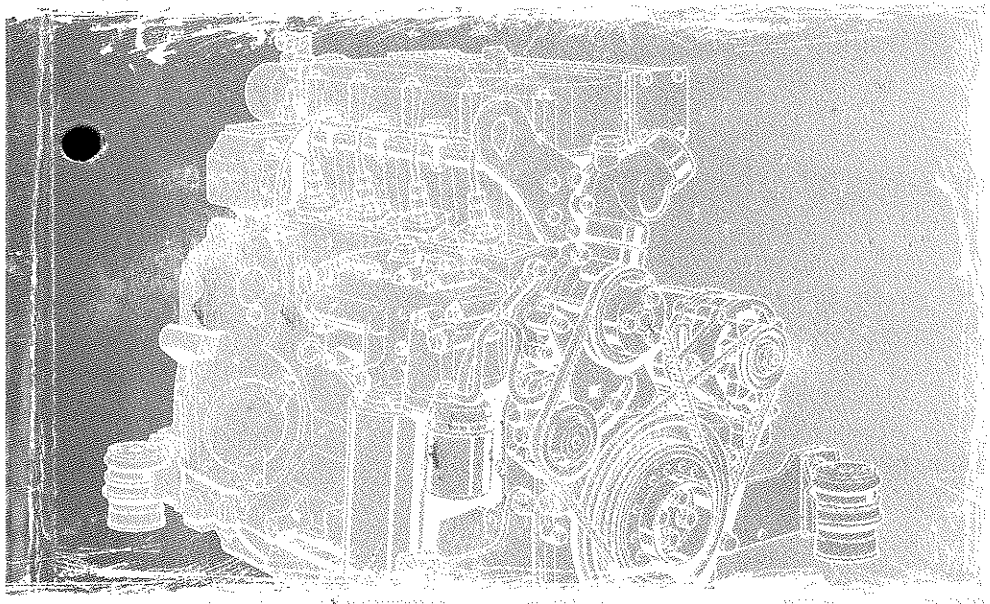


DEUTZ

TE-10

Operation Manual

1012
1013

DEUTZ

- Please read and observe the information given in this Operation Manual. This will enable you to avoid accidents, preserve the manufacturer's warranty and maintain the engine in peak operating condition.
- This engine has been built exclusively for the application specified in the scope of supply – as described by the equipment manufacturer – and is to be used only for the intended purpose. Any use exceeding that scope is considered to be contrary to the intended purpose. The manufacturer will not assume responsibility for any damage resulting therefrom. The risks involved are to be borne solely by the user.
- Use in accordance with the intended purpose also implies compliance with the conditions laid down by the manufacturer for operation, maintenance and servicing. The engine should only be operated by personnel trained in its use and the hazards involved.
- The relevant accident prevention guidelines and other generally accepted safety and industrial hygiene regulations must be observed.
- Unauthorized engine modifications will invalidate any liability claims against the manufacturer for resultant damage.
- Manipulations of the injection and regulating system may also influence the performance of the engine, and its emissions. Adherence to legislation on pollution cannot be guaranteed under such conditions.
- Do not alter, obstruct or reposition the coolant air intake area.

  The manufacturer shall not be liable for any damage which is incurred as a result of such actions.

Operation Manual

1012

1013

0297 7380 en

Engine serial number:

Please enter the engine serial number here. This number should be quoted when inquiring about Customer Service, Repairs or Spare Parts (see Section 2.1).

All rights reserved. Technical modifications required to improve our engines are reserved with regard to specification data and other technical information contained in this Operation Manual. No part of this Manual may be reproduced in any form or by any means without our written approval.

DEUTZ

Foreword

Dear Customer,

Liquid-cooled DEUTZ engines are designed for a large number of applications. Consequently, a wide range of variants are offered to meet the requirements of specific cases.

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 endeavored to highlight any differences so that you will be able to locate the operating and maintenance instructions relevant to your engine quickly and easily.

Please read this Manual before starting your engine, and always observe the operating and maintenance instructions.

We are available to help with any additional inquiries.

