

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

DI12 DC12

Industrial engine

opm96-12a en 1 588 546

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 Scania DC12 and DI12 Industrial Engines. The instructions apply to engines in *programme 96* from engine serial number 5 997 001 onwards.

The engines are of direct-injection, liquid-cooled, four-stroke, 6-cylinder inline diesel type. The engines are equipped with turbocharger and charge air cooler, refer to page 10.

The engines are typically used in earthmoving equipment, generator sets, agricultural, railway and forestry machinery as well as power units in irrigation systems.

The engines are available with different power output and engine speed settings.

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.

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.

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

Scania CV AB
 Industrial and Marine Engines
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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 **Note** 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 turn 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 be 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.

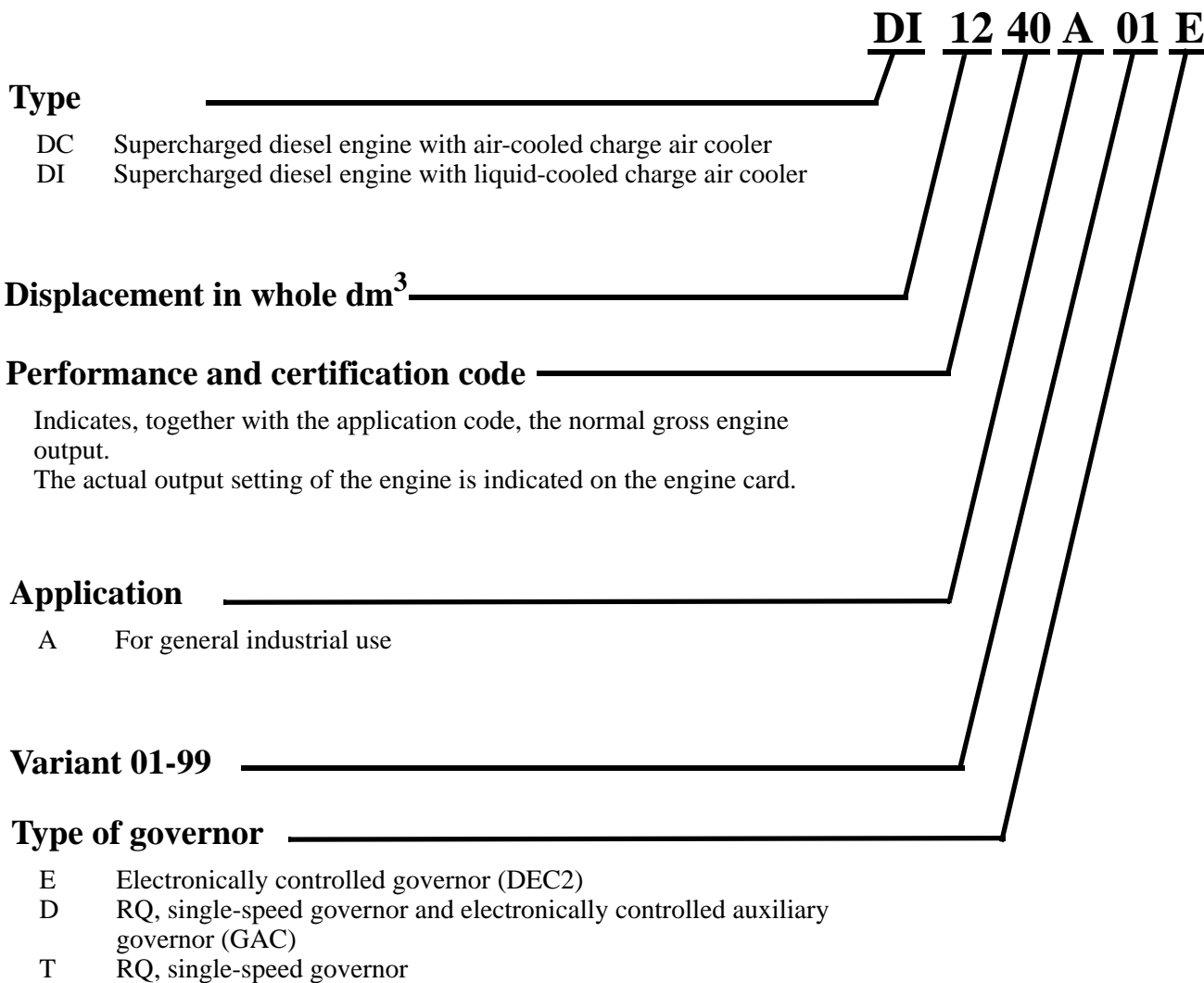
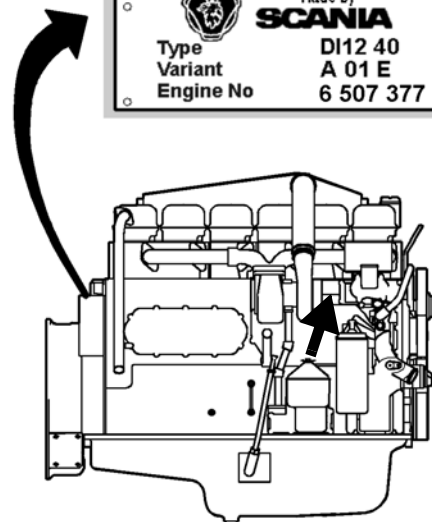
Never start the engine unless the air filter is installed. Otherwise there is a risk of objects entering the compressor wheel or a risk of personal injury from contact with it.

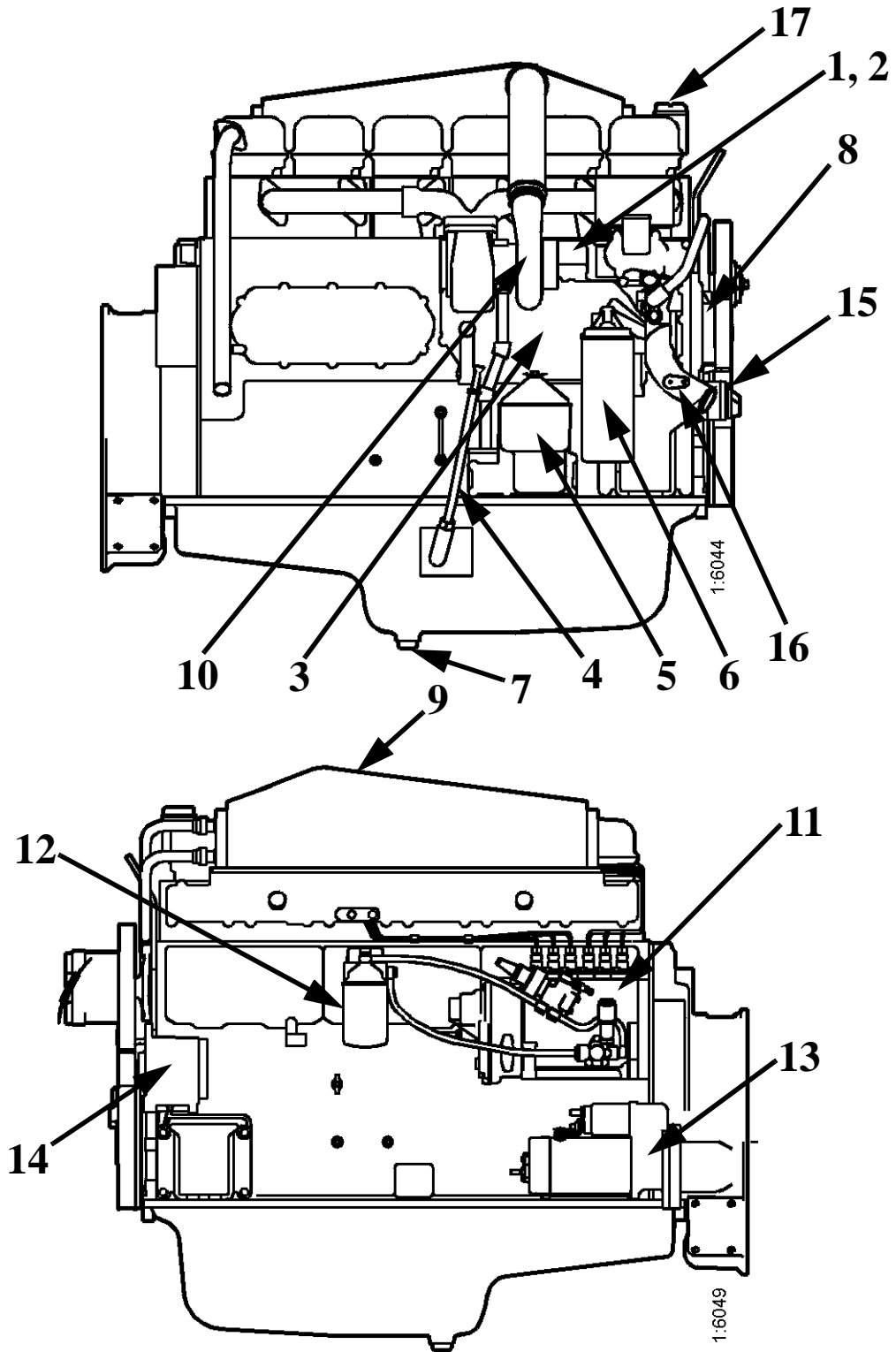
TYPE DESIGNATIONS

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 flywheel housing. The engine serial number is also stamped into the cylinder block on the right hand side. See arrow in the illustration.

Engines that are certified regarding smoke and emissions are fitted with a certification plate specifying the documents they conform to.





The illustrations show a typical DI12 engine configuration.
Your engine may have different equipment from the one shown.

- | | | |
|--|-------------------------|------------------------------|
| 1. Type plate | 6. Oil filter | 13. Starter motor |
| 2. Engine serial number,
stamped into the cylinder
block | 7. Draining, engine oil | 14. Alternator |
| 3. Oil cooler | 8. Coolant pump | 15. Automatic belt tensioner |
| 4. Oil dipstick | 9. Charge air cooler | 16. Draining, coolant |
| 5. Oil cleaner | 10. Turbocharger | 17. Oil top up |
| | 11. Injection pump | |
| | 12. Fuel filter | |

DEC2 CONTROL SYSTEM

This engine has an injection pump with an electromagnetic actuator which adjusts the control rack to give the correct amount of fuel.

