

IMPORTANT INFORMATION

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

SERIOUS RISK OF INJURY

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

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

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



Operator's Manual

D11 DI11

Marine engine

opm96-11m en 1 588 296

1997-11:2

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

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 instruction manual describes the operation and maintenance of the Scania D11 and DI11 Marine Engines. The instructions apply to engines in *program 96* from engine number 5 364 870.

The engines are direct injection, fluid-cooled, four-stroke diesel engines with 6 cylinders in line. The engines are available with or without charge air cooler, see page 4.

The engines may be equipped with two different cooling systems; heat exchangers which are cooled by seawater or keel-cooling which means that there are cooling pipes on the keel through which the engine's internal coolant is cooled.

Common applications are propulsion engines in small boats such as fishing boats and ferries and in large recreational boats or as engines for driving equipment onboard ships.

The engines can have different output and speed settings and may be classed by different classification societies (classified engines are required for certain marine installations).

The normal output setting of the engine (performance code) is indicated on the type plate, see page 4.

Note Only standard components are described in the instruction manual. For special equipment, refer to the instructions issued by the manufacturer.

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

- Read through the Instruction Manual before starting to use your engine. Even those experienced with Scania engines may find new information in this manual.
- Follow the maintenance instructions. Maintenance according to the instructions forms the basis of good function and service life.
- Get to know your engine so that you know what it can do and how it works.
- When necessary, always turn to an authorised Scania workshop. These have special tools, genuine parts and staff with training and practical experience of Scania engines.

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

Scania CV AB
Industrial and Marine Engines
S-151 87 Södertälje

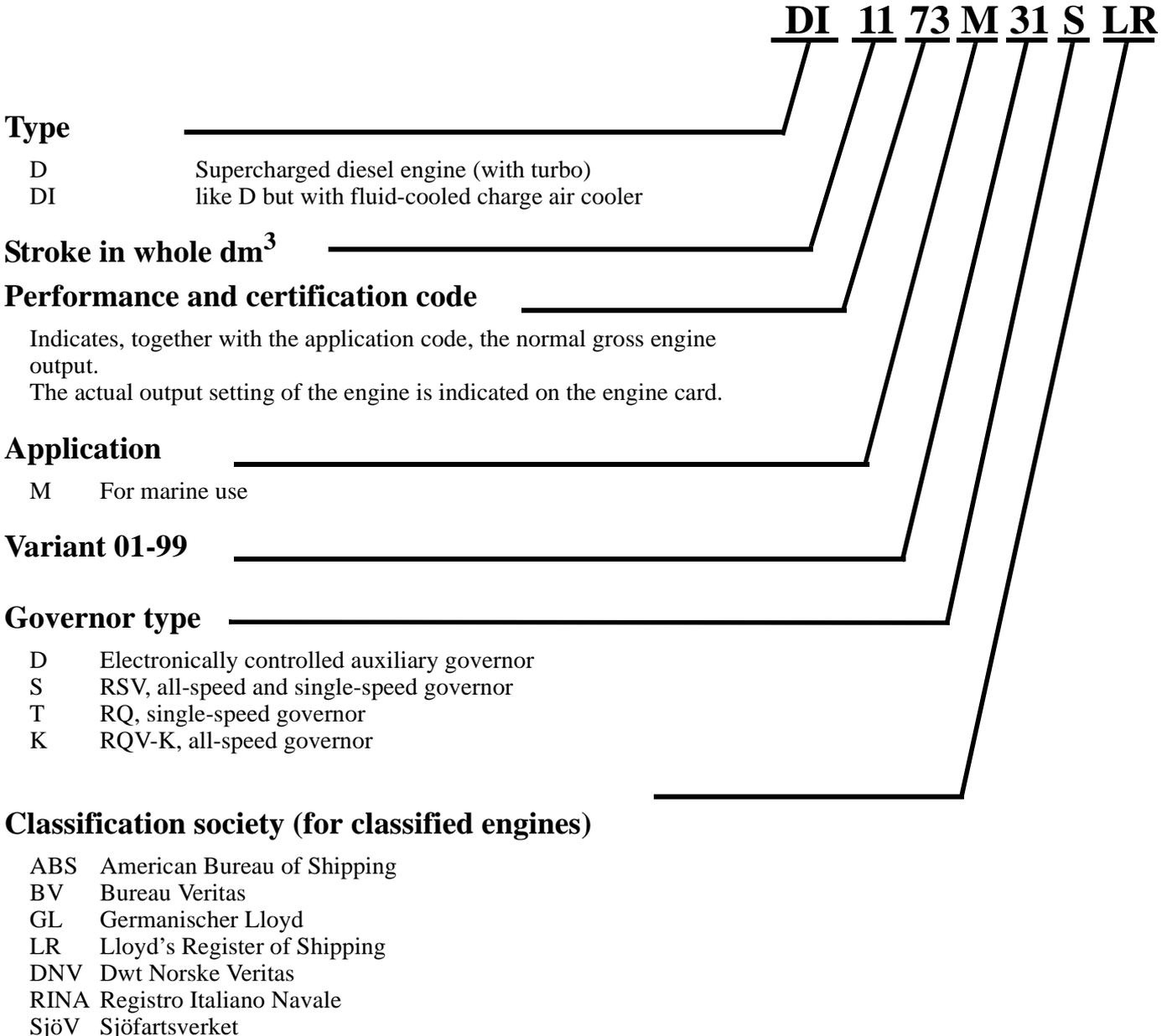
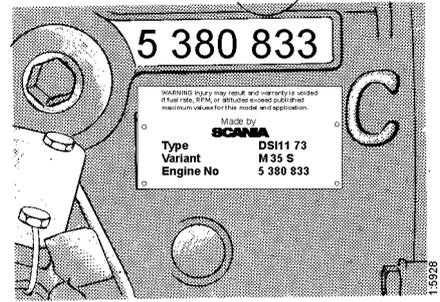
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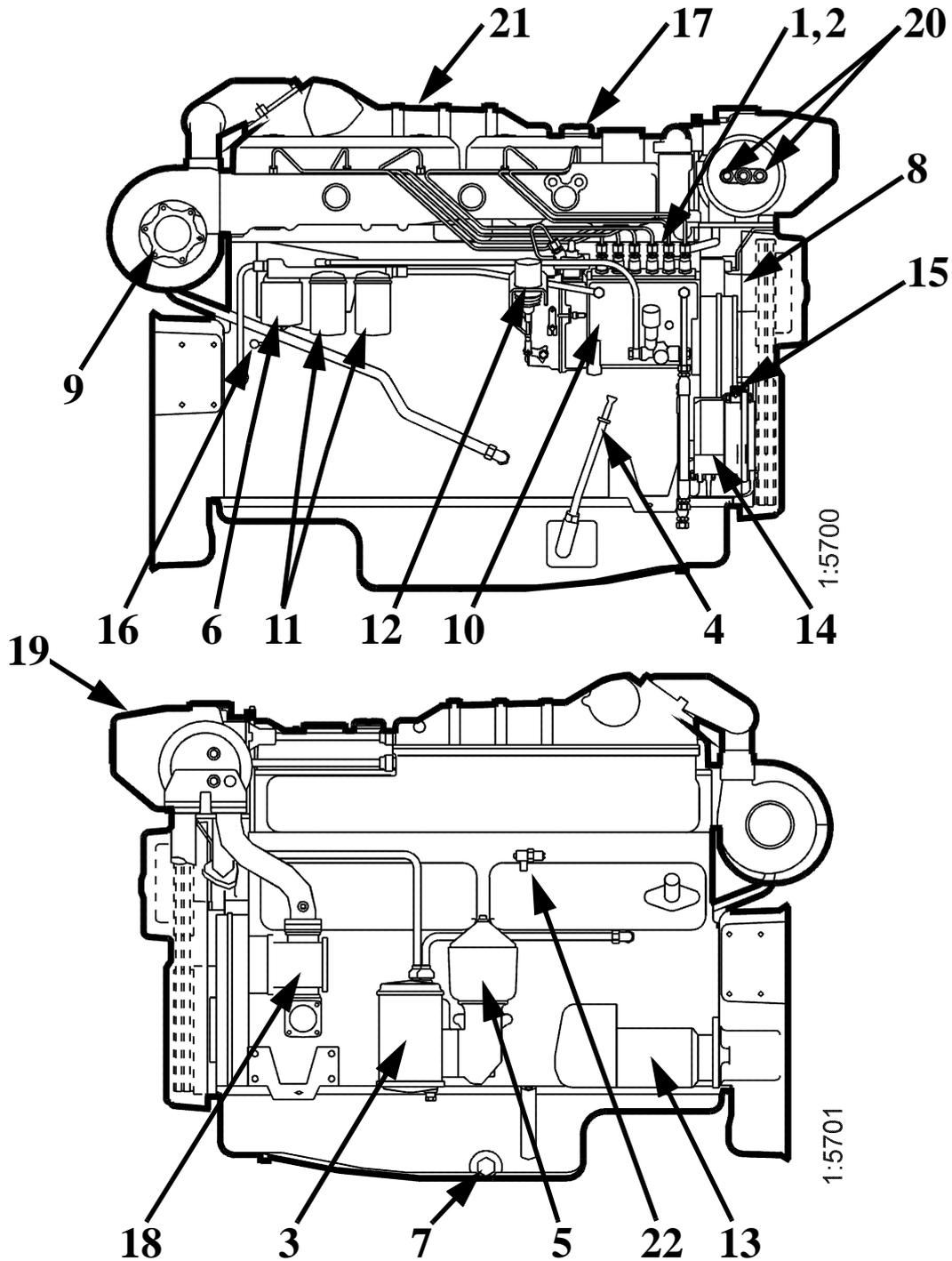
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TYPE DESIGNATIONS

The engine designation indicates, in the form of a code: Engine type, size, application etc.