Sincerely,

DEUTZ AG

Table of contents

1. General

2. Engine Description

2.1 Model
2.1.1 Rating Plate
2.1.2 Rating Plate Location
2.1.3 Engine Serial Number
2.1.4 Cylinder Numbering
2.2 Engine Illustrations
2.2.1 Service Side 1012
2.2.2 Starter Side 1012
2.2.3 Service Side 1012 E
2.2.4 Starter Side 1012 E
2.2.5 Service Side 1013
2.2.6 Starter Side 1013
2.2.7 Service Side 1013 E
2.2.8 Starter Side 1013 E
2.3 Lube Oil Circuit
2.3.1 Lube Oil Circuit Schematic 1012/1012 E
2.3.2 Lube Oil Circuit Schematic 1013/1013 E
2.4 Fuel System
2.4.1 Fuel System Schematic
2.5 Cooling System
2.5.1 Cooling System Schematic 1012
2.5.2 Cooling System Schematic 1012 E
2.5.3 Cooling System Schematic 1013
2.5.4 Cooling System Schematic 1013 E

3. Engine Operation

3.1 Commissioning
3.1.1 Adding Engine Oil
3.1.2 Filling Oil Bath Air Cleaner
3.1.3 Adding Fuel
3.1.4 Filling/Bleeding Cooling System 1012 / 1013
3.1.5 Filling/Bleeding Cooling System 1012 E / 1013 E
3.1.6 Other Preparations
3.2 Starting
3.2.1 Electric Starting
3.3 Monitoring Systems
3.3.1 Engine Oil Pressure
3.3.2 Coolant Temperature
3.3.3 Coolant Level/Coolant Level Gauge
3.4 Stopping
3.4.1 Engines with Mechanical Shutdown
3.4.2 Engines with Electrical Shutdown
3.5 Operating Conditions
3.5.1 Winter Operation
3.5.2 High Ambient Temperature, High Altitude

4. Operating Media

4.1 Lube Oil
4.1.1 Quality Grade
4.1.2 Viscosity
4.2 Fuel
4.2.1 Quality Grade
4.2.2 Winter Grade Fuel
4.3 Coolant
4.3.1 Water Quality for Coolant Preparation
4.3.2 Coolant Preparation
4.3.3 Antifreeze/Chemical Corrosion Inhibitors

5. Routine Maintenance

5.1 Maintenance Schedule
5.2 Maintenance Chart
5.3 Maintenance Record

Table of contents

6. Service and Maintenance

6.1 Lubrication System
6.1.1 Oil Change Intervals
6.1.2 Checking Oil Level, Changing Engine Oil
6.1.3 Changing Oil Filter
6.2 Fuel System
6.2.1 Changing Fuel Filter
6.2.2 Cleaning or replacing the primary fuel filter and filter element
6.2.3 Draining water from the primary fuel filter / venting the primary fuel filter
6.2.4 Changing Fuel Leakage Line
6.3 Cooling System
6.3.1 Cleaning Intervals
6.3.2 Cleaning Cooling System
6.3.3 Draining Cooling System 1012 / 1013
6.3.4 Filling / Bleeding Cooling System 1012 / 1013
6.3.5 Draining / Filling / Bleeding Cooling System 1012 E / 1013 E
6.4 Combustion Air Cleaner
6.4.1 Cleaning Intervals
6.4.2 Emptying Cyclone-Type Precleaner
6.4.3 Cleaning Oil Bath Air Cleaner
6.4.4 Dry Type Air Cleaner
6.5 Belt Drives
6.5.1 Checking V-Belts
6.5.2 Tensioning Fan / Alternator Belts 1012
6.5.3 Changing Fan / Alternator Belts 1012
6.5.4 Tensioning Coolant / Fuel Pump Belts 1012
6.5.5 Changing Coolant / Fuel Pump Belts 1012
6.5.6 Tensioning Coolant / Fuel Pump Belts 1012 E
6.5.7 Changing Coolant / Fuel Pump Belts 1012 E
6.5.8 Tensioning Alternator Belt 1012 E
6.5.9 Changing Alternator Belt 1012 E
6.5.10 Tensioning / Changing Compressor / Alternator Belts 1013
6.5.11 Tensioning Coolant / Fuel Pump Belts 1013
6.5.12 Changing Coolant / Fuel Pump Belts 1013
6.5.13 Tensioning / Changing Alternator Belt 1013
6.5.14 Tensioning Coolant / Fuel Pump Belts 1013 E
6.5.15 Changing Coolant / Fuel Pump Belts 1013 E
6.5.16 Tensioning / Changing Compressor Belt
6.6 Adjustments
6.6.1 Checking / Adjusting Valve Clearances
6.6.1.1 Valve Clearance Adjustment Schematic
6.7 Accessories
6.7.1 Battery
6.7.2 Three-Phase Alternator
6.7.3 Lifting Tackle

