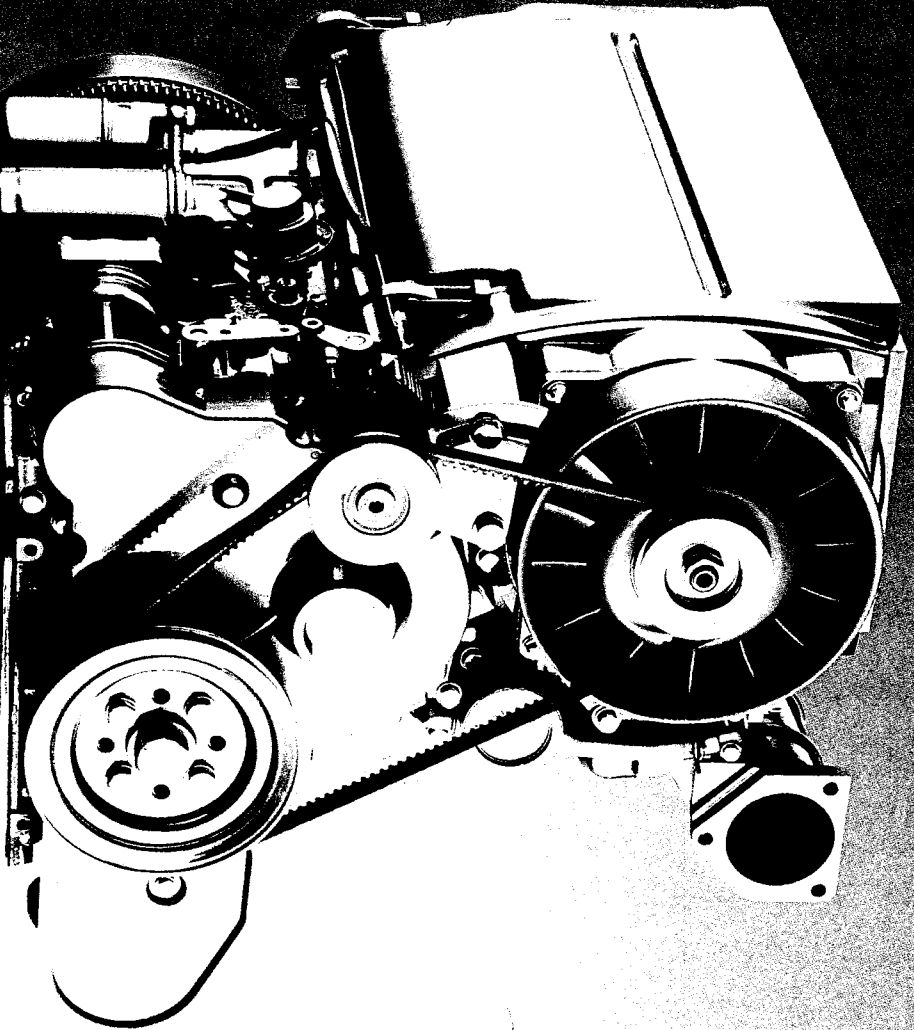



# Operation Manual

## FL 1011



  
**KHD**  
**DEUTZ SERVICE**

  
**KHD**  
**DEUTZ**



- Please read thoroughly and comply with the information provided in this Operation Manual. By doing so you will avoid accidents, preserve the manufacturer's warranty and always enjoy the advantages of an efficient and reliable engine.
- This engine is provided solely for the use provided in the supply scope and defined by the equipment manufacturer (intended use). Use in any other way is considered as contrary to the intended use. The manufacturer accepts no liability for any damage or injury resulting from this misuse. Any risk involved must be borne solely by the user.
- Compliance with and strict adherence to the conditions of operation, maintenance and repair as specified by the manufacturer also constitute essential elements of the intended use. The engine must not be operated, serviced and repaired by persons other than those familiar with all its particular characteristics and acquainted with the safety rules (accident prevention).
- The accident prevention regulations and all other generally recognized regulations on safety and occupational medicine must be observed at all times.
- Any unauthorized modifications carried out on the engine will relieve the manufacturer of all liability for any resulting damage or injury. Likewise, any manipulations on the injection and the control system may affect the performance and exhaust emission characteristics of the engine, thus no longer ensuring compliance with the environmental legislation.



# Operation Manual

## FL 1011



**0297 5190 en**

**Engine Serial  
Number:**

--	--	--	--	--	--	--	--

Please enter here the engine serial number. By quoting this number you will help to facilitate dealing with questions concerning Customer Service, Repairs and Spare Parts (see Section 2.1).

All rights reserved. Technical modifications required to improve our engines are reserved in relation to the specification data and other technical information contained in this operation manual. Duplication, either in whole or in part, will require our approval.





# Foreword

Dear customer

The aircooled DEUTZ engines have been designed for a wide range of applications. Consequently, a correspondingly high number of variants are offered to meet the special requirements of each individual case.

Your engine is appropriately equipped for the installation concerned, which means that not all of the components described in this operation manual are necessarily mounted to your engine.

We have taken pains to point out the differences, so that you may easily find the operating and maintenance instructions relevant to your engine.

Please read these instructions before starting up your engine and bear them in mind.

Should you have any inquiries DEUTZ SERVICE will be pleased to provide advice.

Your

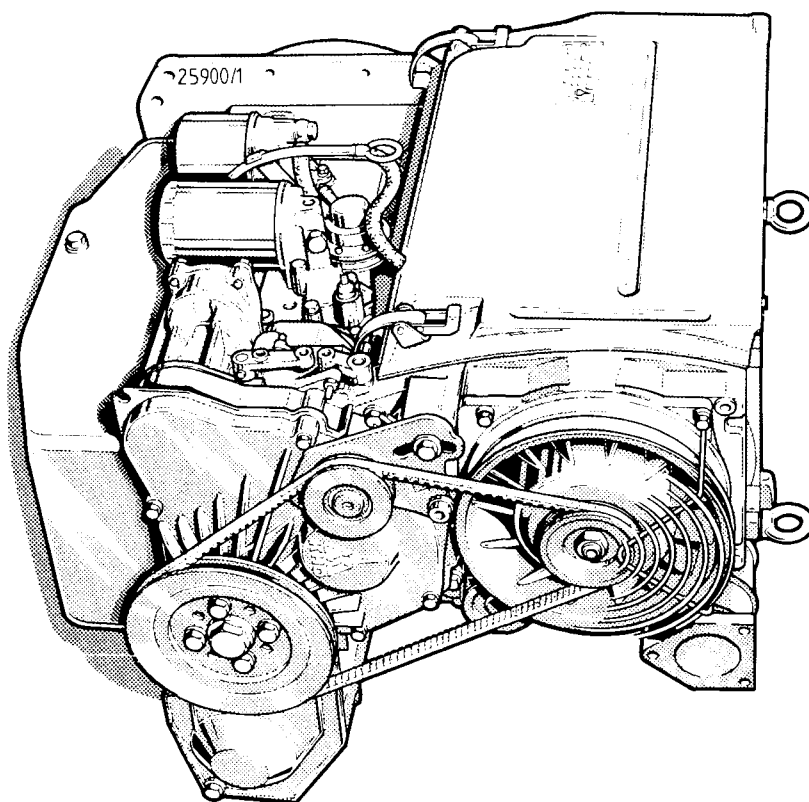
DEUTZ SERVICE INTERNATIONAL GmbH



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## DEUTZ Diesel Engines

are the product of many years of research and development. The resulting know-how, coupled with stringent quality standards, guarantee their long service life, high reliability and low fuel consumption.

It goes without saying that DEUTZ Diesel Engines meet the highest standards for environmental protection.

## Service and Maintenance

Sound service and maintenance practices will ensure that the engine continues to meet your requirements. Recommended service intervals must be observed and service and maintenance work carried out conscientiously.

Special care should be taken under abnormally demanding operating conditions.

## DEUTZ SERVICE INTERNATIONAL GmbH

Please contact DEUTZ SERVICE in the event of breakdowns or for spare parts inquiries. Our trained specialists will carry out repairs quickly and professionally, using only genuine spare parts. Genuine spare parts from DEUTZ SERVICE INTERNATIONAL GmbH are always manufactured to the highest technical standards.

A table of DEUTZ SERVICE INTERNATIONAL GmbH contact numbers is given at the end of this Operating Manual.

## Beware of Running Engine

Shut the engine down before carrying out maintenance or repair work. Make sure that the engine cannot be started accidentally.

– Accident Hazard –

When the work has been completed, be sure to refit any safety devices that may have been removed. Never fill the fuel tank while the engine is running. "When engines are running in enclosed spaces or underground observe industrial safety regulations."

## Safety



All safety instructions in this Manual are designated by the accompanying symbol. Please follow them carefully.

The attention of operating personnel should be drawn to these safety instructions. General safety and accident prevention regulations laid down by law must also be observed.

## Asbestos



The gaskets used in this engine do not contain asbestos. When performing repair work and servicing, take care to use relevant spare parts.



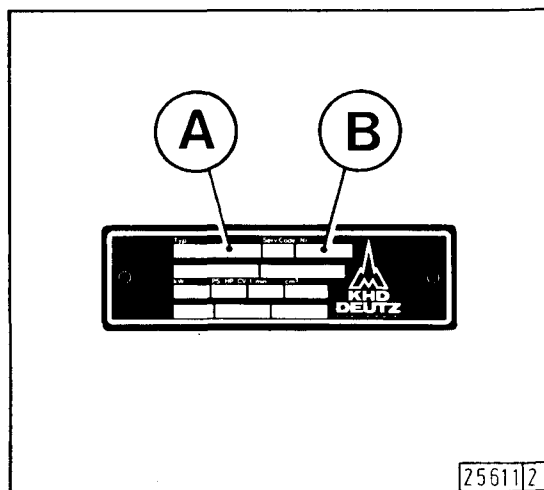
- 2.1 Model Designation
- 2.2 Engine Illustrations
- 2.3 Lube Oil Circuit
- 2.4 Layout of Fuel System



# Description of Engine

## 2.1 Model Designation

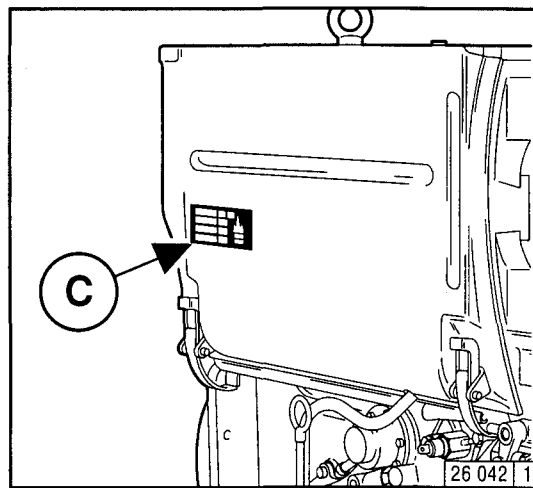
### 2.1.1 Rating Plate



The model designation **A**, the Engine Serial Number **B**, and the performance data are stamped on the rating plate.

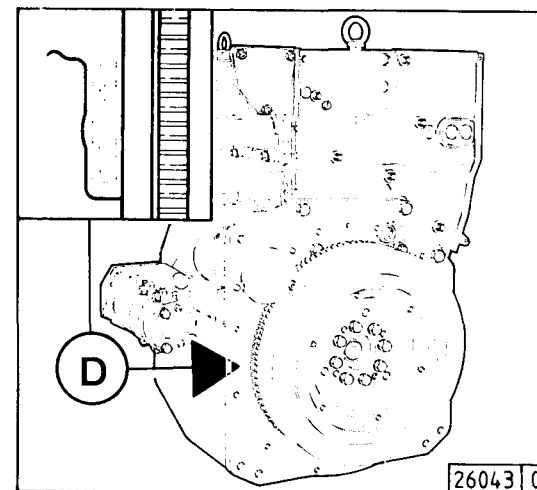
When ordering any parts, it is essential to quote the model designation as well as the Engine Serial Number.

### 2.1.2 Location of Rating Plate



The rating plate **C** is attached to the air cowling.

### 2.1.3 Engine Serial Number



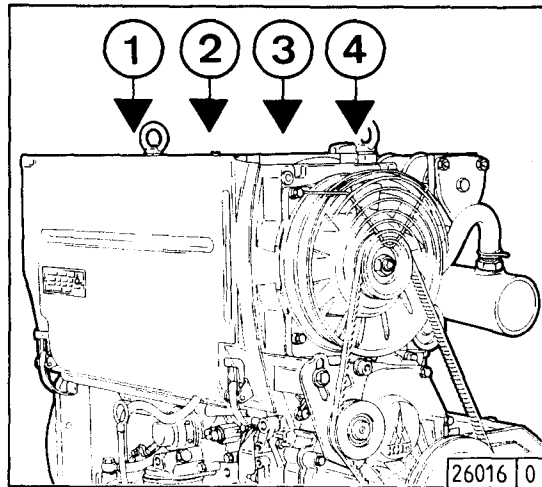
The Engine Serial Number **D** is stamped into the crankcase and also on the rating plate.



## 2.1 Model Designation

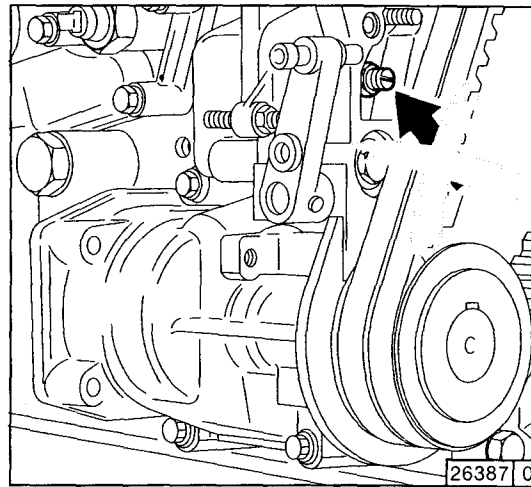
## Description of Engine

### 2.1.4 Numbering of Cylinders



The cylinders are numbered consecutively, beginning at the flywheel end.

### 2.1.5 Flow blockage



The manufacturer is not responsible for any damage occurring as a result if you adjust the regulator yourself.