The system which controls the pump is called DEC2 (Digital Engine Control, generation 2).

The control unit (DEC2) continuously receives signals from sensors for engine speed, charge air temperature and pressure, coolant temperature, oil pressure, throttle position and control rack travel in the injection pump. Using this input data and a control program, the correct amount of fuel for the current operating conditions can be calculated.

The system's sensors may be used only for DEC2, *not for other instruments or other monitoring purposes.*

The control unit contains monitoring functions to protect the engine in the event of a fault which would otherwise damage it. Faults and the more important monitoring functions are indicated on the control unit in the form of light emitting diodes. See illustration on page 15 for a description.

In case of a fault, the **Power** - or **Shutdown** indicator on the DEC2 control unit as well as the main indicator lamp on the main supply box and the instrument panel will illuminate.

If a fault has been indicated on the main indicator lamp the operator can determine the cause of the fault with the help of the LEDs on the control unit and the troubleshooting schedule on page 18, and carry out the required investigation and remedy.

Depending on the nature of the fault, the control system will take different actions to protect the engine such as reducing the power output, keeping the engine running at a constant low speed or, in case of a function impairing fault, shutting down the engine (*Shutdown*).

To enable readout of LED fault codes there is a lamp test/fault code switch located in the main supply box near the control unit.

A PC based program is also available to help service personnel to detect and rectify faults and to adjust certain parameters in the operating program.

Diagnostics and changes to programs must only be performed by authorized personnel.

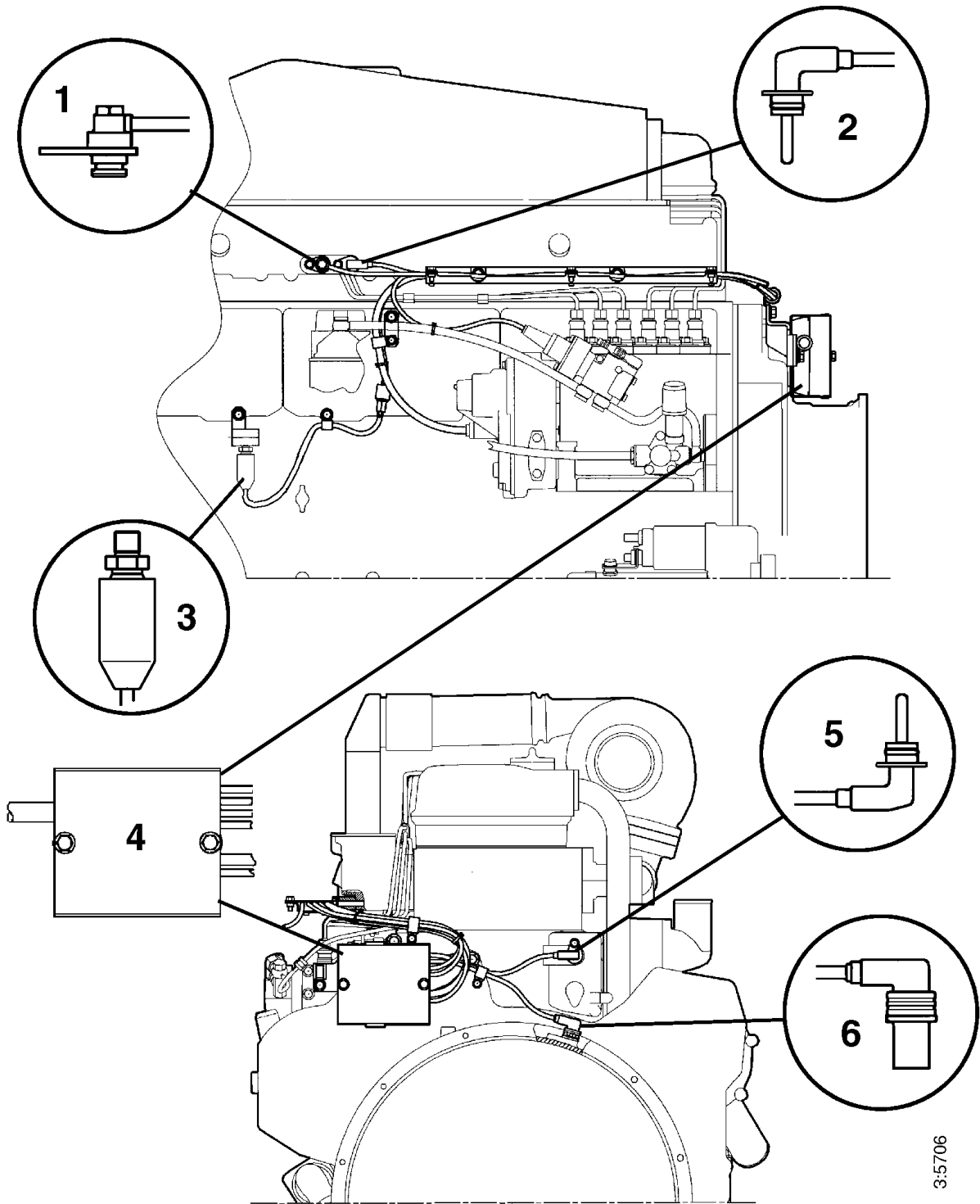
The locations of the sensors and monitors that send signals to the control unit are shown in the illustrations on pages 13 and 14.

There is a description of the functions of the LEDs during normal operation on page 15.

On page 16 there is a description of the functions of the LEDs in case of a fault and actions in case of **Power-** and **Shutdown** indication.

Troubleshooting and fault code reading are described on pages 17 and 18.

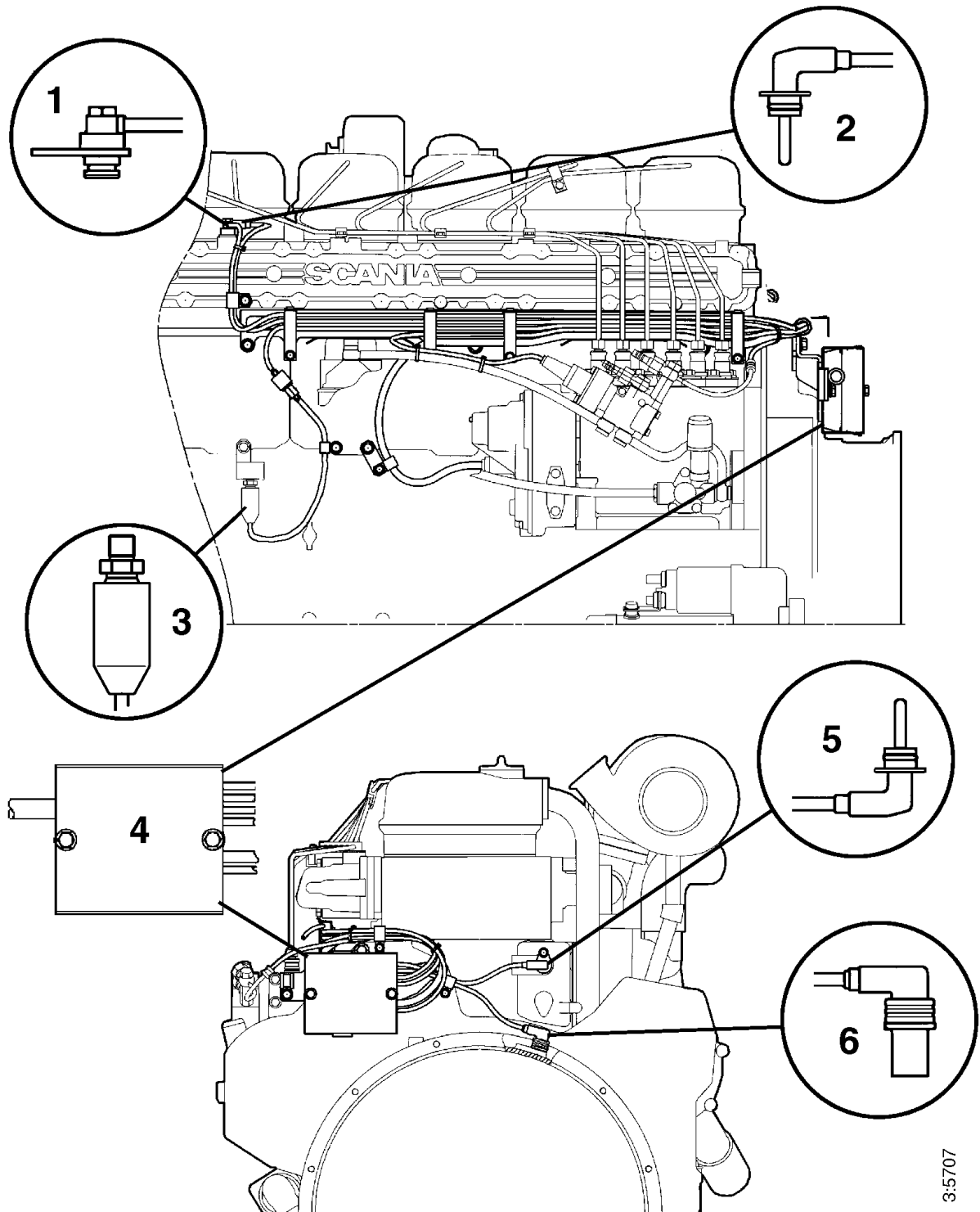
Location of sensors for DEC2 on DI12



3:5706

1. Connection of lead to charge air temperature sensor
2. Charge air temperature sensor
3. Oil pressure monitor
4. Connector panel
5. Coolant temperature sensor
6. Engine speed sensors

Location of sensors for DEC2 on DC12



3:5707

1. Connection of lead to charge air temperature sensor
2. Charge air temperature sensor
3. Oil pressure monitor
4. Connector panel
5. Coolant temperature sensor
6. Engine speed sensors

LED functions during normal operation

Note: The lamp test/fault code switch should not be depressed. All LEDs come on briefly when the control unit is powered up.

CONTROL STATUS

- ✱ The LED flashes continuously when the control unit is supplied with current, regardless of whether the engine is running or not.

SHUTDOWN

- The LED is out.

STARTING

- ✱ The LED lights up as soon as the engine turns over on cranking and follows the programmed starting sequence until it has been completed and then goes out.