7. Troubleshooting

7.1 Diagnosis Chart

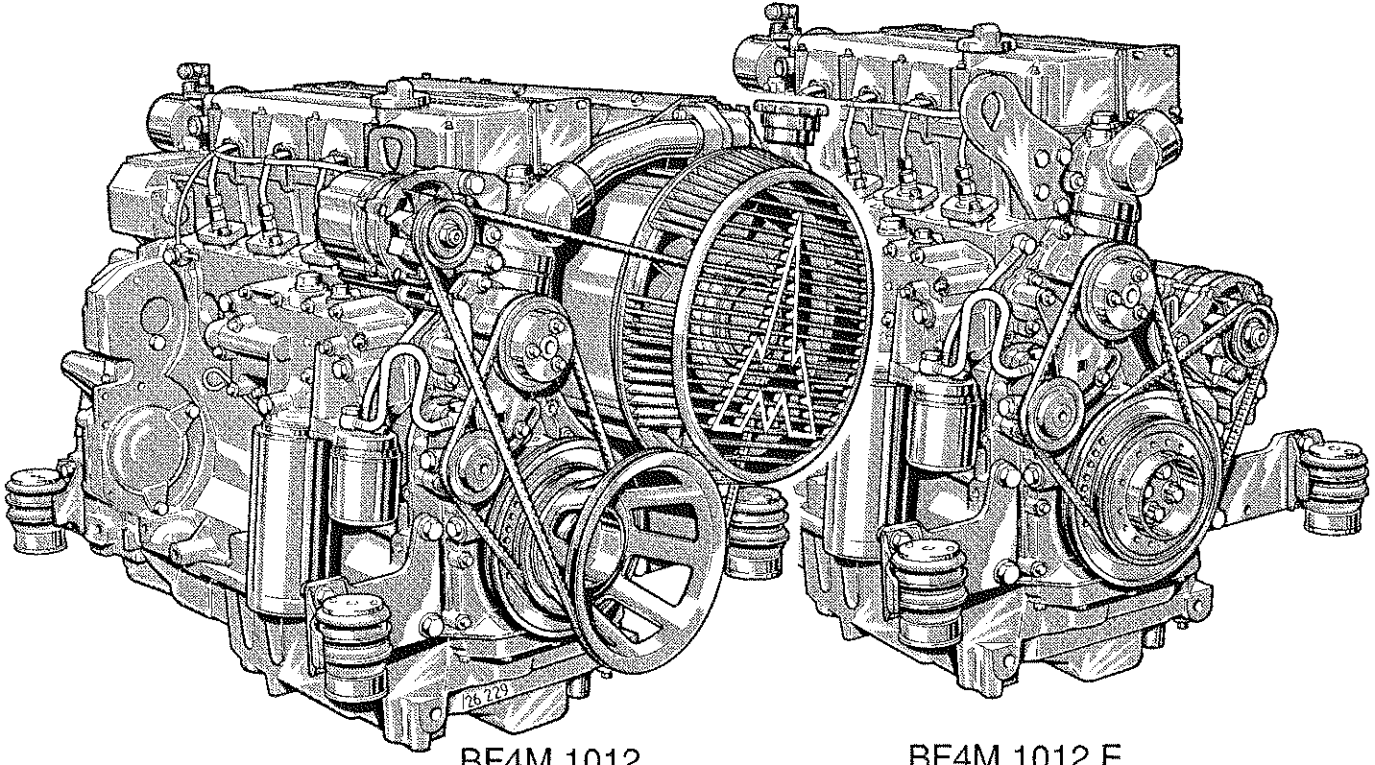
8. Engine Preservation

8.1 Preservation

9. Technical Specifications

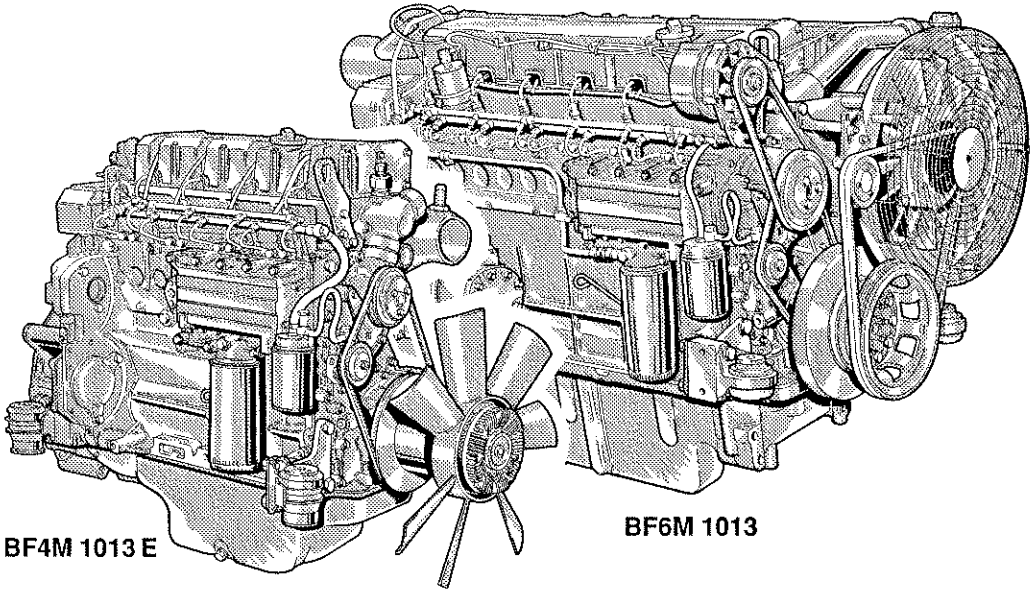
9.1 Engine Specifications and Settings
9.2 Torque Wrench Settings
9.3 Tools

