SCANIA
Industrial & Marine Engines

IMPORTANT INFORMATION

When working on the engine, e.g. when adjusting the belts, changing oil or adjusting the clutch it is important that the engine does not start. The engine may be damaged but above all there is -

SERIOUS RISK OF INJURY.

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

This warning symbol and text is reproduced beside those maintenance points where it is especially important to consider the risk of injury.

Operator's Manual

DI14

Marine engine

opm96-14m en 1 588 297

2001-05:1

START-UP REPORT - WARRANTY

When the start-up report has been filled in and sent to Scania there is a 1 year warranty starting from the start-up date. Also enter the below information since this will facilitate contacts with e.g. service workshops.

Engine number .....

Start-up date .....

User's name and address .....

.....

.....

.....

Signature .....

Engine type .....

Variant .....

Engine type and variant are indicated on the engine type plate

FOREWORD

This operator's manual describes the operation and maintenance of the Scania DI14 marine engines. The instructions apply to engines in ***program 96***, starting with engine number 5 562 819.

The engines are direct injection, fluid-cooled, four-stroke diesel engines with 8 cylinders in a V-configuration. The engines are available with or without charge air cooler, see page 10.

The engines may have two different cooling systems, a heat exchanger which is cooled by sea water or keel cooling which has cooling coils on the keel in which the engine coolant is cooled.

Common areas of usage include propulsion engines in boats like patrol boats and fishing boats, larger pleasure craft or propulsion engines or aggregate engines on board ships.

The engines have different output and speed settings and can be classified in different classification socities (classed engines must be used in certain marine installations).

The normal output setting of the engine (performance code) is indicated on the type plate, see page 10.

Note **Only standard components are described in the operator's manual. Regarding special equipment, refer to the instructions of the relevant manufacturer.**

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

- Read the manual before starting to use the engine. You will find new information in this Operator's Manual even if you have previous experience of Scania engines.
- Follow the maintenance instructions. Proper maintenance is essential to keep the engine operating correctly and to increase engine life.
- ***Pay special attention to the safety information beginning on page 6.***
- Get to know your engine so that you know what it can do and how it works.
- Whenever necessary, always contact an authorised Scania workshop. They have special tools, genuine Scania parts and trained staff with practical experience of Scania engines.

Note: **Always use genuine Scania parts in service and repair to keep the engine operating correctly.**

! *Important*

During the warranty period, only use genuine Scania parts in service and repair for the warranty to be valid.

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

Scania CV AB
Industrial and Marine Engines

S-151 87 Södertälje

CONTENTS

ENVIRONMENTAL RESPONSIBILITY

Scania has always been at the forefront in the development and production of environmentally safe engines.

We have made great progress in reducing harmful exhaust emissions to be able to meet the stringent emission standards that are mandatory for almost all markets.

We have done this without compromising the high quality of Scania industrial and marine engines in terms of performance and cost effective operation.

To maintain these superior properties throughout the life of the engine it is important that the operator/owner follows the instructions of this manual as regards operation, maintenance and choice of fuel and lubricants.

To further contribute to protecting the environment in service, maintenance and repair, ensure that harmful waste (oil, fuel, coolant, filters, batteries etc.) is disposed of and destroyed according to applicable local regulations.

This operator's manual contains highlighted text urging you to protect the environment in different service and maintenance operations.

Refer to example

Mind the environment!

Always use suitable containers to avoid spillage when bleeding systems or renewing components.

CERTIFIED ENGINES

An emission certified engine has been approved according to a specific certification standard. The certified engines delivered by Scania meet the most compelling emission standards in the European (EU) and non-European (USA) markets.

Scania guarantees that all engines of a certified engine type that are delivered, correspond to the engine approved for certification.

The engine is fitted with a certification plate, stating according to which certification rules (standard) the engine has been approved. Refer to page 10.

The following is required for the engine to meet the emission standards after being commissioned:

- ***Service and maintenance must be performed according to this Operator's Manual.***
- ***Only genuine Scania parts must be used.***
- ***Service work on the injection equipment must be performed by an authorized Scania workshop.***
- ***The engine must not be modified with equipment not approved by Scania.***
- ***Seals and setting data may only be broken/modified after approval by Scania, Södertälje. Changes should only be made by qualified personnel.***
- ***Changes affecting the exhaust system and intake system must be approved by Scania.***

Otherwise, follow the instructions in this manual for operation, care and maintenance of the engine. Also observe the safety precautions described in the following four pages.

Important! ***If service and maintenance are not performed as stated above, Scania cannot guarantee that the engine corresponds to the certified configuration and will not assume liability for any damage occurring.***

SAFETY DETAILS

General

This Operator's Manual contains safety information that must be observed in order to avoid personal injuries and damage to the product or property. Refer to page 1.

The text boxes to the right on the pages provide information that is important for the proper operation of the engine and to avoid damage to the engine. Failure to follow these instructions may void the warranty.

Refer to example.

! *Important*

Only use Scania genuine fuel filter.

Corresponding texts may also appear in the text column, headed **Caution!** or ***Important***

The warning text in text boxes to the right on the pages provided with a ***warning triangle*** and headed **WARNING** is ***extremely important*** and warns of serious defects to the engine or improper handling that may lead to personal injury.

Refer to example

⚠ *WARNING*

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY.

The safety precautions that must be observed in the operation and maintenance of Scania engines are compiled on the following three pages. The corresponding text is also often stated next to the maintenance step concerned, shown with different degrees of significance as described above.

All items are marked with a ! to highlight the importance of reading each item in the section.

A general safety rule is that no smoking is allowed:

- Near the engine and the engine bay
- When refuelling and near the filling station
- When work is performed on the fuel system
- Near flammable or explosive materials (fuel, oils, batteries, chemicals etc.)

Safety precautions for operation

! Daily inspection

Always perform visual inspection of the engine and engine bay before the engine is started and when the engine has been stopped after operation.

This will make it easy to detect any leakage of fuel, oil or coolant or any other abnormal condition that may require remedial action.

! Refuelling

When refuelling, there is a risk of fire and explosion. The engine must be stopped and smoking is not allowed.

Do not overfill the tank, since the fuel may expand, and close the fuel filler cap properly.

Only use fuel recommended in the service literature. Fuel of an incorrect grade may cause malfunctions or stoppage by interfering with the operation of the fuel injection pump and the injectors.

This could cause engine damage and possibly personal injury.

! Harmful gases

Only start the engine in a properly ventilated area. The exhaust emissions contain carbon monoxide and nitrogen oxides that are toxic.

When operating the engine in an enclosed area, an effective extraction device for exhaust gases and crankcase gases must be used.

! Starter lock

If the control panel is not fitted with a key switch, the engine bay should be fitted with a lock to prevent unauthorized starting of the engine.

Alternatively, a lockable main switch or battery master switch may be used.

! Starting spray

Never use starting spray or similar as a starting aid. An explosion may occur in the intake pipe, which could cause personal injury.

! Operation

The engine should not be operated in environments with surrounding explosive materials since electrical or mechanical components of the engine may emit sparks.

It is always a safety hazard to be near an engine that is running. Body parts or clothing, or a dropped tool may get stuck in rotating parts, such as the fan, causing bodily injury.

Always cover rotating parts and hot surfaces as much as possible to ensure personal safety.

Safety precautions for handling materials

! Fuel and lubrication oil

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

All work on the fuel system must be performed when the engine is cold. Fuel leakage and spillage on hot surfaces may cause fire.

Store drenched rags and other flammable materials in a safe way to avoid spontaneous combustion.

! Batteries

Batteries, particularly when being recharged, emit highly flammable fumes that can explode. Do not smoke or let open flame or sparks come near the batteries or the battery compartment.

Incorrect connection of a battery cable or jump start cable may cause a spark, which in tun may cause the battery to explode.

! Chemicals

Most chemicals, such as glycol, corrosion inhibitors, preservation oils, degreasers etc. are hazardous. Always follow the safety precautions stated on the container.

Some chemicals, e.g. preservative oil, are flammable.

Always store chemicals and other hazardous materials in approved and distinctly marked containers and out of reach of unauthorized persons. Always dispose of superfluous or used chemicals through an authorized waste disposal contractor.

Safety precautions for care and maintenance

! Stop the engine

Always stop the engine before any maintenance and service work unless otherwise stated.

Prevent unauthorized starting by removing the starter key and turning off the power by the main switch or the battery disconnect switch, locking it in the off position. Also attach a warning tag, stating that work on the engine is in progress, at a suitable location.

It is always a safety hazard to work on an engine that is running. Parts of your body or clothing, or a dropped tool may get stuck in rotating parts, causing bodily injury.

! Hot surfaces and fluids

A hot engine always presents a risk of scalding. Always take care not to touch the exhaust manifold, turbocharger, oil pan, hot coolant and oil in pipes and hoses.

! Lifting the engine

Use the engine lifting eyes when lifting the engine. First check that the lifting equipment is in proper condition and has sufficient lift capacity rating.

Auxiliary equipment fitted to the engine may cause the centre of gravity to be displaced. Thus, additional lift devices may be required in order to provide proper balance and a safe lift.

Never work below a suspended engine!

! Batteries

Batteries contain a highly corrosive electrolyte (sulphuric acid). Always take care to protect your eyes, skin and clothing when charging and handling batteries. Wear protective gloves and goggles.

If electrolyte splashes on the skin, wash the affected part of the body with soap and plenty of water. If electrolyte splashes into the eyes, rinse eyes immediately with plenty of water and seek medical attention.

Dispose of used batteries through an authorized waste disposal contractor.

! Electrical system

Before work is performed on the electrical system, turn off the power by the main switch or the battery disconnect switch.

Also disconnect any external power supply to auxiliary equipment on the engine.

! Arc Welding

Before welding near or on the engine, remove the battery and alternator cables. Also remove the control unit connector.

Connect the weld clamp to the component to be welded, close to the weld location. Never connect it to the engine or in such a way that the current can pass through a bearing.

After the welding is completed, connect the cables to the alternator and the control unit before connecting the batteries.

! Lubrication system

Hot oil may cause scalding and skin irritation. Avoid skin contact with hot oil.

Make sure that the pressure in the lubrication system is relieved before work is carried out. Never start or operate the engine with the oil filler cap removed since oil will be ejected forcefully.

Dispose of used oil through an authorized waste disposal contractor.

! Cooling system

Never open the coolant filler cap while the engine is hot. Steam and hot coolant can come out forcefully and cause scalding.

If the cooling system must still opened or disassembled while the engine is hot, open the filler cap very cautiously and slowly to release the pressure before the cap is removed. Use gloves since the coolant is still very hot.

Dispose of used coolant through an authorized waste disposal contractor.

! Fuel system

Always use gloves when checking for leaks in or performing other work on the fuel system. Always wear eye protection when testing injectors.

Fuel escaping under high pressure can penetrate body tissue and cause serious injury.

Never use non-genuine parts in the fuel system and the electrical system. Genuine parts are designed and manufactured to minimize fire and explosion hazard.

! Before starting

Install any guards that have been removed before the engine is started. Check to ensure that no tools or other objects have been left on the engine.

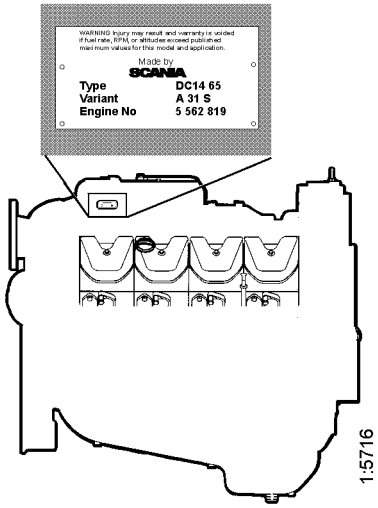
Never start the engine unless the air filter is installed. Otherwise there is a risk of objects entering the compressor wheel or a risk of personal injury from contact with it.

TYPE DESIGNATIONS

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

The type designation and engine serial number are indicated on a type plate affixed to the right-hand side of the engine.The engine number is also stamped in the engine block beside the first cylinder head.

Engines that are certified regarding smoke and emissions are fitted with a certification plate specifying the documents they conform to. The plate is fitted to rocker cover number four from the front on the right hand side.