RUNNING

- ✱ The LED comes on when the engine has started and the "Starting" LED goes out. It remains on until the engine is stopped.

TORQUE LIMIT

- ✱ The LED comes on when the control unit detects that the engine has received the maximum permissible quantity of injected fuel according to its power curve. This means 100% power output at the current rpm. If the load increases, engine rpm will decrease.

BOOST LIMIT

- ✱ The LED comes on when the control unit smoke limiter restricts the maximum fuel quantity. Operation of the smoke limiter is dependent on the charge air pressure.

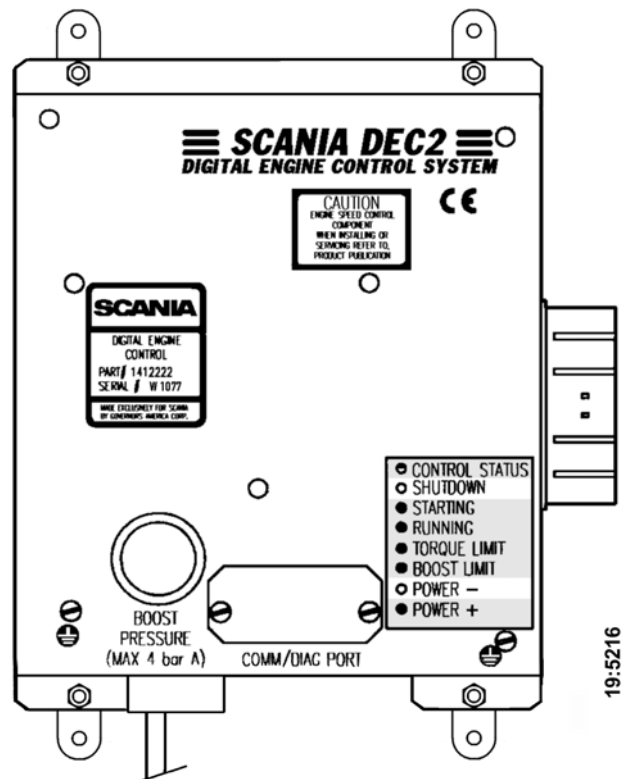
POWER-

- The LED remains out during normal operation as long as no fault is detected by the control unit. See next page for the procedure to be adopted in the event of a fault.

POWER+

- ✱ If the control unit is programmed to allow the engine to be operated according to more than one power/torque curve (map), the following applies.

The LED comes on when the engine is run at more than 100% power output (MAP 2). It goes out when the engine returns to the 100% power output curve (MAP 1) or when the power output required is less than 100%.



19:5216

Action in case of a fault

LED indications in case of a fault

Note: The main indicator lamp in the main supply box and at the instrument panel has indicated a fault. The lamp test/fault code switch should not be depressed.

CONTROL STATUS

- ✱ The LED will continue to flash even in case of a fault as long as voltage is supplied to the control unit.

POWER -

- ✱ If the LED comes on, the control unit has detected a defect that could cause damage to the engine if operation continues.

The control unit automatically reduces engine power output to a predefined level if the corresponding function has been selected.

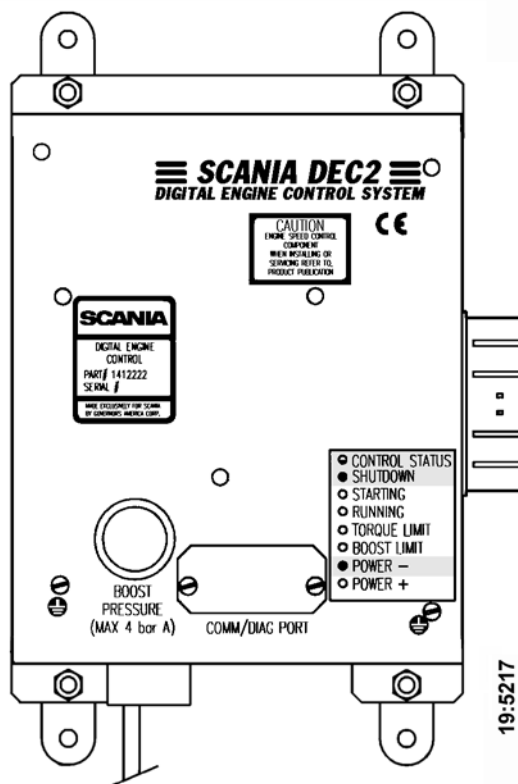
Action: Reduce engine speed to idle if possible and conduct troubleshooting according to instructions on page 17 and the chart on page 18

SHUTDOWN

- ✱ The LED comes on and the *engine is switched off automatically* in case of a severe fault that could cause damage to the engine if operation continues.

Action: Conduct troubleshooting according to instructions on page 17 and the chart on page 18

If the engine has not stopped, reduce engine speed to idle and conduct troubleshooting.



Changing functions using the DIP switches in the control unit

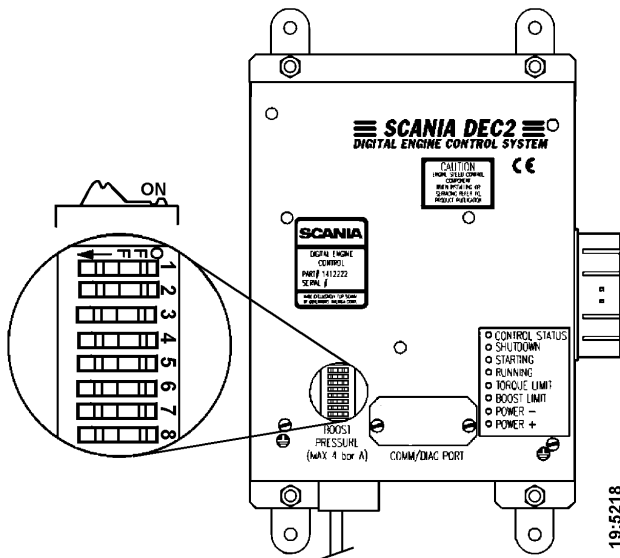
There are 8 DIP switches in the control unit under the round black rubber cover.

These switches shall be in the *ON* position to obtain normal functions according to the operating program. However, for single-speed engines, the normal position of DIP switches 6, 7, and 8 may also be *OFF*

Shutdown at threshold values for low oil pressure and high coolant temperature can be selected by setting DIP switch **4** to *OFF*

With DIP switch **4** in position *ON*, **Power-** indication is obtained for these threshold values. Engine output reduction (*LOP*) can be selected to prevent damage to the engine. Changes to the program must only be performed by authorized personnel.

Note: Do not operate the engine with a Power- indication except for in emergencies.



Readout of fault codes

Note: If the engine has stopped or lost power but the main indicator lamp is out and neither POWER- nor SHUTDOWN are on, the fault is outside the control unit detection range. Probable causes: fuel shortage, temporary overload, mechanical fault.

- Activate the lamp test/fault code switch. In Scania electrical equipment the main indicator lamp is located in this switch on the main supply box.
- All LEDs will then come on for 2 seconds to indicate that they are intact and in working order. This also applies to the main indicator lamp in the main supply box and the instrument panel. Make a note of any LED that is defective.
- All LEDs will then be out for approximately 4 seconds.
- Following this, a fault code will be indicated on one of the LEDs for 2 seconds. Note which LED it is.
- The control unit then resumes the operating mode automatically.
- After having made a note of the fault code, reset the lamp test/fault code switch and reset the control unit by turning off its power supply momentarily.
- The most probable cause of the fault can then be found in the trouble shooting schedule on the next page.
- When the fault or faults have been rectified the engine can be restarted.
- If the control system continues to indicate a fault by way of the main indicator lamp, further faults may have been recorded. The fault code readout must then be repeated as per above since the system can only display one fault code at a time.
- The fault(s) will be stored in a special memory in the control unit along with information about the operating time when it(they) occurred. Stored faults can be accessed and erased by authorised service personnel.

**READOUT OF FAULT CODES
LED INDICATION WHEN THE LAMP TEST/FAULT CODE SWITCH IS ACTIVATED**

CONTROL STATUS	SHUTDOWN	STARTING	RUNNING	TORQUE LIMIT	BOOST LIMIT	POWER -	POWER +	Probable cause	Action				
*								DEC2 has detected an internal fault in the control unit.	Send in the control unit for repair as soon as possible.				
	*							The engine temperature has reached the threshold level or the temperature sensor is inoperative.	Check the cooling system. Check the temperature sensor and cable routing.				
		*						The engine has reached the overrevving limit or the engine speed sensor is inoperative.	Check the wiring and connector. Renew the engine speed sensor.				
			*					Control rack position sensor inoperative.	Check connectors and cables to governor.				
				*				The intake air temperature has reached the threshold level or the charge air temperature sensor is inoperative.	Check the intake system. Check the temperature sensor and cable routing.				
					*			DEC2 detects no charge air pressure. The charge air pressure sensor is inoperative.	Check the charge air pressure hose. Send in the control unit for repair if the connection is damaged.				
						*		Engine speed potentiometer or the idling safety switch is inoperative.	Check the cable routing, connectors and cables.				
							*	The oil pressure has dropped to the threshold level or the oil pressure monitor is inoperative.	Check oil level, connector and cable. Renew the oil pressure monitor.				

***=LED on**

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 27.

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 (refer to page 29).
6. Checking the coolant (refer to page 33).

The coolant should contain anti-corrosive 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 glycols with the following supplier designations:

BASF G48 or BASF D542

- 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. Refer to page 33.
- *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.

Coolant composition:

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

If there is no danger of freezing:

7-12% by volume
Scania Corrosion Inhibitor
(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.

If there is no danger of freezing:

- Only *Scania Corrosion Inhibitor* 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 Corrosion Inhibitor* is free of nitrite.
- First filling: Fill the cooling system with *water + 10% by volume of Scania Corrosion Inhibitor*. 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 Corrosion Inhibitor.*

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.

- 12. Checking the fuel level (refer to page 40).
- 15. Checking the electrolyte level in batteries (refer to page 42).
- 16. Checking the state of charge in batteries refer to page 42).
- 18. Checking the coolant level monitor (if fitted) (refer to page 43).
- 19. Checking the temperature monitor (refer to page 44).
- 20. Checking the oil pressure monitor (refer to page 45).
- 21. Checking the tension of drive belts (refer to page 46).