10. Service



BF4M 1012

BF4M 1012 E



BF4M 1013 E

BF6M 1013

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.

Service

Please contact one of our authorized service representatives 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 Serviceare always manufactured to the highest technical standards.
A table of DEUTZ Service contact numbers is given at the end of this Operation Manual.

Beware of Running Engine

Shut the engine down before carrying out maintenance or repair work. Ensure that the engine cannot be accidentally started.
When the work is complete, be sure to refit any panels and guards that may have been removed.
Never fill the fuel tank while the engine is running.
Observe industrial safety regulations when running the engine in an enclosed space or underground.

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.

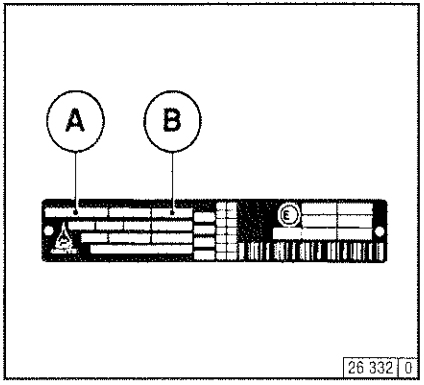
Asbestos

The gaskets used for this engine are asbestos-free. Please use suitable replacement parts when carrying out maintenance and repair work.

2.1 Model
2.2 Engine Illustrations
2.3 Lube Oil Circuit Schematic
2.4 Fuel System Schematic
2.5 Cooling System Schematic

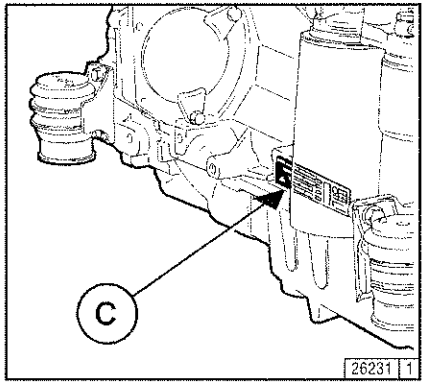
2

2.1.1 Rating Plate



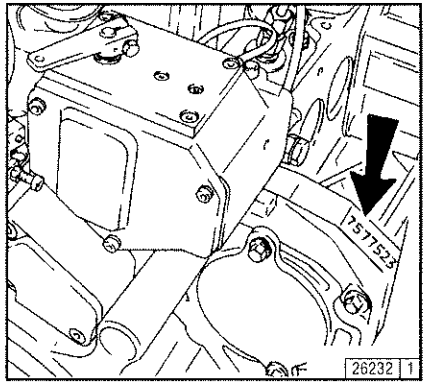
The model **A**, the engine serial number **B** and the performance data are stamped on the rating plate. The model and engine serial number must be given when ordering spare parts.

2.1.2 Rating Plate Location



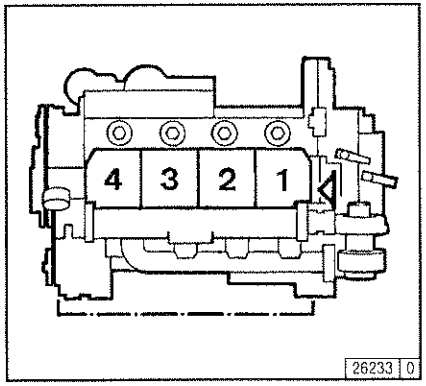
The rating plate **C** is attached to the crankcase.