DI 14 74 M 31 S LR

Type

DI Turbocharged diesel engine with liquid-cooled charge air cooler

Displacement in whole dm^3

Performance and certification code

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

Application

M For marine use

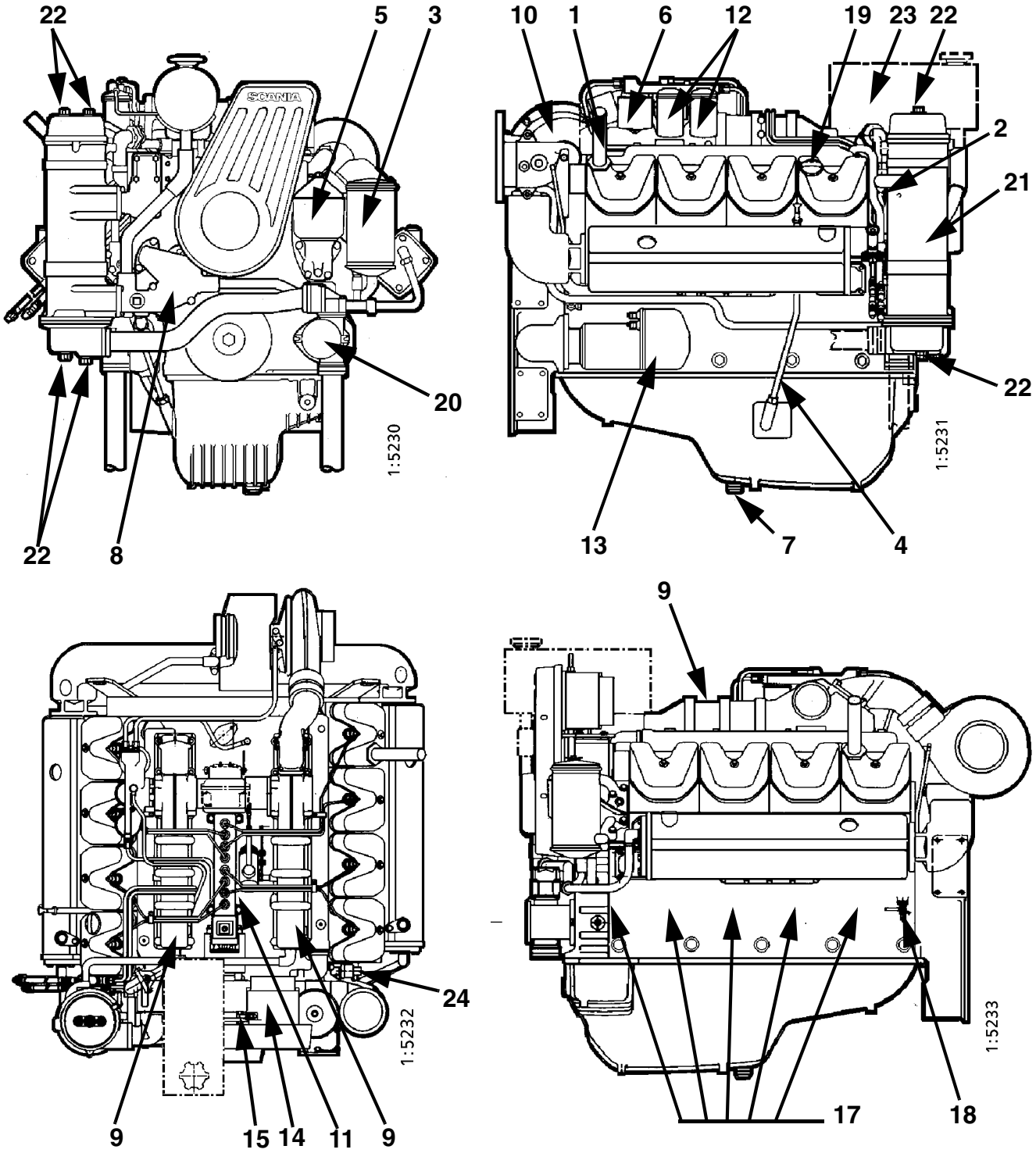
Variant 01-99

Governor type

D Electronically controlled auxiliary governor
S RSV, all-speed and single-speed governor
T RQ, single-speed governor

Classification society (applies to classed engines)

ABS American Bureau of Shipping
BV Bureau Veritas
GL Germanischer Lloyd
LR Lloyd's Register of Shipping
DNV Dwt Norske Veritas
RINA Registro Italiano Navale
SjöV Sjöfartsverket



The drawings illustrate a common type of DI14 engine.
Your engine may have other equipment not shown here.

1. *Type designation plate*
2. *Engine number, stamped in engine block*
3. *Oil cooler*
4. *Oil dipstick*
5. *Oil cleaner*
6. *Oil filter, turbo*
7. *Draining, engine oil*
8. *Coolant pump*
9. *Charge air cooler*
10. *Turbocharger*
11. *Injection pump*
12. *Fuel filter*
13. *Starter motor*
14. *Alternator*
15. *Fan belt adjustment*
16. *Inspection hatch, coolant pump*
17. *Inspection holes, engine block*
18. *Draining, coolant*
19. *Oil filling*
20. *Sea water pump*
21. *Heat exchanger*
22. *Protective anodes*
23. *Exp. tank with pressure cap*
24. *Oil pressure monitor*

STARTING AND RUNNING

AT FIRST START

When the engine is started for the first time, follow the maintenance points listed under "First start" in the maintenance schedule, see page 19.

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

1. Checking the oil level (see page 21).

8. Checking the coolant (see page 26).

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

If there is a danger of freezing:

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

  BASF G48-24 or BASF D542

- The concentration of glycol should be **30 - 60%** by volume depending on the ambient temperature. 30% glycol by volume provides anti-freeze protection down to -16 °C. See page 26.
- The concentration of glycol should be **30 - 60%** by volume depending on the ambient temperature. A content of 30 % by volume provides protection down to -16 °C. See page 26.
- ***Never top up with only water or only glycol. Fluid losses must always be replaced with pre-mixed coolant having the same glycol concentration as that in the engine. If the glycol content drops, both anti-freeze protection and protection against corrosion are impaired.***

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

If there is no danger of freezing:

- Only ***Scania Anti-corrosive*** should be used in the coolant as protection against corrosion. The correct corrosion inhibitor content is 7-12% by volume and must never be less than 7% by volume. The inhibitor in ***Scania Anti-corrosive*** is free of nitrite.
- First filling: Fill the cooling system with ***water + 10% by volume of Scania Anti-corrosive***. Use drinkable water with a pH value of 6 - 9.
- ***Never top up with only water or only anti-corrosive! Fluid losses must always be replaced with premixed coolant: water + 10 % by volume of Scania Anti-corrosive.***

Coolant filter (not standard equipment)

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

Coolant composition:

<u>If there is a danger of freezing:</u>
minimum 30% glycol by volume
maximum 60 % glycol by volume

<u>If there is no danger of freezing:</u>
7-12% by volume
Scania Anti-corrosive
(no glycol)

WARNING

Ethylene glycol and corrosion inhibitor, if swallowed can be fatal.
Avoid contact with the skin.

Important

The recommended glycol must not be mixed with glycol having nitrite-based anti-corrosive.

Important

The use of too much *Scania Anti-corrosive* as mixed with glycol may cause deposits.

Important

If a coolant filter has been fitted it must <u>not</u> contain inhibitor.

14. Checking the fuel level (see page 35).
17. Checking theelectrolyte level in batteries (see page 37).
18. Checking the state of charge in batteries (see page 37).
20. Checking the coolant level monitor (see page 38).
21. Checking the temperature monitor (see page 39).
22. Checking the oil pressure monitor (see page 40).
23. Checking stop feature (see page 40).
24. Checking v-belt tension (see page 42).

WARNING

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY.

CHECKS BEFORE RUNNING

Before running, ”Daily maintenance” as described in the maintenance schedule should be carried out, see page 19.

STARTING THE ENGINE

If the fuel tank has been run dry or if the engine has not been used for a long time, bleed the fuel system, see page 35.

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

- Engines with mechanical stop control: Set the stop control to operating position.
- Open fuel valve (if fitted).
- Declutch the engine (does not apply to engines with fixed clutch, e.g. gensets).
- Engines with battery master switch: Switch on the power using the battery master switch.
- Set the speed control to raised idling. (Does not apply to gensets)
- Start the engine.

WARNING

Only start the engine in a properly ventilated area. When operating the engine in an enclosed area, an effective extraction device for exhaust gases and crankcase gases must be used.

WARNING

Never use starting spray or similar as a starting aid. An explosion may occur in the intake pipe, which could cause personal injury.

Starting at low temperatures

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

To limit white smoke, the engine should be run at low speed and under moderate load. Avoid running it longer than necessary at idling speed.

At temperatures below 0 °C:

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

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

If the engine has flame start:

- Operating flame start ***without timer relay***: Press the control button, which also acts as a pre-glow button (max. 20 seconds). The glow plug continues to glow as long as this button is depressed after the engine has started. Maximum time is 5 minutes.
- Operating flame start ***with timer relay***: Press the pre-glow button (a maximum of 20 seconds). Release it when the engine starts. The timer relay keeps the glow plug glowing for 5 minutes. If a shorter glow time is required, press the release button. The key must be set to the 0 position if the start attempt fails.

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

- Generator sets should be operated under load immediately after starting to avoid the risk of white smoke. This applies in particular to engines that have been installed without aids for heating or applying a basic load.
- Set the appropriate idle speed before the engine reaches 1,000 rpm (does not apply to gensets).
- Warm up the engine with a light load. A light load on a cold engine gives better combustion and faster heating than warming up with no load.

! *Important*

Maximum starter engagement time is 30 seconds. Risk of overheating. Allow starter to cool for 2 minutes after a starting attempt before cranking again.

RUNNING

Check instruments and warning lamps at regular intervals.

Speed

The Scania tachometer is divided into sectors of different colours, as follows.

0 - 500 rpm	red area:	prohibited engine speed, passed when stopping and starting.
500 - 700 rpm	yellow area:	low idle.
700 - 2200 rpm	green area:	normal operating speed. Highest torque and lowest fuel consumption at 1400 - 1600 rpm. Low operating speed gives less engine wear.
2200 - 2600 rpm	yellow/ green striped:	unsuitable operating speed. May occur when switching off.
2600 - 3000 rpm	red area:	prohibited engine speed

Coolant temperature

Correct coolant temperature during operation:

70 - 93 °C for system at atmospheric pressure.

70 - about 100 °C for system with positive pressure.

High coolant temperature leads to engine damage. Reduce the load on the engine in order to lower the temperature. If the temperature does not drop, stop the engine and look for the fault.

During long periods of operation with very low power take-off, the engine may have difficulty in reaching 70 °C. However, if the load is increased, temperature will rise.

Oil pressure

Max. oil pressure:

warm engine running at a speed above 800 rpm	6 bar

Normal oil pressure:

warm engine running at operating speed	3 - 6 bar

Min. oil pressure:

warm engine running at 800 rpm	0.7 bar

At speeds below 800 rpm the gauge may show low oil pressure although no fault is present.

Oil pressure below 0.7 bar at speeds above 800 rpm will cause engine damage. The engine must be stopped immediately.

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

Charging indicator lamp

If the lamp comes on during operation:

- Check/adjust the alternator drive belts as described under the maintenance point. See page 42.
- If the charging indicator lamp is still on, this could be due to an alternator fault or a fault in the electrical system.

STOPPING THE ENGINE

1. Run the engine without a load for a few minutes if it has been run continuously with a heavy load.
2. Stop the engine using the stop control. Engines with a stop solenoid and fuel shut-off valve are stopped using the stop button. Hold the stop button depressed until the engine has fully stopped.
3. Engines with battery master switch: Cut the power using the battery master switch. (Does not apply to emergency power back-up units).
4. Set the control switch to 0. (Does not apply to emergency power back-up units).

! *Important*

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

! *Important*

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

Emergency stop

The stop solenoid linkage system has a knob marked ”STOP”. Pull the linkage system to the stop position using this knob if it is not possible to stop the engine using the stop solenoid.