WARNING

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



Important

The use of too much *Scania Corrosion Inhibitor* as mixed with glycol may cause deposits.



Important

If a coolant filter has been fitted it must not contain inhibitor.



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 27.

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 40).

For environmental reasons, 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.

- Open the fuel cock, if fitted.
- Declutch the engine (not engines with fixed clutch, e.g. generator sets).
- Engines with battery master switch: Switch on the power by means of the battery master switch.
- DEC2: If the main indicator lamp comes on or flashes when the power is turned on, this indicates the presence of a fault in the control system or engine which must be found and rectified before the engine is started. Refer to page 16.
- Start the engine by means of the starter button or starter key.

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.



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.

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 cool 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 turned 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 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.
- 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.

OPERATION

Check instruments and warning lamps at regular intervals.

Engine 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. The engine's operating speed range is controlled by the DEC2 control system.
2200-2600 rpm	yellow/green striped:	unsuitable operating speed. May occur when switching off and during downhill engine braking
2600-3000 rpm	red area:	prohibited engine speed



WARNING! When driving a vehicle down a steep descent or in other installations, where the engine may be propelled by the vehicle motion, DEC2 will set the fuel feed to zero to protect against engine overspeed and shut down the engine. The clutch must *not* be released in such a situation since this may cause vital functions such as steering and brake system to become inoperative when the engine stops.

Coolant temperature

Normal coolant temperature when the engine is running should be 70 - 90°C.

DEC2: If the temperature is high, 98°C or above, you can select for the control system to reduce power output (*Power -*) in order to bring down the temperature. Refer to the DEC section on page 17.

If the temperature continues to rise, the engine will be shut down automatically (*Shutdown*) at 103°C. Refer to the DEC section on page 17.

Excessively high coolant temperature can damage the engine.

If run for extended periods under an extremely light load, the engine may have difficulty in maintaining normal operating temperature. However, the temperature will rise to a normal level again when the load on the engine is increased.

! Important

Overpressure is not allowed in cooling systems with Scania radiators and expansion tanks made of plastic, i.e. the expansion tank must not be fitted with a pressure cap.

Oil pressure

Max. oil pressure:

hot engine at engine speed exceeding 800 rpm 6 bar

Normal oil pressure:

hot engine at operating speed 3 - 6 bar

Min. oil pressure:

hot engine at 800 rpm 0.7 bar

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

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

DEC2: The engine is shut down automatically if this function has been selected. Refer to the DEC section on page 17.

**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 in the maintenance step. Refer to page 46.
- 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 with the stop button. Keep the stop button depressed until the engine is completely stationary.
3. DEC2: Before switching off, check that the control system's main indicator lamp is not on or flashing. Refer to page 16 for troubleshooting.
4. Engines with battery master switch: Switch the power off with the battery master switch. (Does not apply to emergency generator sets).
5. Set the control switch to "0". (Does not apply to emergency generator sets).

! 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.

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 MAY 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 33
- At temperatures below 0 °C: Prepare for the next start by switching on 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 24 points, divided into the following main groups:

- Lubricating oil system page 28
- Cooling system page 32
- Air cleaner page 38
- Fuel system page 40
- Electrical system, monitors, batteries etc. . . page 42
- Miscellaneous page 46

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

Periodic maintenance every 1200 hours of operation (carried out after 1200, 2400, 3600, etc. hours)

Periodic maintenance every 2400 hours of operation (carried out after 2400, 4800 etc. hours)

Periodic maintenance every 4800 hours of operation (carried out after 4800, 9600, etc. hours)

Annual Maintenance

Maintenance every 5th year

ENGINES WITH FEW HOURS OF OPERATION

Emergency generator sets and the like that are not used regularly should be run on test and checked in accordance with the generator set manufacturer's instructions.

Run the engine until it reaches operating temperature and then carry out the maintenance points below:

1. Checking the oil level.
5. Checking the coolant level.
8. Checking the vacuum sensor.
12. Checking the fuel level.
15. Checking the electrolyte level in batteries.
16. Checking the state of charge in batteries.
17. Cleaning the batteries.
22. Checking for leakage, rectify as necessary



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

**For engines with few operating hours that are not subject to periodic maintenance according to the maintenance schedule on page 27, maintenance should be carried out in accordance with the schedule:
"Every year"
"Every 5 years"**

MAINTENANCE SCHEDULE

	Daily	First time at		Interval				At least	
		First start	400 h	200 h	400 h	1200 h	2400 h	4800 h	Annually
LUBRICATING OIL SYSTEM, page 28									
1. Checking the oil level	●	●							
2. Oil change					●1			●	
3. Cleaning the oil cleaner					●1			●	
4. Renewing the oil filter					●1			●	
COOLING SYSTEM, page 32									
5. Checking the coolant level	●								
6. Checking the coolant		●				●4		●	
7. Cleaning the cooling system							●1		●
AIR CLEANER, page 38									
8. Checking the vacuum sensor	●								
9. Cleaning the coarse cleaner				●1					●
10. Cleaning or renewing filter element					●3				●
11. Renewing the safety cartridge						●			●
FUEL SYSTEM, page 40									
12. Checking the fuel level	●	●							
13. Renewing the main filter					●1				●
14. Checking the injectors						●		●	
ELECTRICAL SYSTEM, page 42									
15. Checking the electrolyte level in batteries		●		●2				●	
16. Checking the state of charge in batteries		●		●2				●	
17. Cleaning the batteries				●2				●	
18. Checking the level monitor		●			●			●	
19. Checking the temperature monitor		●			●			●	
20. Checking the oil pressure monitor		●			●			●	
MISCELLANEOUS, page 46									
21. Checking the drive belt		●			●			●	
22. Checking for leakage, rectify as necessary	●								
23. Checking/adjusting valve clearance			●				●		
24. Renewing (or cleaning) the valve for closed crankcase ventilation							●		

1. More often if required
2. For engines with few operating hours, see page 26.
3. Earlier if vacuum indicator shows red.
4. If inhibitor has not been topped up for five years, the coolant should be changed.

LUBRICATING 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.

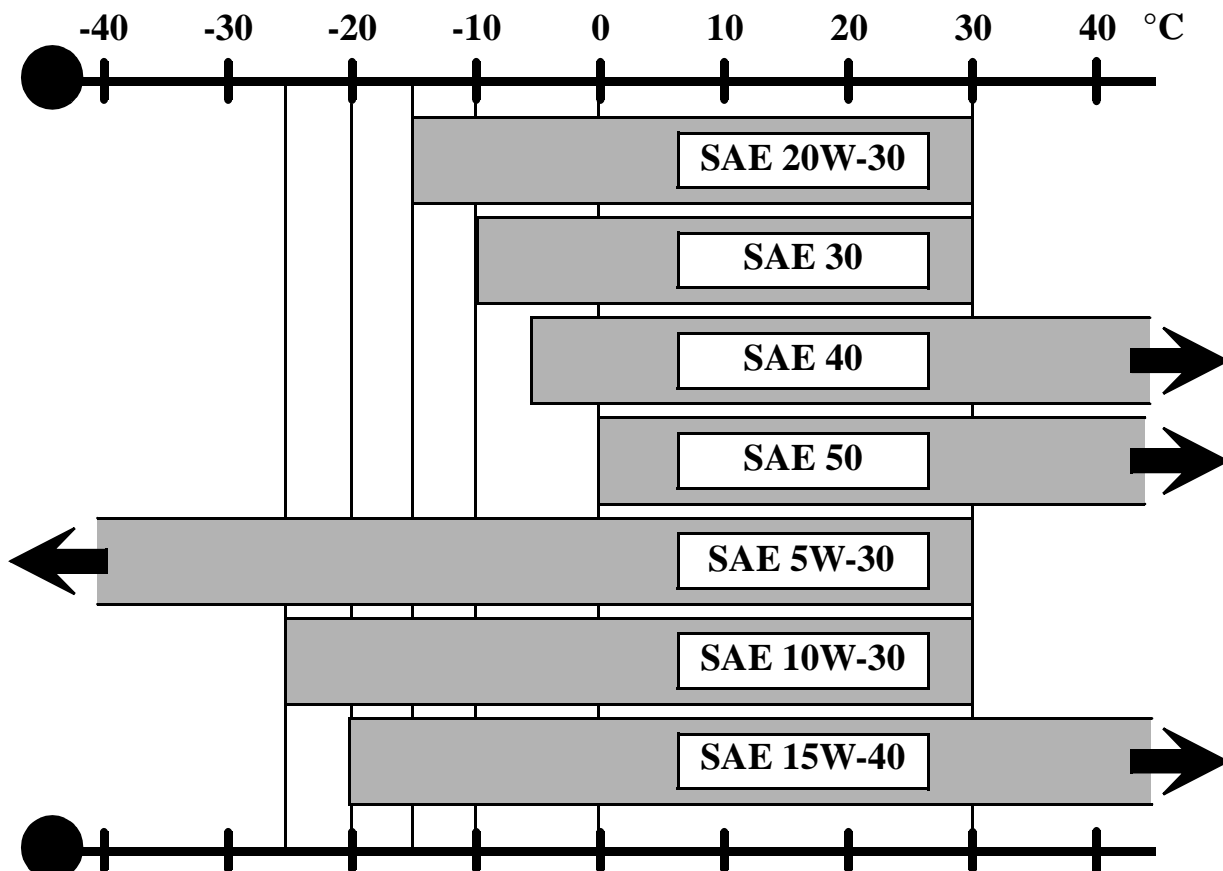
! Important
Additives must not be used.
The oil should be suitable for all temperature variations until the next oil change.

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.

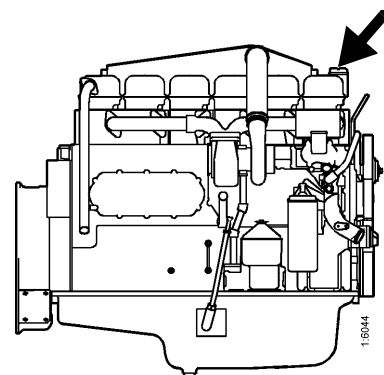
If the conditions are changed, a new oil analysis programme must be carried out to establish the new change interval.