2.1.3 Engine Serial Number



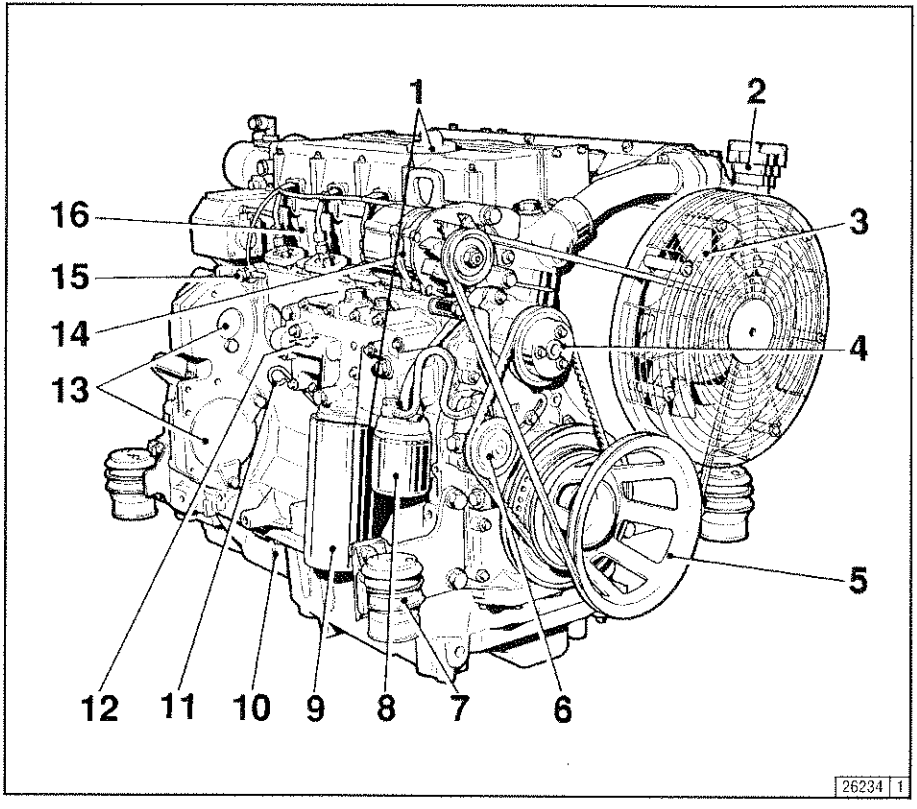
The engine serial number is also stamped on the crankcase itself **(arrow).**

2.1.4 Cylinder Numbering



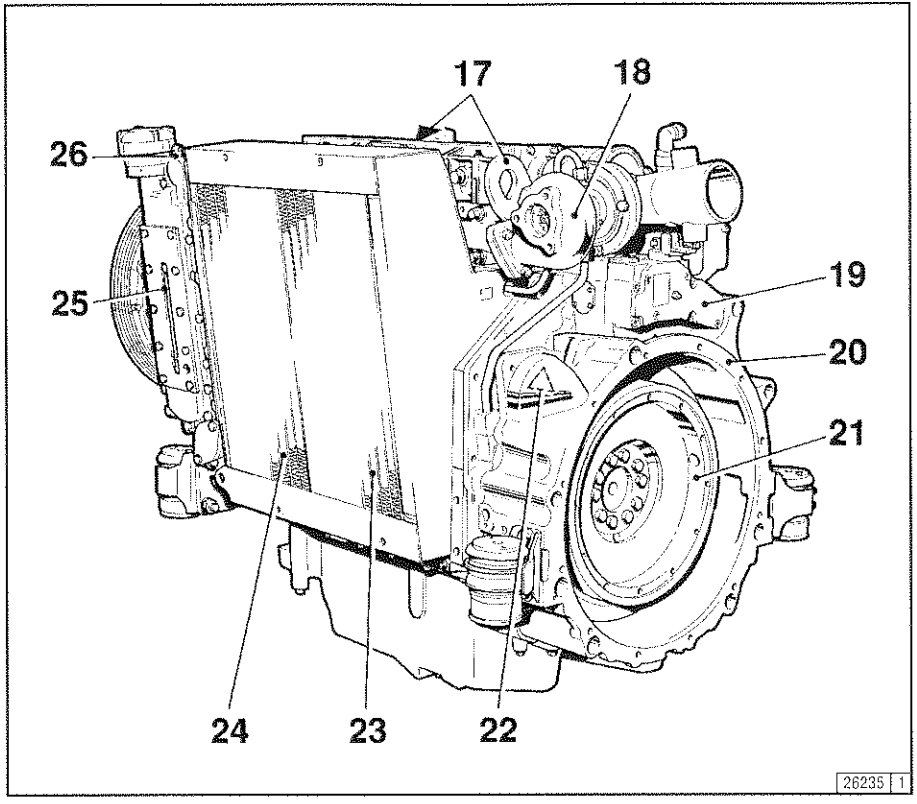
Cylinders are numbered consecutively, beginning at the flywheel end.