Clutch

- ***See the manufacturer's instructions for handling and operating the clutch.***

WARNING **If the clutch output shaft is rotating (e.g. in multiple engine installations where other engines are running), the clutch can, under its own power, be drawn to the engaged position. THIS CAN CAUSE PERSONAL INJURY and engine damage. For this reason, always secure the clutch in the disengaged position if there is a risk of the output shaft starting to rotate.**

CHECKS AFTER RUNNING

- Check that the power is cut from the battery master switch and that the control switch is in the "0" position.
- Fill the fuel tank. Make sure that the filler cap and the area round the filler opening are clean to avoid contamination of the fuel.
- If there is a risk of freezing, the cooling system must be drained if it does not contain a sufficient amount of glycol, refer to page 26.
- Close inlet valve for the sea water system (if fitted).
- ***If there is danger of freezing the sea water system must be emptied.***
- At temperatures below 0 °C: Prepare for the next start by connecting the engine heater (if fitted).

WARNING

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY.

Important

Top up engine coolant when the engine has been stopped after being started for the first time.

MAINTENANCE

The maintenance programme covers 27 points, divided into the following main groups:

WARNING

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY

The maintenance points are divided into intervals as follows:

Daily maintenance

Maintenance before first start

Maintenance after the first 400 hours of operation

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

Periodic maintenance after every 400 hours of operation (carried out after 400, 800, 1200, 1600 etc. hours)

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

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

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

Annual every year

Maintenance every 5th year

ENGINES WITH FEW HOURS OF OPERATION

Emergency back-up power units and the like which are not used regularly should be test run and checked according to the unit manufacturer's instructions.

The engine is run to operating temperature and the maintenance points below should be carried out:

1. Checking oil level.
5. Checking coolant level.
10. Checking low pressure indicator.
14. Checking fuel level.
17. Checking electrolyte level in batteries.
18. Checking battery charge.
19. Cleaning batteries.
25. Look for leaks. Remedy as necessary

Important

For engines with few operating hours that are not subject to periodic maintenance according to the maintenance schedule on page 19, maintenance should be carried out in accordance with the schedule:
"Every year"
"Every 5 years"

MAINTENANCE SCHEDULE

	Daily	*First time at*		*Interval*					*At least*	
		At first start	*400 h*	*200 h*	*400 h*	*1200 h*	*2400 h*	*4800 h*	*Every year*	*Every 5th year*
LUBRICATION OIL SYSTEM, page 20										
1. Checking oil level	●	●								
2. Oil change					●1				●	
3. Cleaning the lubrication oil cleaner					●1				●	
4. Changing the turbo filter					●1				●	
COOLING SYSTEM, page 24										
5. Checking coolant level	●									
6. Checking corrosion protection rods *4)*					●5				●	
7. Checking seawater pump impeller *4)*					●5				●	
8. Checking coolant		●					●6		●6	
9. Cleaning cooling system								●1		●
AIR CLEANER, page 32										
10. Test reading low pressure indicator	●									
11. Cleaning coarse cleaner				●1						●
12. Cleaning or changing filter insert						●3				●
13. Changing safety cartridge							●			●
FUEL SYSTEM, page 35										
14. Checking fuel level	●	●								
15. Changing main filter						●1				●
16. Checking injectors							●		●	
ELECTRICAL SYSTEM, page 37										
17. Checking electrolyte level in batteries		●		●2					●	
18. Checking charge state of batteries		●		●2					●	
19. Cleaning batteries				●2					●	
20. Checking level monitor		●				●			●	
21. Checking temperature monitor		●				●			●	
22. Checking oil pressure monitor		●				●			●	
23. Checking stop function		●			●				●	
MISCELLANEOUS, page 42										
24. Checking V-belts		●		●					●	
25. Look for leaks. Remedy as necessary	●									
26. Checking/adjusting valve clearance.			●				●			
27. Changing (or cleaning) valve for closed crankcase ventilation							●			

1. More often if required
2. For engines with few operating hours, see page 18.
3. Earlier if low pressure indicator shows red.
4. Applies only to M engines with seawater pump.
5. Guidline values. Vary according to composition of seawater.
6. If inhibitor has not been topped up for five years, coolant should be changed.

LUBRICATION OIL SYSTEM

OIL GRADE

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

-ACEA E3, E4 or E5

- The Total Base Number (TBN) should be *minimum 12-13* (ASTM 2896).
- Check with your oil supplier that the oil meets these requirements.
- The specified oil change intervals apply provided that ***the fuel sulphur content does not exceed 0.3% by weight***. If the sulphur content exceeds 0.3 % but is maximum 1.0%, the oil change intervals must be halved (200 h).
- Viscosities as illustrated below.
- For operation at extremely low ambient temperature: Consult your nearest Scania representative on how to avoid starting difficulties.

! *Important*

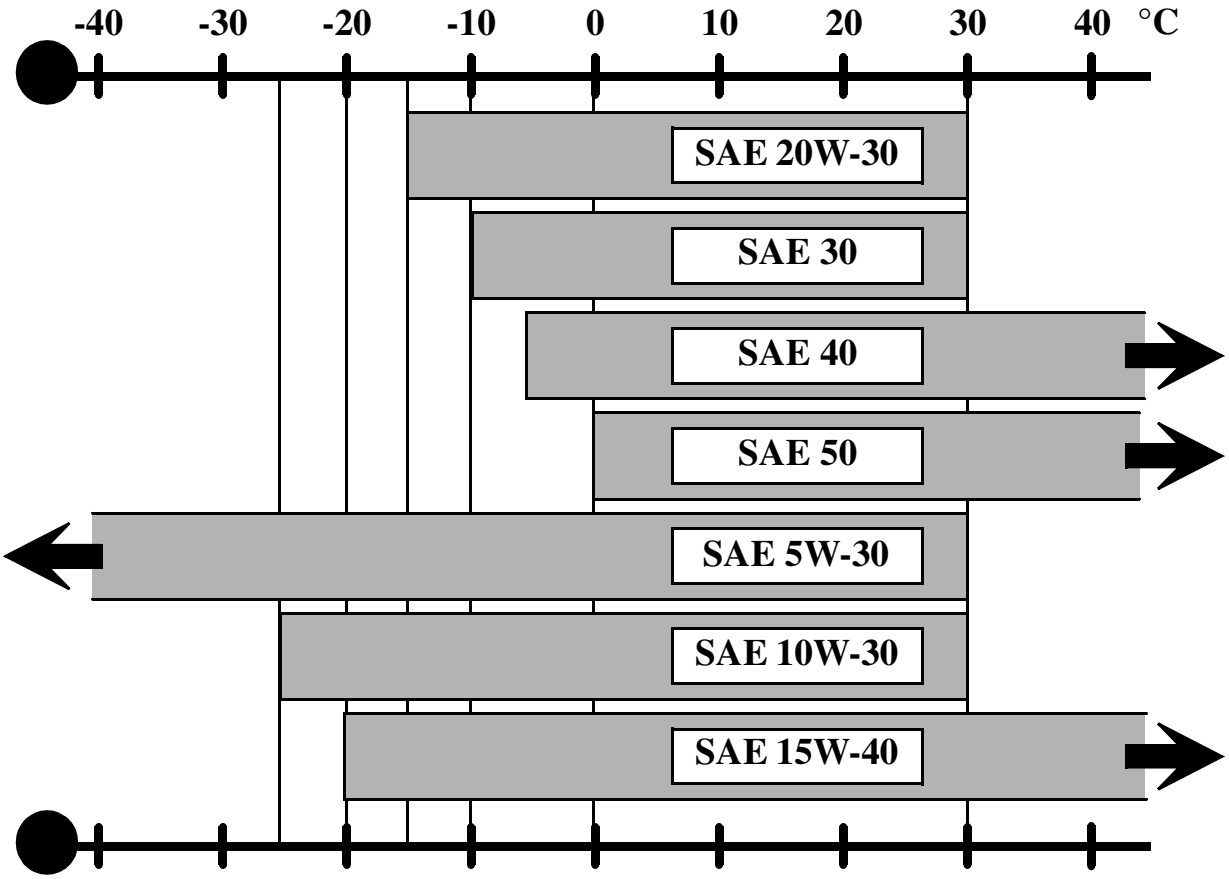
Additives must not be used. The oil should be suitable for all temperature variations until the next oil change.

Oil analysis

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

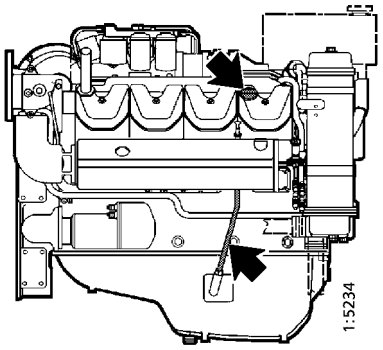
The result of a series of analyses is used as the basis for establishing a suitable oil change interval.

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



1. Daily:

CHECKING OIL LEVEL



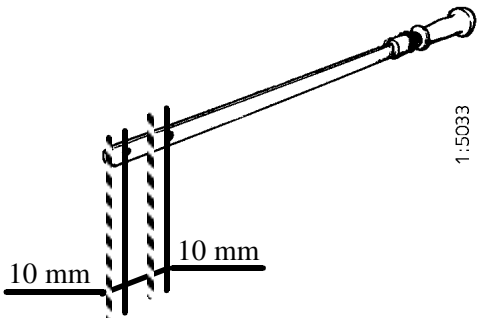
Note **Before checking oil level: Allow the engine to remain stopped for at least 1 minute.**

- The correct level is between the marks on the dipstick. Top up when the level is at the lower mark.
- Correct type, see ”Oil grade”, page 20.

Checking oil level during operation

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

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

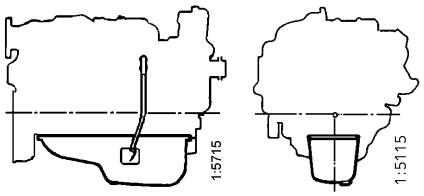


2. Every 400 hours:

OIL CHANGE

Note **Under extremely severe operating conditions, especially in dusty environment or if the deposits in the centrifugal cleaner are thicker than 20 mm: change oil more frequently.**

- Pump out the oil with the oil bilge pump when the engine is warm.
- Fill up with new oil.
- Check the level on the dipstick.



Max 30 dm^3
Min 25 dm^3

Max 26 dm^3
Min 20dm^3

WARNING

The oil may be hot.
Wear protective gloves and goggles

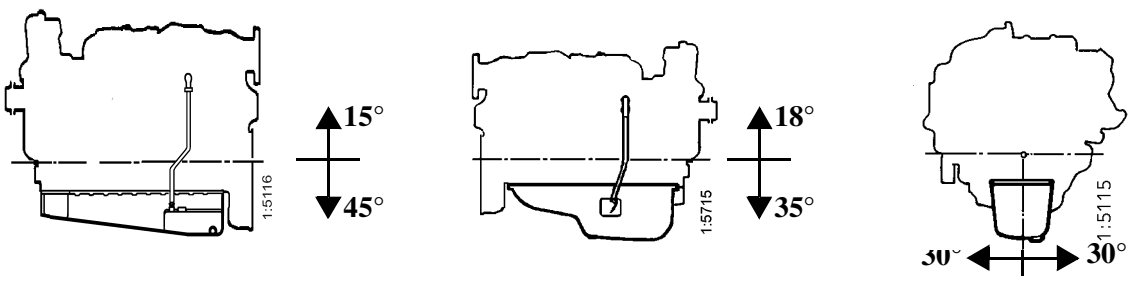
Mind the environment!

Always use a suitable container to avoid spillage when changing oil.
Dispose of used oil through an authorized waste disposal contractor.

Maximum angle of inclination during operation

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

Note **Specified angle may only occur intermittently.**

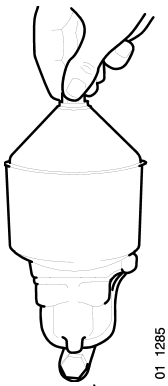


3. Every 400 hours:

CLEANING THE OIL CLEANER

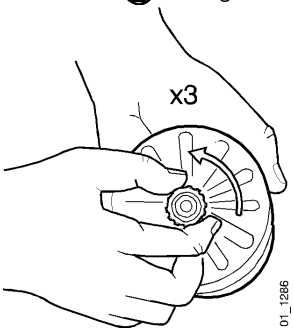
(at same time as oil change)

- Unscrew the nut and remove the cover.