1. Daily: CHECKING THE OIL LEVEL

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

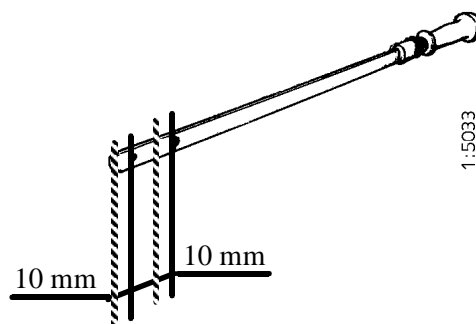
- The correct level is between the marks on the dipstick. Top up when the level is at the lower mark.
- Correct type, see "Oil grade" on page 28.



Checking oil level during operation

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

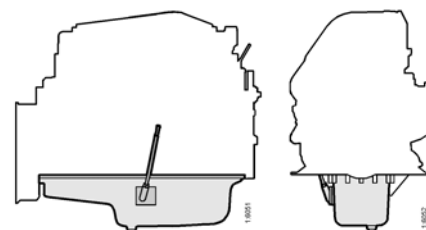
- Remove the oil filler cap to release the pressure in the crankcase.
- Check the level on the dipstick, correct oil level: *10 mm below the minimum and the maximum mark*



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.

- Unscrew the plug and drain the oil when the engine is hot.
- In certain engines the oil is pumped out by means of a bilge pump.
- Clean the magnet on the plug.
- Refit the plug.
- Fill up with oil.
- Check the level on the dipstick.



Max. 33 dm³
Min. 28 dm³

1 dm³ = 1 litre



WARNING

The oil may be hot.
Wear protective gloves and goggles



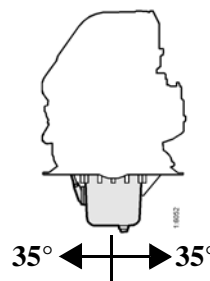
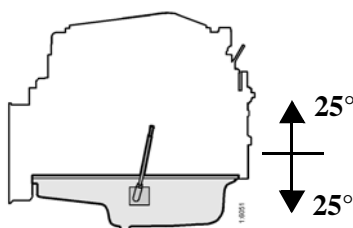
Mind the environment!

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

Maximum angles of inclination during operation

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

Note: Specified angles may only occur intermittently.



3. Every 400 hours: CLEANING THE OIL CLEANER

(at same time as an oil change)

- Unscrew the nut and remove the cover.



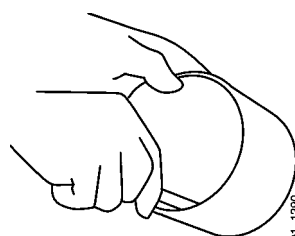
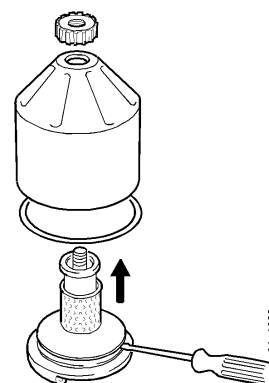
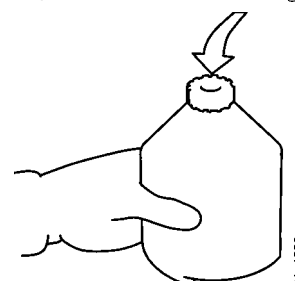
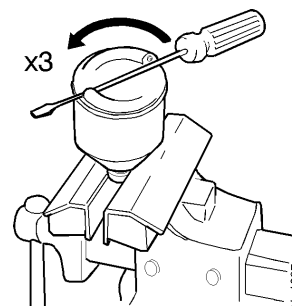
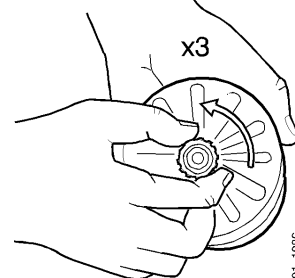
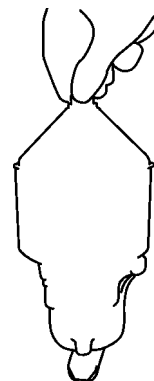
- Lift out the rotor and loosen the nut on the rotor bowl three turns.

- If the nut is jammed:
Clamp the nut, *not the rotor*, in a vise and turn the rotor three revolutions by hand or using a screwdriver.

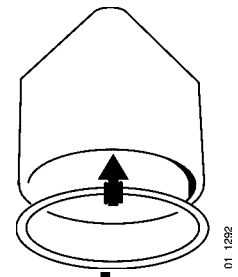
- Tap the nut lightly with your hand or a plastic hammer, to detach the rotor bowl from the bottom plate.

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

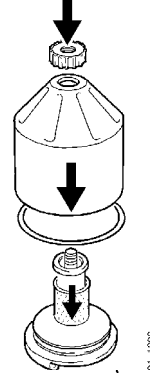
- Scrape off the deposits from the inside of the rotor bowl. If there are no deposits, this indicates that the cleaner is not working properly.
- If the deposits are *thicker than 20 mm: clean more frequently.*



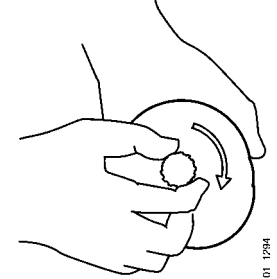
- Rinse all parts in diesel fuel.
- Fit the O-ring in the rotor bowl. **Make sure it is not damaged.**
Renew parts if necessary.



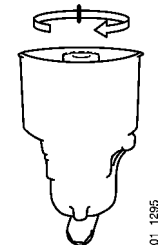
- Assemble the rotor.



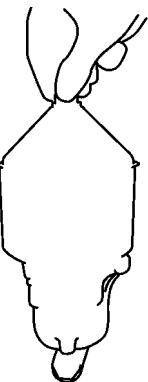
- Tighten the rotor nut firmly **by hand**



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



- Check that the O-ring in the bowl is undamaged.
Renew the O-ring if hard or damaged.
- Secure the bowl firmly, tightening the nut



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

Operational test

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

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

The rotor **normally continues spinning for 30 - 60 seconds** after the engine has stopped.

If not: dismantle and inspect.



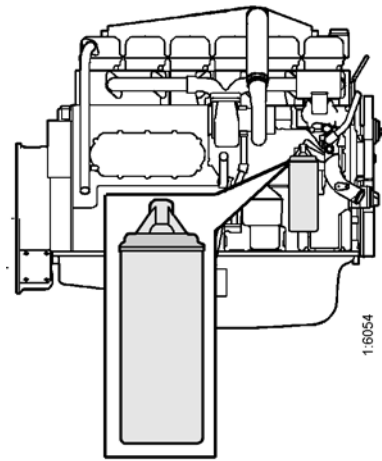
4. Every 400 hours:

RENEWING THE OIL FILTER

(at same time as an 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 are thicker than 20 mm the oil filter should be renewed more frequently. This includes cleaning the centrifugal filter and changing oil.*



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 THE COOLANT LEVEL

- Open the expansion tank filler cap and check the coolant level.
- *Correct level: (Scania plastic expansion tank)*
 - Cold engine: The coolant should be level with the lower edge of the filler neck.
 - Hot engine: The coolant should be approximately 25 mm above the lower edge of the filler neck.
- Other types of expansion tank according to the instructions of the fitter.
- Top up the coolant as necessary, see point 6.

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.



WARNING

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

! Important

Always top up with ready mixed coolant.

6. Every 2400 hours: CHECKING THE COOLANT

Coolant should be checked as follows:

- a) Check the appearance of the coolant.
- b) Coolant with only glycol: Check the glycol content.
- c) Coolant with only *Scania Anti-corrosive*:
Check the corrosion inhibitor.

The composition of the coolant is described in detail under "Starting and running"

a) Checking the appearance of the coolant

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

b) Checking the 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 break 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.*


Coolant composition:

If there is a danger of freezing:

minimum 30% glycol by volume
maximum 60% glycol by volume

If there is no danger of freezing:

7-12% by volume
Scania Anti-corrosive

 **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.

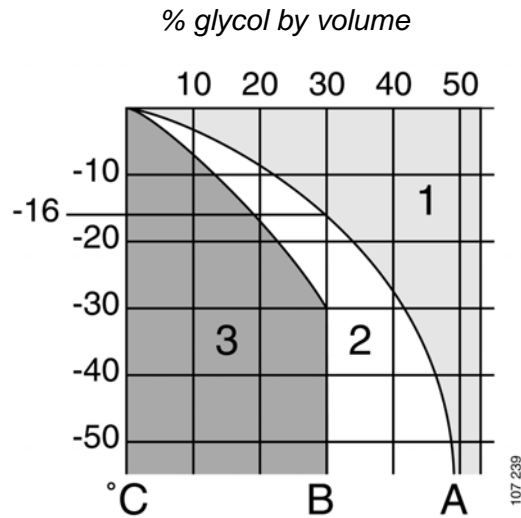
! Important

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

Risk for build up of sludge and reduced cooling capacity.

Properties of glycol at low temperatures:

- Example with 30% glycol by volume
- Ice slush starts to form at -16°C.
- There is risk for malfunctions at -30°C
- No risk of damage by freezing with a minimum content 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, dm ³
Ice slush starts to form at °C	-6	-9	-12	-16	-22	-27	-36	-46	-55	
Glycol dm ³ (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 the corrosion inhibitor

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

If there is no danger of freezing, only *Scania Anti-corrosive* should be used in the coolant.

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

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 4800 hours or minimum every 5 years.



WARNING

Corrosion inhibitor, if swallowed can be fatal.
Avoid contact with the skin.

! Important

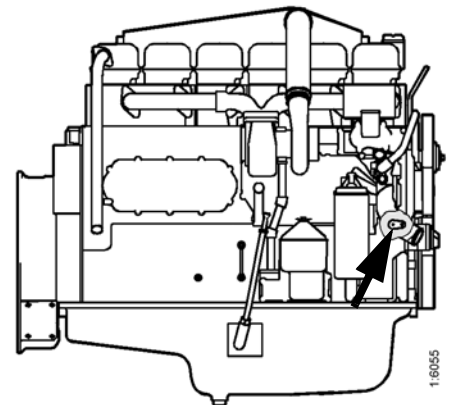
Mixing corrosion inhibitor with glycol or adding too much corrosion inhibitor may cause deposits and reduced cooling capacity.