To prevent this, the locking bolts have been secured as follows:

1. With locking paint:  
with torque control.
2. With plastic protective cap:  
without torque control.

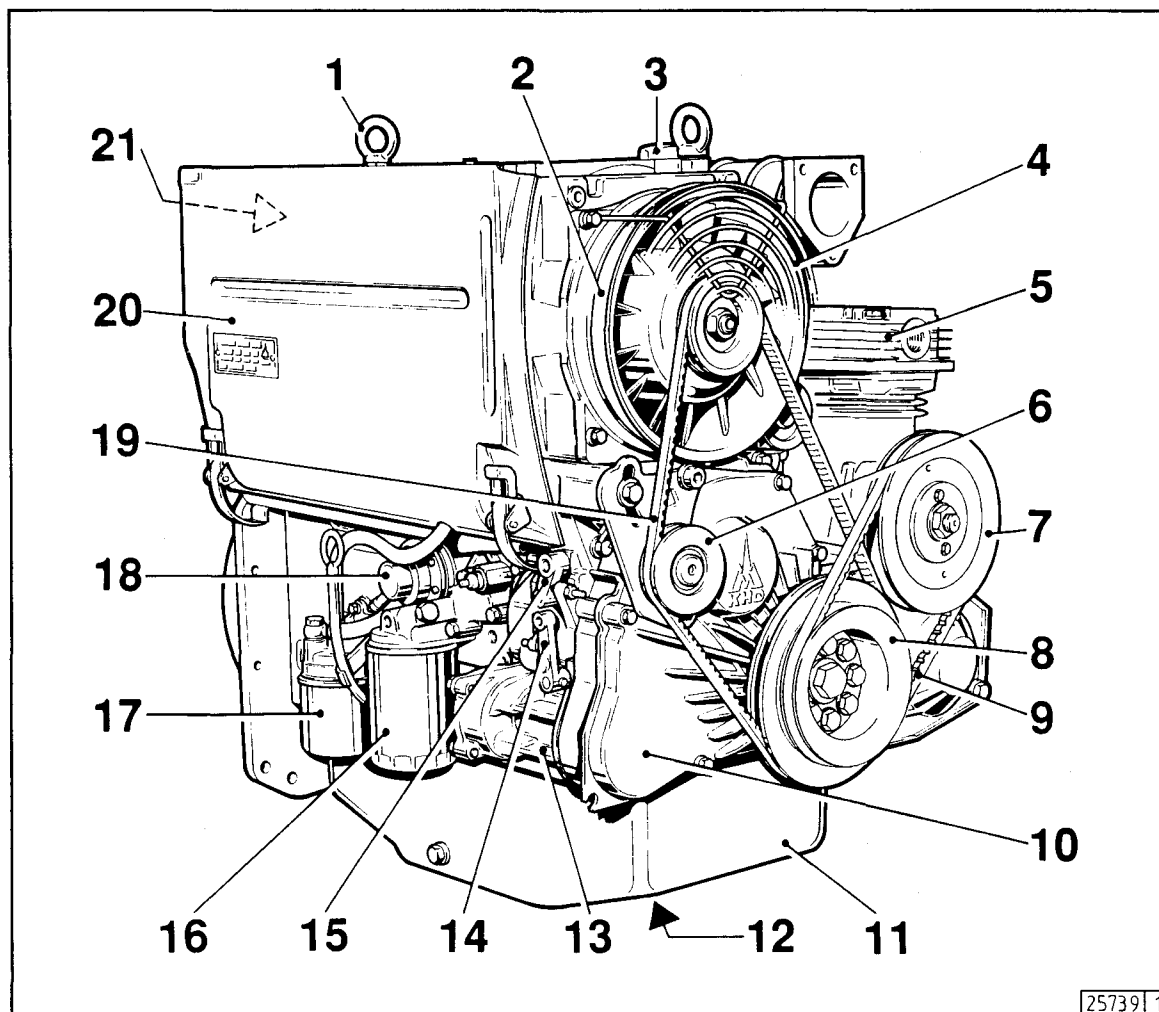


Adjustments to regulator only to be made by authorized DEUTZ SERVICE technical personnel.



### 2.2.1 Service Side

2



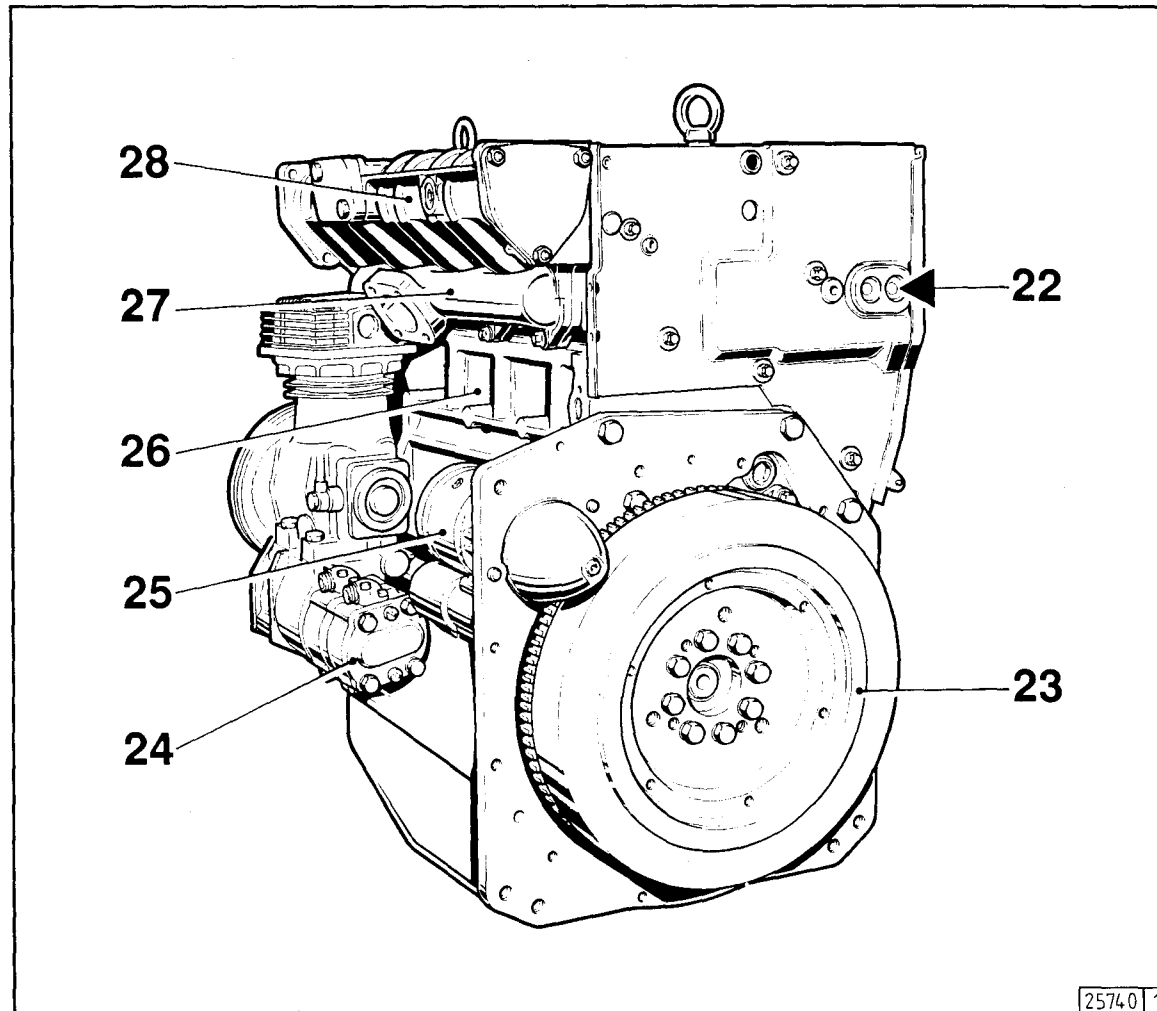
- 1 Lifting eyebolts
- 2 Cooling blower (with integrated alternator)
- 3 Oil filler neck
- 4 Guard
- 5 Air compressor
- 6 V-belt idler pulley
- 7 V-belt pulley (air compressor)
- 8 V-belt pulley (crankshaft)
- 9 Air compressor V-belt
- 10 Hood of toothed belt drive
- 11 Oil pan
- 12 Oil drain plug
- 13 Oil pump
- 14 Speed control lever
- 15 Shut-down lever
- 16 Spin-on lube oil filter
- 17 Spin-on fuel filter
- 18 Fuel feed pump
- 19 Cooling blower V-belt
- 20 Detachable cooling air cowling
- 21 Oil cooler



## 2.2 Engine Illustrations

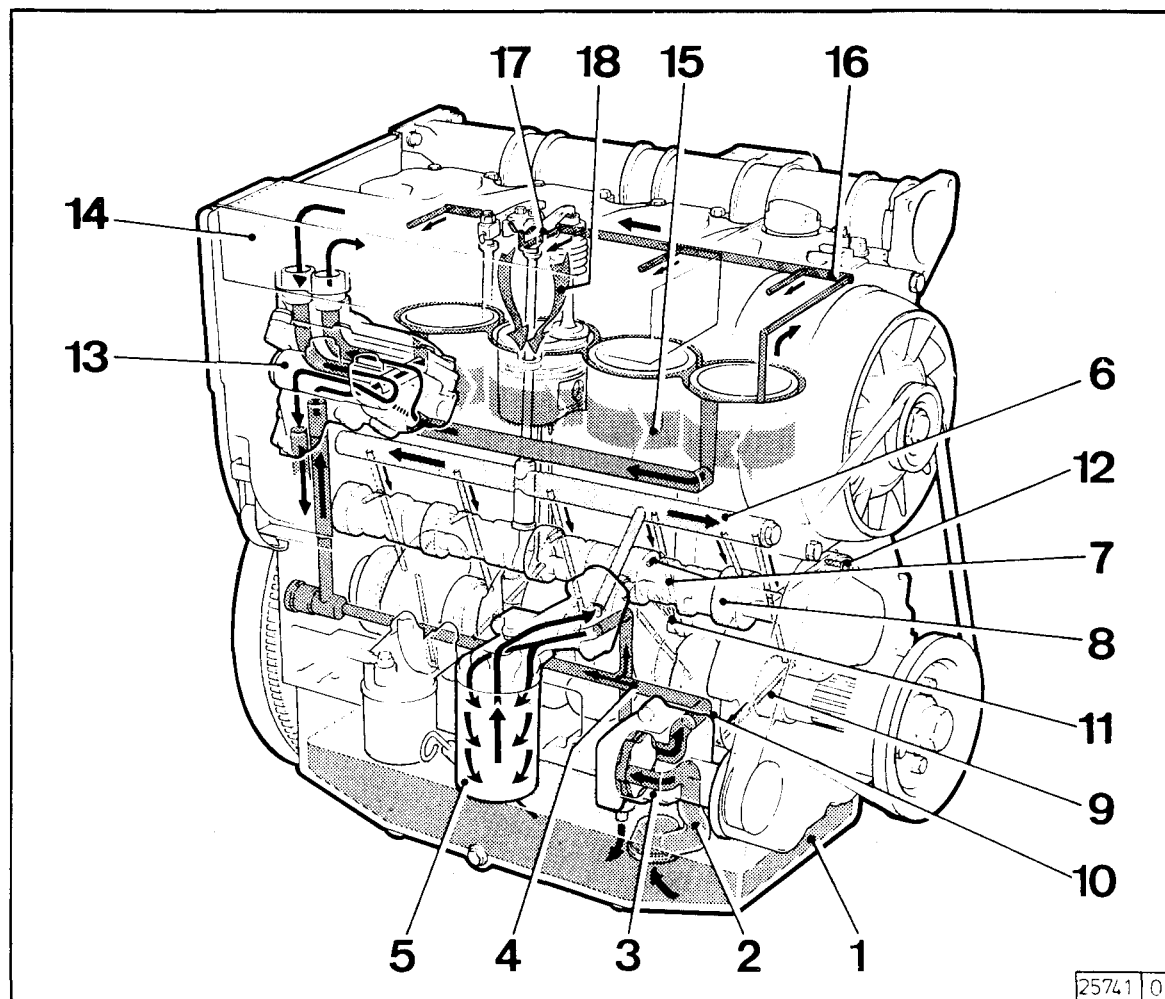
## Description of Engine

### 2.2.2 Exhaust Air Side



- 22 Outlet (on version with oil/air cab heater)
- 23 Flywheel
- 24 Hydraulic pump
- 25 Starter motor
- 26 Crankcase with integrated liners
- 27 Exhaust gas manifold
- 28 Air intake manifold



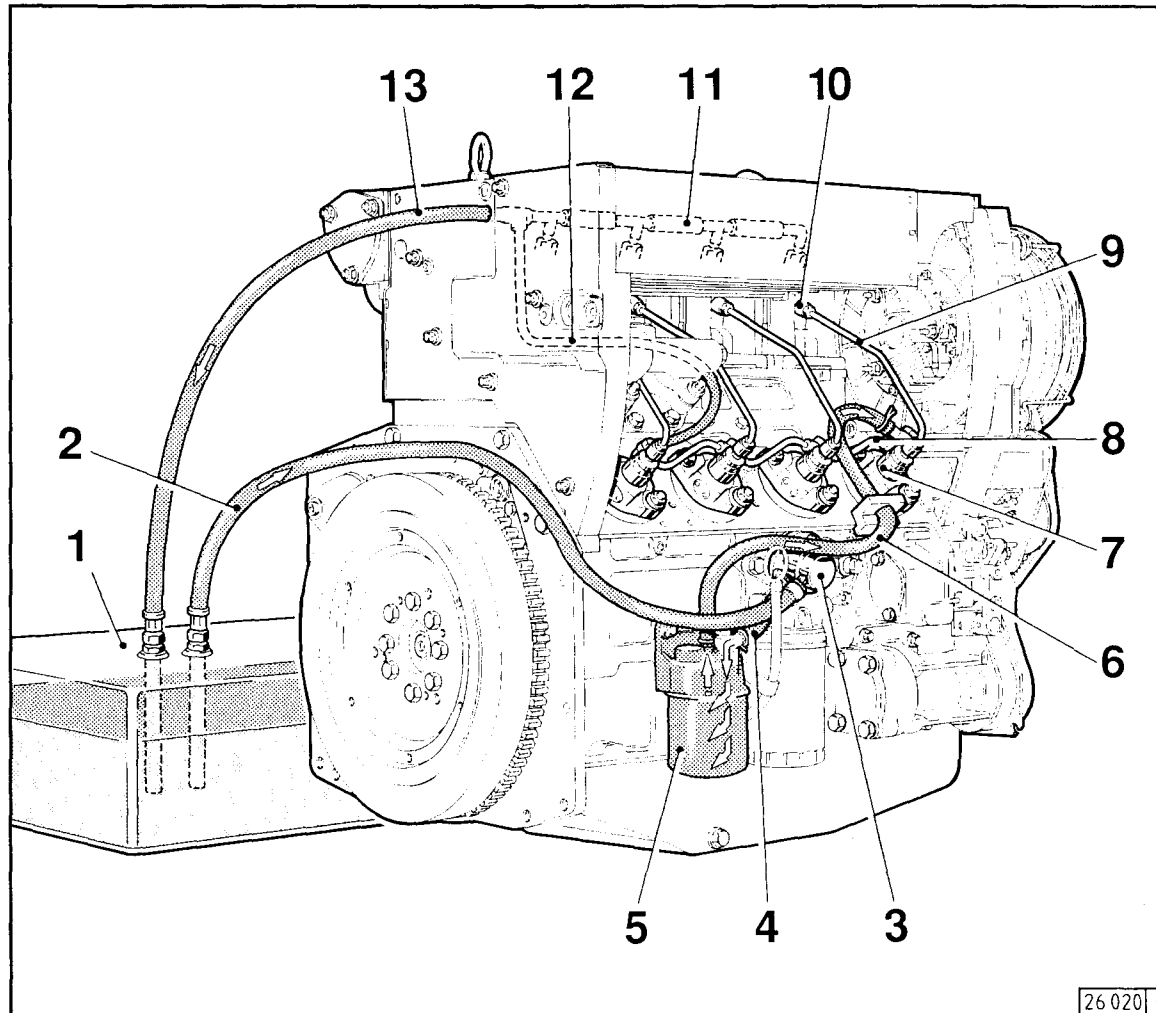


- 1 Oil pan
- 2 Suction pipe
- 3 Oil pump
- 4 Oil duct to oil filter and thermostat housing
- 5 Oil filter
- 6 Oil gallery
- 7 Oil bores to camshaft and main bearings
- 8 Camshaft bearing
- 9 Main bearing
- 10 Bigend bearing
- 11 Spray nozzle for piston cooling
- 12 Connection for air compressor lubrication
- 13 Thermostat housing
- 14 Oil cooler
- 15 Oil-cooled cylinder
- 16 Oil duct for rocker arm lubrication
- 17 Rocker arm
- 18 Oil return via crankcase to oil pan