The type designation and engine number are indicated on a type plate which is located on the right-hand, front side of the engine. The engine number is also stamped in the block beside the type plate.





The drawings illustrate a common type of D11 engine.
Your engine may have other equipment not shown here.

- | | | |
|---|--------------------------|--|
| 1. Type plate | 9. Turbocharger | 17. Oil filling |
| 2. Engine number, stamped in engine block | 10. Injection pump | 18. Seawater pump |
| 3. Oil cooler | 11. Fuel filter | 19. Heat exchanger with expansion tank |
| 4. Oil dipstick | 12. Stop solenoid | 20. Sacrificial anodes |
| 5. Oil cleaner | 13. Starter motor | 21. Charge air cooler |
| 6. Turbo filter | 14. Alternator | 22. Oil pressure monitor |
| 7. Draining, engine oil | 15. Fan belt, adjustment | |
| 8. Coolant pump | 16. Draining, coolant | |

STARTING AND RUNNING

AT FIRST START

When the engine is started for the first time, the maintenance points listed under "First start" in the maintenance schedule should be followed, see page 13.

Since these points are important for the engine to work satisfactorily right from the start, they are also listed below.

1. Checking oil level (see page 15).
8. Checking coolant (see page 20).

The coolant should contain anti-corrosive to protect the cooling system from corrosion.

If there is a danger of freezing:

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

BASF G48 or BASF D542

- The concentration of glycol should be **30 - 60% by volume** depending on ambient temperature. 30% by volume offers protection down to -18 °C. See page 20.
- *Never top up with water only or glycol only. Lost fluid should always be replaced with pre-mixed coolant with the same glycol content as the coolant in the engine. If the concentration of glycol drops, both anti-freeze and corrosion protection will suffer.*

Note A glycol concentration below 30% by volume will not provide sufficient protection against corrosion. A glycol concentration greater than 60% will not increase anti-freeze protection and reduces engine cooling capacity.

If there is no danger of freezing:

- Only *Scania Anti-corrosive* should be used in the coolant to protect against corrosion. The correct level of anti-corrosive is 7-12% by volume and this must never drop below 7% by volume. The inhibitor in *Scania Anti-corrosive* is nitrate-free.
- First fill: Fill with *Scania Anti-corrosive* as indicated on the packaging.
- *Never top up with water only or anti-corrosive only. Lost fluid should always be replaced with pre-mixed coolant: water + 10% Scania Anti-corrosive by volume.*
- Only coolant filter *without inhibitor* may be used. The use of a coolant filter increases the life of the coolant and reduces the risk of deposit corrosion.

Coolant composition:
If there is a danger of freezing:
at least 30% glycol by volume
Max. 60% glycol by volume
If there is no danger of freezing:
7-12% by volume
Scania Anti-corrosive

The recommended glycols may not be mixed with glycol which has a nitrite-based anti-corrosive or with *Scania Anti-corrosive*

***Scania Anti-corrosive* must not be mixed with glycol.**
Mixing or over concentration can cause sludging

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

- 14. Checking fuel level (see page 29).
- 17. Checking electrolyte level in batteries (see page 31).
- 18. Checking battery charge (see page 31).
- 20. Checking coolant level monitor (see page 32).
- 21. Checking temperature monitor (see page 33).
- 22. Checking oil pressure monitor (see page 34).
- 23. Checking stop feature (see page 34).
- 24. Checking v-belt tension (see page 36).



WARNING

**Block the starter 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 13.

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 29.

Out of consideration to our common environment, your new Scania engine has been designed to be started with less fuel. Unnecessarily large fuel supply at start will always result in the release of uncombusted 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 a 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.

Important *A maximum of 3 start attempts per minute may be made when the stop solenoid is activated at start. The timer module can be damaged resulting in the loss of the stop feature.*

Starting at low temperatures

Local environmental requirements should be complied with. Start aids, engine heater and/or flame start should be used to avoid starting problems and white smoke.

At temperatures below 0 °C:

Note Use only start aids recommended by Scania.

- The starter motor may only be used for 30 seconds, after which 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 s). The glow plug continues to glow as long as the button is held down after the engine is started. Max. time is 5 minutes.
- Operating flame start *with timer relay*: Press the pre-glow button (max. 20 s). Release the pre-glow button after the engine starts. The timer relay keeps the glow plug working for 5 minutes. If a shorter on-time is required, press the release button. The key must be set to 0 of the start attempt fails.

Note If the engine is equipped with an INTERLOCK switch, this should be held depressed until sufficient oil pressure has been achieved. If the INTERLOCK switch is released too early, the engine will stop.

- Gensets should be placed under load directly after start to avoid the risk of white smoke. This applies especially to engines which are installed without heating aids or addition of base load.
- Set the appropriate idle speed before the engine reaches 1,000 rpm (does not apply to gensets).
- Run the engine until warm with a light load. A light load on a cold engine gives better combustion and faster heating than warming up with no load.

RUNNING

Check instruments and warning lamps at regular intervals.

Speed

The Scania tachometer is divided into different coloured sections as follows.

| | | |
|-----------------|-----------------------|--|
| 0 - 500 rpm | red area: | prohibited speed, passed when starting and stopping. |
| 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. |
| 2600 - 3000 rpm | red area: | prohibited 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 at speed above 800 rpm 6 bar

Normal oil pressure:

warm engine at operating speed 3 - 6 bar

Min. oil pressure:

warm engine at 800 rpm 0.7 bar

At speeds below 800 rpm, the gauge may show low oil pressure without there being a fault.

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

Charge test lamp

If the lamp lights during operation:

- Check/adjust the alternator drive belts as described under maintenance point. See page 36.
- If the charge test lamp is still lit, there may be a fault in the alternator or in the electrical system.

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

STOPPING THE ENGINE

1. Allow the engine to run without load for a few minutes if it has been run with a high continuous 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).

Danger of turbo damage or boiling over if the engine is stopped without cooling off.

The power must not be cut until 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

Always secure the clutch in disengaged position if there is a risk of the output shaft starting to rotate.

If the engine is started during e.g. service work, there is a **SERIOUS RISK OF INJURY**

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 engaged position. **THIS CAN CAUSE INJURY and engine damage.** Always secure the clutch in 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 set to "0".
- Fill the fuel tank. Make sure that the cap and the area around 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 sufficient anti-freeze, see page 20
- Close intake valve for seawater (if fitted).
- *If there is a danger of freezing, the seawater must also be drained.*
- At temperatures below 0 °C: Prepare for the next start by connecting the engine heater (if fitted).

MAINTENANCE

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

- Lubrication oil system page 14
- Cooling system page 18
- Air cleaner page 26
- Fuel system page 29
- Electrical system, monitors, batteries etc. . . page 31
- Miscellaneous page 36

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)

Maintenance 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

For engines with few operating hours which do not receive periodic maintenance according to the maintenance schedule on page 13 , maintenance should be carried out according to the schedules for:

“Every year”

“Every 5th year”

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 |
| LUBRICATION OIL SYSTEM, page 14 | | | | | | | | | |
| 1. Checking oil level | ● | ● | | | | | | | |
| 2. Oil change | | | | ●1 | | | | | ● |
| 3. Cleaning the lubrication oil cleaner | | | | ●1 | | | | | ● |
| 4. Changing the turbo filter | | | | ●1 | | | | | ● |
| COOLING SYSTEM, page 18 | | | | | | | | | |
| 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 26 | | | | | | | | | |
| 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 29 | | | | | | | | | |
| 14. Checking fuel level | ● | ● | | | | | | | |
| 15. Changing main filter | | | | | ●1 | | | | ● |
| 16. Checking injectors | | | | | | ● | | ● | |
| ELECTRICAL SYSTEM, page 31 | | | | | | | | | |
| 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 36 | | | | | | | | | |
| 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 12.
3. Earlier if low pressure indicator shows red.
4. Applies only to M engines with seawater pump.
5. Guideline 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 should **at least** meet the requirements for one of the following oil classifications:

- Service CE or CF as per API
- CCMC - D5
- Acea E3-96

Additives must not be used.

- Check with your oil supplier if the oil meets these requirements.
- Specified oil change intervals apply under the provision that the sulphur content of the fuel does not exceed 0.3% by weight.
- Viscosities as illustrated.
- At very low outside temperatures: Consult your nearest Scania representative to avoid difficulties.