2.2.1 Service Side 1012



1 Oil filler (option: between filters)
2 Coolant filler
3 Cooling fan
4 Coolant pump
5 Belt pulley
6 Fuel pump
7 Engine mount
8 Fuel filter
9 Lube oil filter
10 Oil pan
11 Dipstick
12 Lube oil cooler
13 Mounting facility for hydraulic pumps
14 Alternator
15 Back leak fuel pipe with pressure-regulating valve
16 Cylinder head

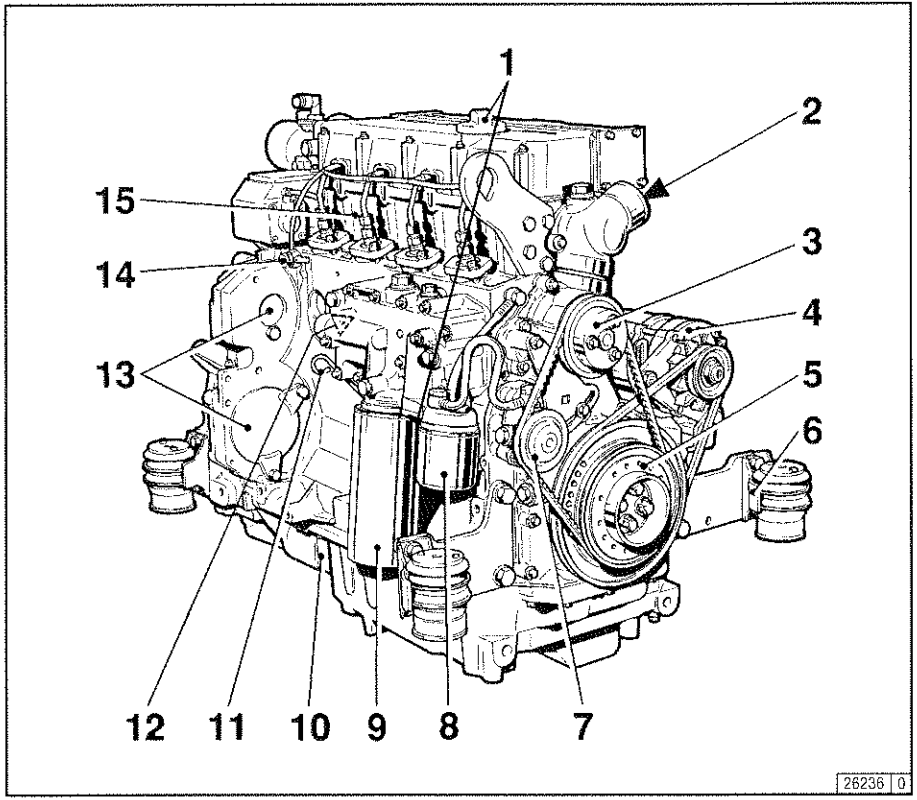
2.2.2 Starter Side 1012



17 Lifting points
18 Exhaust turbocharger
19 Speed governor
20 SAE housing
21 Flywheel
22 Starter motor
23 Hydraulic oil cooler
24 Coolant heat exchanger
25 Coolant level gauge
26 Bleeder valve

