotary control 90° to the right so that it points towards filter B. The fuel then flows through the filter.
2. Connect a transparent plastic hose to the bleed nipple located above filter A. Place the other end in a container with a capacity of at least 3 litres (1 US gallon).
3. Open the bleed nipple on side A; the remaining pressure is released.
4. Clean the exterior of the filter with a cloth.
5. Unscrew the filter.
6. Apply oil to the gasket on the new filter.
7. Screw the filter into place by hand until it makes contact.
8. Turn screw a further half turn by hand.
9. Turn the rotary control 90° to the left so that the rotary control points straight up. Both filters now run simultaneously.
10. When fuel without air bubbles comes out, close the bleed nipple. Because the engine is running, a lot of fuel will come through the hose.
11. Turn the rotary control 90° to the left so that the pin points towards filter A. Filter B can then be renewed following the procedure described for filter A.



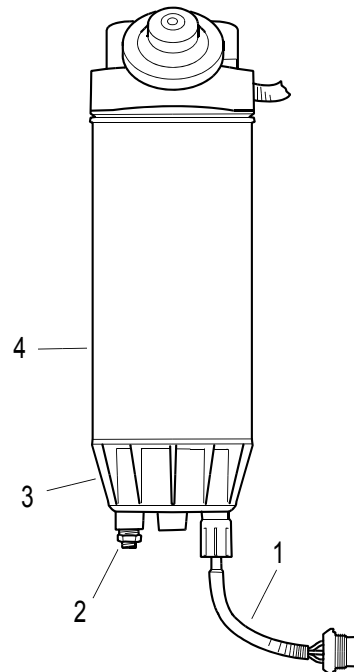
Renewing the water separating fuel filter

1. Close the shut-off cock in the fuel pipe and position a container under the filter.
2. Undo the sensor cable from the connector on the filter bracket.
3. Open the drain tap in the filter cover and let the fluid run down into the container.
4. Unscrew the filter cover.
5. Unscrew the filter from the filter head.
6. Discard the old filter and use a new filter.
7. Lubricate the O-ring in the filter cover with engine oil.
8. Screw the filter cover onto the new filter by hand. Make sure that the drain tap is fully closed.
9. Lubricate the O-ring on the filter with engine oil.
10. Fill the width of the filter with clean fuel.
11. Screw the filter into position until the O-ring rests against the filter head. Tighten the filter another 1/2-3/4 turn by hand.
12. Open the shut-off cock and check the system for leaks.
13. Connect the sensor cable to the connector on the filter bracket.
14. Bleed the fuel system.



IMPORTANT!

The sensor cable is sensitive. Handle it carefully.

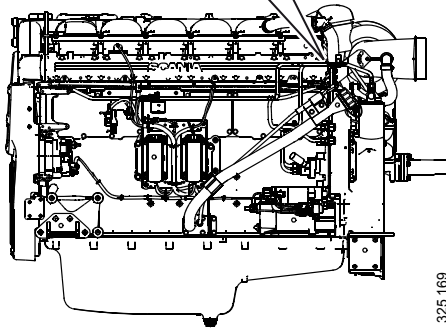
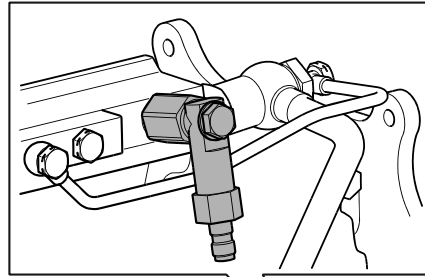


1. Sensor cable
2. Drain tap
3. Filter cover
4. Filter

338 101

Bleeding the fuel system

1. Attach a clear plastic hose to the bleed nipple on the fuel manifold. Place the end of the plastic hose in a container that holds at least 3 litres (1 US gallons).
2. Open the bleed nipple and pump with the hand pump until fuel comes out of the hose. If the fuel system is empty, it is necessary to pump approximately 200 strokes in order to draw up the fuel. Depending on the installation, a much greater number of pump strokes may be required before fuel comes out.
3. Pump until fuel without air bubbles comes out.



325 169

4. Close the bleed nipple on the fuel manifold and remove the plastic hose.
5. Pump approximately 20 strokes with the hand pump until the overflow valve opens. A hissing sound should be heard.
6. Start the engine. The engine should be easy to start.
7. If the fuel filter has been renewed, check that no fuel is leaking from the filter. The fuel filter may then need to be tightened further.