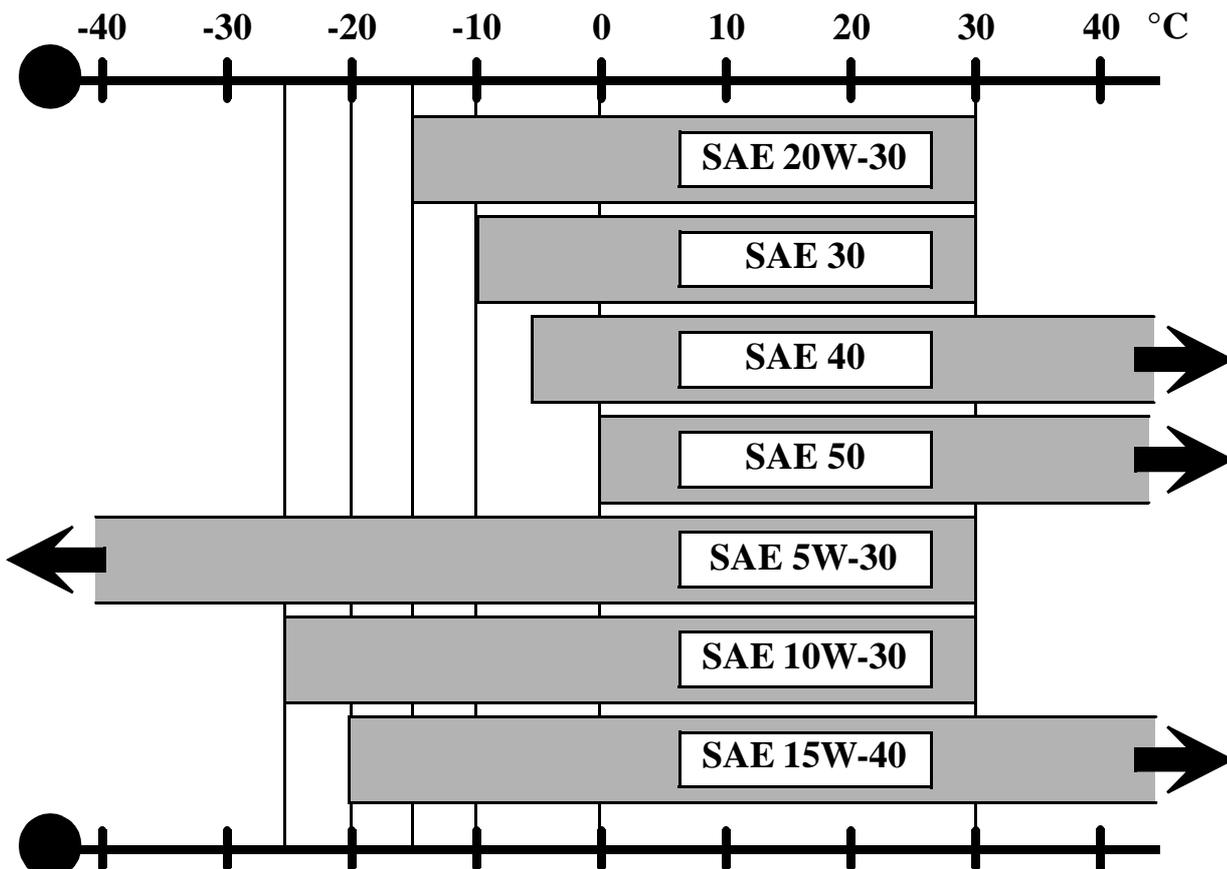
The oil should be able to cope with all temperature variations up until the next oil change.

Oil analysis

Some oil companies can offer analysis of the engine oil. This analysis measures the oil's total base number (TBN), total acid number (TAN), fuel dilution, water content, viscosity and the content of wear particles and soot in the oil.

The result of a series of analyses forms the basis of establishing a suitable oil change interval.

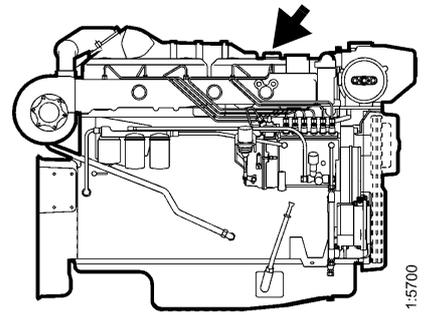
If the conditions are changed, a new oil analysis program must be undertaken to establish a new change interval.



1. Daily: CHECKING OIL LEVEL

Before checking oil level: Let the engine remain stationary for at least 1 minute.

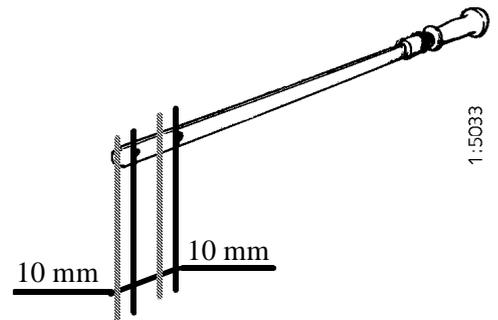
- The correct level is between the marks on the dipstick. Top up when the level is at the lower mark.
- Correct type, see "Oil grade", page 14.



Checking oil level during operation

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

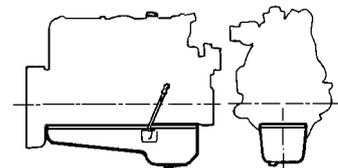
- Remove the oil filler cap to release the pressure in the crankcase.
- Check the level on the dipstick. Correct oil level: **10 mm below Min. or Max. mark.**



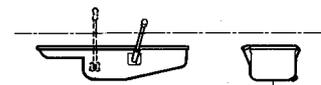
2. Every 400 hours: OIL CHANGE

If the engine is used for particularly demanding operation, especially in a dusty environment or if the deposits in the centrifugal cleaner are thicker than 20 mm: Change the oil more often.

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



Max 30 dm³
Min 22 dm³



Alt
Max 23 dm³ 27 dm³
Min 17 dm³ 21 dm³

1:5049

1 dm³ = 1 litre



WARNING

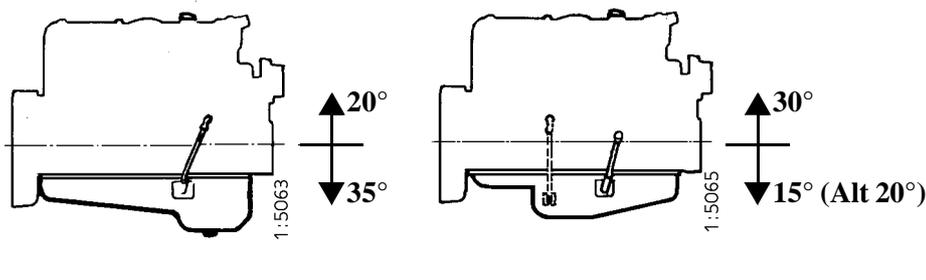
The oil may be hot.

Wear protective gloves
and eye protection

Maximum angle of inclination during operation

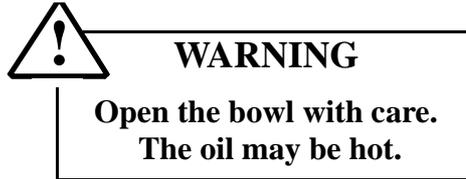
Maximum permitted angles during operation vary depending on the type of oil sump, see drawing.

Note Given angles may only be used intermittently.



3. Every 400 hours: CLEANING THE OIL CLEANER (at same time as oil change)

- Unscrew the nut and remove the cover.



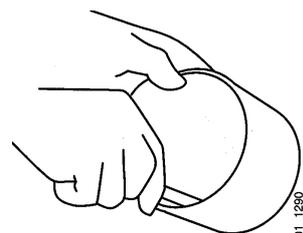
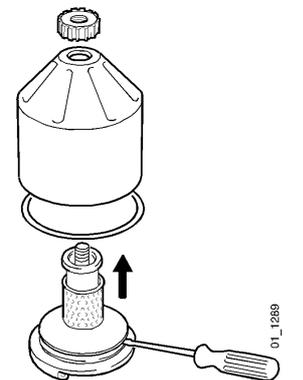
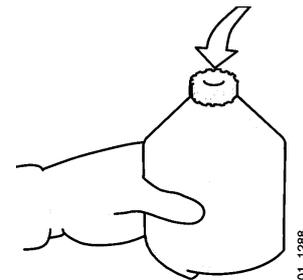
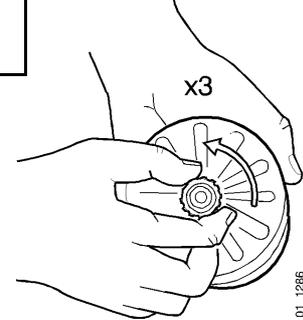
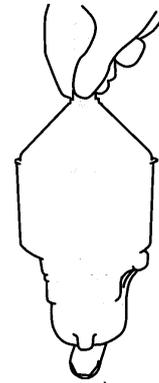
- Lift out the rotor and slacken the nut for the rotor cover three turns.

- If the nut is stuck:
Secure the nut, **absolutely not the rotor**, in a vice and turn the rotor three turns by hand or using a screwdriver.

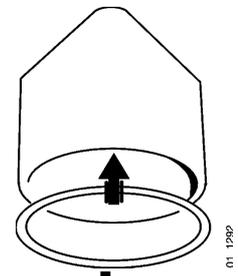
- Gently tap the nut using your hand or a plastic hammer so that the rotor bowl becomes detached from the bottom plate.

- Undo the nut and remove the rotor bowl.
- Carefully prise the strainer loose from the bottom plate.

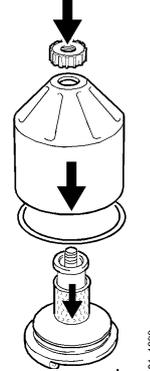
- Scrape away deposits from the inside of the rotor bowl. If there are no deposits, this shows that the cleaner is not working.
- If the deposits are **thicker than 20 mm: Clean more often.**



- Wash all parts in diesel fuel oil.
- Place the O-ring in position in the rotor bowl. ***This must not be damaged.***
Change if necessary.



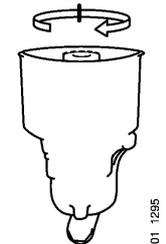
- Assemble the rotor



- Tighten the rotor nut hard by hand



- Refit the rotor.
- Check that it turns easily.



- Check that the O-ring in the bowl is not damaged.
A hardened or damaged O-ring should be replaced.
- Screw down the bowl hard ***by hand***



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

Operational test

The rotor turns very quickly 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 check.