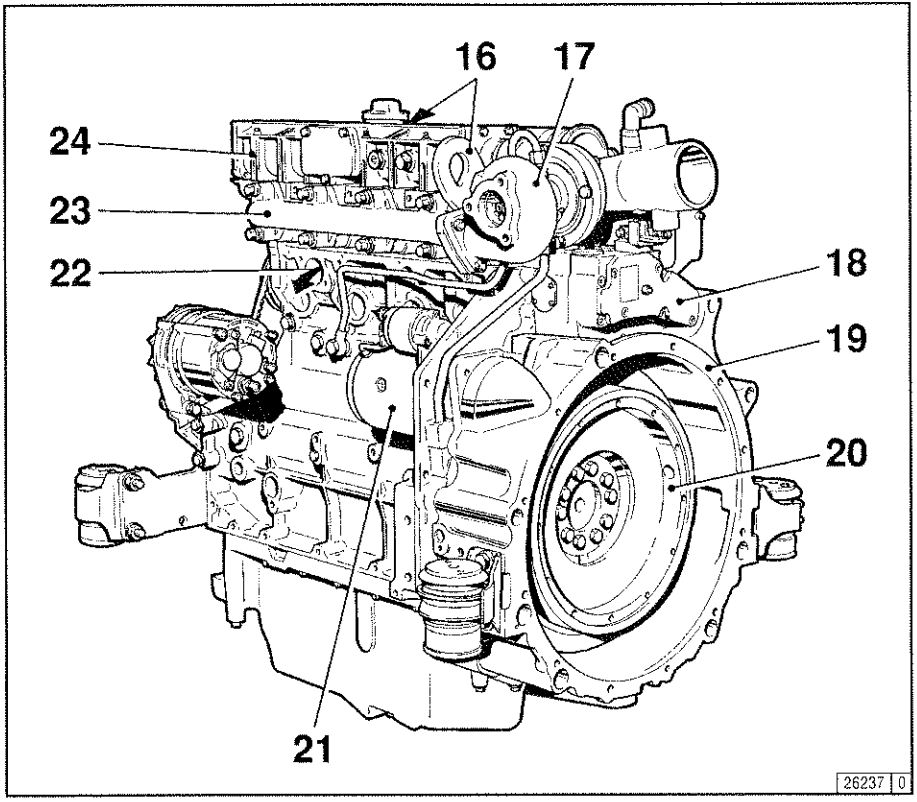
2

2.2.3 Service Side 1012 E



1 Oil filler (option: between filters)
2 Coolant inlet
3 Coolant pump
4 Alternator
5 Belt pulley
6 Engine mount
7 Fuel pump
8 Fuel filter
9 Lube oil filter
10 Oil pan
11 Dipstick
12 Lube oil cooler
13 Mounting facility for hydraulic pump
14 Back leak fuel pipe with pressure-regulating valve
15 Cylinder head

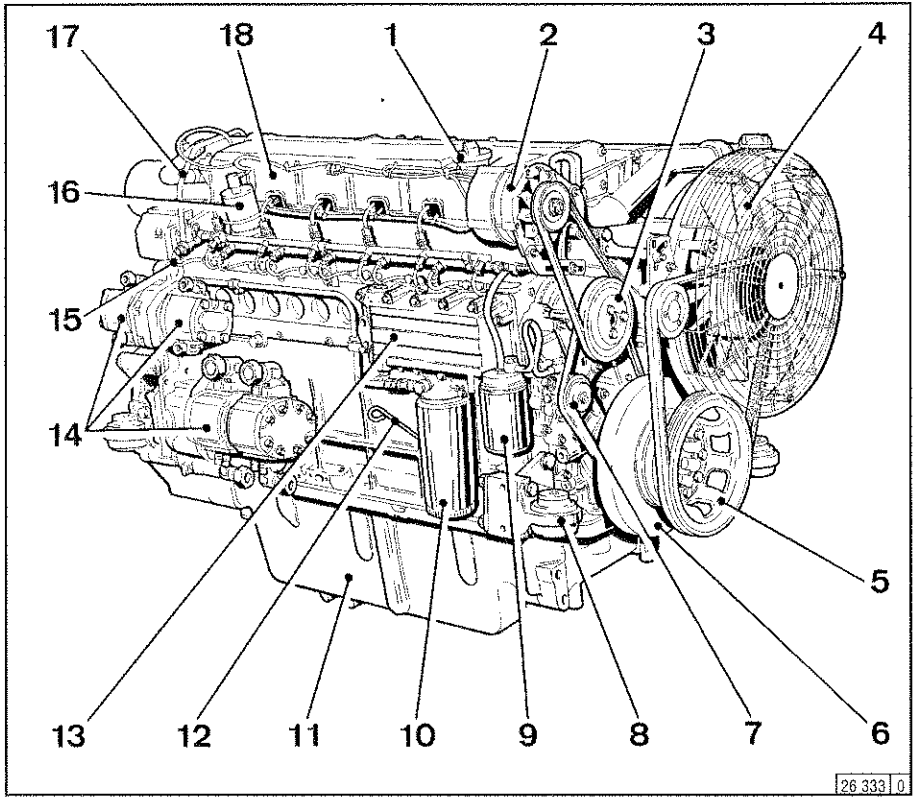
2.2.4 Starter Side 1012 E



16 Lifting points
17 Exhaust turbocharger
18 Speed governor
19 SAE housing
20 Flywheel
21 Starter motor
22 Coolant outlet to heat exchanger
23 Exhaust manifold
24 Air intake manifold