Miscellaneous

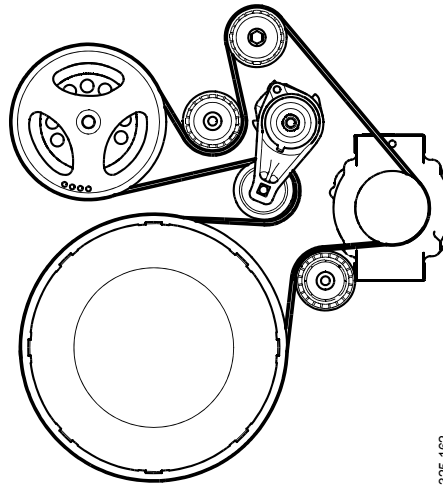
Checking the drive belt



IMPORTANT!

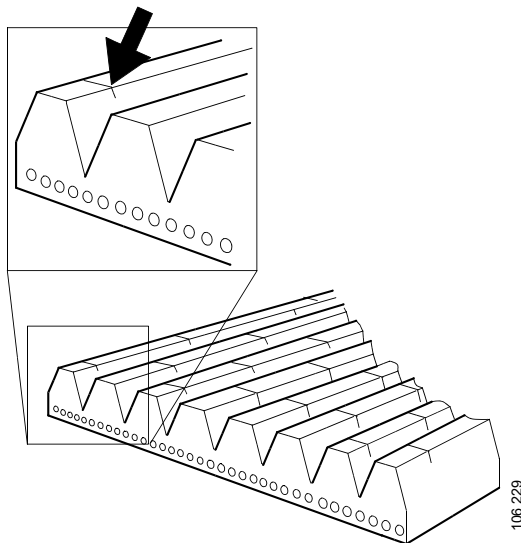
Refit the drive belt with the same direction of rotation as it had before removal.

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



325 162

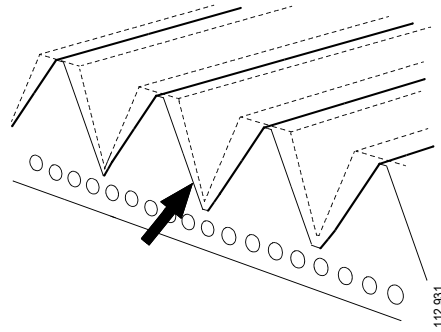
Check the drive belt for cracks.



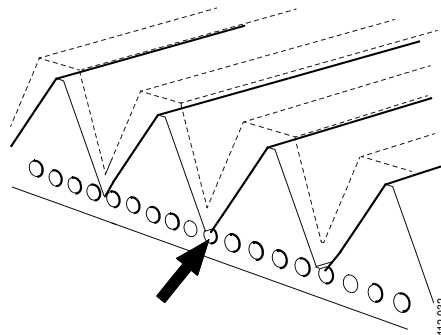
106 229

The drive belt must be renewed if it has cracks.

Check drive belt wear.



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



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

Checking for leaks

- Start the engine.
- Check for oil, coolant, fuel, air or exhaust leaks.
- Tighten or renew leaking connections. Check the overflow holes which show whether the O-rings between the cylinder liners and crankcase are leaking.



IMPORTANT!

If serious leakage occurs, contact your nearest Scania workshop.

Checking and adjusting the valve clearance

Note:

Checking and adjusting valve clearances should also be done after the first 500 hours of operation.

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

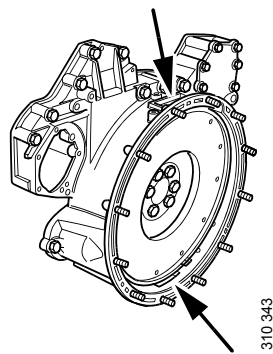


WARNING!

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

Readings can be taken from the flywheel through openings in the flywheel housing either from above or below depending on access when fitting.

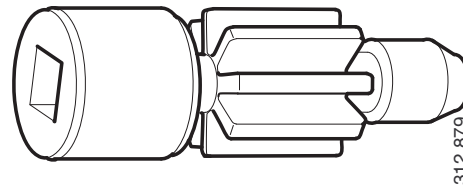
"TDC up" or "TDC down" is found on the flywheel. Both openings are fitted with a blanking piece on delivery.



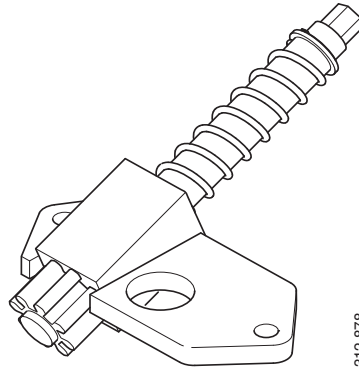
Openings for taking readings on the flywheel housing.