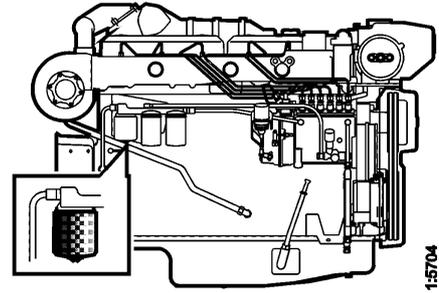


4. Every 400 hours:

CHANGING THE TURBO FILTER

(at the same time as the oil change)

- Remove the old filter and discard it according to environmental requirements.
- Oil the rubber gasket a fit a new Scania genuine filter.
- Tighten the filter by hand.
Never use tools as the filter may sustain damage, interfering with circulation.
- Start the engine and check for leaks.



If the deposits in the centrifugal cleaner exceed 20 mm, the turbo filter must be changed more often, at the same time as cleaning the centrifugal filter and changing the oil.

COOLING SYSTEM

5. Daily:

CHECKING COOLANT LEVEL

- Open the expansion tank cap and check coolant level.
- *Correct level: (integrated expansion tank in heat exchanger)*
 - Cold engine: Coolant level should be between 10 - 20 mm below the expansion tank's inner upper part.
 - Warm engine: Coolant level reach the expansion tank's inner upper part.
- Other types of expansion tank according to the installer's instructions.
- Top up coolant as necessary, see point 6.

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



WARNING

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

**Always top up using pre-
 mixed coolant.**

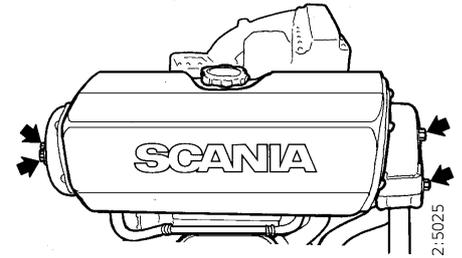
6. Every 400 hours:

CHECKING CORROSION PROTECTION RODS

(Only engines with heat exchanger)

- Drain the seawater circuit and check the corrosion protection rods (sacrificial anodes). Location as per drawing on page 5.
- Scrape away all loose material from the anode.
- Change if less than half the rod remains.
New rods are 55 mm long, diameter 17 mm.

If the corrosion protection rods are highly eroded, they should be checked more often, e.g. every 200 hours.



7. Every 400 hours:

CHECKING SEAWATER PUMP IMPELLER

(Only engines with heat exchanger)

- Close the bottom valve if the seawater pump is below the water line.
- Drain the seawater circuit.
- Remove the cover from the seawater pump.
- Check that the impeller vanes are not worn or damaged.

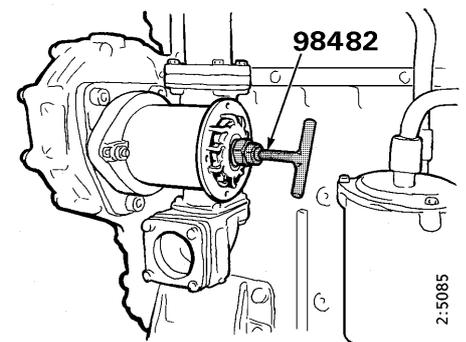
If the impeller often requires changing, it is necessary to improve the purity of the seawater.

Changing the impeller

- Extract the impeller using extractor 98 482 (Scania special tool).
- Fit new impeller and the cover. Check that the cover seal is not hard or damaged.

Note A spare impeller should be carried onboard.

- The impeller can become deformed after long periods of standstill. Change before starting or remove the impeller before long periods of disuse. Also see "Mothballing".



8. Every 2,400 hours: CHECKING 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”

a) Checking the appearance of the coolant

- Take a little coolant in a vessel and check that it is clean and clear.
- If the coolant is contaminated or cloudy: Consider changing the coolant
- The water for the coolant should be free of dirt.
- Use drinking water with a pH of 6 - 9.

b) Checking glycol content

If there is a danger of freezing, use only glycol as protection against corrosion in the coolant.

- Cooling systems with glycol must contain at least 30% glycol by volume to offer sufficient protection against corrosion.
- 30% glycol by volume provides anti-freeze protection down to -18 °C. If more protection is required, see the table on the next page for calculating the necessary amount of glycol.

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

BASF G48 or BASF D542

- *Always top up the anti-freeze if the content drops below 30% by volume. A glycol content above 60% by volume will not improve the protection against corrosion.*
- The table shows the temperature at which ice (slush) starts to form. The engine freezes and breaks at significantly lower temperatures, see graph.
- Ice forming in the coolant often causes malfunction without any risk of damage. The engine must not be loaded hard when ice is forming.

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

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

Coolant composition:
If there is a danger of freezing:
 at least 30% glycol by volume,
 max. 60% glycol by volume
If there is no danger of freezing:
 7-12% by volume
Scania Anti-corrosive



WARNING

Ethylene glycol is toxic if ingested.

Avoid contact with the skin.

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

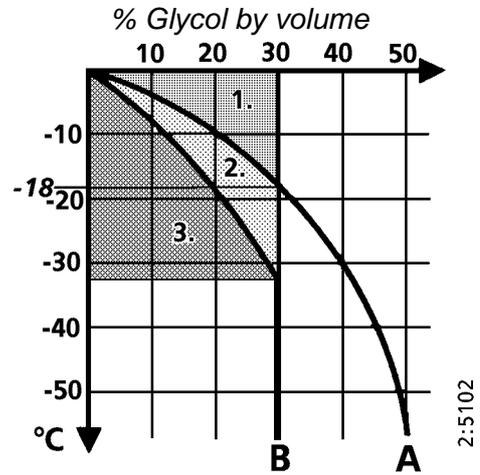
Never top up with only water or only glycol.

The recommended glycols must not be mixed with glycol which has nitrite-based anti-corrosive.

This could cause sludging and reduced cooling capacity.

Cold characteristics of glycol:

- Example with 30% glycol by volume
- Ice slush starts to form at -18 °C.
- At -30 °C there is a risk of malfunction
- The engine cannot be damaged if there is at least 30% glycol by volume



- Line A: Ice starts to form (slush)
- Line B: Temperature at which engine freezes and breaks
- 1. Safe range
- 2. Malfunction can arise (ice slush)
- 3. Coolant frozen

A

| % Glycol by volume | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | Cooling system capacity, dm ³ |
|---------------------------------|----|-----|-----|-----|-----|-----|-----|-----|--|
| Ice slush starts to form at °C | -7 | -10 | -14 | -18 | -24 | -30 | -38 | -40 | |
| Glycol dm ³ (litres) | 5 | 6 | 8 | 9 | 11 | 12 | 14 | 15 | 30 |
| | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 40 |
| | 8 | 10 | 13 | 15 | 18 | 20 | 23 | 25 | 50 |
| | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 60 |
| | 11 | 14 | 18 | 21 | 25 | 28 | 32 | 35 | 70 |
| | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 80 |
| | 14 | 18 | 23 | 27 | 32 | 36 | 41 | 45 | 90 |
| | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 100 |
| | 17 | 22 | 28 | 33 | 39 | 44 | 50 | 55 | 110 |
| | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 120 |
| | 20 | 26 | 33 | 39 | 46 | 52 | 59 | 65 | 130 |
| | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 140 |
| | 23 | 30 | 38 | 45 | 53 | 60 | 68 | 75 | 150 |
| | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 160 |
| | 26 | 34 | 43 | 51 | 60 | 68 | 77 | 85 | 170 |
| | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 180 |
| | 29 | 38 | 48 | 57 | 67 | 76 | 86 | 95 | 190 |
| 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | |

A= Range to be avoided. Only for calculation of glycol mix.
 Freezing point of coolant when ice slush 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 level of anti-corrosive is **7-12% by volume**.

- Fill with *Scania Anti-corrosive* as indicated on the packaging.
- Topping up with 1.0% by volume of *Scania Anti-corrosive* should be done after every 2,400 operating hours.
- *Never top up with water only or anti-corrosive only. Lost fluid should always be replaced with pre-mixed coolant: water + 10% Scania Anti-corrosive by volume.*

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

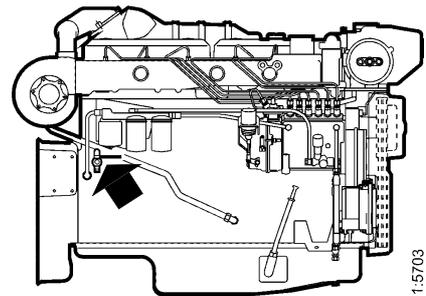
Scania Anti-corrosive must not be mixed with glycol.

Mixing or over concentration can cause sludging and reduced cooling capacity.

Any coolant filter must not contain inhibitor.

Changing coolant

1. Remove the filler cap from the expansion tank.
 2. The coolant is drained at two points:
 - the "lowest point" of the engine block, see drawing
 - the "lowest point" of the cooling system.
 3. Close the valves.
 4. Fill coolant through the expansion tank filler hole.
- Mix coolant as described on page 20.



1:5703

9. Every 4,800 hours: CLEANING 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 file.
7. Assemble the heat exchanger. Change damaged and hardened O-rings.
8. Refit hose and pipe connections.
9. Fill the system with coolant as described in the specifications on page 20.