! Important

If a coolant filter has been fitted it must not contain inhibitor.

Changing the 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 illustration.
 - the "lowest point" of the cooling system.
3. Close the cocks.
4. Fill up with coolant through the expansion tank's filler hole.
Mix coolant as described on page 33.



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.

7. Every 4800 hours: CLEANING THE COOLING SYSTEM

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

External cleaning

Radiator

- Check that the radiator is not clogged on the air side and that the cooling fins are not damaged.
- Carefully scrape the deposit off the radiator's cooling fins. If necessary, a paraffin-based engine cleaner can be used.
- Bent fins can be straightened using a wire brush, for example, and exercising care.

! Important

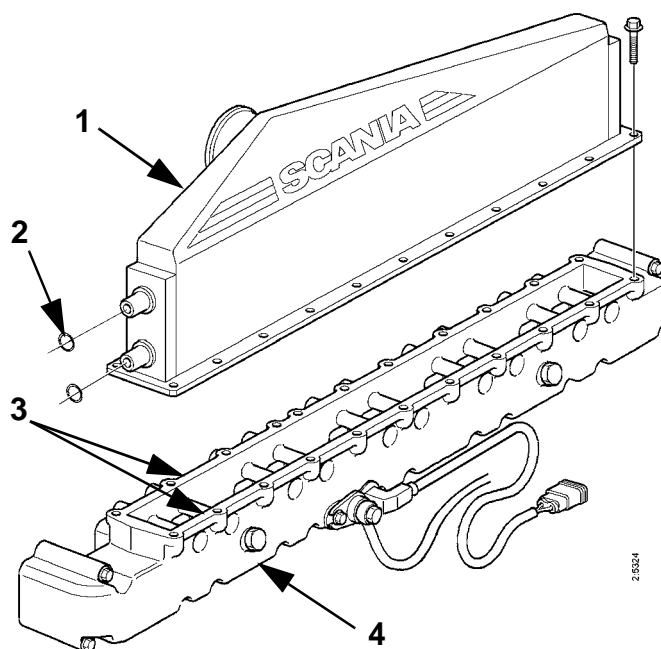
The cooling system must never be cleaned with caustic soda. There is a risk of damage to aluminium parts.

Charge air cooler (DI engine)

1. Drain the coolant from the engine, refer to "Changing the coolant".
2. Detach the intake manifold from the turbo.
3. Detach the charge air cooler inlet and outlet connections.
4. Unbolt the charge air cooler assembly from the intake manifold. The charge air element is integrated into the housing.
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 pipe with a spirit based cleaner.
7. Apply sealant (silicone 816 064) in a uniform bead, approximately 2-3 mm, on the sealing surface of the air intake pipe.
8. Install the charge air cooler within 15 minutes of applying the sealant. Torque tighten the bolts to 26 Nm.
9. Refit the inlet and outlet connections with new O rings
10. Refit the delivery pipe clamps.
11. Connect the intake manifold from the turbo.
12. Fill up with coolant according to the specification on page 33.

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

1. Charge air cooler housing with core
2. O-ring
3. Sealant 816 064
4. Air intake pipe



Internal cleaning

Removing oil and grease

- If possible, run the engine until it has reached the operating temperature and then drain the cooling system.
- Remove the thermostat.
- Fill the system with clean, hot water mixed with liquid dishwasher detergent intended 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 thermostat.
- Fill up with new coolant according to the specification on page 33.



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 operating temperature and then drain the cooling system.
- Remove the thermostat.
- Fill the system with clean, hot water mixed with a commercially available radiator cleaner 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 thermostat.
- Fill up with new coolant according to the specification on page 33.



Mind the environment!

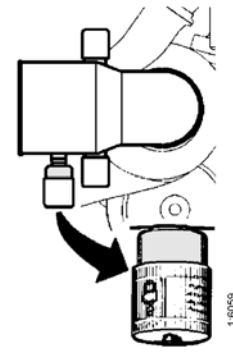
**Always collect fluid in a suitable container to avoid spillage when draining coolant.
Dispose of used coolant through an authorized waste disposal contractor.**

AIR CLEANER

8. Daily:

CHECKING THE VACUUM INDICATOR

If the entire red plunger of the indicator is visible, renew or clean the air filter element, paragraph 10. This is especially important if the engine is operated under heavy load and at high engine speed.

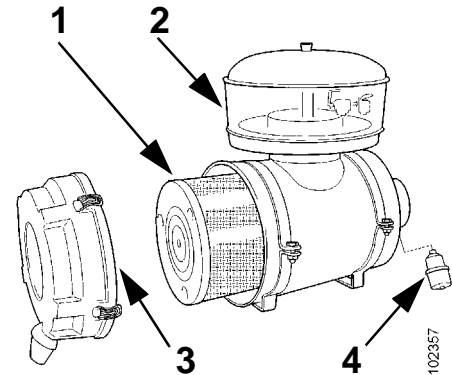


9. Every 200 hours:

CLEANING THE AIR CLEANER COARSE CLEANER

1. Remove the cover from coarse cleaner 2.
2. Remove the conical coarse separator. Empty out the particles of dirt and clean it.
3. Fit the coarse separator as shown in the figure and screw the cover in place.

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



1. Filter element
2. Coarse cleaner
3. Cover
4. Vacuum sensor

Air cleaner with safety cartridge

10. Every 1200 hours:

CLEANING OR CHANGING THE FILTER ELEMENT

Note: Earlier if the vacuum indicator shows red

Dismantling

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 be cleaned a maximum of four times. After cleaning, it has less dust separation capacity than a new element.

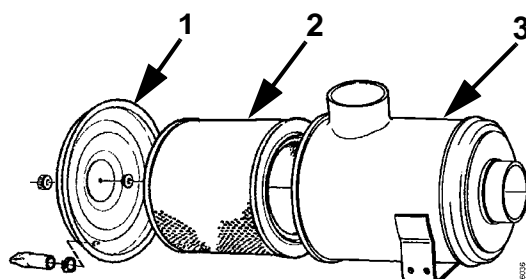
3. Mark the filter when it has been cleaned.

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.

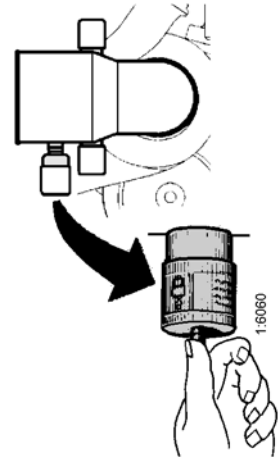


1. Cover
2. Filter element
3. Filter housing

! WARNING
Never start the engine unless the air filter is installed.
Danger of personal injury or engine damage.

Checking

- Insert a torch into the element and check from the outside that there are no holes or cracks in the filter paper.
- Change the filter element if it has the slightest damage. Danger of engine damage.



Assembly

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

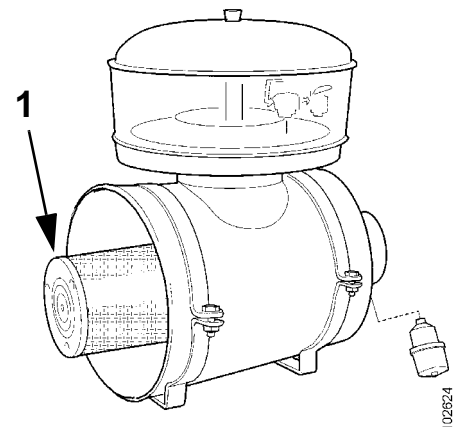
11. Every 2400 hours:

RENEWING THE SAFETY CARTRIDGE

Note Not all filters are equipped with a safety cartridge. When changing the safety cartridge, take great care to ensure that no dirt or other impurities can get into the engine.

1. Remove the side cover from the air cleaner.
2. Remove the filter element.
3. Remove the safety cartridge.
4. Fit a new genuine Scania safety cartridge.
5. Renew or clean the filter element, refer to paragraph 10.
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

12. Daily:

CHECKING THE FUEL LEVEL

- Top up with fuel if necessary.
- If the tank has been run dry, bleed the fuel system, refer to paragraph 13.

! Important

Observe the utmost cleanliness when working on the fuel system. Malfunctions could easily occur and the injection equipment could be damaged.

13. Every 1200 hours:

RENEWING THE FUEL FILTER

Fuel tanks

- Drain any water from the fuel tanks.

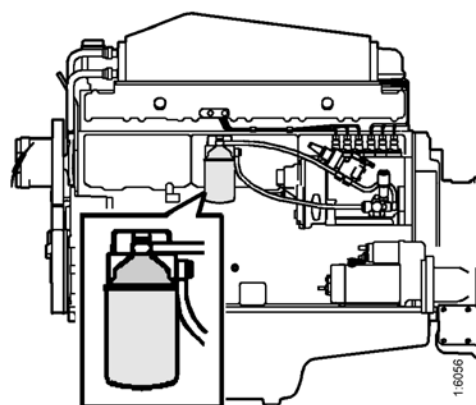
Filter

The filter consists of a filter unit.

- Wash the outside of the filter and unscrew it.
- Tighten the new filter *by hand*.

Never use a tool for tightening. The filters can be damaged, obstructing circulation.

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



! Important

Only use Scania genuine fuel filter.

Bleeding the fuel system

- Turn on the power so that the fuel shut-off valve opens.
- Undo the connection on fuel filter outlet 1 (upwards).
- Pump hand pump 3 until fuel without air bubbles flows out of the opened connection.
- Tighten the connection on the filter.
- Undo the overflow valve 2 at the fuel shut-off valve outlet.
- Pump with the hand pump until the fuel coming out of the open overflow valve is free of air bubbles.
- Tighten the overflow valve and pump the hand pump an additional 10 strokes.

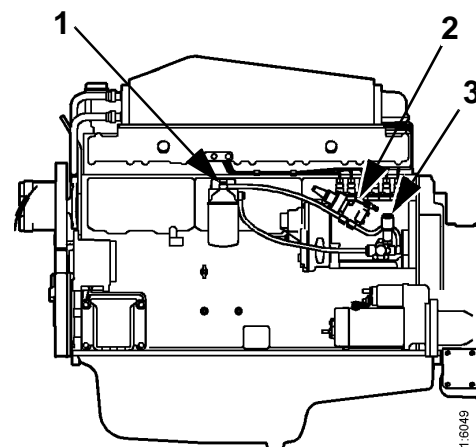
If the engine fails to start after bleeding.