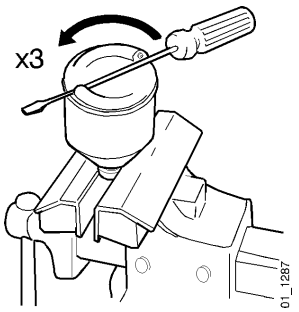


> ***WARNING***
>
> **Open the cap carefully. The oil may be hot.**

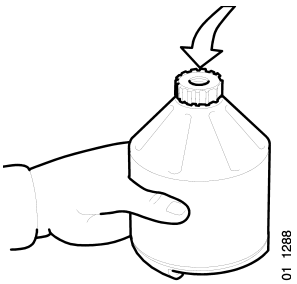
- Lift out the rotor and slacken the rotor bowl retaining nut three turns.



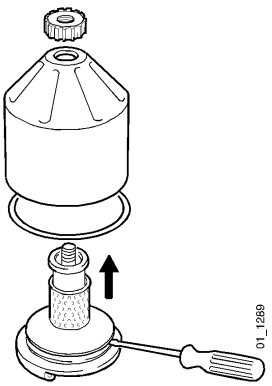
- If the nut is jammed:
  Clamp the nut, ***never the rotor***, in a vice and turn the rotor three turns by hand or with a screwdriver.



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

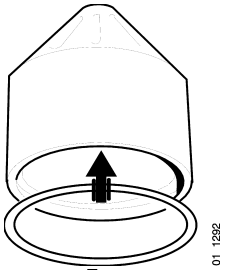


- Unscrew the nut and remove the rotor bowl.
- Prise carefully to detach the strainer from the bottom plate.



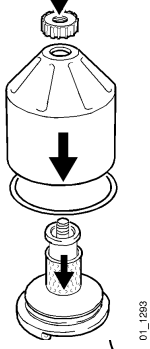
- Scrape off the deposits from the inside of the rotor bowl. If there are no deposits, this indicates that the cleaner is not working properly.
- If the deposits are ***thicker than 20 mm: clean more often***.

- Clean all parts in diesel fuel.



- Fit the O-ring in the rotor bowl. ***Make sure it is not damaged***. Change if necessary.

- Assemble the rotor

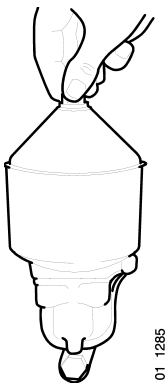


- Tighten the rotor nut firmly ***by hand***.

- Refit the rotor.
- Make sure that it spins easily.

- Check that the O-ring in the bowl is undamaged. A hardened or damaged O-ring must be changed.
- Screw the bowl down hard ***by hand***

If the nut is tightened using a tool, the rotor shaft, nut or bowl may be damaged.



Operational test

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

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

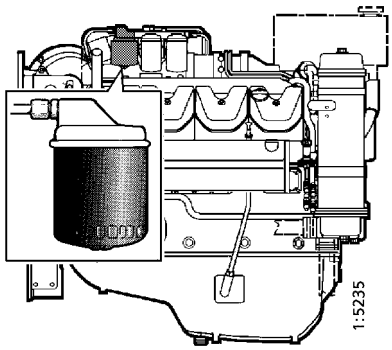
The rotor normally rotates ***30 - 60 seconds*** after the engine has stopped.

If not: Dismantle and inspect.

4. Every 400 hours:

CHANGING THE TURBO FILTER

(at the same time as the oil change)



- Remove the old filter.
- Oil the rubber gasket and fit a new genuine Scania filter.
- Tighten the filter by hand.
  Never use a tool for tightening. The filter could be damaged, obstructing circulation.
- Start the engine and check for leaks.

Important ***If the deposits in the centrifugal cleaner exceed 20 mm the oil filter must be changed at more frequent intervals, at the same time as the centrifugal filter is cleaned and the oil changed.***

Mind the environment!

Always collect oil in a suitable container to avoid spillage when renewing the oil filter. Dispose of used filters through an authorized waste disposal contractor.

COOLING SYSTEM

5. Daily:

CHECKING COOLANT LEVEL

WARNING

Carefully open the cap. Hot water and steam may blow out.

- Open the expansion tank filler cap and check the coolant level.
- *Correct level: (Scania expansion tank)* .
  - Cold engine: Coolant level should reach the lowest part of the filler pipe.
  - Warm engine: Coolant level should be between 10-20 mm above the lowest part of the filler pipe.
- Other types of expansion tank according to the installer's instructions.
- Top up the coolant as necessary, see point 6.

Important

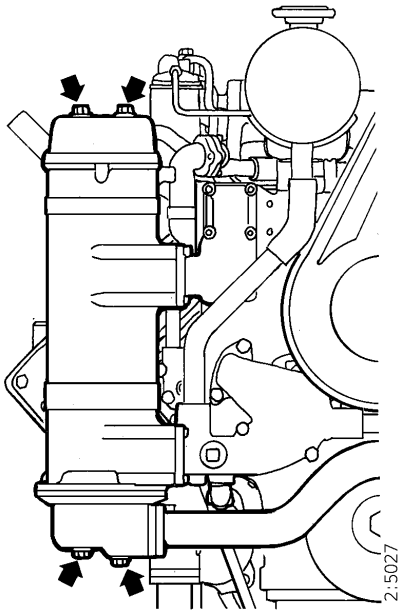
Always top up with ready mixed coolant.

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

6. Every 400 hours:

CHECKING CORROSION BARS

(Only engines with heat exchanger)



- Empty the sea water circuit and check the corrosion bars (protection anodes). Located as illustrated.
- Scrape off all loose material on the anode.
- Change if less than half the bar is left.
  A new bar is 55 mm long with a diameter of 17 mm.

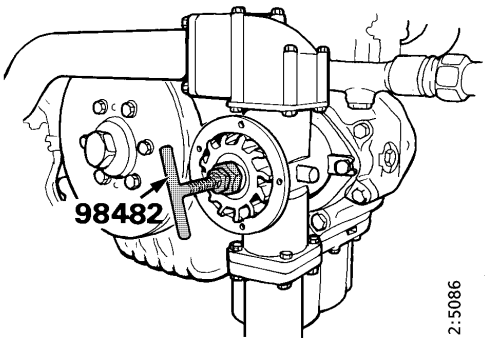
Important ***If the corrosion bars are very corroded they need to be checked more often, for example every 200 hours.***

7. Every 400 hours:

CHECKING THE SEAWATER PUMP IMPELLER

(Only engines with heat exchanger)

- Close the bottom valve if the seawater pump is below the water line.
- Empty the sea water circuit.
- Take off the seawater pump cap.
- Check that the impeller vanes are not worn or damaged.



Important ***If the impeller must be changed frequently, the cleaning of th sea water must be improved.***

Changing the impeller

- Pull out the impeller with puller 98 482 (Scania Special Tools).
- Fit new impeller and cap. Check that the cap seal is not hard or damaged.

Note **A spare impeller should be kept on board.**

- The impeller can be deformed at longer periods of inactivity. Change before or remove the impeller before longer periods of stoppage. Also see "Preparations of storage".

8. Every 2400 hours:

CHECKING THE COOLANT

Coolant should be checked as follows:

a) Check the appearance of the coolant.

b) Coolant with glycol: Check the glycol content.

c) Coolant with ***Scania Anti-corrosive***:
Check the protection against corrosion.

The composition of the coolant is also described under **"Starting and running"**

Coolant composition:

<u>If there is a danger of freezing:</u>

minimum 30% glycol by volume

maximum 60% glycol by volume

<u>If there is no danger of freezing:</u>

7-12% by volume

Scania Anti-corrosive

a)

Checking the appearance of the coolant

- Fill a receptacle with a little coolant and check that it is clean and clear.
- If the coolant is contaminated or cloudy, consider changing it.
- Water added to the coolant should be clean and free from dirt of any kind.
- Use drinking water with a pH of 6 - 9.

b)

Checking glycol content

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

- Cooling systems with glycol should contain at least 30% glycol by volume to provide acceptable protection against corrosion.
- A content of 30% glycol by volume protects against freezing down to -16°C. If further protection is needed, refer to the table on the next page for calculating the required amount of glycol.

We recommend only ***nitrite-free*** anti-freeze glycol with the following supplier designations:

BASF G48 or BASF D542

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

Note **Change the coolant when cleaning the cooling system: Every 4800 hours or minimum every 5 years.**

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

WARNING

Ethylene glycol is highly dangerous if ingested and can prove fatal.

Avoid skin contact with glycol.

Important

The coolant should be ready mixed when it is poured into the cooling system.

Never top up with only water or only glycol.

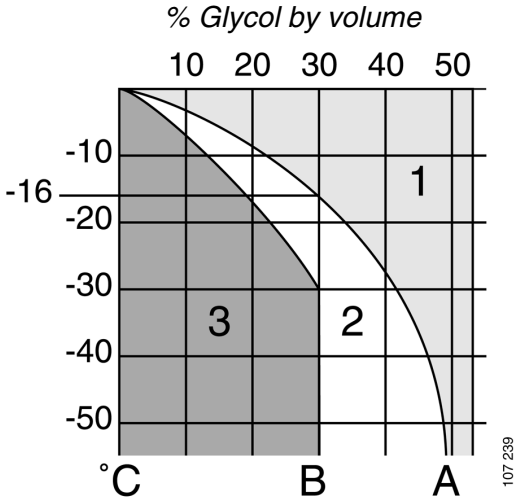
Important

The recommended glycol must not be mixed with glycol having nitrite-based anti-corrosive.

Risk for build up of sludge and reduced cooling capacity.

Characteristics of glycol at low temperatures:

- *Example with 30% glycol by volume*
- *Ice slush starts to form at -18 °C*
- *There is risk for malfunctions at -30 °C*
- *The engine cannot freeze and fracture with a minimum of 30% glycol by volume*



Curve A: Ice build up starts (slush)

Curve B: Temperature at which damage due to freezing can occur

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

A

% glycol by volume	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**60**	**Cooling system capacity, dm³**
Ice slush starts to form at °C	**-6**	**-9**	**-12**	**-16**	**-22**	**-27**	**-36**	**-46**	**-55**	
Glycol dm³ (litres)	5	6	8	9	11	12	14	15	18	30
	6	8	10	12	14	16	18	20	24	40
	8	10	13	15	18	20	23	25	30	50
	9	12	15	18	21	24	27	30	36	60
	11	14	18	21	25	28	32	35	42	70
	12	16	20	24	28	32	36	40	48	80
	14	18	23	27	32	36	41	45	54	90
	15	20	25	30	35	40	45	50	60	100
	17	22	28	33	39	44	50	55	66	110
	18	24	30	36	42	48	54	60	72	120
	20	26	33	39	46	52	59	65	78	130
	21	28	35	42	49	56	63	70	84	140
	23	30	38	45	53	60	68	75	90	150
	24	32	40	48	56	64	72	80	96	160
	26	34	43	51	60	68	77	85	102	170
	27	36	45	54	63	72	81	90	108	180
	29	38	48	57	67	76	86	95	114	190
	30	40	50	60	70	80	90	100	120	200

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

Coolant freezing temperature when ice starts to form at different glycol mixes

c)

Checking Protection against corrosion

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

If there is no danger of freezing use only ***Scania Anti-corrosive***.

The inhibitor in ***Scania Anti-corrosive*** is nitrite-free.

The correct proportion of anti-corrosive is ***7-12% by volume***.

- Topping up with 1.0% ***Scania Anti-corrosive*** by volume should be done after every 2400 hours of operation.
- ***Never top up with only water or only anti-corrosive! Fluid losses must always be replaced with premixed coolant: water + 10% by volume of Scania Anti-corrosive.***

Note **The coolant should be changed when the cooling system is cleaned: every 4,800 hours or minimum every 5th year.**

WARNING

Corrosion inhibitor, if swallowed can be fatal.

Avoid contact with the skin.

Important

Mixing corrosion inhibitor with glycol or adding too much corrosion inhibitor may cause deposits and reduced cooling capacity.