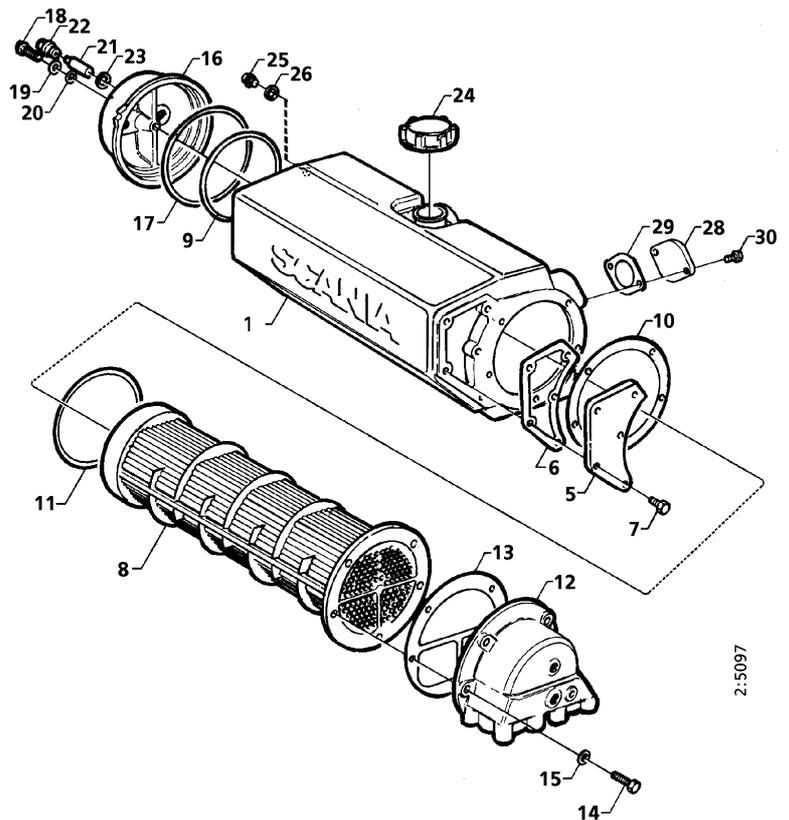
The cooling system must not be cleaned using caustic soda.

Risk of damaging aluminium parts.

Note

There is a spring and a retainer in the heat exchanger, between the housing and the element, which are not illustrated.

- | | |
|----------------------------|------------------------------|
| 1. Heat exchanger housing | 17. O-ring |
| 5. Cover | 18. Screw |
| 6. Gasket | 19. Washer |
| 7. Screw | 20. O-ring |
| 8. Cooling element (4 pcs) | 21. Protective anode (4 pcs) |
| 9. O-ring | 22. Plug |
| 10. Gasket | 23. Gasket |
| 11. O-ring (DS only) | 24. Pressure cap |
| 12. Cover | 28. Cover (DS only) |
| 13. Gasket | 29. Gasket (DS only) |
| 14. Screw | 30. Screw (DS only) |
| 15. Washer | |
| 16. Cover | |



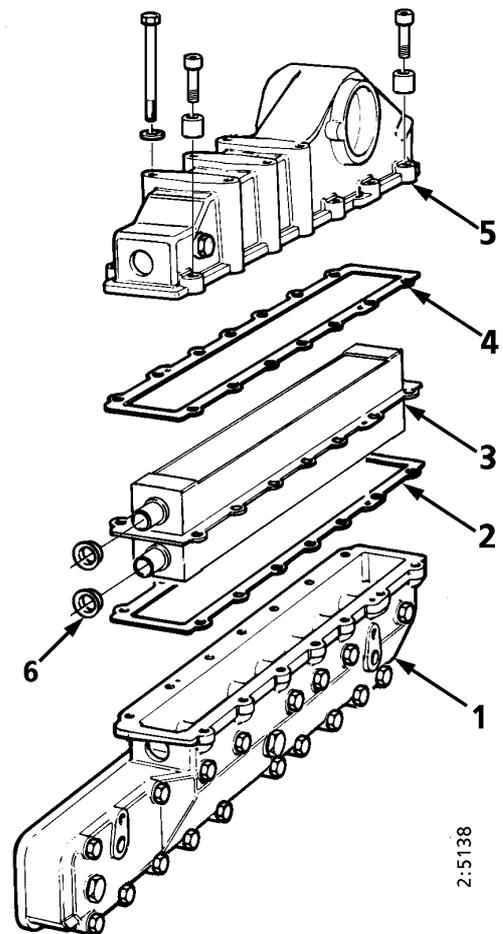
2:5097

Charge air cooler (DSI engine)

1. Drain the coolant from the engine, see “Changing coolant”.
2. Detach the upper part of the intake manifold.
3. Detach the charge air cooler hose and pipe connections.
4. Dismantle the charge air cooler as illustrated.
Take care not to damage the element’s water connections.
5. Clean the outside of the element. Use a paraffin-based engine cleaner.
6. Assemble the charge air cooler. Change all seals and gaskets.
7. Refit hose and pipe connections.
8. Fill coolant as described on page 20.
9. Connect the intake manifold from the turbo.

**The cooling system must not be cleaned using caustic soda.
Risk of damaging aluminium parts.**

1. Intake manifold, lower part
2. Gasket
3. Radiator element
4. Gasket
5. Intake manifold, upper part
6. V-ring seal



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 is warm and then drain the cooling system.
- Remove the thermostat(s).
- Fill the system with clean, hot water mixed with liquid dishwasher detergent designed for household machines. Mix 1% (0.1/10 l).
- Run the engine until warm (about 20 or 30 minutes). Do not forget any cab heating system.
- Drain the cooling system.
- Fill the system again using clean, hot water and run the engine for about 20-30 minutes.
- Drain the water from the system.
- Refit the thermostat(s).
- Fill the system with coolant as described in the specifications on page 20.



WARNING

When handling cleaners for the cooling system:

Study the warning on the packaging.

Removing deposits

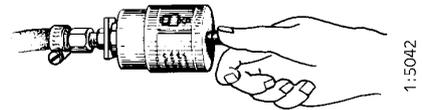
- If possible, run the engine until it is warm and then drain the cooling system.
- Remove the thermostat(s).
- Fill the system with clean, hot water mixed with one of the commercially available radiator cleaners based on sulphamin acid and containing dispersing agents. Follow the manufacturer's instructions for mix ratios and cleaning times.
- Run the engine for the for the specified time and then drain the cooling system.
- Fill the system again with hot water and run the engine for about 20 or 30 minutes.
- Drain the water from the system.
- Refit the thermostat(s).
- Fill the system with coolant as described in the specifications on page 20.

AIR CLEANER

10. Daily:

TEST READING LOW PRESSURE INDICATOR

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



11. Every 200 hours:

CLEANING THE AIR CLEANER COARSE CLEANER

1. Detach the eccentric catch and remove the coarse cleaner.
2. Remove the plastic cover from the coarse cleaner and clean the parts.
3. Check that the plastic cover is intact and that it makes a seal against the air cleaner housing during assembly.
4. Assemble the air cleaner

The coarse cleaner should be fitted with the marking "TOP" facing up.

12. Every 1,200 hours:

CLEANING OR CHANGING FILTER INSERT

Note Earlier if low pressure indicator shows red

Dismantling

1. Remove and clean the coarse cleaner, see point 11.
2. Undo the nut securing the filter insert and remove it.
3. Change or clean the insert.

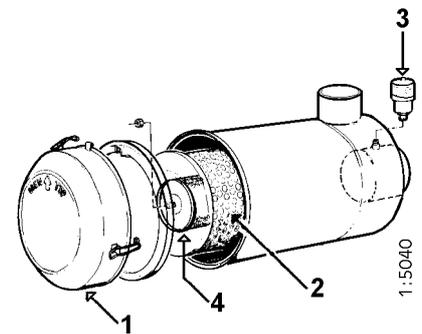
Note Cleaning the insert always means a risk of damage. The insert may only be cleaned no more than four times. After cleaning, it has a lower dust capacity than a new insert.

4. Mark the filter when it has been cleaned.

Cleaning insert

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

Note This insert must not be washed using water.



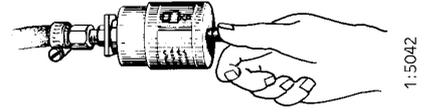
1. Pre-filter with cover
2. Filter insert
3. Low pressure indicator
4. Safety cartridge

Use only Scania genuine air filter.

Change damaged filter inserts.
Major risk of engine damage if the filter insert is damaged.

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.



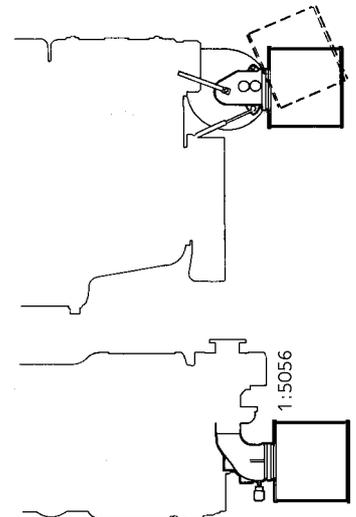
Assembly

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

Filters with non-replaceable insert (unit cleaner)

Cleaning

- The filter must be cleaned no more than 3 times. Make a mark on it each time it is cleaned.
 - Use a solution of water and 1% mild detergent
1. Pour the washing solution into the filter intake while turning the filter so that the solution runs out of it in the direction of air flow.
 2. Leave the filter in the washing solution for 5 minutes and then lift it to drain off the solution
 3. Rinse the filter with about 30 litres of clean water at 30 - 40 °C. Pour the rinse water into the filter in the same way as the washing solution.
 4. Lift the filter and allow the rinse water to drain.
 5. Repeat this procedure until the rinse water runs clear.
 6. Leave the filter to dry in a warm place for several days.