## 2.4 Layout of Fuel System

## Description of Engine



- 1 Fuel tank
- 2 Fuel line from tank to fuel feed pump
- 3 Fuel feed pump
- 4 Fuel line from feed pump to spin-on fuel filter
- 5 Spin-on fuel filter
- 6 Fuel line from filter to plug-in injection pump
- 7 Plug-in injection pump
- 8 Fuel distribution line
- 9 Fuel injection line
- 10 Injector
- 11 Fuel backleakage line
- 12 Fuel overflow line
- 13 Fuel return line to tank



## **3.1 Commissioning**

### **3.2 Starting**

### **3.3 Monitoring Systems**

### **3.4 Stopping**

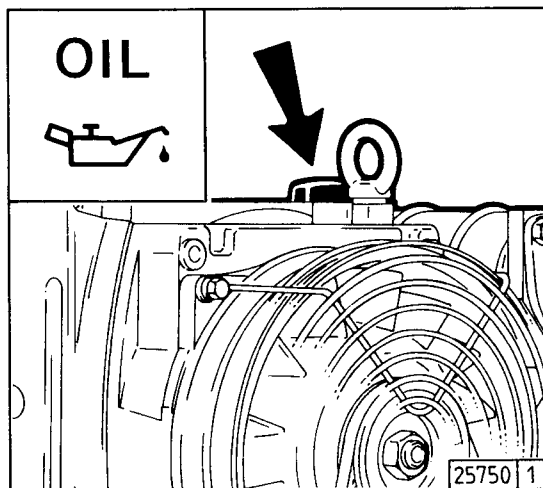
### **3.5 Operating Conditions**



# Engine Operation

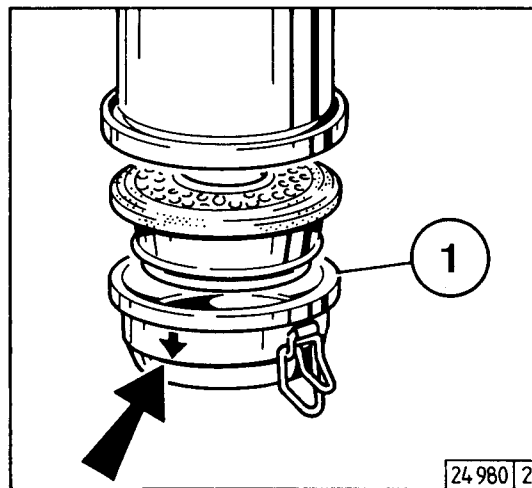
## 3.1 Commissioning

### 3.1.1 Filling in Engine Oil



As a rule, the engines are delivered without oil filling.  
Fill in lube oil through the oil filler neck (arrow).  
For oil filling volume – see 9.1.  
For oil quality grade and oil viscosity – see 4.1.

### 3.1.2 Filling Oil Bath Air Cleaner with Engine Oil

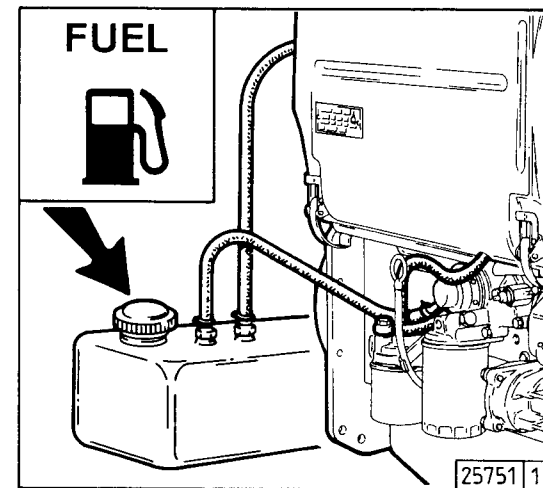


Fill engine oil into bowl of oil bath air cleaner up to the arrow mark.  
For oil quality grade and oil viscosity – see 4.1.



Never fill oil into the precleaner's dust collector, if provided.

### 3.1.3 Filling the Fuel Tank



Use only commercial-grade diesel fuel. For fuel quality grade – see 4.2.  
In accordance with the ambient temperatures, summer- or winter-grade diesel fuel should be used.



Never fill the fuel tank while the engine is running! Strict cleanliness is important! Do not spill any fuel!



### 3.1.4 Other Preparations

- Check battery and battery cable connections – see 6.7.1.

- Remove lifting eyebolts, if fitted – see 6.7.3.

- Trial Run

Upon completing the preparations, run the engine for a short trial run of about 10 minutes without load.

Steps to be taken during and after the trial run:

- Check engine for leaks.
- Check oil level – see 6.1.2, top up oil as necessary – see 3.1.1.
- Retension V-belts – see 6.5.

- Breaking-in

During the braking-in phase – approx. 200 running hours – it is recommended to check the oil level twice a day. After the braking-in phase, checking once a day will be sufficient.

### 3.1.5 Additional Maintenance Jobs

After 50 running hours the following maintenance jobs are to be carried out:

- Change the engine oil – see 6.1.2.

- Renew the oil filter cartridge – see 6.1.3.

- Renew the fuel filter cartridge – see 6.2.1.

- Check the V-belt tension and retension if necessary – see 6.5.

- Check the valve clearances and readjust if necessary – see 6.6.1.

- Check the engine for leaks.

- Check the engine mountings and retighten if necessary – see 9.2.



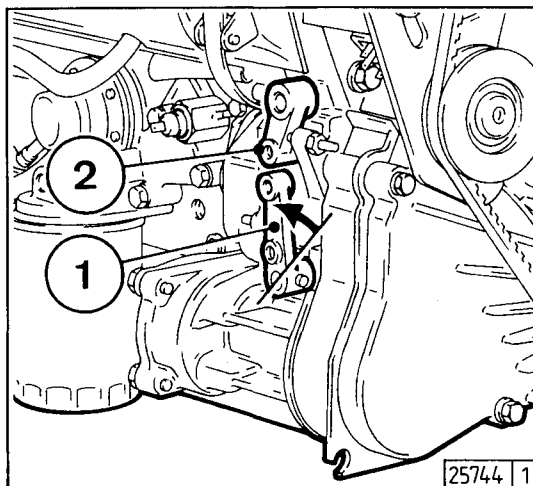
### 3.2.1 Electric Starting



Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine.

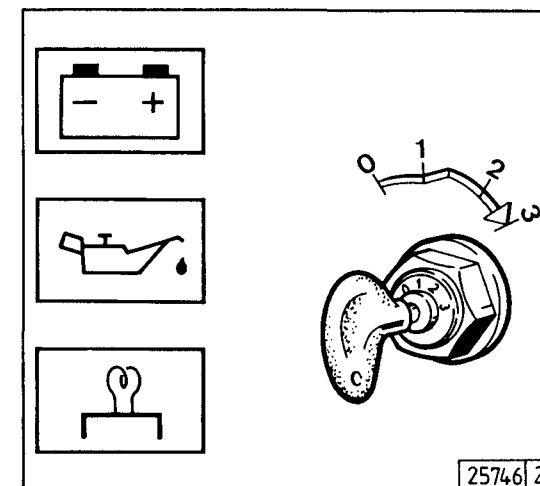
After having carried out repairs, make certain that all removed panels and guards are put back in place and that all tools are removed from the engine. When starting with heating plug, do not use any other additional starting aids.

**A combination of the ether starting system with heating plug or any other cold-starting aids is not permitted either. Danger of accident!**



- Disengage the clutch – where possible – to separate the engine from the driven equipment.
- Move speed control lever 1 to idle position.
- Move shut-down lever 2 to operating position.

### without Cold-Starting Aid



- Insert key.
  - Position 0 = no operating voltage.
- Turn key clockwise.
  - Position 1 = operating voltage.
  - Pilot lamps light up.
- Push key in deeper and turn further clockwise against spring action.
  - Position 2 = no function.
  - Position 3 = starting.
- Release key as soon as the engine starts firing.
  - Pilot lamps go out.

Do not actuate the starter for more than 20 seconds at a time. If the engine does not start, wait one minute before repeating the attempt.

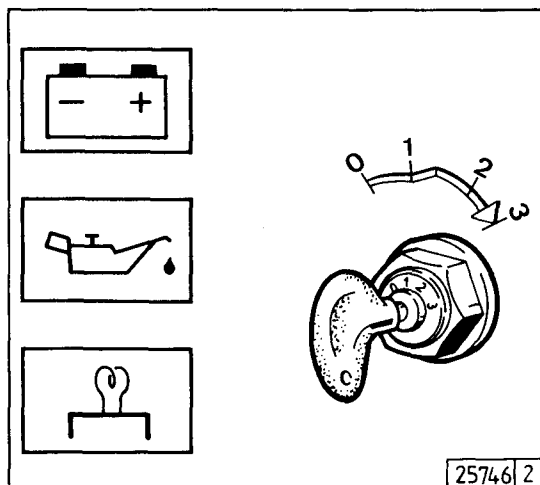
If the engine does not start after two attempts, trace the cause with the aid of the Diagnosis Chart (see 7.1).



## 3.2 Starting

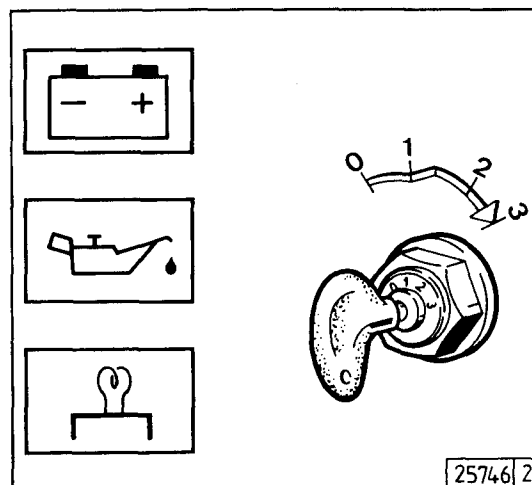
## Engine operation

### with Cold-Starting Aid - Heating plug

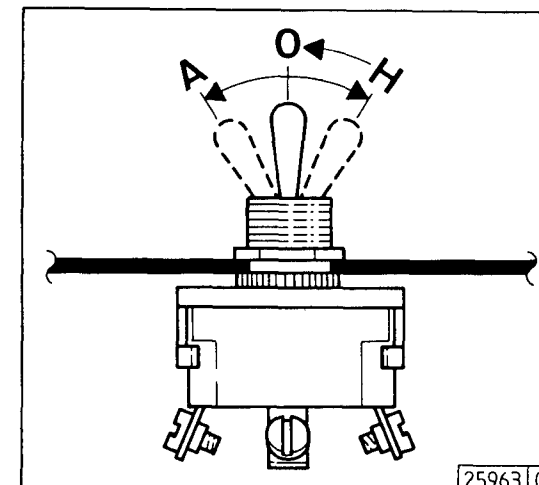


- Insert key.
  - Position 0 = no operating voltage.
- Turn key clockwise.
  - Position 1 = operating voltage.
  - Pilot lamps light up.
- Push key in deeper and turn further clockwise against spring action.
  - Position 2 = preheating, hold for roughly one minute.
  - Preheating lamp lights up.
  - Position 3 = starting.
- Release key as soon as the engine starts firing.
  - Pilot lamps go out.

### with Cold-Starting Aid - Ether Starting System



- Insert key.
  - Position 0 = no operating voltage.
- Turn key clockwise.
  - Position 1 = operating voltage.
  - Pilot lamps light up.
- Push key in deeper and turn further clockwise against spring action.
  - Position 2 = no function.
  - Position 3 = starting.
- Release key as soon as the engine starts firing.
  - Pilot lamps go out.



- Injection of the starting fluid is automatic with switch in position **A** as long as the starter is actuated.
- To assist the engine in picking up speed at low temperatures and to keep down the white smoke emission, briefly hold the Artic switch in position **H**.

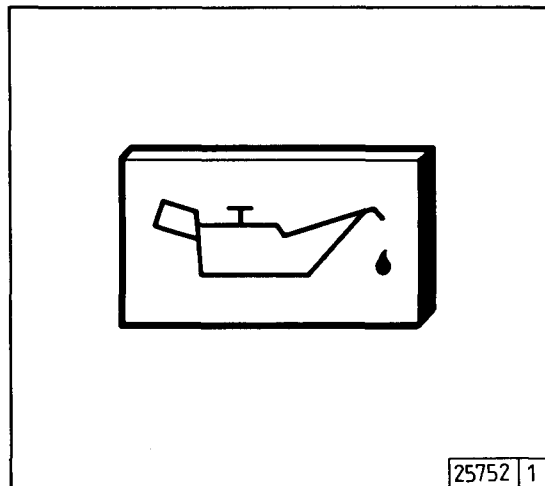


Never bring switch into position **H** with the engine stationary and the ignition ON.



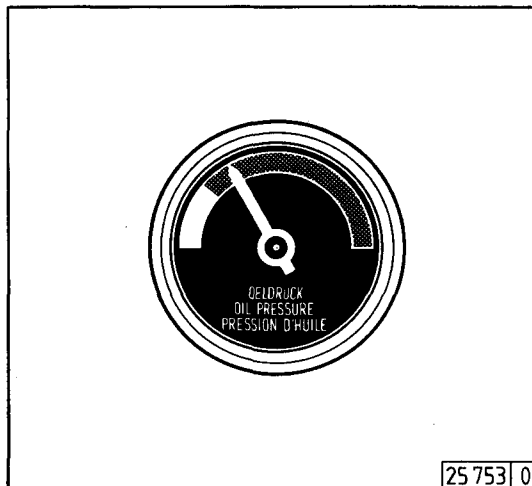
### 3.3.1 Engine Oil Pressure

#### Oil Pressure Pilot Lamp



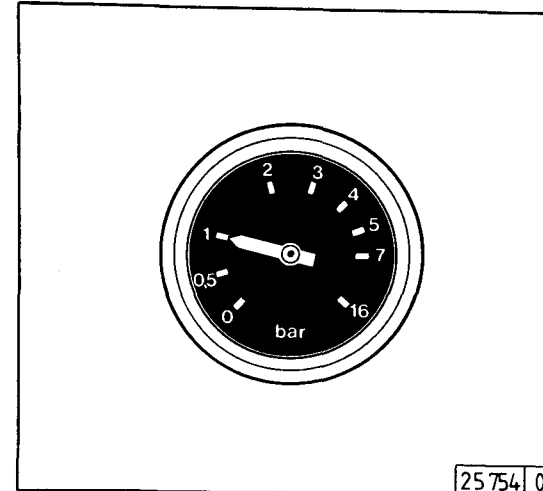
- The oil pressure pilot lamp is on with operating voltage applied and engine stationary.
- The oil pressure pilot lamp must be out when the engine is running.

#### Oil Pressure Indicator



- The pointer of the oil pressure indicator must remain in the green sector over the entire operating range.

#### Oil Pressure Gauge

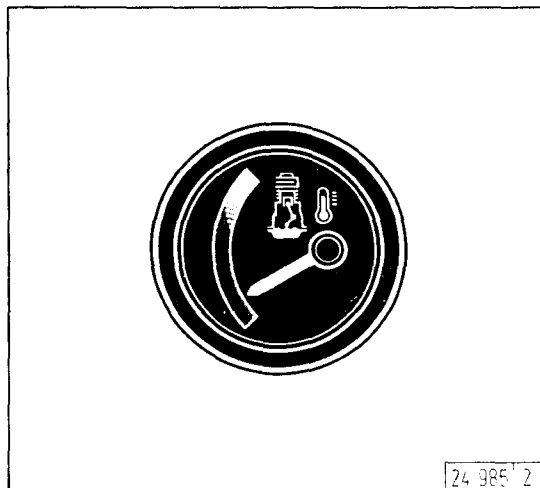


- The pointer of the oil pressure gauge must show the minimum oil pressure (see 9.1).