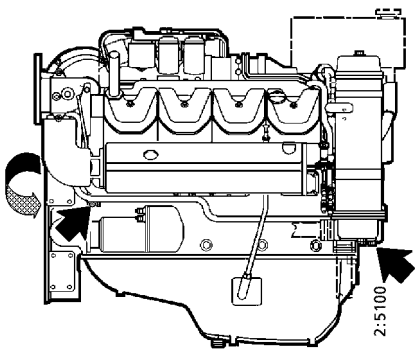
Important

If a coolant filter has been fitted it must <u>not</u> contain inhibitor.

Changing coolant

1. Remove the filler cap from the expansion tank.
2. The coolant is drained at two points as illustrated:
   - the ”lowest point” of the engine block, see drawing
   - the ”lowest point” of the cooling system.
3. Close the valves.
4. Top up with coolant through the expansion tank filler hole.

   Mix coolant as described on page 26.



Mind the environment!

Always collect fluid in a suitable container to avoid spillage when changing coolant.

Dispose of used coolant through an authorized waste disposal contractor.

9. Every 4800 hours:

CLEANING THE COOLING SYSTEM

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

External cleaning

Heat exchanger

1. Drain the coolant from the engine, see “Changing coolant”.
2. Drain the seawater circuit.
3. Detach the heat exchanger hose and pipe connections.
4. Dismantle the heat exchanger as illustrated.
5. Clean the outside of the element. Use a paraffin-based engine cleaner.
6. Any deposit on the inside of the pipes is removed mechanically using a round rod.
7. Assemble the heat exchanger with new gaskets and O-rings. Grease O-ring *4* before fitting.
8. Refit hose and pipe connections.
9. Fill the system with coolant as described on page 26.

! *Important*

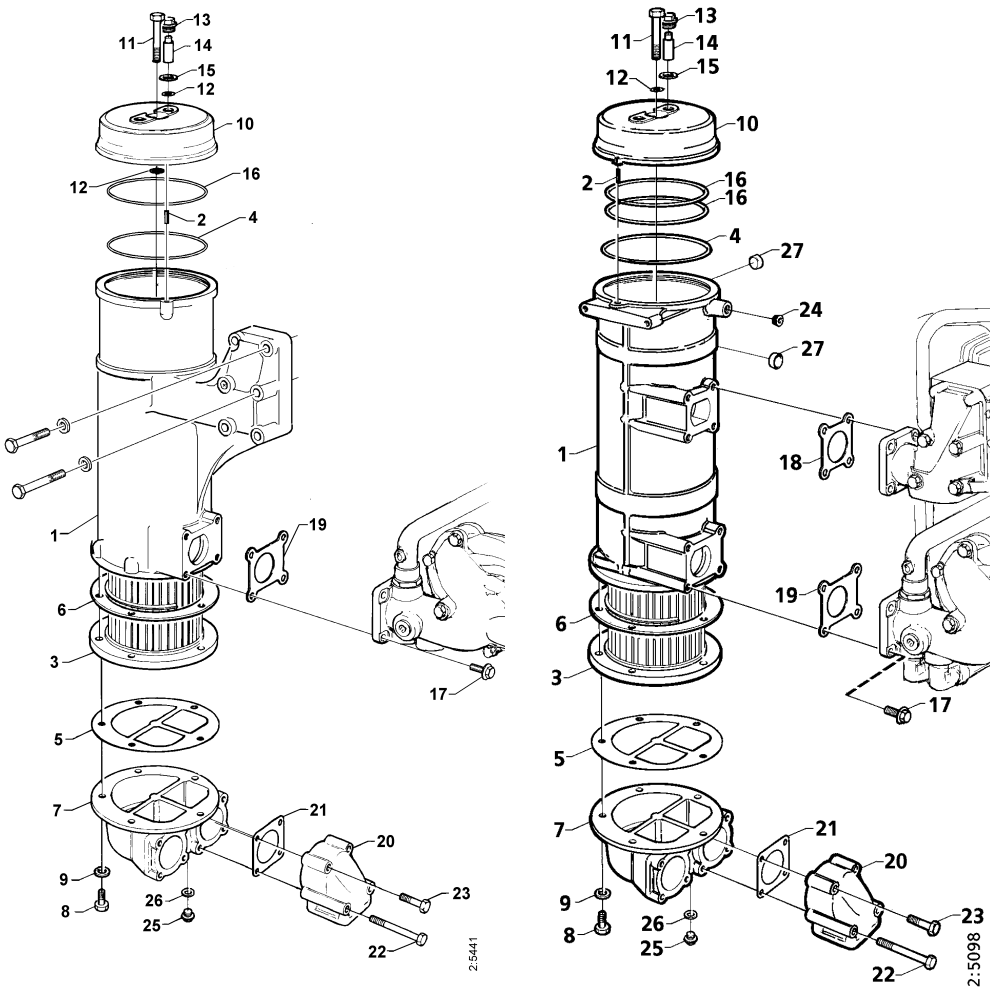
The cooling system must never be cleaned with caustic soda.

There is a risk of damage to aluminium parts.

! *Important*

There are springs and seal strips in the heat exchanger to the right, between the housing and the element, which are not illustrated.

1. *Housing*
2. *Spiral pin*
3. *Element*
4. *O-ring (DSI only)*
5. *Gasket*
6. *Gasket*
7. *Cover*
8. *Screw*
9. *Screw*
10. *Cover*
11. *Screw*
12. *O-ring*
13. *Plug*
14. *Protective anode*
15. *Gasket*
16. *O-ring*
17. *Screw*
18. *Gasket*
19. *Gasket*
20. *Flange pipe*
21. *Gasket*
22. *Screw*
23. *Screw*
24. *Plug*
25. *Plug*
26. *Washer*
27. *Plug*



DI14 68, DI14 75

Charge air cooler

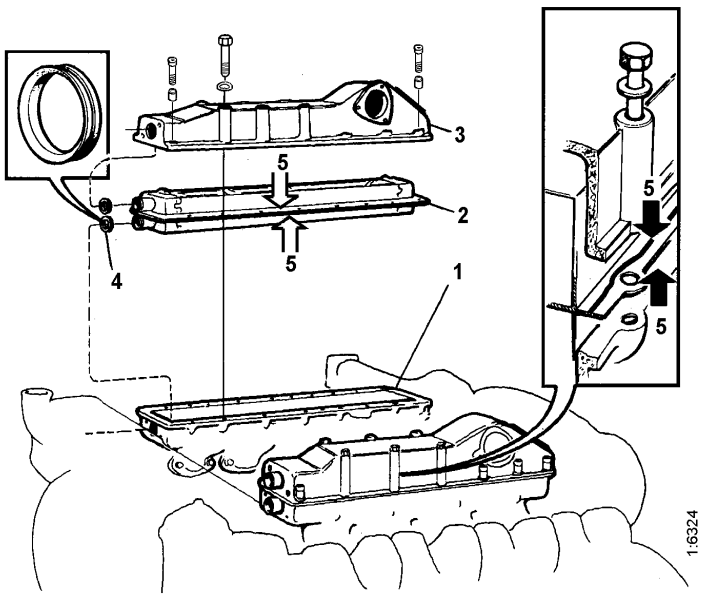
1. Drain the coolant from the engine, refer to “Changing coolant”.
2. Detach the charge air cooler inlet and outlet connections.
3. Detach the upper part of the intake manifold.
4. Dismantle the charge air cooler as illustrated.
   Be careful - do not damage the core water connections.
5. Clean the outside of the element. This is especially important if the engine is equipped with closed crankcase ventilation. Use a paraffin-based engine cleaner.
6. Clean and degrease the sealing surfaces on the core and the air intake manifold upper and lower parts with a spirit based cleaner.
7. Apply sealant (silicone 816 064) in a uniform bead, approximately 2-3 mm, on both sealing surfaces of the element.
8. Fit new V-ring seals on the connections of the element.
9. Assemble the charge air cooler within 15 minutes of applying the sealant. Torque tighten the bolts to 50 Nm.
10. Refit the inlet and outlet connections with new O rings.
11. Connect the intake manifold from the turbo.
12. Fill up with coolant according to the specification on page 26.

Important ***Allow the sealant to cure for minimum 24 hours before the engine is used.***

! *Important*

The cooling system must never be cleaned with caustic soda.

There is a risk of damage to aluminium parts.



1. *Intake manifold, lower part*
2. *Radiator element*
3. *Intake manifold, upper part*
4. *V-ring seal*
5. *Sealant 816 064*

Engines without heat exchanger (keel-cooling)

1. Check cooling elements/cooling pipes on the inside and outside of the keel.
2. Clean as necessary using a paraffin-based engine cleaner or carefully scrape off deposits from external pipes.

   Take care - do not damage cooling elements or cooling pipes.

Internal cleaning

Removing oils and greases

- If possible, run the engine until it has reached the operating temperature and then drain the cooling system.
- Remove the thermostats.
- Fill the system with clean, hot water mixed with liquid dishwasher detergent designed for household use.
  Concentration 1% (0.1/10 l).
- Run the engine until warm for about 20-30 minutes. Do not forget the cab heating system (if fitted).
- Drain the cooling system.
- Fill the system again using clean, hot water and run the engine for approximately 20-30 minutes.
- Drain the water from the system.
- Refit the thermostats.
- Fill up with new coolant according to the specification on page 26**.**

WARNING

Handling cleaning agents for the cooling system:

Read the warning label on the container.

Removing deposits

- If possible, run the engine until it has reached the operating temperature and then drain the cooling system.
- Remove the thermostats.
- Fill the system with clean, hot water mixed with one of the commercially available radiator cleaners based on sulphamic acid and containing dispersing agents. Follow the manufacturer's instructions for mixing proportions and cleaning times.
- Run the engine for the specified time and then drain the cooling system.
- Refill the system with hot water and run the engine for approximately 20-30 minutes.
- Drain the water from the system.
- Refit the thermostats.
- Fill up with new coolant according to the specification on page 26.

Mind the environment!

Always collect fluid in a suitable container to avoid spillage when draining coolant.

Dispose of used coolant through an authorized waste disposal contractor.

Preventive replacement of coolant pump gear wheel

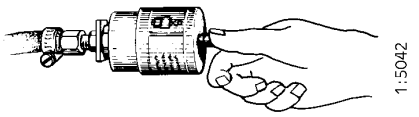
Note **Should be carried out when cleaning the cooling system.**

- Detach the coolant pump.
- Remove the gear wheel.
- Fit a new gear wheel and tighten the nut with 200 Nm.

Note **The tightening torque must no be applied across the gear wheel..**

- Refit the coolant pump with new gaskets against the timing gear housing.

AIR CLEANER



10. Daily:

READING THE LOW PRESSURE INDICATOR

If the indicator's red plunger is fully visible, change or clean the air cleaner filter element, point 12.

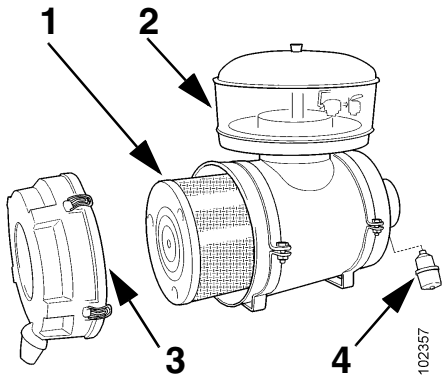
! *Important*

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

11. Every 200 hours:

CLEANING THE AIR CLEANER COARSE CLEANER

1. Remove the cover from the coarse cleaner.
2. Lift off the conical coarse separator. Remove the particles of dirt and clean it.
3. Fit the coarse separator and screw down the cover.



1. Filter insert
2. Coarse cleaner
3. Cover
4. Low pressure indicator

Air cleaner with coarse cleaner

12. Every 1200 hours:

CLEANING OR CHANGING THE FILTER ELEMENT

Note **Earlier if the vacuum indicator shows red**

Disassembly

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

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

3. Mark the filter when it has been cleaned.

Cleaning the element

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

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

! *Important*

Only use Scania genuine air filter. Change the filter element if it is damaged.

Danger of engine damage if the filter element is damaged.