Specifications	
Valve clearance, intake valve	0.45 mm (0.018 in)
Valve clearance, exhaust valve	0.70 mm (0.028 in)

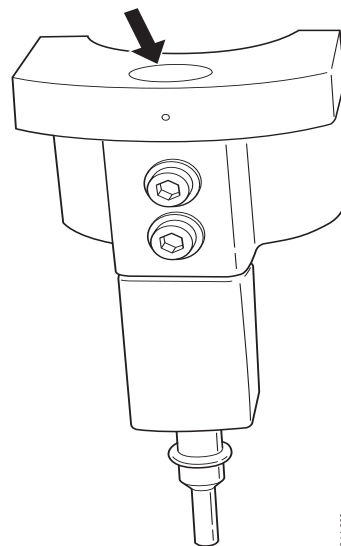
Tightening torques	
Lock nut for valves	35 Nm (26 lbf/ft)
Lock nut for unit injectors	39 Nm (29 lbf/ft)



Special tool 99 309 is used when turning from below.



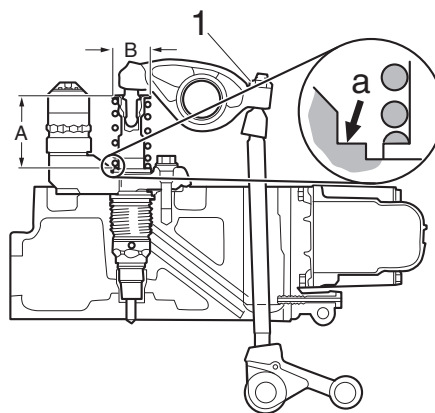
Special tool 99 109 is used when turning from above.



Special tool 99 442 is used to check the height of the unit injectors.

From below	Valve transition	Valve adjustment	Injector	From above
TDC down	1	6	2	TDC up
120/480	5	2	4	300/660
240/600	3	4	1	60/420
TDC down	6	1	5	TDC up
120/480	2	5	3	300/600
240/600	4	3	6	60/420

- Turn the flywheel in the engine's direction of rotation so that TDC down or TDC up is visible in the flywheel housing window.
- Check the valve transition and start adjusting as indicated in the table.



314 823

Checking and adjusting the unit injector

The unit injectors are adjusted using setting tool 99 442 or a digital sliding caliper.

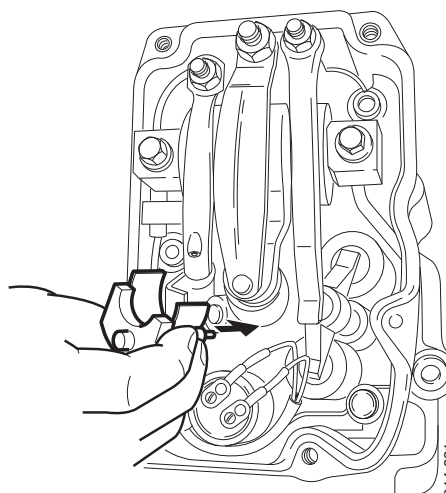
Dimension A = 69.9 +/- 0.1 (2.75 in)

Dimension B = 38.8 (1.53 in)

8. Fit the setting tool with the metal plate around the unit injector

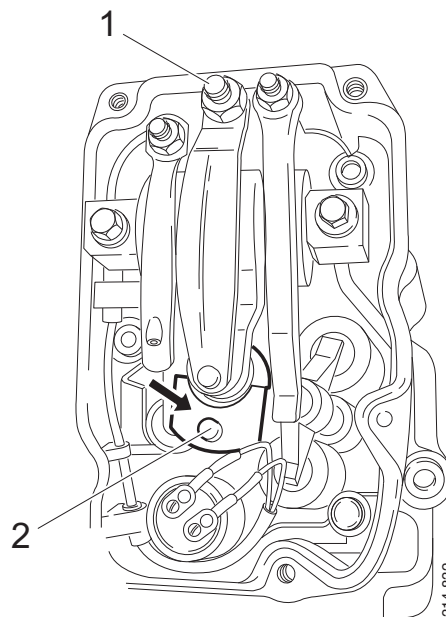
**WARNING!**

Be very careful when checking the unit injector if the measurement is outside the setting dimension. The spring is pre-tensioned and can come loose, causing personal injury.



9. When adjusting, undo the lock nut around the adjusting screw and adjust the unit injector with the adjusting screw 1.

The unit injector is correctly set when the small piston 2 is level with the flat upper surface of the tool. Use a finger to check. The setting dimension is 69.9 +/- 0.1 mm (2.75 in).



Diesel

Composition of the fuel

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

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

The fuel must conform to EU standard EN590.

The table shows some of the key properties.