### 3.3.2 Engine Temperature

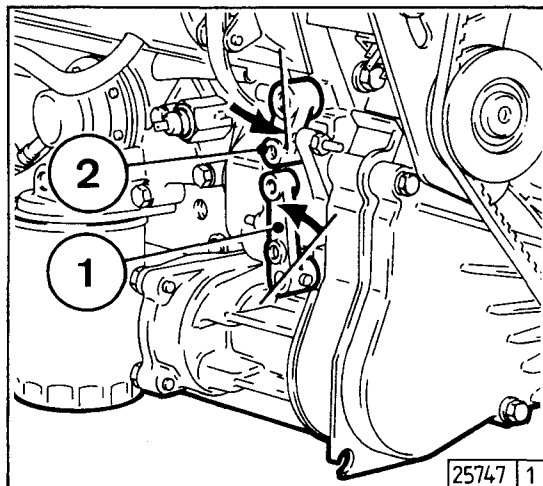
#### Temperature Indicator



- The pointer of the engine temperature indicator must always be in the green sector – in the yellow-green area as an exception only. If the pointer moves to the orange sector, the engine is becoming too hot. Stop the engine and trace the trouble cause with the aid of the Diagnosis Chart (see 7.1).

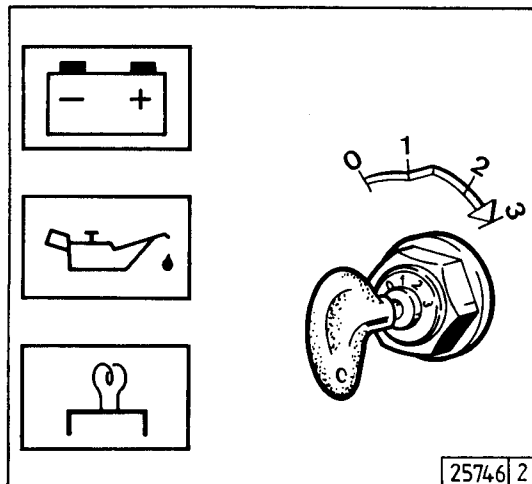


### 3.4.1 Mechanical Shut-Down



- Move the speed control lever 1 to the low-speed position.
- Actuate the shut-down lever 2 until the engine stops. charging current and oil pressure pilot lamps light up when engine has come to rest.
- Turn key counterclockwise (to Position 0) and remove. Pilot lamps go out.

### 3.4.2 Electric Shut-Down (Ignition Key)



- Turn key counterclockwise (to Position 0) and remove. Pilot lamps go out.

Do not abruptly shut down an engine running at full load.



### 3.5.1 Operation in Winter

- Lube Oil Viscosity

- Select the oil viscosity (SAE grade) according to the ambient temperature prevailing at the time of starting the engine – see 4.1.2.
- Keep shorter periods between oil changes when operating at temperatures below  $-10^{\circ}\text{C}$  ( $+14^{\circ}\text{F}$ ) – see 6.1.1.

- Diesel Fuel

- Use winter-grade diesel fuel for operation at sub-zero temperatures ( $+32^{\circ}\text{F}$ ) – see 4.2.2.

- Additional Maintenance Jobs

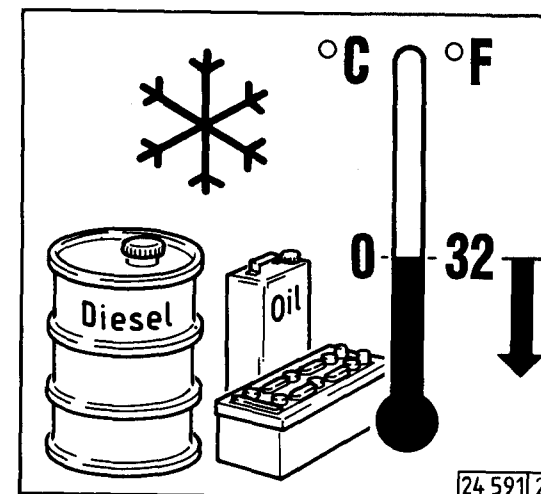
- Drain the thick sludge from the fuel tank once a week (by undoing the sludge drain plug).
- Adjust the oil filling in the oil bath air cleaner (if fitted) to the prevalent ambient temperature, as in case of the engine oil.
- At temperatures below  $-20^{\circ}\text{C}$  ( $-4^{\circ}\text{F}$ ) lubricate the flywheel ring gear with low-temperature grease, e.g. Bosch FT1V31, from time to time through the pinion hole (if necessary, remove the starter).

- Cold-Starting Aids

- At temperatures near or below freezing point, start with heating plug, if necessary – see 3.2.1.
- This not only lowers the starting limit temperature, but proves also useful at temperatures normally not requiring a starting aid.

- Battery

- Cold starting requires a good state of charge of the battery – see 6.7.1.
- Lowering the starting limit temperatures by  $4-5^{\circ}\text{C}$  ( $39-41^{\circ}\text{F}$ ) is possible by raising the battery temperature to about  $+20^{\circ}\text{C}$  ( $+68^{\circ}\text{F}$ ). This is achieved by removing the battery and storing it in a warm room.



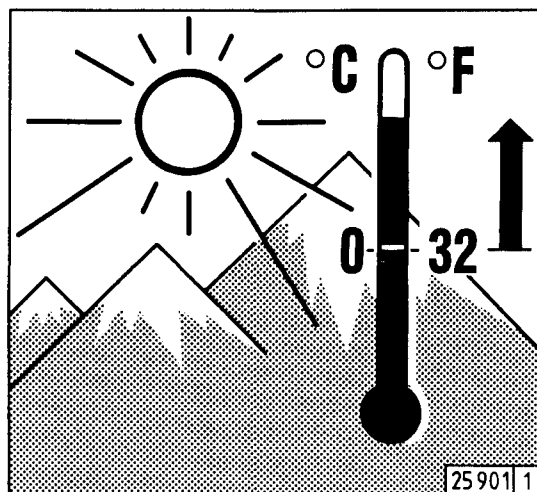


### 3.5.2 High Ambient Temperature, High Altitude

- With increasing altitude and rising ambient temperatures the density of the air tends to decrease, which affects the maximum power output of the engine, the exhaust gas quality, the temperature level and, in extreme cases, the starting behavior. Under transient running conditions, operation at altitudes up to 1000 meters is admissible (at ambient temperatures up to 30 °C = 86 °F).

If an engine is operating under more severe conditions (at higher altitudes or ambient temperatures), it will be necessary to reduce the injected fuel quantity and thus the engine power.

- In case of doubt concerning such engine applications ask your engine or equipment dealer whether, in the interest of operational reliability, service life and exhaust gas quality (smoke), an engine power derating is considered necessary, or simply contact your DEUTZ SERVICE agent.





**4.1 Lube Oil**

**4.2 Fuel**



### 4.1.1 Quality Grade

Lube oils are differentiated according to their performance and quality class. In common use are the **API** Specifications named after the "American Petroleum Institute".

Approved **API** oil classes:

Naturally aspirated engines:

CC/SE	CC/SF
CD/SE	CD/SF
CE/SF	CE/SG

Turbocharged engines:

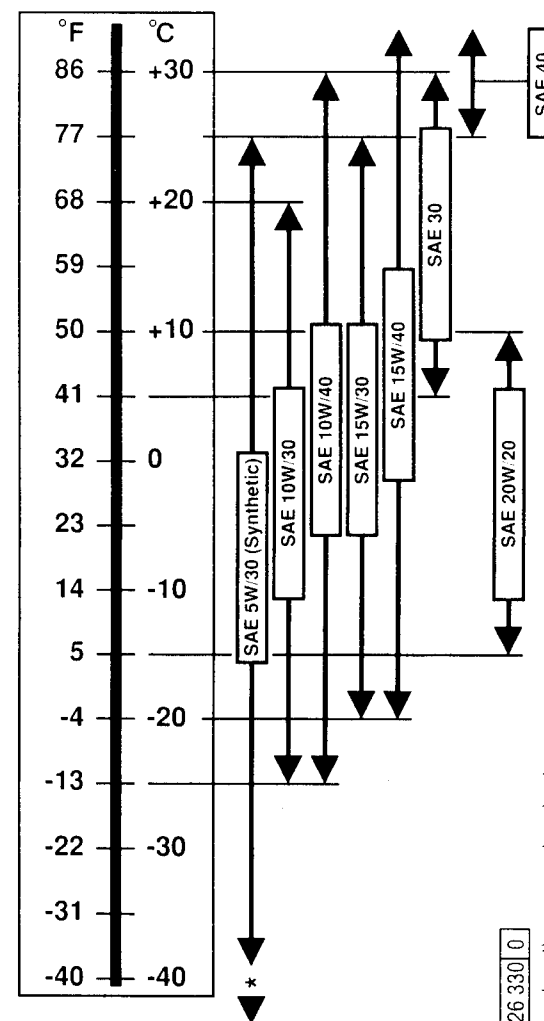
CD/SE	CD/SF
CE/SF	CE/SG
SHPD*	

\* SHPD (Super High Performance Diesel) oils are approved by KHD by name only, since a valid specification had not yet been laid down at the time of printing.  
Should you be in doubt, ask your DEUTZ SERVICE agent.

### 4.1.2 Viscosity

As the viscosity of lube oil is dependent on the temperature, the choice of the SAE-grade should be governed by the ambient temperature prevailing at the engine operating site. Optimum operating behavior will be attained if you take as a guide the oil viscosity diagram appearing alongside.

Should the temperatures temporarily fall below the limits of the SAE-grade selected, this will merely affect the starting performance, but will not cause any damage to the engine. The application limits should not be exceeded over lengthy periods of time in order to keep wear down to a minimum. Oil changes dictated by the time of the year can be avoided by using multi-grade lube oils. Multi-grade lube oils – particularly light-flowing oils – also reduce the fuel consumption.



For oil change intervals – see 6.1.1.

For oil filling volumes – see 9.1.



### 4.2.1 Quality Grade

Always use commercial brands of diesel fuel having a sulfur content of less than 0.5 %. In the case of a higher sulfur content the periods between oil changes must be shorter – see 6.1.1.

The following fuel specifications are approved:

- DIN 51 601
- BS 2869: A1 and A2  
(in case of A2 note sulfur content)
- ASTM D 975-81: 1-D and 2-D
- VV-F 800C: DF-A, DF-1 and DF-2

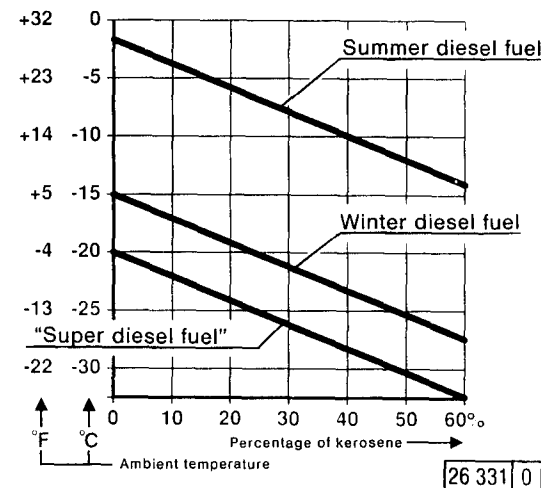
### 4.2.2 Winter-Grade Fuel

At low temperatures, waxing may occur and clog the fuel system, causing operational trouble. In case of sub-zero (+32 °F) ambient temperatures it is recommended to use winter-grade diesel fuel (down to -15 °C = +5 °F). Normally, such fuel is offered at the filling stations in good time before the cold season starts. Diesel fuel containing additives ("Super Diesel") is frequently also on sale for use at temperatures down to -20 °C (-4 °F).

- At temperatures as low as -15 °C (-5 °F) to -20 °C (-4 °F), kerosene should be added to the diesel fuel. The necessary percentages are to be seen in the diagram at the right.

If summer-grade diesel fuel has to be used at temperatures below zero (+32 °F), up to 60 % kerosene may be added (see diagram at the right).

In most cases, adequate resistance to cold is also attained by adding a flow-improver (fuel additive). Ask your DEUTZ SERVICE agent for this.



Prepare the fuel mixture in the tank! Fill in the necessary amount of kerosene first, then add diesel fuel.



## **Routine Maintenance**

- 5.1 Maintenance Schedule**
- 5.2 Maintenance Chart**
- 5.3 Completed Maintenance Jobs**



## Routine Maintenance

## 5.1 Maintenance Schedule

Every 10 h or daily	Non-re- current after 50 <sup>2)</sup>	In running hours (h) <sup>1)</sup>								Check			See Section
		Every									Clean	Renew	
●									●			Oil level in engine / separate tank	6.1.2
	●								●			Engine for leaks	
●									●			Oil bath and dry-type air cleaners <sup>3)6)</sup>	6.4
		●							●			Battery and battery cable connections	6.7.1
		●	●	●		●	●		●			Cooling system (dep. on engine use) <sup>3)</sup>	6.3.1
	●			● <sup>4)</sup>	● <sup>5)</sup>					●		Engine oil (dep. on engine use) <sup>7)</sup>	6.1.2
	●			●	●					●		Oil filter cartridge (dep. on oil change interval)	6.1.3
	●					●				●		Fuel filter cartridge	6.2.2
	●					●			●			Valve clearance (readjust if necessary)	6.6.1
	●								●			Engine mountings (retighten if necessary)	9.2
	●			●					●			V-belts (retension if necessary)	6.5
						●			●			Toothed belts <sup>8)</sup> (and idler-pulley)	6.5.5
								●	●			Injectors	
						●				●		Fuel feed pump	6.2.2



## 5.2 Maintenance Chart

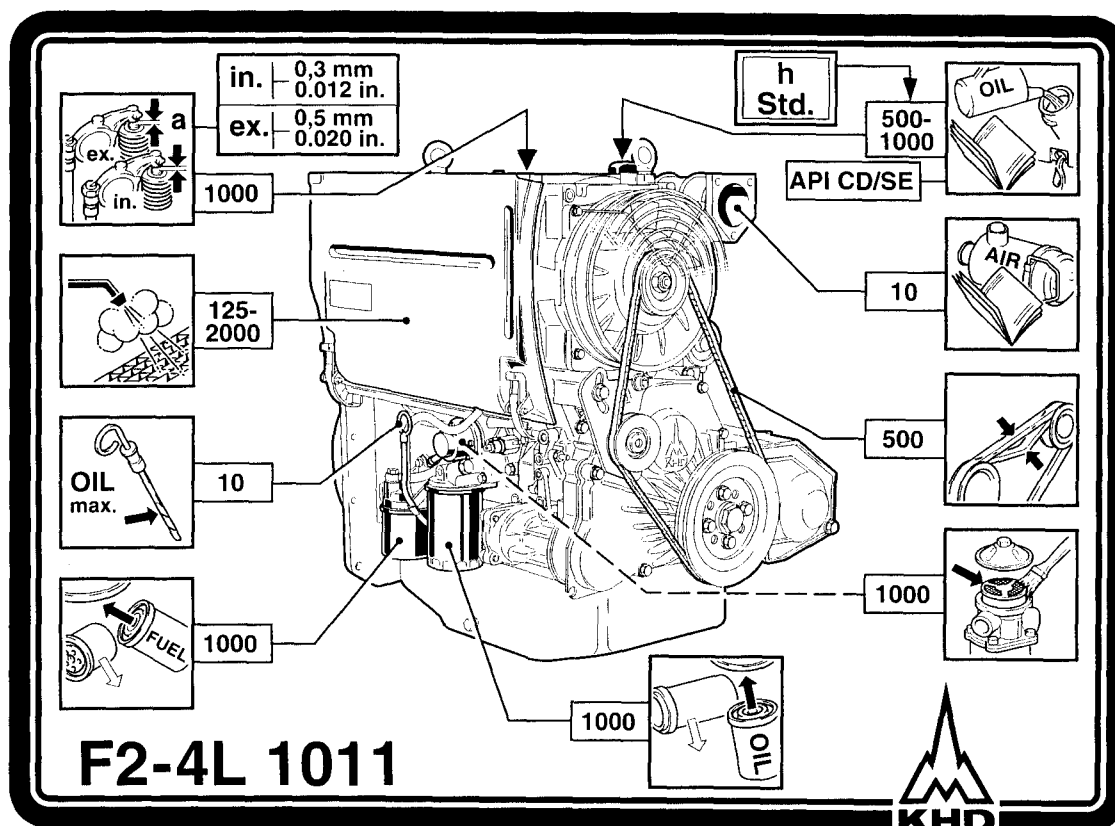
## Routine Maintenance

The maintenance chart displayed here is supplied as self-adhesive label along with each engine. It should be adhered at a convenient location on the engine or driven equipment.