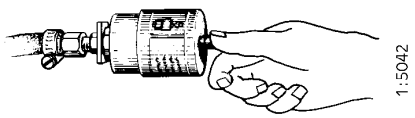
! *WARNING*

Never start the engine unless the air filter is installed.

Danger of personal injury or engine damage.

Checking

- Insert a flashlamp into the insert and check from the outside that there are no holes or cracks in the filter paper.
- Change the filter insert if there is any damage at all. Danger of engine damage.



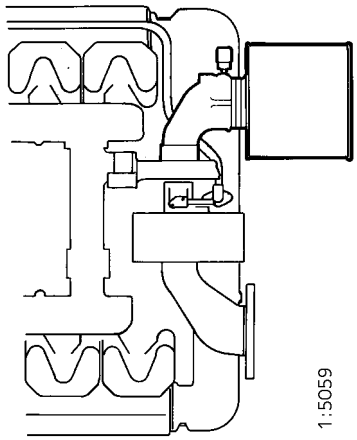
Assembly

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

Filter with a non-changeable element (unit cleaner)

Cleaning

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

Note **The element must not be dried with compressed air.**

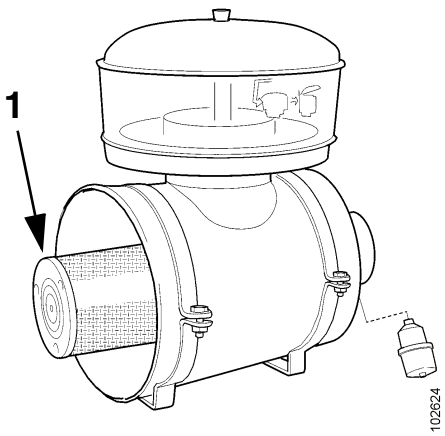
13. Every 2400 hours:
CHANGING SAFETY CARTRIDGE

Note **All filters are not fitted with safety cartridge.**

1. Remove the side cover from the air cleaner.
2. Remove the filter insert.
3. Remove the safety cartridge.
4. Fit a new genuine safety cartridge.
5. Change or clean the filter element, see point 12.
6. Assemble the air cleaner.

! *Important*

Do not remove the safety cartridge unnecessarily.



1. Safety cartridge

Air cleaner with safety cartridge

! *Important*

Never clean the safety cartridge

FUEL SYSTEM

! *Important*

Be extremely careful with cleanliness when working on the fuel system.

Malfunctions can easily arise and the injection equipment can be damaged.

14. Daily:

CHECKING FUEL LEVEL

- Top up fuel if necessary.
- If the tank is run dry, bleed the fuel system, see point 15.

15. Every 1200 hours:

CHANGING THE FUEL FILTER

Fuel tanks

- Drain any water from the fuel tanks.

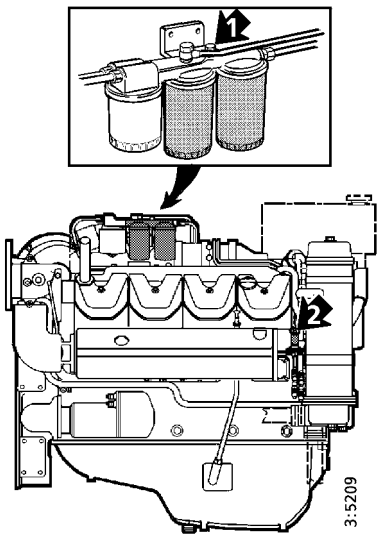
Main filter

The filter consists of two parallel coupled filter units.

- Wash the outside of the filters and unscrew them. Dispose of the filters according to environmental regulations.
- Do up the new filter ***by hand***.

  Never use tools for this. The filters can be damaged, obstructing circulation.

- Bleed the fuel system as described below.
- Start the engine and check for leaks.



Bleeding the fuel system

- Open the bleed screw **1** on the main filter.
- Pump the hand pump **2** until air-free fuel flows out at the maim bleed screw.
- Close the bleed screw. Pump a few times using the hand pump.

If the engine is difficult to start after bleeding . . . . .

- Slacken the injection pump overflow valve **3** one half turn and try starting again.

If the engine still won't start . . . . . .

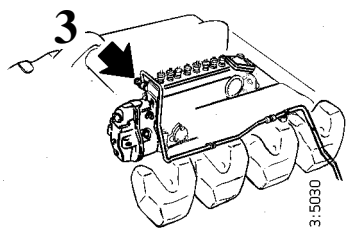
- Pump the hand pump until bubble-free fuel flows from the overflow valve.
- Tighten the overflow valve when the engine has started.

! *Important*

Only use Scania genuine fuel filter.

Mind the environment!

Always collect fuel in a suitable container to avoid spillage when bleeding system or renewing components.



16. Every 2400 hours:

CHECKING THE INJECTORS

Injectors should be inspected by trained personnel with access to the necessary equipment. Inspection should be carried out at least once a year or every 2400 hours.

Removal

1. Clean round the injectors and connections, including clamps and brackets.
2. Detach the delivery pipe bundle and leak-off fuel lines.
3. Unscrew the injector.
4. Fit protective plugs on the injector and delivery pipe.
5. Lift up the seal from the bottom of the injector seat if it does not come out together with the injector.
6. Fit a core plug in the injector seat in the cylinder head.
7. Clean the injectors and check/adjust in a nozzle tester.

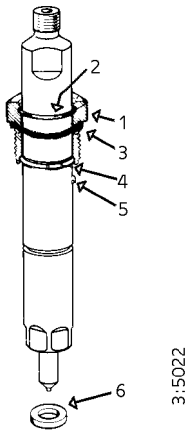
Correct opening pressure, see Technical data, page 49.

Fitting

1. Check that there is no old seal in place and fit a new seal in the bottom of the injector seat.
2. Fit a new O-ring in the threaded socket nut and a new seal under the socket nut.
3. Fit the injector.
4. Tighten the socket nut to 70 Nm (7.0 kpm).
5. Fit the delivery pipe and tighten the cap nut to 20 Nm (2.0 kpm). Fit clamps and brackets.

Important ***Take care to fit the delivery pipe without tension and make sure that the cone on it is correctly positioned in the connection.***

6. Fit the leak-off fuel line. Tighten the bolts to 11 Nm (1.1 kpm).



1. Socket nut
2. O-ring
3. O-ring
4. Stop ring
5. Guide pin
6. Seal

! *Important*

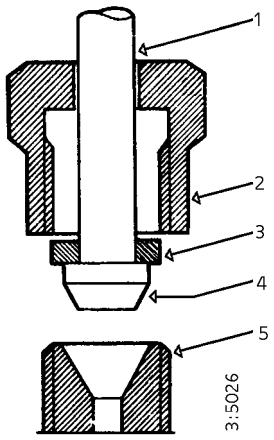
The delivery pipes must not be bent.

All clamps must be refitted.

⚠ *WARNING*

Always wear gloves and eye protection when testing injectors.

Fuel escaping under high pressure can penetrate body tissue and cause serious injury.



1. Delivery pipes
2. Cap nut
3. Washer
4. Cone
5. Connector on injector or injection pump

Delivery pipe connection

ELECTRICAL SYSTEM

17. Every 200 hours:

CHECKING THE ELECTROLYTE LEVEL IN BATTERIES

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

WARNING

Do not let open flame or sparks come near the batteries.

When batteries are charged, they emit highly flammable fumes that can explode.

18. Every 200 hours:

CHECKING THE STATE OF CHARGE IN BATTERIES

Note **Every 200 hours applies to gensets and the like. Other installations every 1200 hours.**

- Check the density with an acid tester.

In a fully charged battery it should be:

1,280 at +20 °C

1,294 at 0 °C

1,308 at -20 °C

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

Do not rapid-charge the batteries. This will damage the battery in the long run.

WARNING

Wear gloves and eye protection when charging and handling batteries.

Batteries contain a highly corrosive acid.

19. Every 200 hours:

CLEANING BATTERIES

Note **Every 200 hours applies to gensets and the like. Other installations every 1,200 hours.**

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

WARNING

Do not connect the cables to the wrong terminals.

This could cause serious damage to the electrical system.

If the terminals are shortcircuited, sparks will be generated.

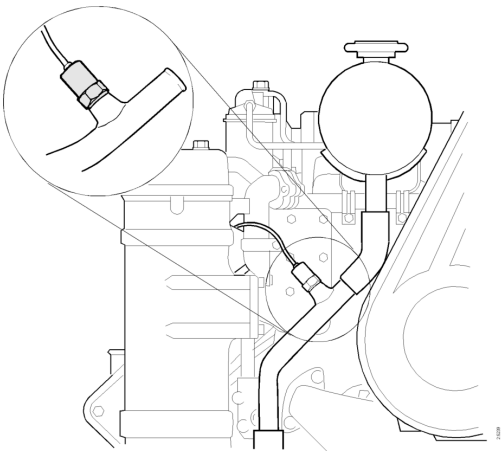
20. Every 1200 hours:

CHECKING THE COOLANT LEVEL MONITOR

(optional equipment)

Note **Check the coolant level monitor when the engine is cold.**

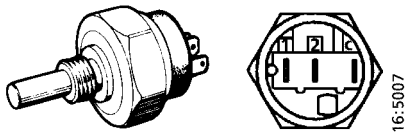
1. Loosen clamping of level monitor cable on the engine and disconnect the connector.
2. Put a container under the water-cooled exhaust manifold and unscrew the monitor. Immediately insert a threaded plug M18x1.5 in the hole for the monitor. ***Avoid contact with the skin when handling coolant.***
3. Connect the monitor connector and put the control switch in the "ON" position.
4. Check that the warning lamp remains on and that the buzzer sounds (if fitted).
5. Lower the monitor into a metal container (steel) with liquid. It is important that the monitor body is in contact with the metal.
6. After approximately 2 seconds the warning lamp should go out.
7. Remove the monitor from the liquid. After approximately 7 seconds the warning lamp will come on and the buzzer sound (if fitted).
8. Disconnect the monitor connector and screw on the monitor again.
9. Clamp the monitor cable as before and connect the connector.
10. Top up the system with coolant according to the specification on page 26.



2-pole level monitor

21. Every 1200 hours:

CHECKING THE TEMPERATURE MONITOR



C = Common connection

1 = Connection C -1 closes at stamped temperature

2 = Connection C -2 opens at stamped temperature

2-pole temperature monitor

1. Drain the coolant, allowing the temperature monitor to be removed.
2. Remove the temperature monitor cable(s).
3. Unscrew the monitor.
4. Refit the cable(s) to the monitor.
5. Submerge the monitor sensor body in water. Heat the water slowly (about 1° per minute) using e.g. an immersion heater.
6. Set the control switch to "ON". Use a thermometer to check that the warning lamp comes on or that an alarm is initiated at the correct temperature.

   The correct temperature is stamped on the hexagonal part of the monitor.

   The temperature tolerance is ± 3°.

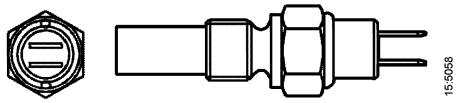
Mind the environment!

Always use a suitable container to avoid spillage when draining coolant.

Dispose of used coolant through an authorized waste disposal contractor.

CHECKING TEMPERATURE SENSOR

1. Drain the coolant, allowing the temperature sensor to be removed.
2. Remove the temperature sensor cable(s).
3. Unscrew the sensor.
4. Connect an ohmmeter to the temperature sensor.
5. Submerge the sensor body in water. Heat the water slowly (about 1° per minute) with for example an immersion heater.
6. Check the resistance at the temperatures given below.
7. The sensor should give the following readings:



2-pole temperature sensor

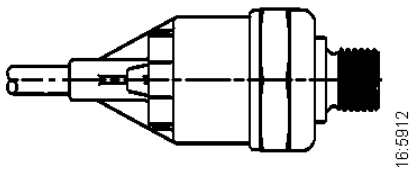
At temp. °C	Resistance Ω	Tolerance °C
60	134 ± 13.5	±4
90	51.2 ± 4.3	±3
100	38.5 ± 3	±3

22. Every 1200 hours:

Sensor function

Measure the sensor output voltage (pin 3) at different oil pressures. The sensor output voltage shall be as follows:

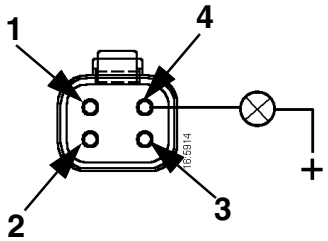
0.85-1.15 bar	=	2.45 volt
1.80-2.20 bar	=	3.70 volt
2.75-3.25 bar	=	4.50 volt
3.79-4.20 bar	=	5.20 volt
4.55-5.45 bar	=	5.70 volt
5.40-6.6 bar	=	6.10 volt



The tolerances apply at +30°C - 110°C. At lower temperatures the tolerance range is wider, e.g. 0°C = x 1.4.