- Open the overflow valve again and pump the hand pump until fuel without air bubbles flows out.
- Close the overflow valve firmly and start the engine.



Mind the environment!

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



14. 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 around 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.

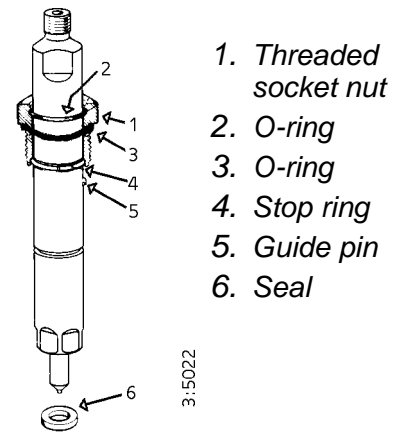
Correct opening pressure, see Technical data, page 54.

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 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 union nuts to 20 Nm (2.0 kpm). Fit clamps and brackets.

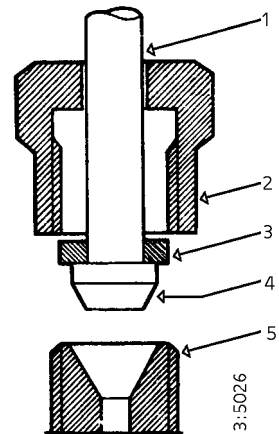
Important *Take care to fit the delivery pipe without tension and make sure that the cone on it is correctly positioned in the connection.*

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



! 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 pipe
2. Union nut
3. Washer
4. Cone
5. Connection on injector or injection pump

ELECTRICAL SYSTEM

15. Every 200 hours:

CHECKING THE ELECTROLYTE LEVEL IN BATTERIES

1. Unscrew the plugs and check the electrolyte level in all cells.
2. Top up with 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.

16. Every 200 hours:

CHECKING THE STATE OF CHARGE IN BATTERIES

Note: Every 200 hours applies to generator sets 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°
- 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.

17. Every 200 hours:

CLEANING THE BATTERIES

Note: Every 200 hours applies to generator sets and the like. Other installations every 1200 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

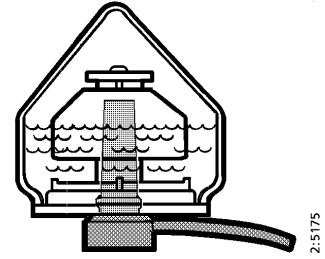
Do not connect the cables to the wrong terminals.
This could cause serious damage to the electrical system.
If the terminals are shortcircuited, sparks will be generated.

18. Every 1200 hours:

CHECKING THE COOLANT LEVEL MONITOR

(optional equipment)

1. Start the engine.
2. Lower the coolant level in the expansion tank.
3. *Automatic stop in case of fault:* The engine stops, the indicator lamp comes on and the buzzer sounds if the level monitor is OK.
4. *Without automatic stop in case of fault:* The indicator lamp comes on and the buzzer sounds if the level monitor is OK.
5. Top up coolant to the correct level, refer to page 32.



2-pin level monitor installed in coolant expansion tank delivered by Scania



Mind the environment!

**Always use a suitable container to avoid spillage when draining coolant.
Dispose of used coolant through an authorized waste disposal contractor.**

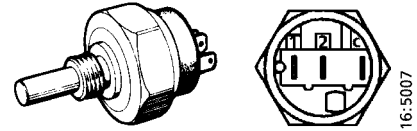
19. Every 1200 hours:

CHECKING THE 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 (approx. 1° 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 monitor tolerance is $\pm 3^\circ$.



C = Common connection

1 = Connection C -1 closes at the stamped temperature

2 = Connection C -2 opens at the stamped temperature

2-pole temperature monitor

CHECKING THE 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 (approximately 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:

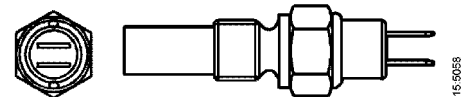
At temp. °C	Resistance Ω	Tolerance °C
60	134 ± 13.5	± 4
90	51.2 ± 4.3	± 3
100	38.5 ± 3	± 3



Mind the environment!

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

Dispose of used coolant through an authorized waste disposal contractor.



2-pole temperature sensor

20. Every 1200 hours:

CHECKING THE OIL PRESSURE SENSOR/MONITOR

Sensor function

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

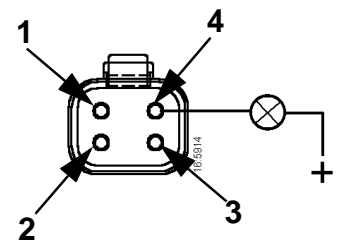
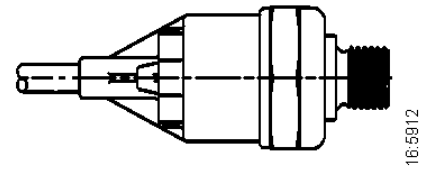
0.85-1.15 bar	=	2.45 volt
1.80-2.20 bar	=	3.70 volt
2.75-3.25 bar	=	4.50 volt
3.79-4.20 bar	=	5.20 volt
4.55-5.45 bar	=	5.70 volt
5.40-6.6 bar	=	6.10 volt

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

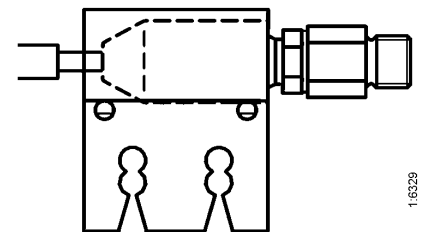
Connect a test lamp to the oil pressure monitor, pin 4 (- ground), and check that the monitor switches on at the correct pressure when the engine is started and stopped. The monitor shall switch on at $0.7 \pm 0.15 \text{ bar}$ when the engine is stopped.

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



CHECKING THE OIL PRESSURE MONITOR FOR DEC 2

Connect an ohmmeter or a test lamp to the oil pressure monitor and check that the monitor switches off/on at the correct pressure when the engine is started and stopped. The monitor shall switch off at $1.1 \pm 0.15 \text{ bar}$ when the engine is started and switch on at $0.7 \pm 0.15 \text{ bar}$ when the engine is stopped.



RENEWING THE 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.

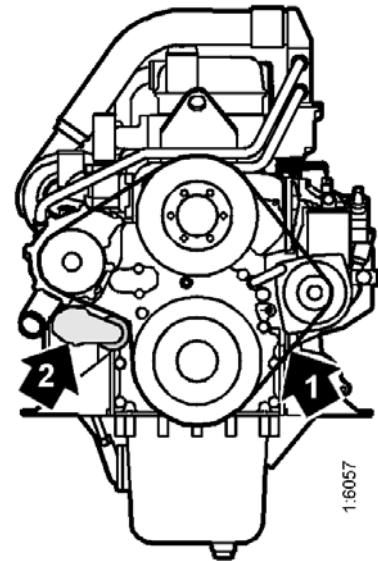
MISCELLANEOUS

21. Every 1200 hours:

CHECKING THE DRIVE BELT

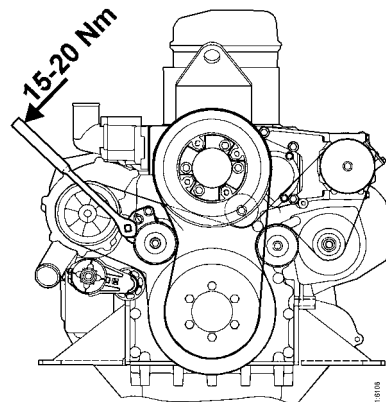
Replace the drive belt (1) (poly V-belt) if worn or damaged.

Also check that the automatic belt tensioner (2) is working and keeps the drive belt correctly tensioned.



On installations with dual belt circuits, the second belt circuit has a drive belt with manual belt tensioner.

This drive belt should be tensioned to 15-20 Nm as shown in the figure.



22. Daily:

CHECKING FOR LEAKAGE, RECTIFY AS NECESSARY

- Start the engine.
- Check for oil, coolant, fuel, air and exhaust leakage.
- Tighten or change leaking connections. Check the overflow holes (1) (below the side covers) which show whether the O rings between the cylinder liners and crankcase are leaking, refer to illustration.
 - a) If coolant is evident, the O-ring is leaking.
 - b) If oil is running out, the liner shelf is leaking.
- Check that the coolant pump drain hole (2) is not clogged, refer to illustration. If there is leakage, renew the pump seal or the coolant pump assembly.

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

This leakage normally stops after a time.

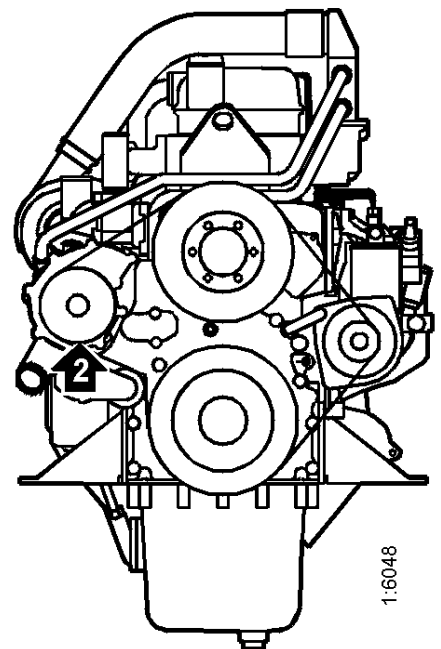
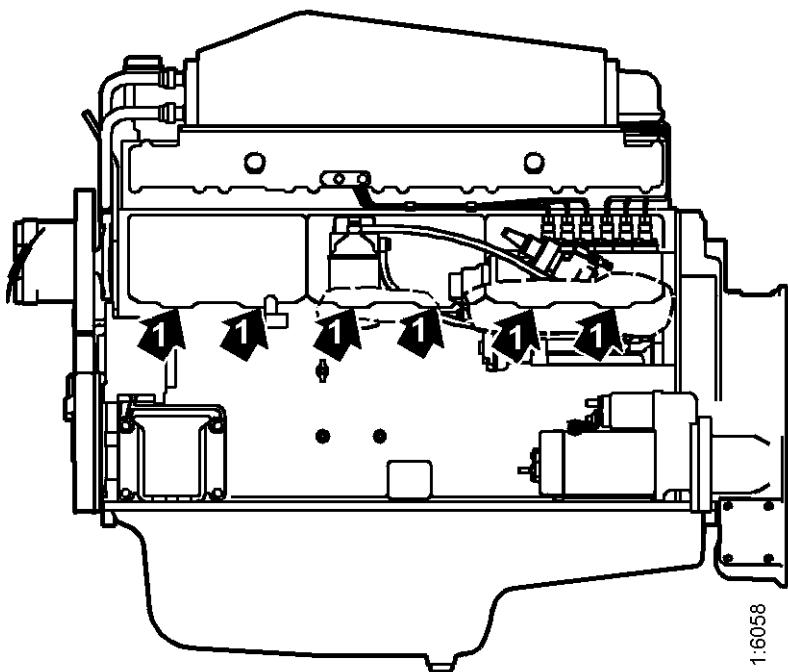


Mind the environment!