Check and make sure that this has been done!

If necessary, ask your engine or equipment dealer for a fresh supply of labels!

Valid for routine maintenance work is the maintenance schedule – see 5.1.



297 4047



Stop engine before starting with any maintenance work.



# Routine Maintenance

## 5.3 Completed Maintenance Jobs

Running hours	Date	Signature/Stamp	Running hours	Date	Signature/Stamp
*50			-		
125			250		
375			500		
625			750		
875			1000		
1125			1250		
1375			1500		
1625			1750		
1875			2000		
2125			2250		
2375			2500		
2625			2750		

Duly completed maintenance jobs can be recorded and signed off in the above chart.

\* After commissioning of new and overhauled engines.



### 5.3 Completed Maintenance Jobs

### Routine Maintenance

Running hours	Date	Signature/Stamp	Running hours	Date	Signature/Stamp
2875			3000		
3125			3250		
3375			3500		
3625			3750		
3875			4000		
4125			4250		
4375			4500		
4625			4750		
4875			5000		
5125			5250		
5375			5500		
5625			5750		
Duly completed maintenance jobs can be recorded and signed off in the above chart.					



# Routine Maintenance

## 5.3 Completed Maintenance Jobs

Running hours	Date	Signature/Stamp	Running hours	Date	Signature/Stamp
5875			6000		
6125			6250		
6375			6500		
6625			6750		
6875			7000		
7125			7250		
7375			7500		
7625			7750		
7875			8000		
8125			8250		
8375			8500		
8625			8750		

Duly completed maintenance jobs can be recorded and signed off in the above chart.



## **Service and Maintenance**

- 6.1 Lubrication System**
- 6.2 Fuel System**
- 6.3 Cooling System**
- 6.4 Combustion Air Cleaner**
- 6.5 Belt Drives**
- 6.6 Adjustments**
- 6.7 Accessories**



### 6.1.1 Oil Change Intervals

- The oil change intervals are dependent on the engine application and the quality of the lubricating oil.
- Should, within **one year**, the engine run less than the hours stated in the table, the oil must be changed at least **once a year**.
- The table refers to the following conditions:
  - For diesel fuel: sulfur content max. 0.5 % by wt.
  - Prevailing ambient temperatures down to  $-10\text{ }^{\circ}\text{C}$  ( $+14\text{ }^{\circ}\text{F}$ ).
- In the case of a sulfur content  $> 0.5$  up to 1 %, or prevailing ambient temperatures below  $-10\text{ }^{\circ}\text{C}$  ( $+14\text{ }^{\circ}\text{F}$ ), the intervals between oil changes must be halved.
- In the case of fuels containing more than 1 % sulfur ask your DEUTZ SERVICE agent.

Oil Grade	Naturally Aspirated Engines			
API-Classification	CC <sup>1)</sup>		CD <sup>1)</sup>	
CCMC-Classification	–		D4 + D5 <sup>2)</sup> (SHPD) <sup>3)</sup>	
Oil change intervals*	normal [Bh]	heavy [Bh]	normal [Bh]	heavy [Bh]
FL 1011	500	250	1000	500

<sup>1)</sup> Oils with C and S-classification, e.g. CD/SE, may be used. Oils with only one C-classification, e.g. Ca, are to be preferred because of their usually superior performance in diesel engines.

<sup>2)</sup> D5 oil grade with sulfate-ash comend 1.8 % by mass.

<sup>3)</sup> SHPD lube oils may be used. These correspond to DS grade.

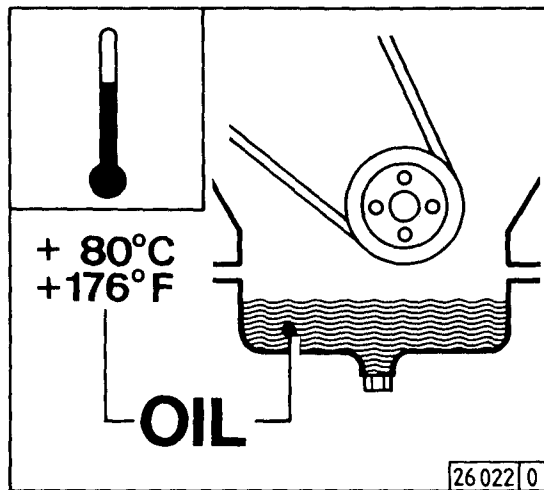
\* **Normal use**, e.g. road vehicles, tractors, lift trucks, cranes, construction equipment, rail traction units, ships, generating sets, pumps.

\* **Heavy-duty use**, e.g. combines, underground mining equipment, road sweepers, winter service equipment, emergency gensets, emergency pumps.

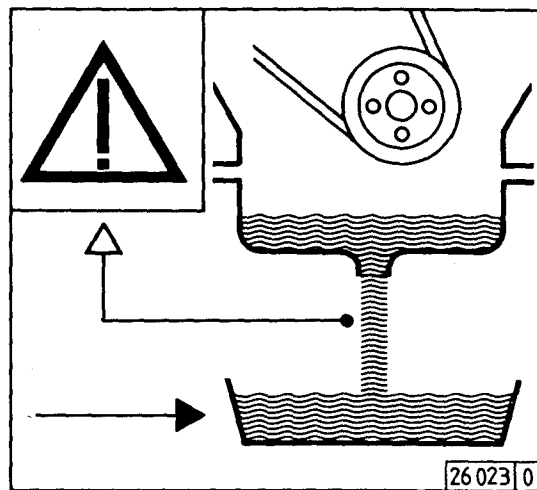
Have the oil changed with engine warm and stationary.  
(engine oil temperature approx.  $80\text{ }^{\circ}\text{C}$  [ $176\text{ }^{\circ}\text{F}$ ])



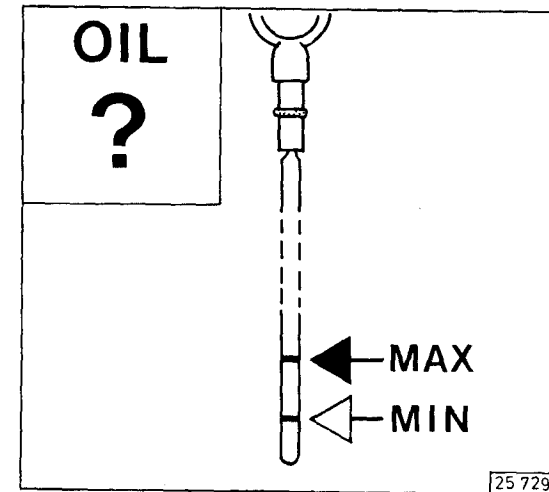
### 6.1.2 Changing Engine Oil Checking Oil Level



- Position engine or vehicle on level surface.
- Set cab heater actuating lever to maximum heating capacity (in case of vehicles having engine oil/air cab heating)
- Run up engine to service temperature.
  - Engine oil temperature approx. 80°C (176 °F).
- Stop engine.



- Place an oil tray underneath the engine.
- Screw out drain plug.
- Drain oil.
- Refit oil drain plug complete with new sealing ring and tighten firmly. (For tightening torque - see 9.2)
- Fill in fresh lube oil.
  - For oil grade/viscosity - see 4.1.
  - For filling volumes - see 9.1.
- Start the engine and run at low idling speed (for about 2 minutes when equipped with oil/air cab heating).



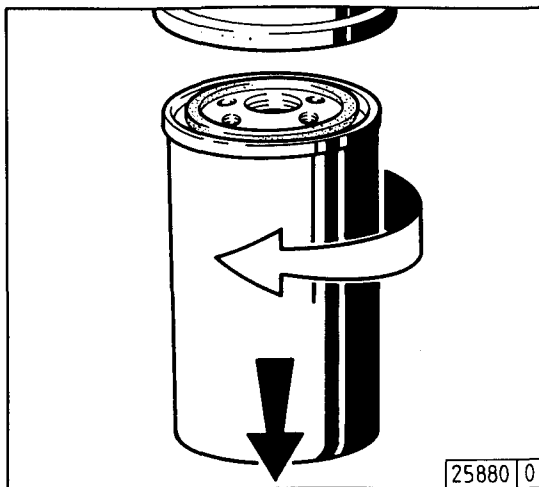
- Stop engine.
- Check oil level.
  - in case of dipsticks having double marking (● and -) the dash mark is applicable.
  - If necessary, top up with oil as far as the upper dash mark.



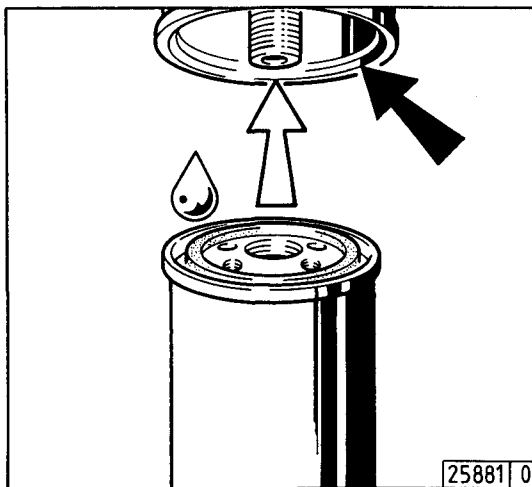
Take care when draining off hot oil: Danger of scalding! Catch used oil in appropriate container for proper disposal to prevent environmental pollution!



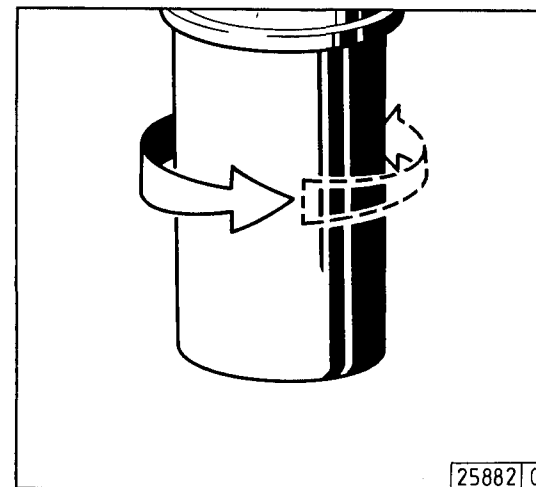
### 6.1.3 Renewing Oil Filter



- Undo oil filter cartridge using a commercial tool and spin off.
- Catch any escaping oil in a container.



- Clean sealing surface of filter carrier.
- Apply a light film of oil to rubber gasket of new oil filter cartridge.
- Screw cartridge into position fingertight taking care that the gasket is evenly seated.



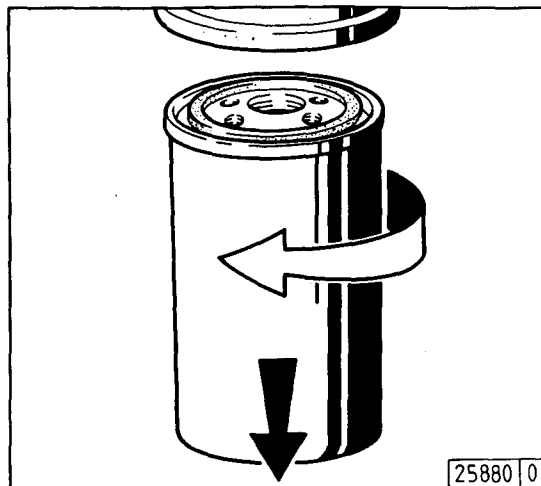
- Pull new oil filter cartridge tight by giving it another final half turn.
- For checking oil level – see 6.1.2.
- For checking oil pressure – see 3.3.1.
- Check oil filter cartridge for leaks.



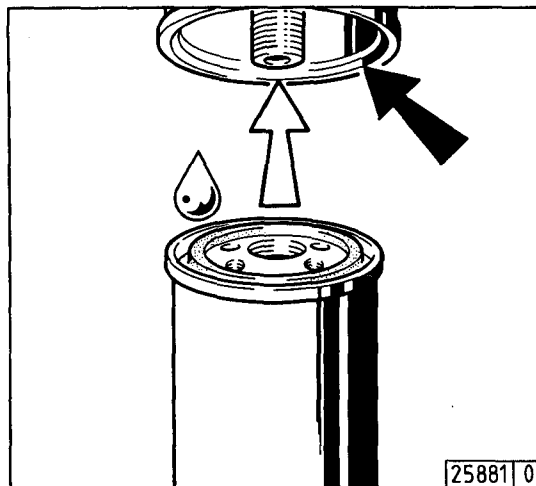
Beware of hot oil:  
Danger of scalding!



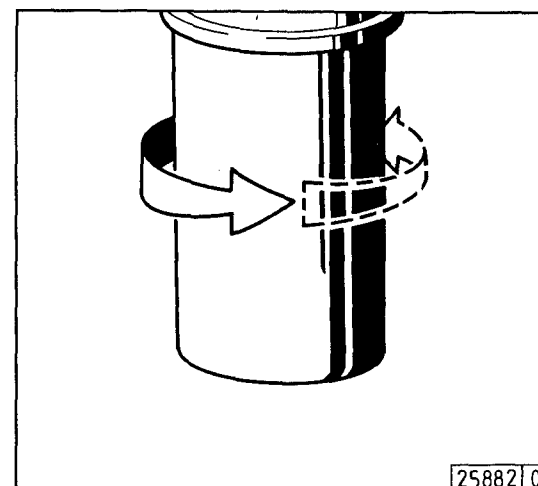
### 6.2.1 Renewing Fuel Filter



- Close fuel stopcock.
- Undo fuel filter cartridge using a commercial tool and spin off.
- Catch escaping fuel in a appropriate container.



- Clean sealing surface of the filter carrier.
- Apply a light film of oil or diesel fuel to the rubber gasket of the new fuel filter cartridge.
- Screw cartridge into position fingertight taking care that the gasket is evenly seated.



- Pull new fuel filter cartridge tight by giving in another final half turn.
- Open fuel stopcock.
- Check assembly for leaks.

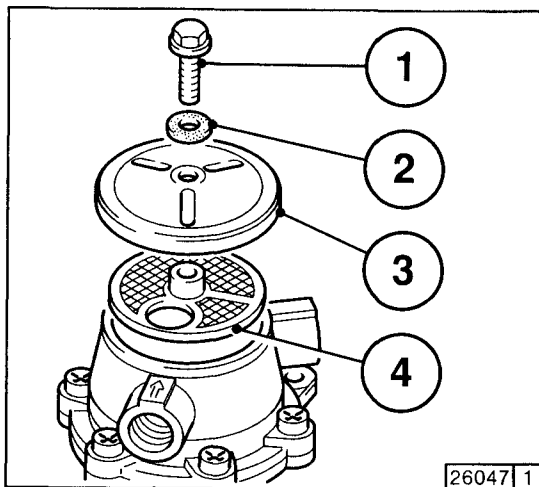


Keep open flames away when working on the fuel system! Do not smoke!