Monitor function

Connect a test lamp to the oil pressure monitor, pin 4 (- ground), and check that the monitor switches on at the correct pressure when the engine is started and stopped. The monitor shall switch on at ***0.7 ± 0.15 bar*** when the engine is stopped.



Important ***The sensor/monitor must be supplied with voltage during the measurement. Maximum 4 W load from a test lamp.***

Monitor connected for automatic stop in case of a fault:

1. Start the engine.
2. Check on the oil pressure gauge that oil pressure rises.
3. Stop the engine manually (using the emergency stop).
4. Check on the oil pressure gauge at what pressure the stop solenoid operates and the monitor opens. Correct pressure: ***0.7 ± 0.15 bar.***

Monitor connected to buzzer:

1. Main power switch in operating position, check that buzzer sounds.
2. With the engine running, check that the buzzer falls silent when the oil pressure is ***above 1.1 ±0.15 bar*** and the monitor closes.

23. Every 400 hours:

CHECKING THE STOP FEATURE

Check that the stop solenoid is activated and stops the engine when the stop signal is given by the button, temperature monitor, coolant level monitor and oil pressure monitor if these are coupled for automatic stop in the case of fault.

CHECKING THE STOP SOLENOID

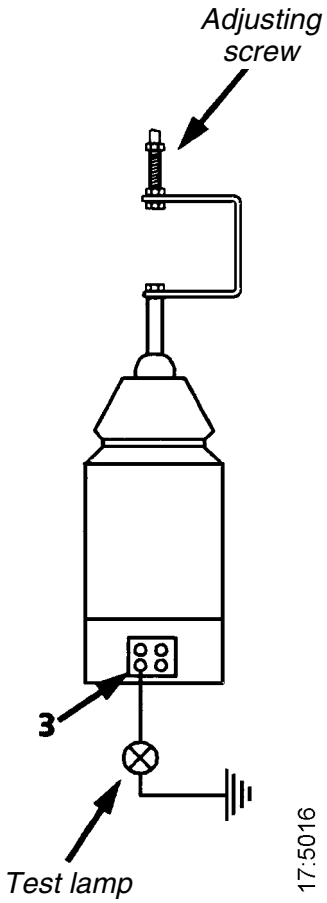
The following should be checked when changing the stop solenoid:

Plunger end position

- Connect a test lamp between connector pin **3** in the stop solenoid connector and battery negative.
- With the stop solenoid in energized position, the test lamp should light, i.e. there should be power on pin **3**). Adjust the stop solenoid linkage until the test lamp lights (adjusting screw at yoke, see drawing) with the solenoid energized.

  The test lamp indicates that the pull coil is disconnected and that the latch coil is connected.

  If the pull coil is connected for more than 10 seconds, the solenoid is damaged.



Check the stop arm on the injection pump

RSV governor

- The stop arm should precisely touch the end stop in both operating and stop positions.

RQ/RQV-K governor

- The stop arm should be against the mechanical stop inside the governor housing in both operating and stop positions.

Important ***Adjust as necessary with the yoke adjusting nut.***

CHANGING BATTERY

Removal

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

Fitting

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

WARNING

Do not connect the cables to the wrong terminals.

This could cause serious damage to the electrical system.

If the terminals are short-circuited, sparks will be generated.

Mind the environment!

Dispose of used batteries through an authorized waste disposal contractor.

MISCELLANEOUS

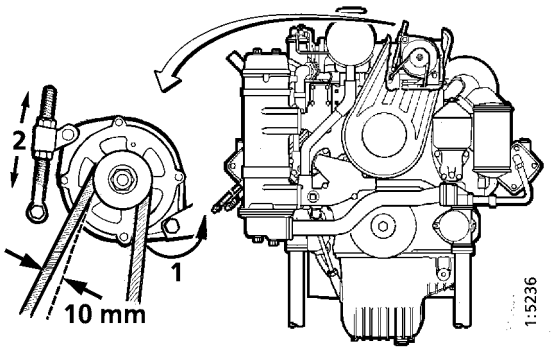
24. Every 200 hours: CHECK/TENSION V-BELTS

Correctly tensioned drive belts should be possible to depress about 10 mm with a force of 35-50 N (depending on the free length of the belt) when pressing on one belt.

Change worn or damaged belts.

1. Detach the securing screws.
2. Set the correct tension using the adjusting screw.

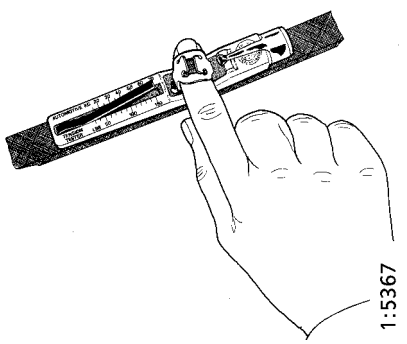
   Do not over-tighten the belts.



Measurement using belt tension gauge Krikit (Part. No. 587 495)

1. Zero the gauge by pressing the measuring arm.
2. Place the gauge on the V-belt at an equal distance from two pulleys.
3. Press until the gauge clicks.
4. Read the gauge.

- Recommended tension in Scania genuine belts at test is ***300 N***.
- When changing belts, slightly higher (10-15%) tension should be used.



25. Daily:

CHECKING FOR LEAKAGE, RECTIFY AS NECESSARY

- Start the engine.
- Check for oil, coolant, fuel, air and exhaust leakages.
- Tighten or change leaking connections. Check the overflow holes (1) which show whether the O-rings between the cylinder liner and crankcase are leaking, see drawing.

  a) If coolant is leaking out, the two upper O-rings are leaking.

  b) If oil is leaking out, the lower O-ring is leaking.
- Check that the drain hole (2) on the coolant pump is not blocked, see drawing. If there is leakage, change the pump seal.
- Check that the drain for the "V" behind the injection pump is open all the way through the block and drain pipe so that no fluid can collect in the "V". See illustration.

  A small amount of leakage from the overflow holes during the engine's running-in period is normal. (Seals and O-rings are lubricated with soap or oil when fitted.).

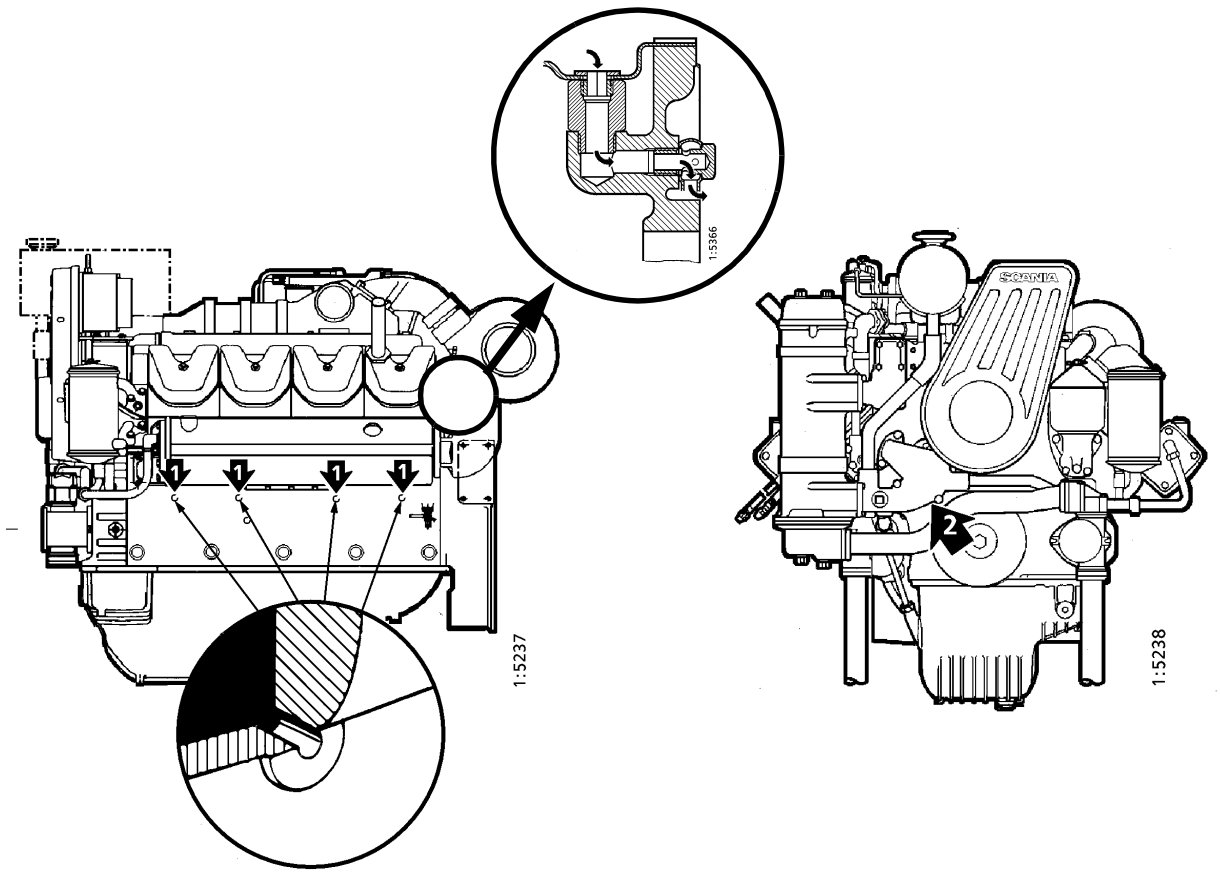
  This leakage normally stops after a time.

Mind the environment!

Ensure that any leakage does not pollute the environment.

! Important

In case of major leakage, contact the nearest Scania workshop.



26. Every 2400 hours:

CHECK/ ADJUST VALVE CLEARANCE

Note **Checking/adjusting valve clearances should also be carried out after the first 400 hours of operation.**

Valves should be adjusted when the engine is cold, at least 30 minutes after operation.

Rocker cover gaskets should be changed as necessary. Tightening torque: 25 Nm.

Intake valve clearance: 0.45 mm
Outlet valve clearance: 0.80 mm.

WARNING

Immobilise the starting device when working on the engine. If the engine starts out of control, there is a SERIOUS RISK OF INJURY.

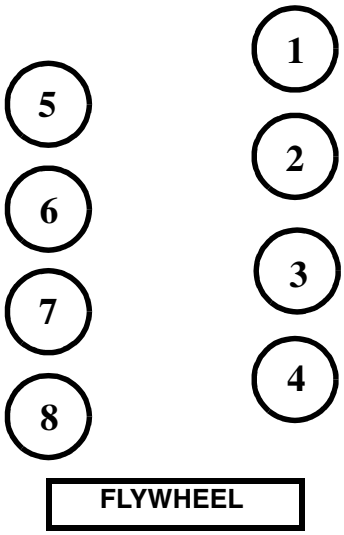
Alternative 1

- Turn the crankshaft in its direction of rotation until the No. 1 cylinder is at 30 after TDC on the combustion stroke. There is a mark, ⊥ , at this point.
- Adjust the following valves:

Right side	Cyl 1	Intake and exhaust
	2	Ex
	4	Ex
Left side	Cyl 5	In and ex
	7	In
	8	In

- Turn the crankshaft one revolution in its direction of rotation to the mark ⊥. The No. 1 cylinder piston is then at 30 after TDC in the induction stroke.
- Adjust the following valves:

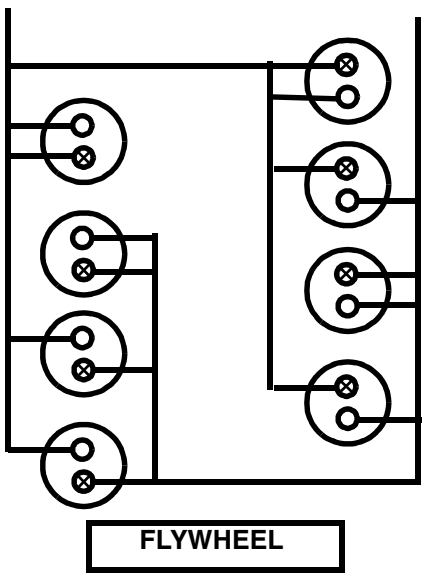
Right side	Cyl 2	In
	3	In and ex
	4	In
Left side	Cyl 6	In and ex
	7	Ex
	8	Ex



Cylinder numbering

No. 1 cylinder piston 30° after TDC in

combustion stroke *induction stroke*



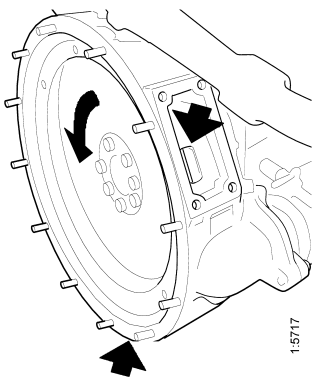
Intake valve

Exhaust valve

Note

On *silumin casings* readings can only be taken from underneath.