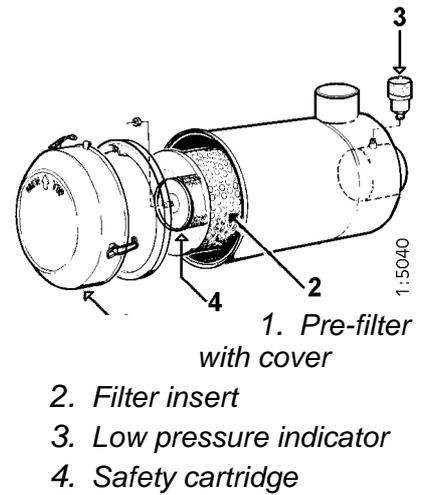


Note The filter must not be blown dry using compressed air.

13. Every 2,400 hours: CHANGING SAFETY CARTRIDGE

1. Remove and clean the coarse cleaner, see point 11.
2. Undo the nut securing the filter insert and remove it.
3. Change or clean the filter insert, see point 12.
4. Undo the nut securing the safety cartridge and remove it.
5. Fit a new Scania genuine safety cartridge.
6. Assemble the air cleaner.

Do not remove the safety cartridge unnecessarily.



Never clean the safety cartridge.

FUEL SYSTEM

14. Daily:

CHECKING FUEL LEVEL

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

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

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

15. Every 1,200 hours:

CHANGING THE FUEL FILTER

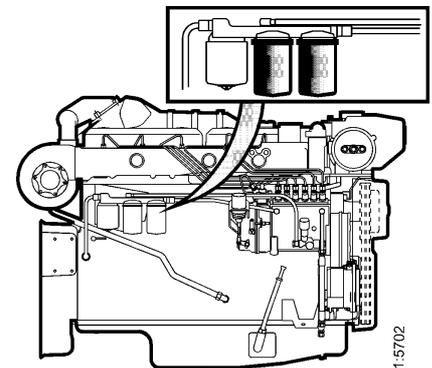
Fuel tanks

- 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. The filters may be damaged, inhibiting circulation.

- Bleed the fuel system as 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 main bleed screw.
- Close the bleed screw. Pump a few times using the hand pump.

Use only Scania genuine fuel filter

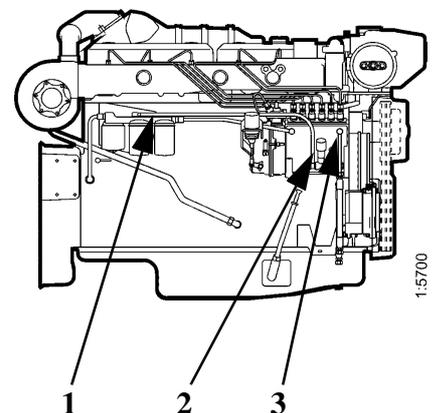
If the engine is difficult to start after bleeding

- Slacken the injection pump overflow valve **3** one half turn and try starting again. On the 8000 pump, the overflow valve is located on the fuel shut-off valve.

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.



16. Every 2,400 hours: CHECKING INJECTORS

Injectors should be inspected by trained personnel with access to the required equipment, at least once every year or every 2,400 hours.

Removal

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

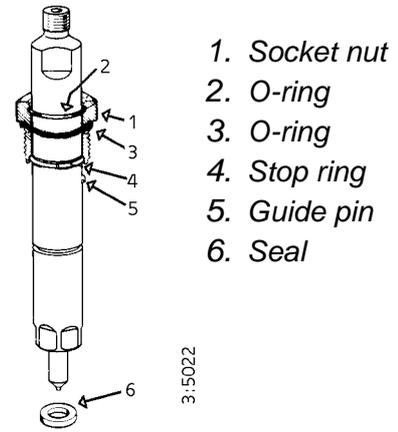
Correct opening pressure, see Technical data, page 43.

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 socket nut and a new seal under it.
3. Fit the injector.
4. Tighten the socket nut to 70 Nm (7.0 kpm).
5. Fit the delivery pipe and tighten the cap nuts to 20 Nm (2.0 kpm). Fit clamps and brackets.

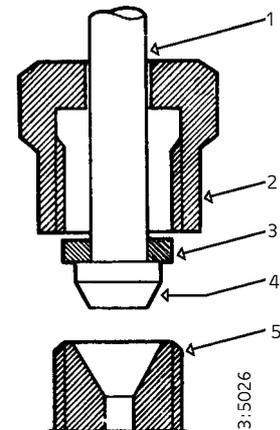
Take care to fit the delivery pipe without tension and make sure that the cone on the delivery pipe is correctly positioned in the connector.

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



The delivery pipes must not be bent.

All clamps must be refitted.



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 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.

18. Every 200 hours:

CHECKING CHARGE STATE IN THE BATTERIES

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

- Check specific gravity using a battery electrolyte tester.

In a fully charged battery it should be:

1,280 at +20°C

1,294 at 0°

1,308 at -20°C

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

Avoid boost charging. This will damage the battery in the long term.

19. Every 200 hours:

CLEANING BATTERIES

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

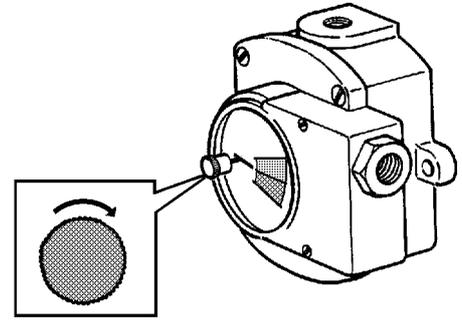
1. Clean batteries, cables and cable terminals.
2. Check that all cable terminals are well tightened.
3. Grease posts and cable terminals using petroleum jelly.

20. Every 1,200 hours:

CHECKING COOLANT LEVEL MONITOR

(optional equipment)

1. Start the engine.
2. Check the level monitor by turning the "TEST" knob to the right.
3. **Automatic stop in case of fault:** Engine stops, warning lamp lights and buzzer sounds if there is no fault in the level monitor.
4. **No automatic stop in case of fault:** Warning lamp lights, buzzer sounds if there is no fault in the level monitor.



C = Common connection

NC = Connection NC - C breaks at low coolant level

NO = Connection NC - C closes at low coolant level

2-pole level monitor

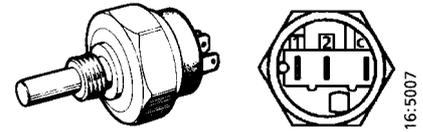
21. Every 1,200 hours:

CHECKING TEMPERATURE MONITOR

1. Drain sufficient coolant for 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. Dip the monitor sensor in water. Slowly heat the water (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 lights when the alarm is given at the correct temperature.

Correct temperature is stamped on the monitor's hexagon.

Tolerance is $\pm 3^\circ$ for the monitor.



C = Common connection

1 = Connection C -1 closes at stamped temperature

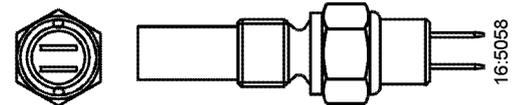
2 = Connection C -2 opens at stamped temperature

2-pole temperature monitor

CHECKING TEMPERATURE SENSOR

1. Drain sufficient coolant for 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. Dip the sensor body into water. Slowly heat the water (about 1° per minute) using e.g. an immersion heater.
6. Check the resistance at the temperatures given below.
7. The sensor should give the following readings:

| At temp. °C | Resistance Ω | Tolerance °C |
|-------------|---------------------|--------------|
| 60 | $134 \pm 13,5$ | ± 4 |
| 90 | $51,2 \pm 4,3$ | ± 3 |
| 100 | $38,5 \pm 3$ | ± 3 |



2-pole temperature sensor

22. Every 1,200 hours:

CHECKING THE OIL PRESSURE MONITOR

Alternative 1

Connect an ohmmeter to the oil pressure monitor and check that the monitor opens/closes at the correct pressure when the engine is started and stopped.

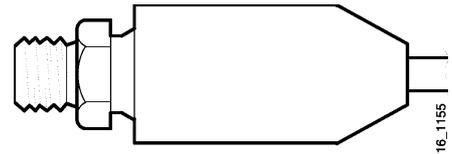
Alternative 2

Monitor coupled for automatic stop in case of 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: **$0.7 \pm 0.15 \text{ bar}$** .

Monitor coupled to buzzer:

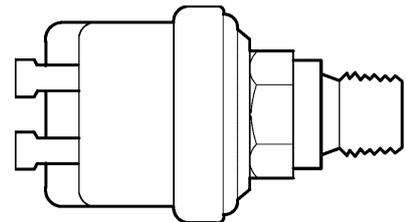
1. Main switch in operate position, check that buzzer sounds.
2. With the engine running, check that the buzzer stops sounding when oil pressure is **above $1.1 \pm 0.15 \text{ bar}$** and the monitor closes.



2-pole oil pressure monitor

CHECKING OIL PRESSURE SENSOR

- Connect an ohmmeter to the oil pressure sensor and check the resistance.
- The sensor should give the following readings:
 - 0 bar - $10 \pm 3 \Omega$
 - 2 bar - $56 \pm 6 \Omega$
 - 4 bar - $88 \pm 6 \Omega$
 - 6 bar - $124 \pm 6 \Omega$
 - 7 bar - $140 \pm 6 \Omega$



2-pole oil pressure sensor

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.