Bleeding of the fuel system is not necessary.



### 6.2.2 Fuel feed pump (version that can be serviced) Cleaning strainer



- Close fuel stop cock.
- loosen hex. bolt 1 together with sealing ring 2 and screw out.
- Lift off cover 3.
- Take out fuel strainer 4.
- Clean strainer with fuel and renew if necessary.
- Reassemble in reverse order.
- Check for leaks.



When working on the fuel system,  
keep naked lights away! Do not  
smoke!



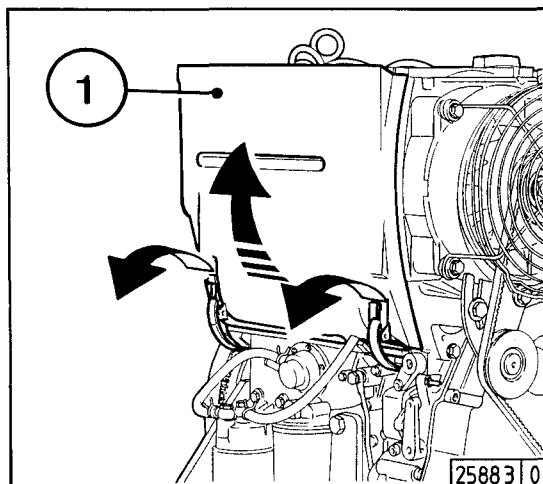
### 6.3.1 Cleaning Intervals

- The degree of soiling of the cooling system is dependent on the type of engine application.
- The danger of contamination is increased by any spilled/leaked oil or fuel that remains on the engine. Therefore carefully check the equipment for leaks when the application involves high dust fall-out.
- More severe contamination can occur e.g. in case of:
  - Construction site applications in heavily dust-laden air.
  - Harvesting work, due, for example, to the high concentrations of chaff and chopped straw in the vicinity of the machine.
- In view of the varying conditions of application, the cleaning intervals must be determined from case to case. The cleaning intervals stated in the table can be taken as guide values.

Checking/Cleaning Intervals Guide Values (running hours)	Engine Application
2000	Ships, power sets in enclosed rooms, pumps
1000	Vehicles on paved roads
500	Tractors, lift trucks, mobile power sets
250	Vehicles on construction sites and unpaved roads, construction machinery, compressors, underground mining equipment
125	Farm equipment, tractors doing harvesting work

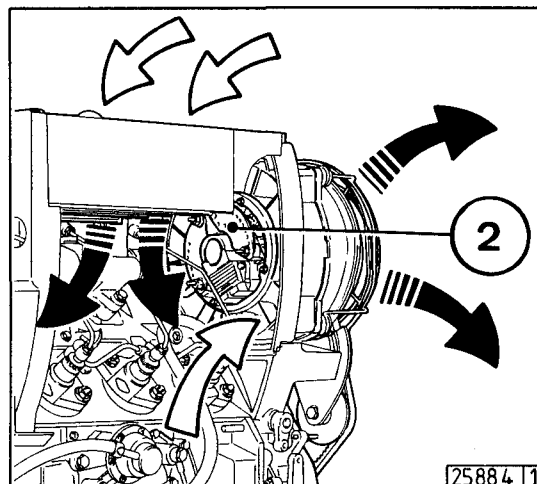


### 6.3.2 Cleaning the Cooling System



#### Using Compressed Air

- Remove cooling air cowling 1.
- Start blowing through the engine with compressed air from the exhaust air side, paying particular attention not to damage cooling fins and oil cooler. Remove any dirt blown into the air cowling space.
- Remount the cooling air cowling 1.



#### Using Cold Cleansing Agent

- Remove cooling air cowling 1.
- Spray engine with a commercial cold cleansing agent and allow to soak for a period of about 10 minutes.
- Wash the engine clean with a powerful water jet (taking care to avoid direct contact of the water jet with sensitive engine components, e.g. alternator 2.)
- Repeat the procedure, if necessary.
- Remount cooling air cowling 1.
- Run engine up to service temperature in order to allow the remaining water to evaporate.

#### Using High-Pressure Steam Jet

- Remove cooling air cowling 1.
- Clean engine with steam jet (taking care to avoid direct contact of the steam jet with sensitive engine components, e.g. alternator 2).
- Remount cooling air cowling 1.
- Run engine up to service temperature in order to allow the remaining water to evaporate.

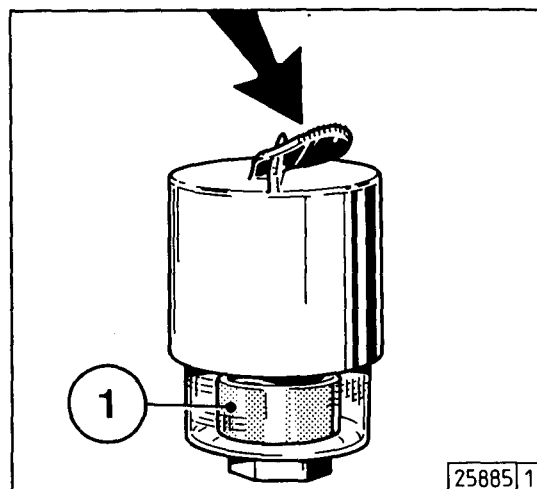


Cleaning work must only be carried out with the engine stopped and cooled down!



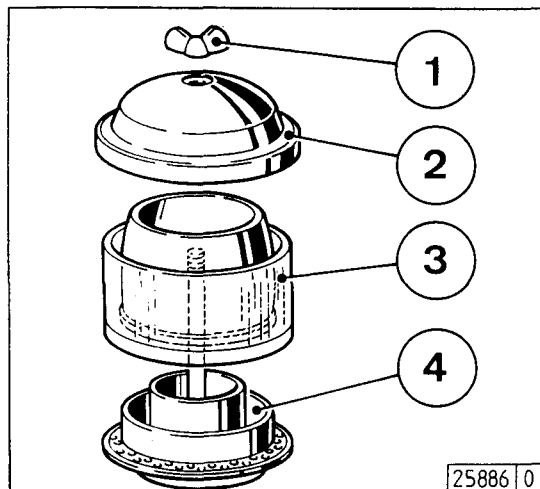
### 6.4.1 Cleaning Intervals

- The degree of soiling of the combustion air cleaner depends on the amount of dust contained in the air and the size of the filter used. If very dusty air is to be expected, the combustion air cleaner can be preceded by a cyclone-type precleaner.
- Consequently, the cleaning intervals cannot be fixed generally, but have to be determined from case to case.
- If a dry-type air cleaner is used, clean only when a need for air cleaner service is indicated by the air cleaner service indicator/service switch.
- The air cleaner is due for servicing when:
  - the entire red sector 1 in the **service indicator** is visible with the engine shut off.
  - the yellow pilot lamp of the **service switch** lights up while the engine is running.
- After servicing the air cleaner, reset the signal by pressing the reset button of the service indicator. The service indicator is ready to resume its function.





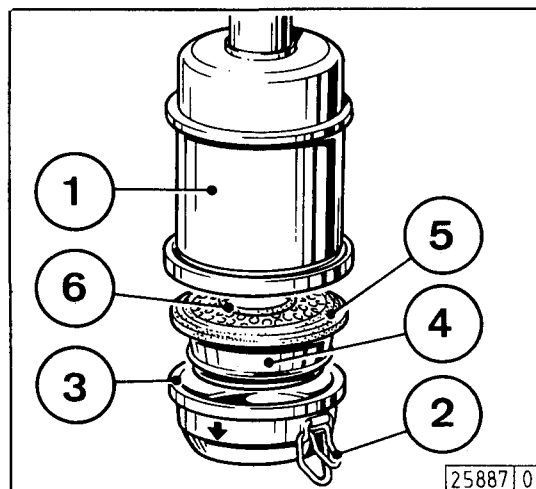
### 6.4.2 Emptying the Cyclone-Type Air Precleaner



- Undo wing nut 1 and take off housing cap 2.
- Lift dust collector 3 off cyclone base 4 and empty. Clean cyclone base by removing leaves, straw, etc.
- Put dust collector 3 back in position on base 4 and fasten housing cap 2 in place by tightening wing nut 1.

Never fill dust collector with oil! Renew dust collector if damaged!

### 6.4.3 Cleaning Oil Bath Air Cleaner



- Shut off the engine and wait for about 10 minutes until the oil has drained from the filter housing 1.
- Release clip fasteners 2 and remove oil bowl 3 together with filter element 4, loosening the filter element at the joint by means of a screwdriver if necessary. Do not damage rubber seal 5!
- Remove dirty oil and sludge, then clean oil bowl.
- Rinse filter element 4 in diesel fuel and allow to drip-dry thoroughly.
- Clean filter housing 1, if necessary.
- Inspect rubber seals 5 and 6 and renew as necessary.
- Fill oil bowl with engine oil up to oil level mark (arrow). For oil viscosity – see 4.1.2.
- Bring oil bowl together with filter element back in position on the filter housing and secure with clip fasteners.

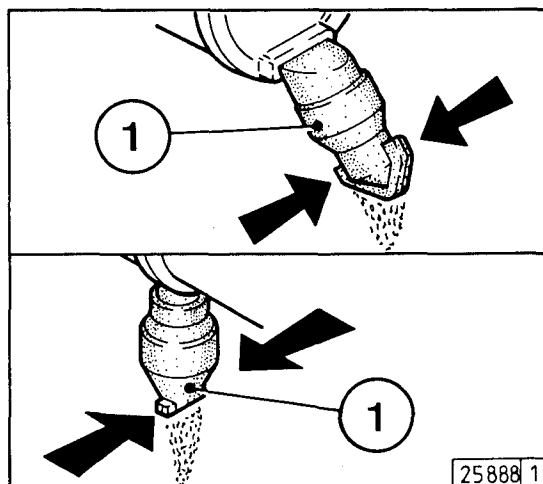


Never rinse the filter in petrol (gasoline)!  
Dispose of used oil in accordance with the statutory regulations!



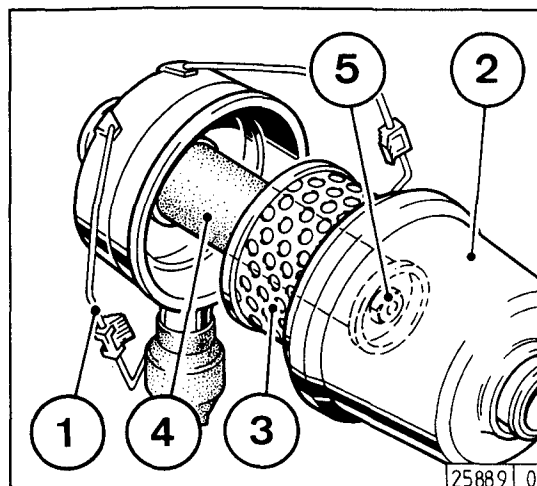
### 6.4.4 Dry-Type Air Cleaner

#### Dust Discharge Valve



- Empty the dust discharge valve 1 by pressing apart the lips of the discharge slot, applying pressure as indicated by the arrows.
- Clean the discharge slot from time to time.
- Remove any cake of dust by pressing together the upper part of the valve.

#### Filter Cartridges



- Release the fastening clamps 1.
- Take off the filter hood 2 and pull out the filter cartridge 3.
- Clean filter cartridge, renew after one year at the latest.
- To clean the filter cartridge 3:
  - Blow through with dry compressed air (max. 5 bar), applied from inside to outside, or
  - tap out (makeshift solution only), taking care not to damage the cartridge, or
  - wash out according to manufacturers' instructions.
- Frequent dismantling and refitting may cause damage to the sealing element of the filter cartridge. Check cartridge for damage to filter

paper (by shining the paper through with a light), and inspect sealing element. Renew if necessary.

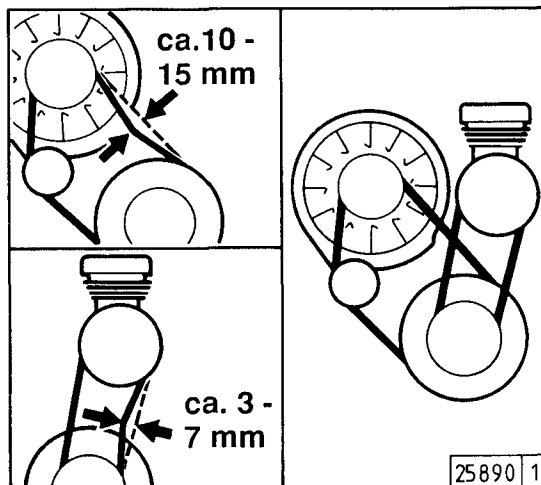
- After having serviced the filter cartridge five times, or after two years at the latest, renew safety cartridge 4 (never clean!). To do this, proceed as follows:
  - Undo hex. nut 5 and pull out cartridge 4.
  - Insert new safety cartridge and secure with hex. nut 5.
- Refit filter cartridge 3, place hood 2 back in position and secure with fastening clamps 1.



In no event use petrol (gasoline) or hot liquids for washing the filter cartridge!

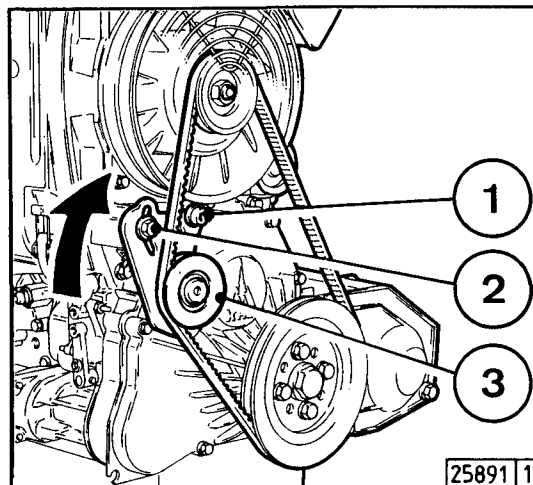


### 6.5.1 Checking V-Belts



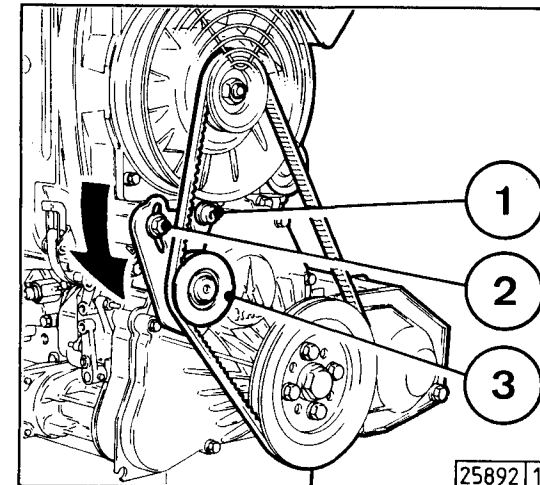
- Inspect V-belt over its full length for damage and cracks. Renew damaged or cracked V-belts.
- Check by pressing with the thumb midway between the pulleys to see whether the V-belt deflects inwards by not more than ca. 10-15 mm (cooling blower) or 3-7 mm (air compressor).
- Retension the V-belts as necessary – see 6.5.2 and 6.5.4.

### 6.5.2 Retensioning the Blower V-Belt



- Slightly relax bolts 1 and 2.
- Push idler pulley 3 outward until the correct V-belt tension is attained.
- Lock bolts 1 and 2 tight again.