On *cast iron casings* readings can be taken from either underneath or from the side (60°) according to the accessibility.



Covers for reading on flywheel casing

Alternative 2

- Set the No. 1 cylinder to TDC by turning the engine in its direction of rotation until both valves are closed.
- Adjust both the valves for the No.1 cylinder. Correct valve clearance is indicated on the instruction plate on one of the rocker covers.
- Repeat this procedure with the remaining cylinders in the order 5 - 4 - 2 - 6 - 3 - 7 - 8 (firing sequence) by turning the engine 1/4 revolution in its direction of rotation between each adjustment.

27. Every 2400 hours:

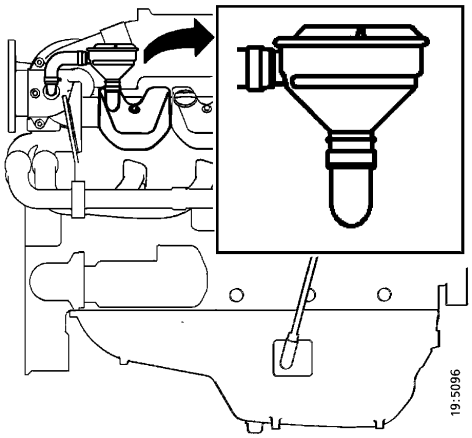
CHANGING (or CLEANING) VALVE FOR CLOSED CRANKCASE VENTILATION

Alternative 1:

Change the valve at the specified interval.

Alternative 2:

- Remove the valve after the specified interval.
- Clean the valve by placing it in a bath of diesel oil overnight. Then rinse it several times in diesel and allow it to drip dry.
- Refit the valve.
- The valve may be reused (cleaned), ***maximum twice*** after the initial 2400 hours of operation. Take care to mark the valve after cleaning it.



LONG-TERM STORAGE

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

The engine can normally stand idle for up to six months. If it remains unused for longer than this the following measures, which provide protection for about four years, should be adopted.

Preparing the engine for long-term storage means:

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

Preservative coolant

If the engine is to be stored with a full cooling system, use coolant containing 50% glycol by volume. Glycol ***without*** nitrite-based inhibitor must be used. E.g. **BASF G48** or **BASF D542**.

WARNING

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

Preservative fuel

- Use diesel fuel oil mixed with Lubrizol 560A or the equivalent.
- Mix 1 cm^3 (ml) Lubrizol 560A in 10 dm^3 (l) of fuel.

HANDLING LUBRIZOL 560A

Hazardous!

Contains aromatic hydrocarbons

Use spot extractors where there is a danger of vapour build-up.
Wear protective gloves and goggles when handling Lubrizol. Do not use contaminated clothing.

In case of splashes in the eye: Rinse with moderate water spray (for min. 15 minutes). Seek medical attention.

In case of skin contact:	Wash affected areas with soap and water.
If you inhale it:	Fresh air, rest and warmth
Flammable:	Fire class 2A. Flash point + 27°. ***In case of fire***: Extinguish using carbonic acid, powder or foam
Storage:	In properly sealed container in a dry, cool place. **Keep out of reach of children.**

Preservative oil

Suitable preservative oil can be supplied by most petroleum companies.

For example: Dinitrol 40 or the equivalent.

Preparations for storage

- Drain and flush the cooling system. Top up with preservative coolant.
- Warm up the engine on regular fuel. Stop the engine and drain the oil.
- Change the fuel filter and turbo filter.
- Fill the engine with preservative oil up to the minimum level on the dipstick.
- Mix preservative fuel in a can. Detach the fuel pipe at the feed pump suction line and connect a hose from the can.
- Detach the fuel pipe at the overflow valve and connect a return hose to the can.
- Start the engine and run it at about 1000 rpm (not single-speed engines) for 20-25 minutes.
- Stop the engine, remove the hoses and connect the regular fuel lines.
- Oil the valve mechanism generously with preservative oil.
- Remove the injectors and spray preservative oil into each cylinder, ***max 30 cm^3 (ml)***.
  Turn the engine over a few times using the starter motor. Spray a ***small*** amount of oil additionally into each cylinder.
  After this the engine must not be cranked. Refit the injectors.
- Drain the preservative oil from the engine. Fresh engine oil can be filled directly or when the engine is taken out of storage.
- Drain the coolant if the engine is not to be stored with a full cooling system. Plug and tape over all coolant connections (if the cooling system is not completely assembled).
- Air cleaner: Clean or change the filter element.
- Cover air intakes and exhaust pipes.
- Alternator and starter motor:
- Spray with water-repellent anti-corrosive oil, CRC 226, LPS1 or equal.
- Spray the outside of bright metal engine parts, first with penetrating preservative oil such as Dinitrol 25B and then with Dinitrol 112 or equal.

Winter storage

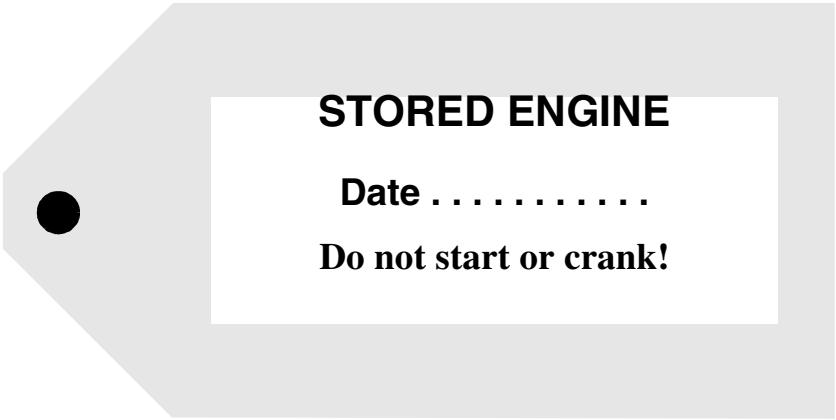
- In order to minmize the risk of condensation water in the fuel tank during a winter stop it should be filled with fuel.

Mind the environment!

Always use suitable containers to avoid spillage when draining oil and coolant.

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

- *Attach a label to the engine showing the date of preservation and clearly stating that it must not be started or cranked.*



Batteries

Remove the batteries for trickle charging at a charging station. (This does not apply to batteries which, according to the manufacturer, are maintenance free.) The same is applicable for short-term storage if the engine has not been prepared for storage as above.

WARNING

Wear gloves and eye protection when charging and handling batteries.

Batteries contain a highly corrosive acid.

Storage

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

Taking out of storage

(Procedure when the engine is to be put into operation)

- Remove plugs and tape from coolant connections, air intakes and exhaust pipes.
- Fill the system with coolant, see page 12.
- Check the oil level in the engine or top up with new motor oil.
- Turn the engine over a few times with the injectors removed, at the same time copiously oiling the valve mechanism with pushrods and tappets.

Important ***The engine must be turned over with the injectors removed so that surplus preservative oil will be pressed out of the cylinders.***

- Fit the injectors.
- Empty the fuel system main filter of preservative oil.
- Bleed the fuel system.
- Wash off any externally applied preservative oil, using white spirit.

Mind the environment!

Always use suitable containers to avoid spillage when draining oil and coolant.

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

TECHNICAL DATA

GENERAL		DI14
Number of cylinders		V8, 90°
Cylinder bore	mm	127
Stroke	mm	140
Displacement	dm^3 (litres)	14.2
Number of main bearings		5
Firing sequence		1 - 5 - 4 - 2 - 6 - 3 - 7 - 8
Compression ratio		15:1 High output engine:13.5:1
Engine direction of rotation viewed from rear		Anti-clockwise
Fan direction of rotation viewed from the front		Anti-clockwise
Cooling		Fluid
Valve clearance, cold engine: intake valve exhaust valve	 mm mm	 0.45 0.80
Weight (without coolant and oil) engine with heat exchanger engine without heat exchanger (keel-cooling)	 kg kg	 1400 1325
Output		see “Engine record card”
LUBRICATION SYSTEM		
Max. oil pressure (warm engine at speed above 800 rpm)	bar (kp/cm^2)	6
Normal oil pressure (warm engine at operating speed)	bar (kp/cm^2)	3 - 6
Min. oil pressure (warm engine 800 rpm)	bar (kp/cm^2)	0.7
Oil capacity, see page 21.		
Crankcase pressure with closed crankcase ventilation	mm VP	-55 - +20

FUEL SYSTEM		DI14
Pump setting BTDC		See plate on rocker cover
Injectors, opening pressure	bar (kp/cm^2)	300
Low idle	rpm	700
Maximum full load speed		See engine card
Fuel		Diesel fuel oil[1)]
Tightening torques: Socket nut for injectors Cap nut for delivery pipe Oil leakage connection	 Nm Nm Nm	 70 20 11
[1)] see page 51		
COOLING SYSTEM		
Number of thermostats		2
Thermostat, opening temperature	°C	79
Coolant temperature: system with atmospheric pressure system with positive pressure	 °C °C	 70 - 93 70 - about 100
Capacity with heat exchanger without heat exchanger (keel-cooling)	 dm^3 (litres) dm^3 (litres)	 93 50
ELECTRICAL SYSTEM		
System voltage	V	24
Alternator, current	A	65 or 120 or 2x65
Starter motor power	kW (hp)	6,7 (9,1)
Monitors, settings: oil pressure monitor temperature monitor	 bar (kp/cm^2) °C	 2-pole: 0.7 ± 0.15 Stamped on monitor hexagon

FUEL

Diesel fuel

The composition of the diesel fuel is vitally important to the operation and life of the engine and the fuel injection pump. The engine power output and the exhaust emissions are also dependent on the fuel quality.

The requirements and the test standards for the most important properties are described in the workshop manual in sections that can be ordered from your Scania dealer or directly from Scania. The address of Scania is printed on the cover.

The diesel fuel shall comply with the following standard:
EN 590 (European standard).

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

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

Environmentally favourable fuels (low sulphur fuels)

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

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

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

Temperature dependence of diesel fuel

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

The diesel 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 lower temperature than normal, **first identify the temperature properties of the fuel concerned**.

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

- If the fuel concerned is not intended for the expected temperature and no diesel fuel with the correct temperature properties is available, we recommend that an electric fuel heater be installed **as a preventative measure.**
- The low temperature properties of diesel fuel may be improved by adding kerosene **as a preventative measure**. A maximum of 20% may be added. When refuelling, the kerosene should be added first, so that it mixes thoroughly with the diesel fuel.

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

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

Drain fuel tanks and drain or renew fuel filters at regular intervals.

WARNING

It is not permitted to mix kerosene with diesel fuel that is already adapted for the climate concerned. The injection pump may be damaged. All use of paraffin other than kerosene is forbidden, as it causes engine damage.

Important

It is not permissible to mix petrol with diesel fuel. Petrol may cause wear to the fuel injection pump and it may also cause damage to the engine.

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