Important *Stop solenoids with a timer module may be activated for start and stop a maximum of 3 times per minute. Otherwise, the timer module may be damaged and the stop feature cease.*

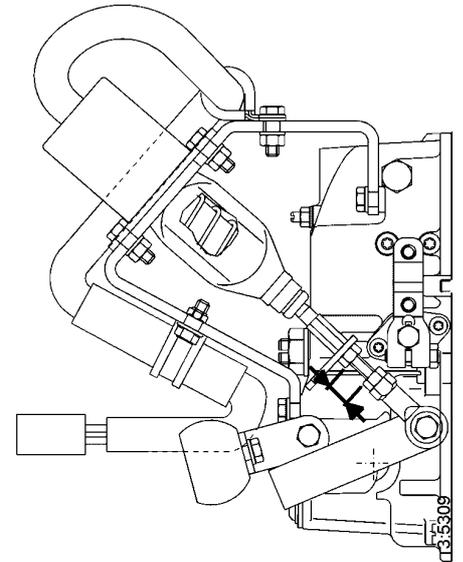
CHECKING STOP SOLENOID STOP POSITION

When changing the stop solenoid, or if the stop feature is not satisfactory, the following should be done (the figures show the stop control with the engine in stop position):

The stop position at “Pull to stop”.

- Check and/or set the length of the link rod so that the distance between the locknuts (nut height 5.2 mm) is 21.0 ± 0.1 mm when the nuts are tightened.
- Fit the stop solenoid in the bracket as in the figure.
- Connect the stop solenoid electrically, **red** to battery + and **black** to battery -, and activate it so that it is fully pulled. **Note: Pole reversal will damage the timer module.**
- Screw the clevis onto the stop lever using the link pin and check, in stop position, that there is a small clearance (0.2-0.3 mm) between the stop lever and the operating point on the governor
- Check the stop feature by starting the engine and then stopping it by activating the stop solenoid.

Important *The stop solenoid must not be activated more than 3 times per minute as the timer module can be damaged.*

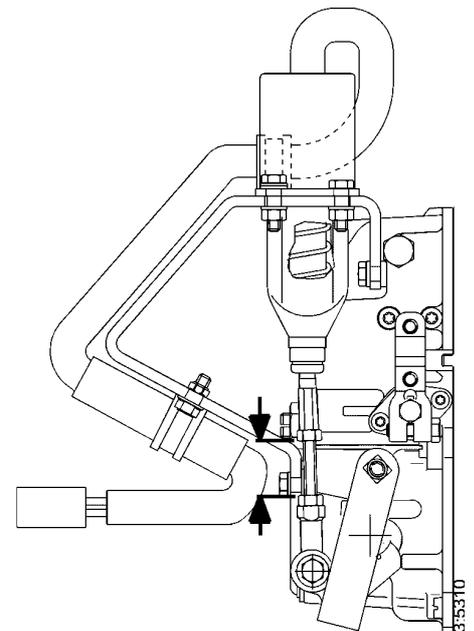


Installation “Pull to stop”

Stop position at “Drawn during operation”.

- Check and/or set the length of the link rod so that the distance between the locknuts (nut height 5.2 mm) is 26.0 ± 0.1 mm when the nuts are tightened.
- Fit the stop solenoid in the bracket as in the figure.
- Connect the stop solenoid electrically, **red** to battery + and **black** to battery -, and activate it so that it is fully pulled. **Note: Pole reversal will damage the timer module.**
- Turn the stop lever to operating position and screw the clevis onto the stop lever using the link pin and check, in operating position, that there is a small clearance (0.2-0.3 mm) between the stop lever and the operating point on the governor
- Activate the stop solenoid and start the engine. Stop the engine by cutting the power to the stop solenoid.

Important *The stop solenoid must not be activated more than 3 times per minute as the timer module can be damaged.*



Installation “Pulled during operation”

CHANGING BATTERY

Removal

1. Detach the negative lead (-) from the battery (cable to engine casing).
2. Detach the positive lead (+) from the battery (cable to starter motor).

Fitting

1. Connect the positive lead (+) to the battery (cable to starter motor).
2. Connect the negative lead (-) to the battery (cable to engine casing).

MISCELLANEOUS

24. Every 200 hours:

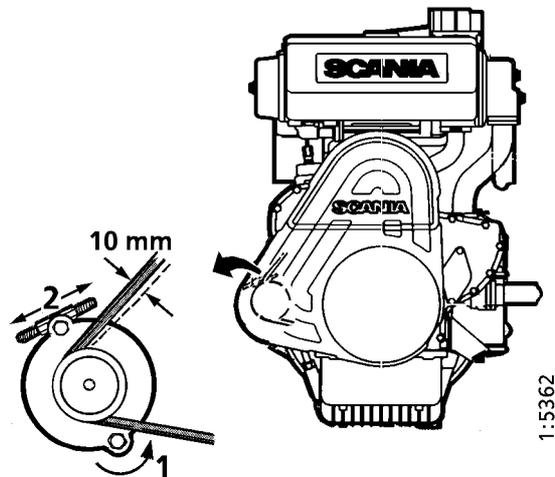
CHECK/TENSION V-BELTS

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.

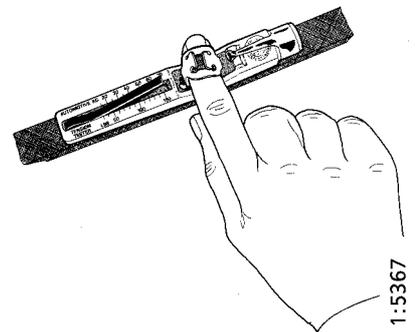
1. Detach the securing screws.
2. Set the correct tension using the adjusting screw.

Do not over-tighten the belts.



Measurement using belt tension gauge Kriket (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:

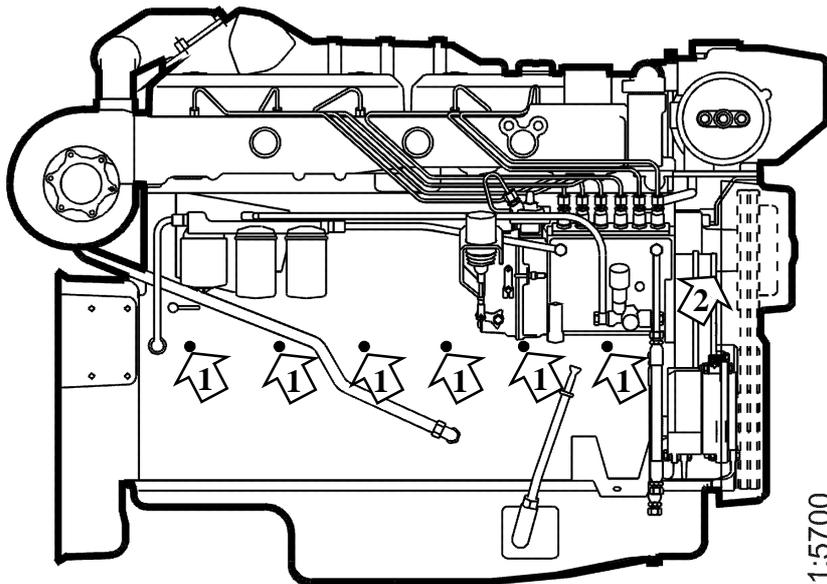
LOOK FOR LEAKAGE, REMEDY AS NECESSARY

- Start the engine.
- Look for leakage of oil, coolant, fuel, air and exhaust.
- Tighten or change leaking connections. Check the overflow holes (1) which show whether the O-rings between the cylinder liner and crank-case 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 a leakage, change the pump seal.

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

This leakage normally stops after a time.

If there is a large amount of leakage - contact your nearest Scania workshop.



1:5700

26. Every 2,400 hours: CHECK/ ADJUST VALVE CLEARANCE

Checking/adjusting valve clearance can also be done 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.

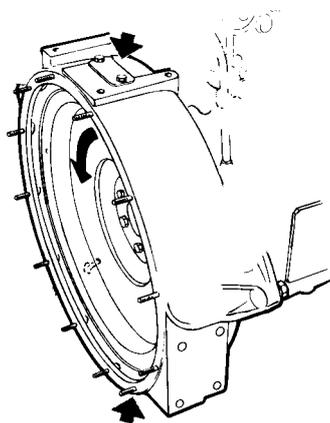
Alternative 1

- Set No. 1 cylinder to TDC by turning the engine in its direction of rotation until both valves are closed.
- Adjust the following valves. Correct valve clearance is indicated on the instruction plate on one of the rocker covers:

| | |
|------------|--------------------|
| Cylinder 1 | Intake and exhaust |
| 2 | In |
| 3 | Ex |
| 4 | In |
| 5 | Ex |

- Set No. 6 cylinder to TDC by turning the engine one revolution in its direction of rotation.
- Adjust the following valves:

| | |
|------------|-----------|
| Cylinder 2 | Ex |
| 3 | In |
| 4 | Ex |
| 5 | In |
| 6 | In and ex |



Covers for reading
on flywheel casing

Note:

On *silumin casings* readings can be taken either from the top or from underneath, depending on which flywheel is used.

The cover not being used is covered with a seal and an instruction plate.

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



WARNING

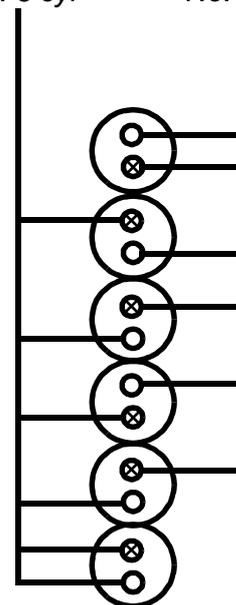
Block the starter device
when working on the engine.
If the engine starts, there is a
**SERIOUS RISK OF
INJURY**



FLYWHEEL

Cylinder numbering

TDC TDC
No. 6 cyl No. 1 cyl



FLYWHEEL

○ Intake valve

⊗ Exhaust valve

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 - 3 - 6 - 2 - 4 (firing sequence) by turning the engine 1/3 revolution in its direction of rotation between each adjustment.