### 6.5.3 Renewing the Blower V-Belt



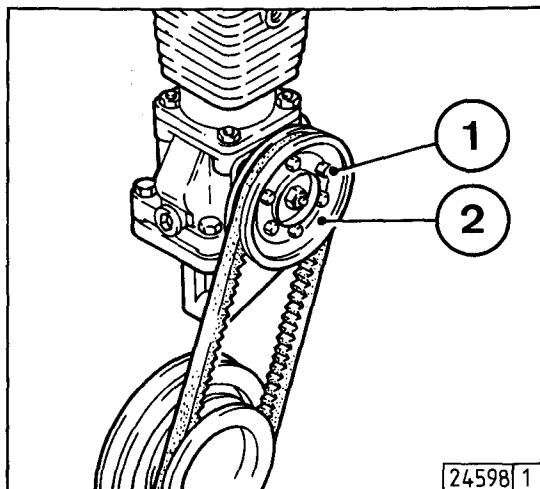
- If equipped with an air compressor: First remove the compressor V-belt – see 6.5.4.
- Relax bolts 1 and 2.
- Move the idler pulley 3 inwards.
- Remove the V-belt, replace with a new one.
- Move the idler pulley 3 outwards until the correct V-belt tension is attained.
- Pull bolts 1 and 2 tight again.
- Refit air compressor V-belt, if provided – see 6.5.4.



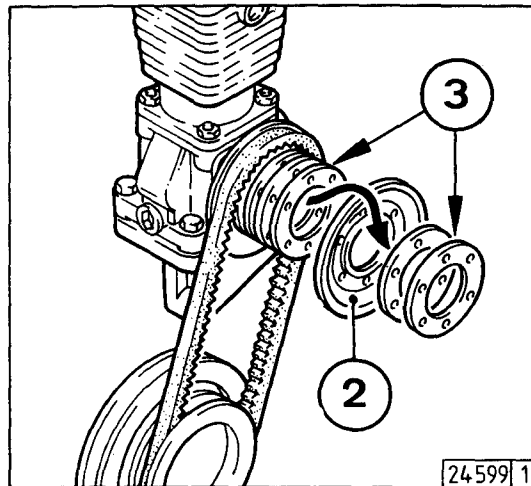
Never retension / renew V-belts while the engine is running! Refit V-belt guard, if provided.



### 6.5.4 Retensioning or Renewing the Air Compressor V-Belt



- Undo hex. bolts 1.
- Take off the outer half-pulley 2.
- Renew the V-belt if necessary.
- To retension, remove one or more of the shims 3 – as may be required – from the inside and place them outside of the removed half-pulley 2.



- Pull hex. bolts 1 tight again, while turning engine over to prevent the V-belt being squeezed.

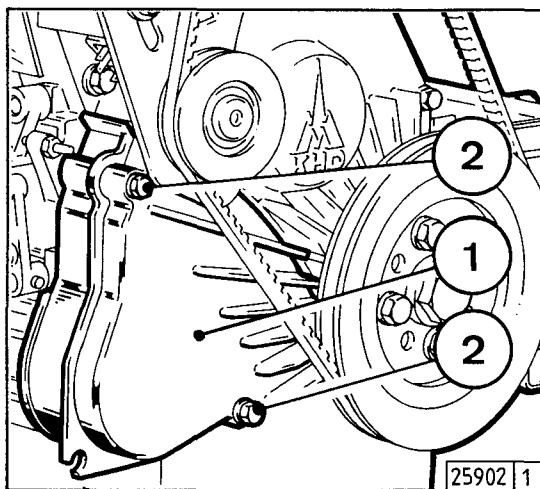


Never retension / renew V-belts while the engine is running! Refit the V-belt guard, if provided.

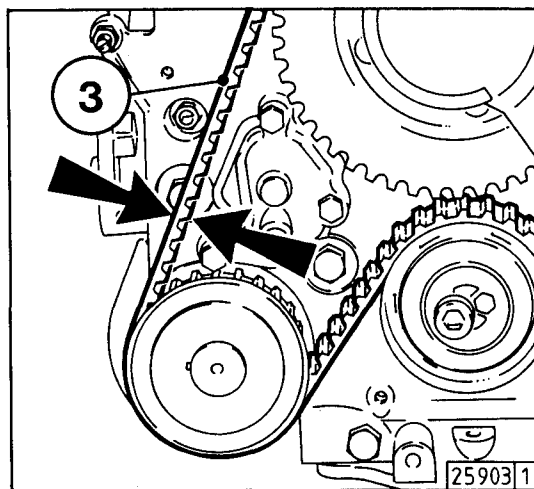
In case of new V-belts check the belt tension again after fifteen minutes running time.



### 6.5.5 Checking the Toothed Belts Toothed Belt for Camshaft Drive



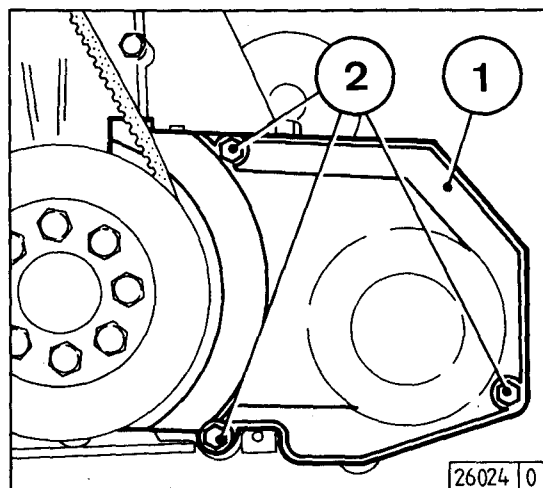
- Undo hex. bolts 2. Lift off hood 1.



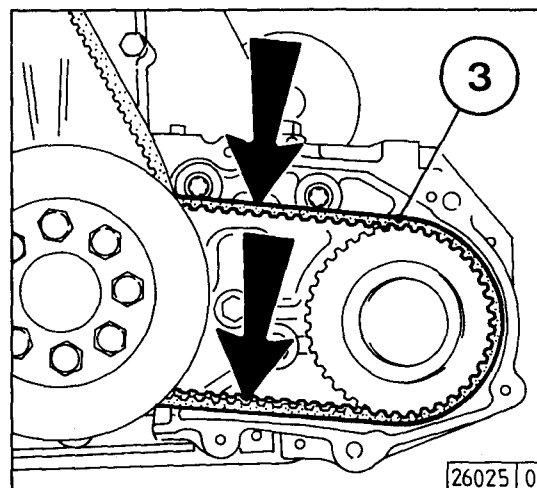
- Check toothed belt 3 over its full length, inspecting tooth roots, tips and flanks for perfect condition (see arrows).
- To do this, turn engine over two times.
- If damage is found, renew the toothed belt (see Workshop Manual).
- Put hood 1 back in place and fasten with hex. bolts 2.



### Toothed Belt for Hydraulic Pump



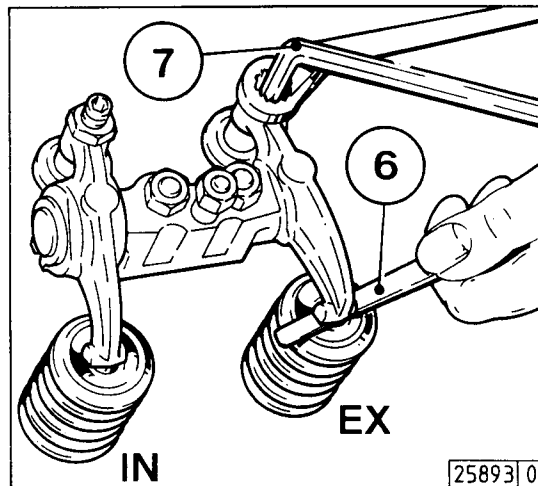
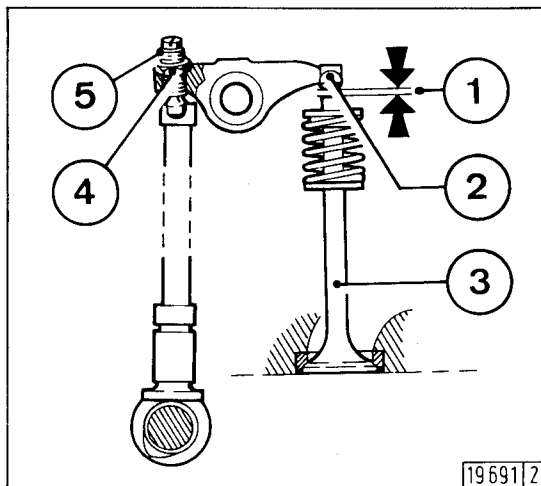
- Undo hex. bolts 2. Lift off hood 1.



- Check toothed belt 3 over its full length, inspecting tooth roots, tips and flanks for perfect condition (see arrows).
- To do this, turn engine over twice.
- If damage is found, renew the toothed belt (see Workshop Manual).
- Put hood 1 back in place and fasten with hex. bolts 2.



### 6.6.1 Checking/Adjusting the Valve Clearances

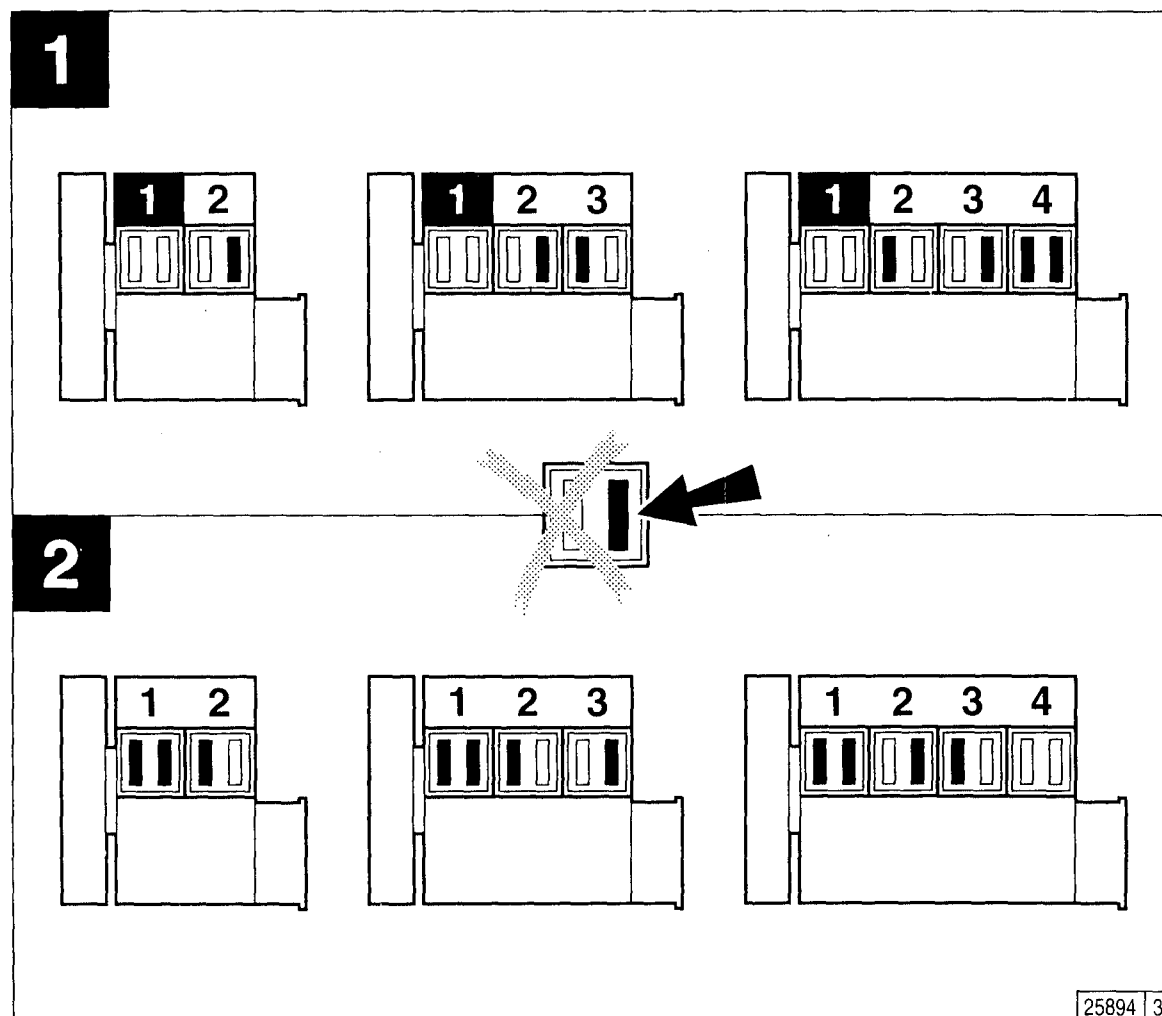


- Remove the rocker cover.
- Position the crankshaft as per the setting schematic – see 6.6.1.1.
- Before adjusting any valve clearances: Allow the engine to cool down for at least 30 minutes (oil temperature below 80 °C [176 °F]).
- Check the valve clearance 1 between pad of rocker arm 2 and valve 3 with feeler blade 6 (clearance is correct if the feeler blade can just be inserted in the gap with a slight drag).  
For permissible valve clearances – see 9.1.

- If necessary, adjust valve clearances as follows:
  - Release locknut 4.
  - Using Allen (hexagon head socket) spanner 7, adjust setscrew 5 so that, after locknut 4 has been tightened, the correct valve clearance is attained.
- Check the valve clearance on all remaining cylinders and adjust as necessary.
- Refit rocker cover using new seal.



## 6.6.1.1 Setting Schematic for Adjusting Valve Clearances



### ● Crankshaft Position 1:

Turn the crankshaft until both valves at cylinder 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearances of the valves **marked all-black** in the illustration at the left. Mark the respective rocker arm with chalk to show that the adjustment has been made.

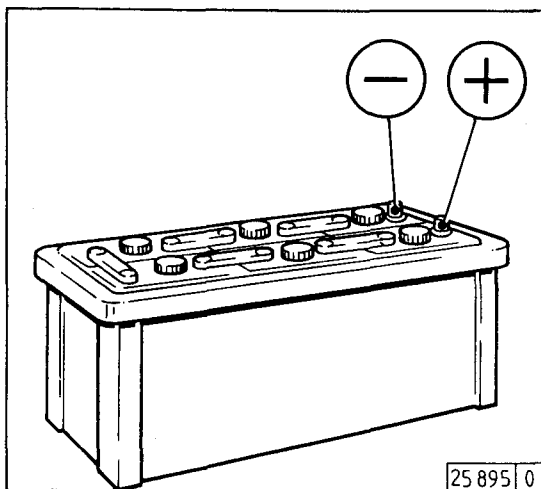
### ● Crankshaft Position 2:

Turn the crankshaft further by one revolution (360°C). The clearances of the other valves (**marked all-black** in the illustration at the left) can now be adjusted.



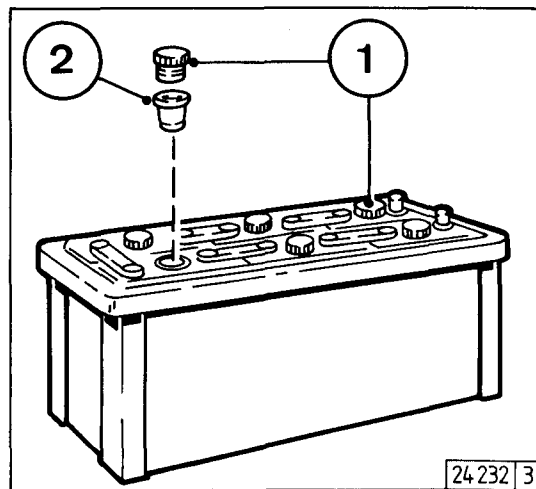
### 6.7.1 Battery

#### 6.7.1.1 Checking the Battery and the Battery Cable Connections



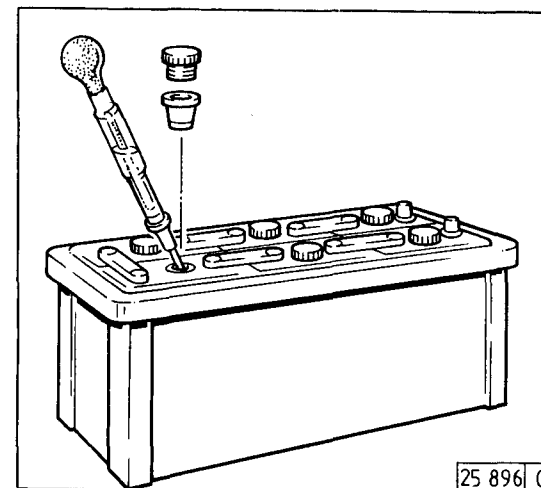
- Keep the battery clean and dry.
- Loosen soiled terminals.
- Clean battery plus and minus poles and terminals and apply a film of acid-free and acid-resistant grease.
- When reconnecting, assure good contact of terminals. Pull clamping bolts fingertight.