Ensure that any leakage does not pollute the environment.

! Important

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



23. Every 2400 hours:

CHECKING/ADJUSTING VALVE CLEARANCE

Note: Checking/adjusting valve clearance should also be done after the first 400 hours of operation.

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

The rocker cover gaskets should be changed as necessary. Tightening torques: 26 Nm.

Intake valve clearance: 0.45 mm
Outlet valve clearance: 0.70 mm.

Alternative 1

- Position No. 1 cylinder at TDC by turning the crankshaft in its normal direction of rotation until all four valves are closed.
- Adjust the following valves. The correct valve clearance is also stated on the instruction plate on one of the valve covers:

Cylinder	1	Intake and outlet
	2	Intake
	3	Outlet
	4	Intake
	5	Outlet

- Position No. 6 cylinder at TDC by turning the crankshaft one revolution in its normal direction of rotation and adjust the following valves:

Cylinder	2	Outlet
	3	Intake
	4	Outlet
	5	Intake
	6	Intake and outlet



WARNING

Immobilise the starting device when working on the engine.

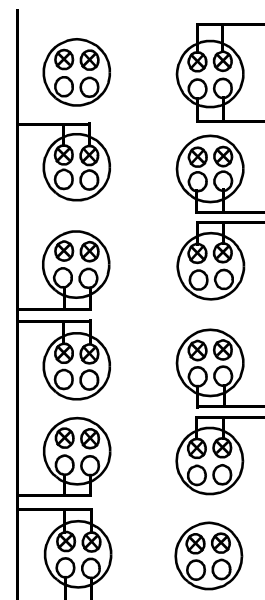
If the engine starts out of control, there is a **SERIOUS RISK OF INJURY.**



FLYWHEEL

Cylinder numeration

TDC no. 6 cylinder TDC no. 1 cylinder



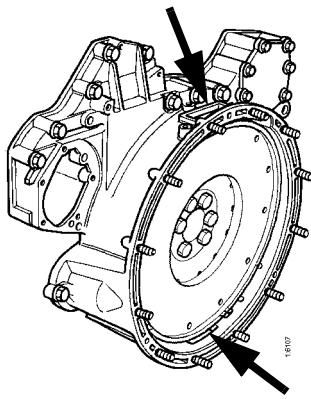
FLYWHEEL

○ Intake valve

⊗ exhaust valve

Alternative 2

- Position No. 1 cylinder at TDC by turning the crankshaft in its normal direction of rotation until all four valves are closed.
- Adjust all valves for No. 1 cylinder. Correct valve clearances are indicated on the instruction plate on one of the rocker covers.
- Proceed in the same way for the remaining cylinders in the sequence 5 - 3 - 6 - 2 - 4 (firing order) by turning the crankshaft 1/3 of a revolution in its normal direction of rotation after each adjustment.



*Covers for reading
on the flywheel housing*

Note:

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

It says *up* and *down* respectively on the flywheel

Both covers are fitted with a cover at delivery.

24. Every 2400 hours:

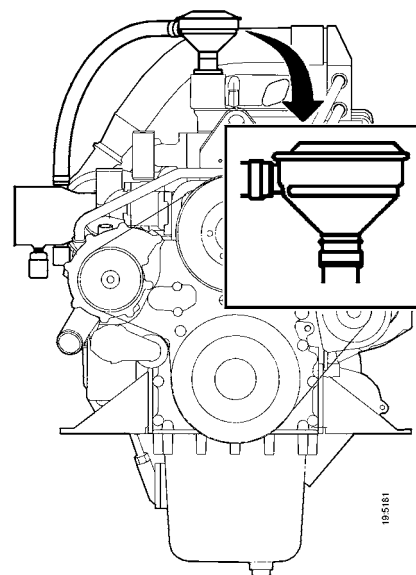
CHANGING (or CLEANING) THE CLOSED CRANKCASE VENTILATION VALVE.

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

Preparing the engine for long-term storage means:

- Thoroughly cleaning the engine
- To run the engine for a period of time with preservative fuel, preservative oil and preservative 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 mixed with Lubrizol 560A or equal.
- Mix 1 cm³ (ml) of Lubrizol 560A with 10 dm³ (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.

E.g. 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 approximately 1000 rpm (not single-speed engines) for 20-25 minutes.
- Stop the engine, remove the hoses and connect the normal fuel lines.
- Oil the valve mechanism generously with preservative oil.
- Remove the injectors and spray preservative oil into each cylinder, **maximum 30 cm³ (ml)**.
Turn the engine over a few revolutions using the starter motor. Spray an additional **small** amount of oil 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 renew 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.

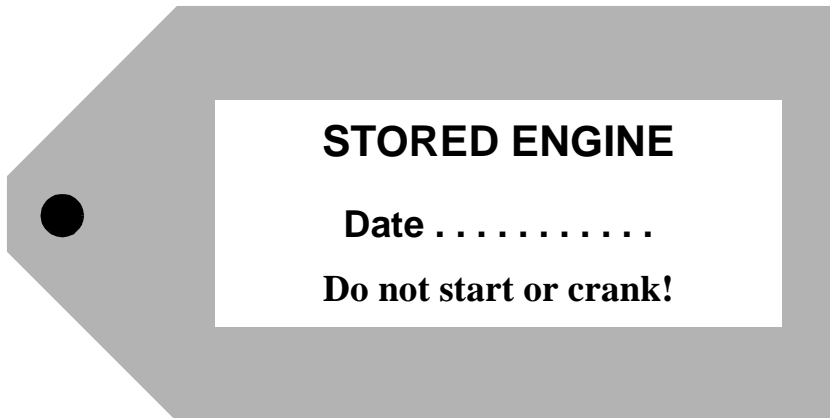


Mind the environment!

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. (Does not apply to batteries, which the manufacturer specifies to be maintenance free). The same is applicable for short-term storage if the engine has not been prepared for storage as above.

Storage

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

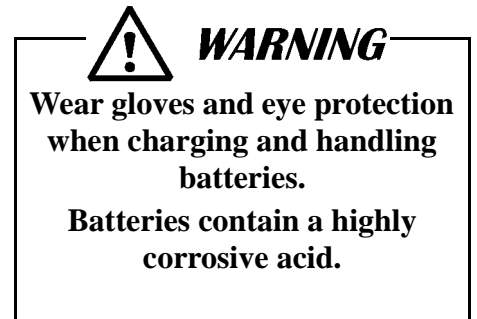
Taking out of storage

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

- Remove plugs and tape from coolant connections, air intakes and exhaust pipes.
- Fill the cooling system with coolant, refer to page 19.
- Check the oil level in the engine or fill up with fresh 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 cranked with the injectors removed so that surplus preservative oil will be pressed out of the cylinders.*

- Fit the injectors.
- Empty the fuel system's main filter of preservative oil.
- Bleed the fuel system, refer to page 40.
- Wash off any externally applied preservative oil, using white spirit.



TECHNICAL DATA

GENERAL	DC12	DI12
Number of cylinders	6 in line	
Bore mm	127	
Stroke mm	154	
Displacement dm³ (litres)	11.70	
No. of main bearings	7	
Firing order	1 - 5 - 3 - 6 - 2 - 4	
Compression ratio	15:1(DC12 40=17:1)	17:1
Engine direction of rotation viewed from rear	Anti-clockwise	
Fan direction of rotation viewed from front	Clockwise	
Cooling	Liquid	
Valve clearances, cold engine intake valve mm outlet valve mm	0.45 0.70	
Weight, without coolant and oil kg *With charge air cooler, radiator, expansion tank and pipes	1065*	995
Power	refer to, "Engine record card"	
LUBRICATION SYSTEM		
Max. oil pressure (warm engine at engine speed exceeding 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, refer to page 29		
Crankcase pressure with closed crankcase ventilation mm H2O	-55 - +20	

FUEL SYSTEM		DC12	DI12
Pump setting BTDC		See plate on rocker cover	
Injectors, opening pressure	bar (kp/cm ²)	300	
Low idle speed	rpm	700	
Maximum full load speed		See engine card	
Fuel		Diesel fuel ¹	
Tightening torques:			
Socket nut for injectors	Nm	70	
Union nut for delivery pipe	Nm	20	
Leak-off connection	Nm	11	
¹ refer to page 56			
COOLING SYSTEM			
Number of thermostats		1 (dual thermostat)	
Thermostat, opening temperature	°C	83	
Coolant temperature:			
System with ambient pressure	°C	70 - 93	
System with overpressure	°C	70 - approx. 100	
Capacity, including radiator, engine and expansions tank and, for DI12, charge air cooler			
with 0.75 m ² radiator	dm ³ (litres)	54	56
with 1.0 m ² radiator	dm ³ (litres)	59	61
with 1.2 m ² radiator	dm ³ (litres)	63	65
ELECTRICAL SYSTEM			
System voltage	V	24	
Alternator, charging current	A	65 or 90	
Starter motor output	kW (hp)	6.7 (9.1)	
Monitors, alarm values:			
oil pressure monitor	bar (kp/cm ²)	0.7 ± 0.15	
temperature monitor	°C	Stamped on hexagonal part of monitor	

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 lose 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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