Property	Requirements
Viscosity at 40°C (104°F)	2.0-4.5 cSt
Density at 15°C (59°F)	0.82-0.86 cSt
Ignitability (CET rating)	minimum 49
Flashpoint	56°C (132°F)

Sulphur content of fuel

- A sulphur content of 0-2,000 ppm in the fuel (0.2%) gives an oil change interval of up to 500 hours.
- With a sulphur content of 2,000-4,000 ppm in the fuel, the oil change interval is halved to max. 250 hours.
- Maximum permitted sulphur contents in the fuel is 4,000 ppm.

Using DMX and DMA fuels in marine engines

DMX and DMA fuels normally cause increased wear on the injection system. As a result of the high sulphur content in these fuels the engine oil is also affected. The engine oil must have as high a Total Base Number (TBN) as possible.



REQUIREMENT!

For engines running on DMX and DMA fuels the engine oil must have a TBN of at least 12.

When the engine is taken into operation the engine oil must be analysed every 50 hours to determine the correct oil change interval. The oil analysis must be carried out according to the Oil analysis section in this Operator's manual.

Bear in mind that the emission limit for the current engine type may limit the maximum permitted sulphur content of the fuel.

Temperature dependency of the fuel

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

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

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

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



IMPORTANT!

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

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

Preparing the engine for storage

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

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

Handling the engine

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

Preparations for storage:

- Thoroughly clean the engine.
- 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 coolant

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



WARNING!

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

Preservative fuel

Use diesel mixed with Lubrizol 560H or the equivalent. Mix 1 cm³ (ml)/0.06 in³ Lubrizol 560H in 10 dm³/2.3 US gallons of fuel.



WARNING!

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

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

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

Preservative oil

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

Preparations for storage



Environment

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

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

Note:

Do not remove the injectors.

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

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

Batteries

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

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



WARNING!

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

Storage

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

When the engine is to be taken into operation again

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

Technical data

General data

Number of cylinders and configuration	6, straight
Working principle	4-stroke engine
Cylinder diameter (mm/in)	130/5.12
Piston stroke (mm/in)	160/6.3
Displacement (dm ³ /in ³)	12.7/775.0
Firing sequence	1 - 5 - 3 - 6 - 2 - 4
Compression ratio	
DI13 070//071/072/073/077/078M	16.3:1
DI13 080/081/082M	17.3:1
Engine direction of rotation viewed from rear	Anti-clockwise
Fan direction of rotation viewed from front	Clockwise
Cooling	Coolant
Valve clearances, cold engine	
Intake valve (mm/in)	0.45/0.018
Outlet valve (mm/in)	0.70/0.028
Number of teeth on the flywheel	158
Low idling speed (rpm)	600-750
Maximum full-load speed (rpm)	2,300
Fuel	Diesel
Approximate weight, without coolant and oil (kg/lb)	
With heat exchanger	1,190/2,624
With keel cooling	1,140/2,513
Without heat exchanger and liquid-cooled charge air cooler	1,123/2,476

Lubrication system

Oil volume	See Inspection
Oil cleaning	Centrifugal oil cleaning
Oil cooler	Coolant cooled, full flow
Oil filter	Paper filter, full flow
Interval between oil changes (h)	500
Oil grade	
Engines run on low-sulphur fuel	ACEA E5 or E7
Engines not run on low-sulphur fuel	Total Base Number (TBN) > 12 (ASTM 2896)
Oil pressure (bar)	
Normal with the engine at operating temperature, operating speed	3-6
Minimum permitted at idling speed	0.7

Crankcase pressure with closed crankcase ventilation (mbar)	-5.4 to 2.0
---	-------------

Injection system

Type	PDE (unit injector)
Control system	EMS
Fuel filter	Paper filter from Scania
Fuel filter with water separator	Paper filter from Scania

Cooling system

Coolant volume, excluding radiator (dm ³ /US gallons)	
With heat exchanger	40/10.6
With keel cooling, 1 coolant circuit	24/6.3
With keel cooling, 2 coolant circuits	20/5.3
Without heat exchanger and liquid-cooled charge air cooler	20/5.3
Coolant temperature (°C/°F)	
With heat exchanger	90-95/194-203
With keel cooling	83-88/181-190
Without heat exchanger and liquid-cooled charge air cooler	83-88/181-190
Number of thermostats	1
Thermostat opening temperature (°C/°F)	
With heat exchanger	80/176 and 87/187
With keel cooling	75/167
Without heat exchanger and liquid-cooled charge air cooler	75/167

Intake system

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

Electrical system

Type	2-pin, 24 V, DC
Starter motor, standard equipment	2-pin, 24 V, 7.0 kW
Alternator, standard equipment	2-pin, 28 V, 100 A

Scania Assistance

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

Always call the contact for your country.

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

Other countries: +46 8 52 24 24 24

Note:

Calls will be recorded for training purposes.