27. Every 2,400 hours:

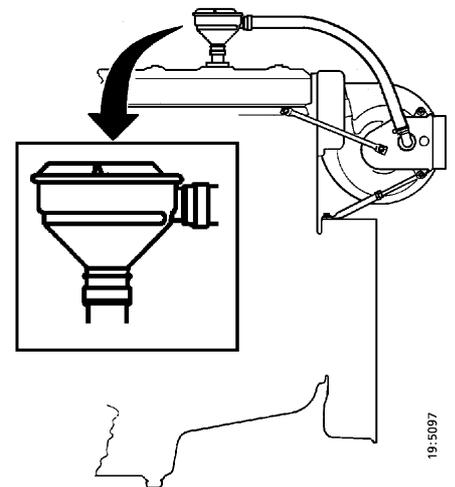
CHANGING (or CLEANING) VALVE FOR CLOSED CRANKCASE VENTILATION

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 fuel oil overnight. Then rinse it several times in diesel and let it drip off.
- Refit the valve.
- The valve may be reused (cleaned) *a maximum of two times* after the first 2,400 hours of use. Take care to mark the valve after cleaning it.



LONG-TERM STORAGE

If the engine is not to be used for a long period of time, special measures should be taken to protect against corrosion in the cooling system, fuel system and combustion chamber and to protect against external corrosion.

The engine can normally stand idle for up to six months. If disuse is longer, the following measures should be taken, providing protection for about four years.

Preparing the the engine for long-term storage means:

- Thoroughly cleaning the engine
- Running the engine for a certain time with 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 50% glycol by volume. If the engine is to be stored with an empty cooling system, use glycol *wihtout* nitrite-based inhibitor, such as **BASF G48** or **BASF D542**.

Note Only glycol, no water.

Nitrite-based inhibitors in an empty cooling system give rise to ammonia vapour which can damage brass components such as monitors and sensors.

Preservative fuel

- Use diesel fuel oil mixed with Lubrizol 560A or equivalent.
- Mix 1 cm³ (ml) Lubrizol 560A in 10 dm³ (l) fuel.



HANDLING LUBRIZOL 560A

Hazardous!

Contains aromatic hydrocarbons

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

Wear eye protection and protective gloves when handling. Do not use contaminated clothing.

- | | |
|-------------------------------|--|
| In case of contact with eyes: | Rinse with a gentle stream of water (at least 15 minutes). Seek medical attention. |
| In case of contact with skin: | Wash with soap and water |
| In case of inhalation: | Fresh air, rest and keep warm |
| Flammable: | Fire class 2A. Flash point + 27°. <i>In case of fire:</i> Extinguish using carbon dioxide, powder or foam |
| Storage: | In well sealed vessel in dry, cool place. Keep out of reach of children. |

Preservative oil

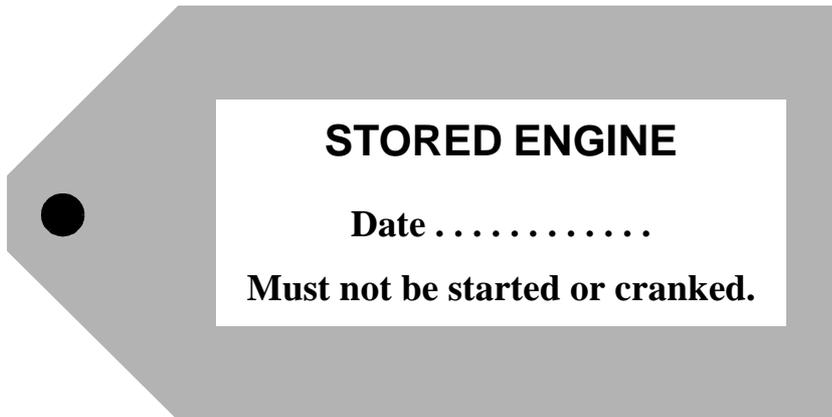
Suitable preservative oil can be supplied by most oil companies.

E.g. Dinitrol 40 or equivalent.

Preparations for storage

- Drain and flush the cooling system. Fill with preservative coolant.
- Run the engine until warm with ordinary fuel. Stop the engine and drain the oil.
- Change fuel filter and turbo filter.
- Fill the engine with preservative oil to the minimum level on the dipstick.
- Mix the preservative fuel in a can. Detach the fuel pipe at the feed pump suction line and connect a hose from the can.
- Detach the fuel pipe at the overflow valve and connect a return hose to the can.
- Start the engine and run it at about 1,000 rpm (does not apply to single-speed engines) for 20 - 25 minutes.
- Stop the engine, remove the hoses and connect the normal fuel lines.
- Oil the valve mechanism with plenty of preservative oil.
- Remove the injectors and spray preservative oil into each cylinder **max. 30 cm³ (ml)**.
Crank the engine several revolutions using the starter motor. Spray a **little** more into each cylinder.
The engine must not then be cranked. Refit the injectors.
- Drain the preservative oil from the engine. New engine oil can be filled directly or when taking 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 and change the filter insert.
- Cover air intakes and exhaust pipes.
- Alternator and starter motor:
- Spray with water-repellent anti-corrosive oil, CRC 226, LPS1 or equivalent.
- Spray the outside of shiny engine parts, first using penetrating preservative oil such as Dinitrol 25B and then using Dinitrol 112 or equivalent.

- *Equip the engine with a clear notice giving the date of preservative and stating that the engine must not be started or cranked.*



Batteries

Remove the batteries for maintenance charging in the charging station. (Does not apply to batteries which, according to the manufacturer, are maintenance-free). The same applies even for short periods of disuse, even if the engine is not stored as above.

Storage

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

Taking out of storage

(action when the engine is taken into operation)

- Remove plugs and tape from coolant connections, air intakes and exhaust pipes.
- Fill the cooling system with coolant, see page 6.
- Check the oil level in the engine and top up with new oil.
- Crank the engine several revolutions with the injectors removed, oiling the valve mechanism, pushrods and tappets with plenty of oil.

Important *The engine must be cranked with the injectors removed so that excess preservative oil can be forced out of the cylinders.*

- Fit the injectors.
- Drain the fuel system's main filter of preservative fuel.
- Bleed the fuel system.
- Wash off externally applied preservative oil using white spirit.

TECHNICAL DATA

| GENERAL | D11 | DI11 |
|--|--------------------------|---------------------|
| Number of cylinders | 6 in line | |
| Cylinder bore mm | 127 | |
| Stroke mm | 145 | |
| Swept volume dm³ (litres) | 11.0 | |
| Number of main bearings | 7 | |
| Firing sequence | 1 - 5 - 3 - 6 - 2 - 4 | |
| Compression ratio | 15:1 | High output: 13.5:1 |
| Engine direction of rotation viewed from rear | Anti-clockwise | |
| Cooling | Fluid | |
| Valve clearance, cold engine | | |
| intake valve mm | 0.45 | |
| exhaust valve mm | 0.80 | |
| Weight, without coolant and oil | | |
| engine <u>with</u> heat exchanger kg | 1100 | 1125 |
| engine <u>without</u> heat exchanger (keel-cooling) kg | 1010 | 1025 |
| Output | see "Engine record card" | |
| LUBRICATION SYSTEM | | |
| Max. oil pressure (warm engine at speed above 800 rpm) bar (kp/cm²) | 6 | |
| Normal oil pressure (warm engine at operating speed) bar (kp/cm²) | 3 - 6 | |
| Min. oil pressure (warm engine 800 rpm) bar (kp/cm²) | 0.7 | |
| Oil capacity, see page 15 | | |
| Crankcase pressure with closed crankcase ventilation mm VP | -55 - +20 | |

FUEL

Diesel fuel oil

The composition of the diesel fuel oil is extremely important for engine and injection pump function and service life. Even engine output and exhaust emissions are dependent on fuel quality. The requirements and testing norms for the most important properties are described in the service manual in sections which can be ordered from your Scania dealer or directly from Scania. The address for Scania is printed on the cover.

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 | 0.80 - 0.86 kg/dm ³ |
| Sulphur (concentration by mass) | max 0.3 % |
| Ignition characteristic (cetane number) | min 49 |
| Flash point | 56 °C |

Environmentally-friendly fuels (low sulphur fuels)

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

Additives

At low temperatures, paraffin can precipitate and block filters and lines. This can cause the engine to lose power or stop.

Winter fuel is usually available in cold climates. If necessary, the properties of this can be improved *before* operating at low temperatures. However, extremely low temperatures can cause problems.

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

1. **Lamp paraffin or heating oil:** Max 50% may be added. Add the paraffin first so that the fuel is blended fully. In a number of countries, the use of paraffin as an engine fuel is prohibited.
2. **Petrol:** Only in *emergencies* and then no more than 30%. Petrol lowers the ignition characteristics (cetane number) which can lead to difficulty starting. There will also be emissions of blue smoke and fuel consumption will be higher. Even very small quantities of petrol will lower the flash point of the fuel which can mean the risk of fire.
3. **Alcohol:** 0.5 - 2% to prevent water in the fuel freezing to form ice.
4. **Light diesel:** Can be used for Scania engines in pure form or in the same way as lamp paraffin to improve the properties of the fuel when cold. Light diesel is paraffin with a suitable ignition characteristic and with a lubricating additive. Without this, the injection pump would seize.

Drain fuel tank, drain fuel filter, clean the pre-filter and change fuel filter regularly.

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