#### 6.7.1.2 Checking the Electrolyte Level



- Remove cell caps 1.
- If electrolyte test elements 2 are provided: The level should be high enough to wet the bottom of these.
- If no such elements are provided: Check to make sure that the level is 10-15 mm above the top edge of the plates.
- Top up with distilled water as necessary.
- Fit cell caps 1 back in position.

#### 6.7.1.3 Checking the Specific Gravity of the Electrolyte



- Measure the specific gravity of the individual cells with a commercial hydrometer.

The measured values (see table alongside) indicate the state of the battery charge. During the measurement, the temperature of the electrolyte should preferably read 20 °C (68 °F).



Specific Gravity				
in kg/l		in ° Bé (Baumé)*		State of Charge
Normal	Tropics	Normal	Tropics	
1.28	1.23	32	27	Fully charged
1.20	1.12	24	16	Half charged, recharge
1.12	1.08	16	11	Discharged, charge up immediately

\*) Measurement of the specific gravity in ° Bé (Baumé) is out of date and rarely used today.



The gases emitted by the battery are explosive! Avoid formation of sparks in the vicinity of the battery, keep away any open flames! Do not allow any acid to come into contact with the skin or clothing! Wear protective goggles! Do not place any tools on the battery!

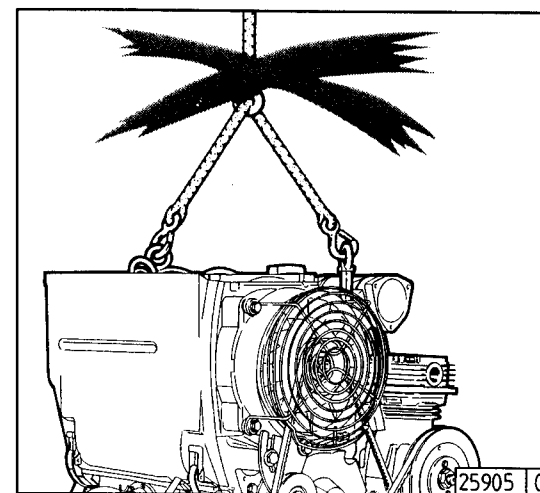
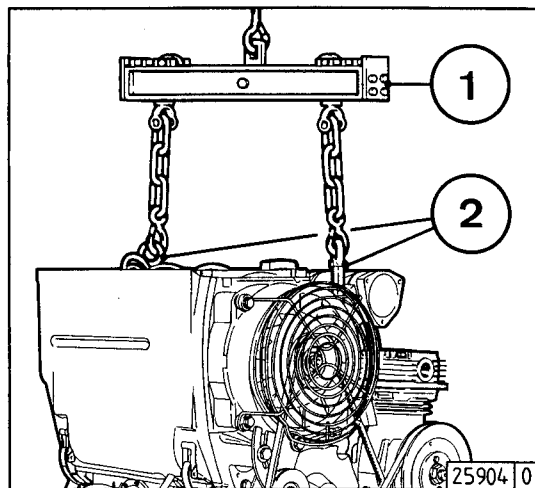


### 6.7.2 Three-Phase Alternator

Notes on the three-phase current system:

- When the engine is running, never disconnect the cables between battery, alternator and regulator.
- Where it is, however, necessary to start and operate the engine without battery, disconnect the regulator from the alternator before starting.
- Be sure not to confuse the battery terminals.
- Renew a defective charging pilot light bulb immediately.
- Before washing the engine, cover up the alternator and the regulator.
- The habit of touching a lead against frame to check whether it is live must under no circumstances be applied with a three-phase electric system.
- In case of electric welding, connect the earth terminal of the welding unit direct to the part to be welded.

### 6.7.3 Lifting Gear



- For transporting the engine always use the proper lifting tackle 1.
- Upon completion of transport operations, prior to commissioning the engine:  
Remove lifting eyebolts 2.

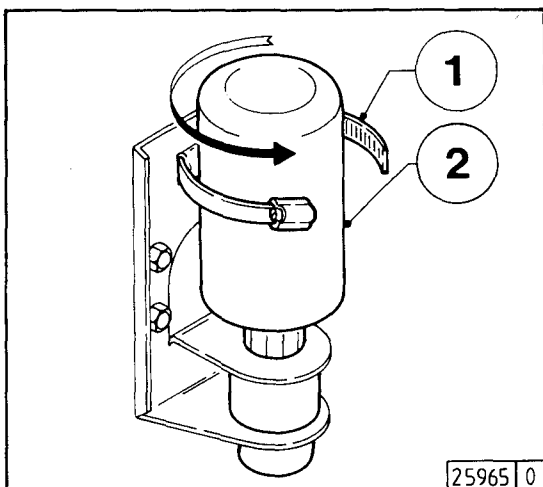


Always use the proper lifting gear!

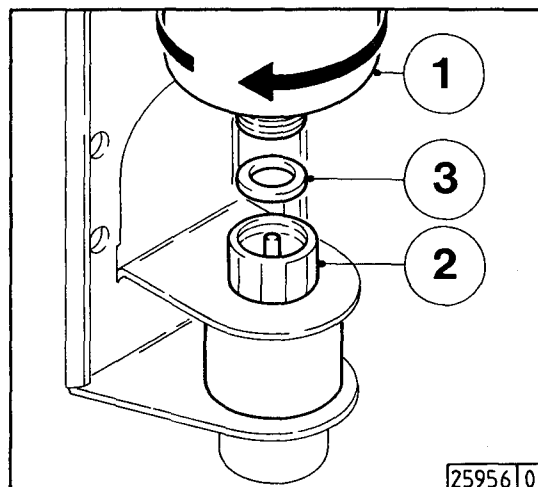


### 6.7.4 Ether Starting System

#### 6.7.4.1 Renewing the Fluid Cylinder



- Clean neck of cylinder and top of solenoid valve from any dirt before removing the fluid cylinder.
- Release clamp 1.
- Unscrew fluid cylinder 2 from the solenoid valve.
- Exchange the empty/pressureless fluid cylinder for a pressurized one.



- Put the new cylinder 1 in place on the solenoid valve 2 and pull fingertight.
- When assembling, make sure that gasket 3 is properly seated.
- Tighten clamp 1.
- Check assembly for leaks.



Allow the contents of the fluid cylinder to settle back down for 15 minutes before starting operation. Check for leaks.

The starting fluid is inflammable. Be careful not to damage the fluid cylinder. Check to make sure that no foreign matter can enter it. Max. cylinder storage temperature 50 °C (122 °F).



**7.1 Diagnosis Chart**



- If engine problems occur, they frequently have their cause in improper operation or maintenance of the engine.
- So, in case of trouble, always check first whether the operating and maintenance instructions have been observed.
- A helpful Diagnosis Chart is to be found on the page opposite.
- If you cannot identify the cause of the trouble or are unable to rectify it yourself, contact your DEUTZ SERVICE agent.



## 7.1 Diganosis Chart

## Troubleshooting

Trouble										Remedy	
Engine fails (or difficult) to start										Check	CH
Engine starts, but runs unevenly or stalls										Adjust	A
Engine becomes too hot, temperature monitor gives warning										Renew	R
Engine gives poor performance										Clean	CL
Engine not working on all cylinders										Top up	TU
Engine has little or no oil pressure										Lower level	LL
Engine oil consumption excessive											
Engine smokes											
- blue											
- white											
- black											
Cause										Section	
●									Not declutched (declutch where possible)	Operation	CH
●							●		Below start limit temperature		CH
		●			●				Oil level too low		TU
		●	●		●	●			Oil level too high		CH
					●	●	●		Excessive inclination of engine		CH
●					●				Wrong SAE-grade of engine oil and oil quality	Op. Media	R
●	●		●				●		Fuel quality not as quoted in Op. Manual		R
		●	●				●		Air cleaner contaminated	Combustion Air	R
		●	●				●		Air cleaner service switch / service indicator defective		R
		●							Cooling fins soiled	Cooling System	R
		●							Cooling blower faulty, V-belt broken/loose		CH/R
		●							Cooling air temperature rise / Hot air recirculation		CH
●									Battery defective or flat	Electrics	CH
●									Starter circuit / cable connections loose / oxidized		CH
●									Starter faulty or pinion does not engage		CH
●	●		●				●		Valve clearance incorrect	Engine	A
	●		●	●					Injection line leaky		CH
●	●	●	●	●			●	●	Injector defective		CH/R



## **8.1 Preservation**



### 8.1 Preservation

If the engine is to remain idle for a lengthy period of time, it is necessary to take protective measures to prevent rust formation. The preservative measures described here will protect the engine for a period of up to six months. Before taking up engine operation again, the preservatives must be removed.

- Anti-corrosion oils to Specifications:
  - MIL-L-21260B
  - TL 9150-037/2
  - NATO Code C 640 / 642
- Anti-corrosion agent to Specification:
  - NATO Code C 632
- Recommended cleansing agent for removing preservatives:
  - Petroleum benzene (hazardous materials class A 3)

### 8.1.1 Preserving Engine

- Clean engine with high-pressure jet (plus cold cleansing agent as necessary): see 6.3.2.
- Run engine up to service temperature, then stop.
- Drain engine oil – see 6.1.2 – and fill in anti-corrosion oil.
- Clean oil bath air cleaner, if provided: see 6.4.3, and fill in anti-corrosion oil.
- Drain fuel from tank.
- Prepare a mixture of 90 % diesel fuel and 10 % anti-corrosion oil and fill up tank.
- Run engine for about 10 minutes.
- Stop engine.
- Turn engine over several times by hand, for preservation of cylinders and combustion chambers.
- Remove V-belts and store in wrapped condition.
- Spray grooves of V-belt pulleys with anti-corrosion agent, which must be wiped off before putting engine back into service.
- Close intake and exhaust pipe openings.

### 8.1.2 Removing Engine Preservatives

- Remove anti-corrosion agent from the grooves of V-belt pulleys.
- Fit V-belts. Retension later, if necessary, after short period of operation: see 6.5.
- Remove closures of intake and exhaust pipe openings.
- Start up engine as specified under point 2), section 5.1.



**9.1 Engine Specifications and Settings**  
**9.2 Torque Wrench Settings**



# Specification Data

## 9.1 Engine Specifications and Settings

### Model

		F2L 1011	F3L 1011	F4L 1011
Number of cylinders		2	3	4
Cylinder arrangement		vertical in-line		
Bore	mm	91	91	91
Stroke	mm	105	105	105
Engine swept volume	ccm	1366	2049	2732
Compression ratio		18.5	18.5	18.5
Working cycle		four-stroke diesel		
Combustion system		naturally aspirated, direct injection		
Direction of rotation (facing flywheel)		counterclockwise		
Weight incl. integrated cooling system (excl. starter, incl. alternator)	approx. kg	162	202	242
Power	kW (HP)	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Speed	rpm	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Lubrication system		forced-feed lubrication		
Min. oil pressure (engine warm, oil temp. 120 °C [212 °F], ref. to SAE 20W/20 oil),				
at: 900 rpm	bar	1.1 <sup>3)</sup>	1.1 <sup>3)</sup>	1.1 <sup>3)</sup>
1800 rpm	bar	1.6 <sup>3)</sup>	1.6 <sup>3)</sup>	1.6 <sup>3)</sup>
3600 rpm	bar	3.4 <sup>3)</sup>	3.4 <sup>3)</sup>	3.4 <sup>3)</sup>
Oil capacity (initial filling)	approx. ltr. <sup>2)</sup>	8.0	8.0	13.0
Oil capacity with filter renewal (standard 0.5 ltr.)	approx. ltr. <sup>2)</sup>	6.5	6.0	10.5
Valve clearance with engine cold	mm	inlet valve 0.3		
(engine allowed to cool down for at least 30 min.: oil temperature below 80 °C [176 °F])	mm	exhaust valve 0.5		
Fuel injector opening pressure	bar	250 <sup>+8</sup>	250 <sup>+8</sup>	250 <sup>+8</sup>
Fuel pump timing	°CA BTDC	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Firing order		1-2	1-2-3	1-3-4-2

<sup>1)</sup> Engine power, speed and fuel pump timing data are stamped on the rating plate, see also 2.1.

<sup>2)</sup> Approximate values, can vary depending on engine specification. Decisive as always the upper dipstick mark.

<sup>3)</sup> Data referring to engines without oil/air cab heating system.



# Specification Data

## 9.2 Torque Wrench Settings

Location	Preloading (Nm)	Tightening (Nm)				Total (Nm)	Remarks
		1st Stage	2nd Stage	3rd Stage	4th Stage		
Idler pulley / V-belt pulley	-	-	-	-	-	45	
Rocker cover	-	-	-	-	-	8,5	
Rocker arm setscrew	-	-	-	-	-	20	
Rear flywheel-end mounting foot	-	-	-	-	-	106	
Front blower-end mounting foot	-	-	-	-	-	168	
Intake manifold	-	-	-	-	-	21	TORX
Exhaust manifold	-	-	-	-	-	40	TORX plus Never Seize paste
Oil drain plug	-	-	-	-	-	55	
Injector fastening	-	-	-	-	-	20	TORX
Union nut, injector	-	-	-	-	-	45	
Union nut, injection line	-	-	-	-	-	15	

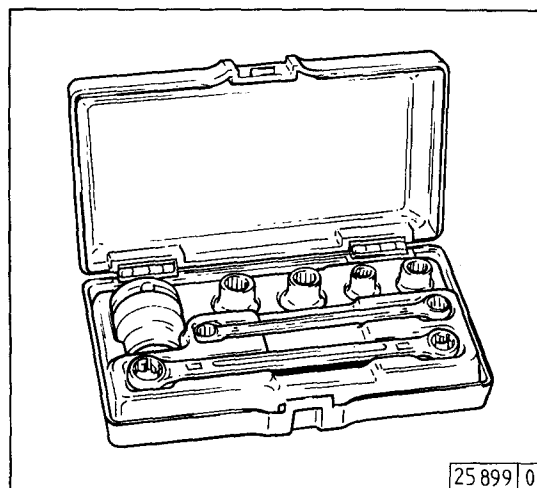


On series 1011 engines the TORX Fastener System is applied at specific locations. This screw fastener system was introduced in view of its many advantages, as there are:

- Excellent access to the bolts/screws.
- Highly efficient torque transmission when loosening and tightening.
- Slipping or breaking of the wrench and any resulting danger of injury are practically ruled out.

TORX tools are obtainable as a set under the Order No. 8189 from:

Messrs. WILBÄR  
Postfach 14 05 80  
D-42826 Remscheid





**DEUTZ SERVICE INTERNATIONAL GmbH**  
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Direct dial from 8.00 a.m. to 5.00 p.m.

At night, on weekends and holidays automatic phone answerer.

(We shall responds the next working day.)