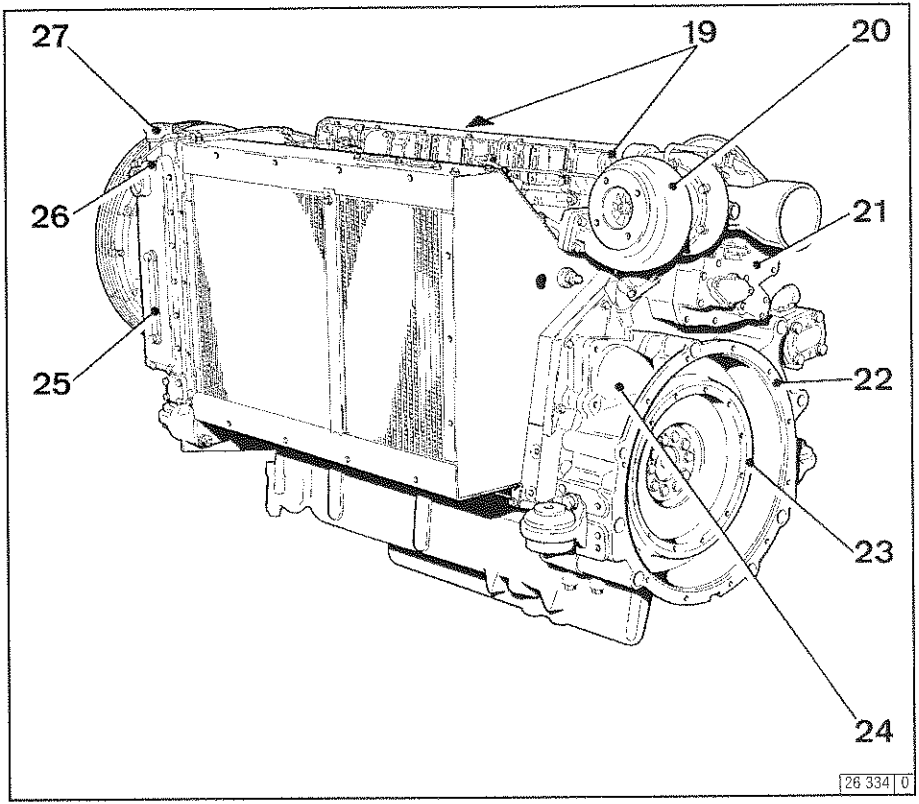
2

2.2.5 Service Side 1013



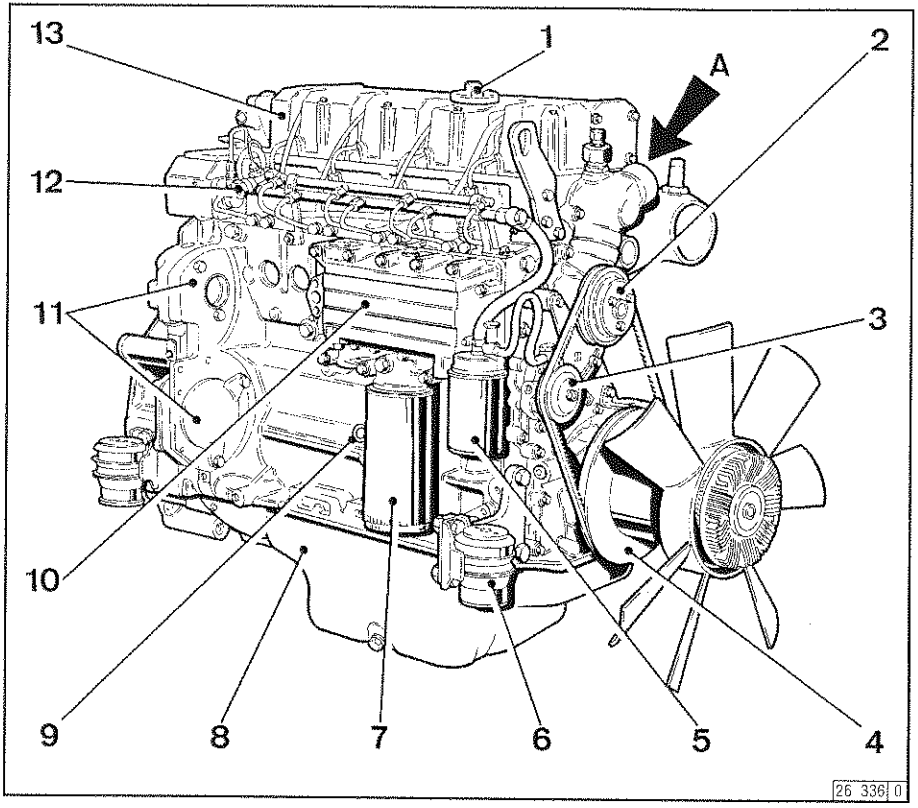
1 Oil filler (option: between filters)
2 Alternator
3 Coolant pump
4 Fan
5 Belt Pulley
6 Vibration damper
7 Fuel pump
8 Engine mount
9 Fuel filter
10 Lube oil filter
11 Oil pan
12 Dipstick
13 Lube oil cooler
14 Hydraulic pumps (or compressor)
15 Fuel pipe
16 Solenoid
17 Lube oil line to turbocharger
18 Cylinder head

2.2.6 Starter Side 1013



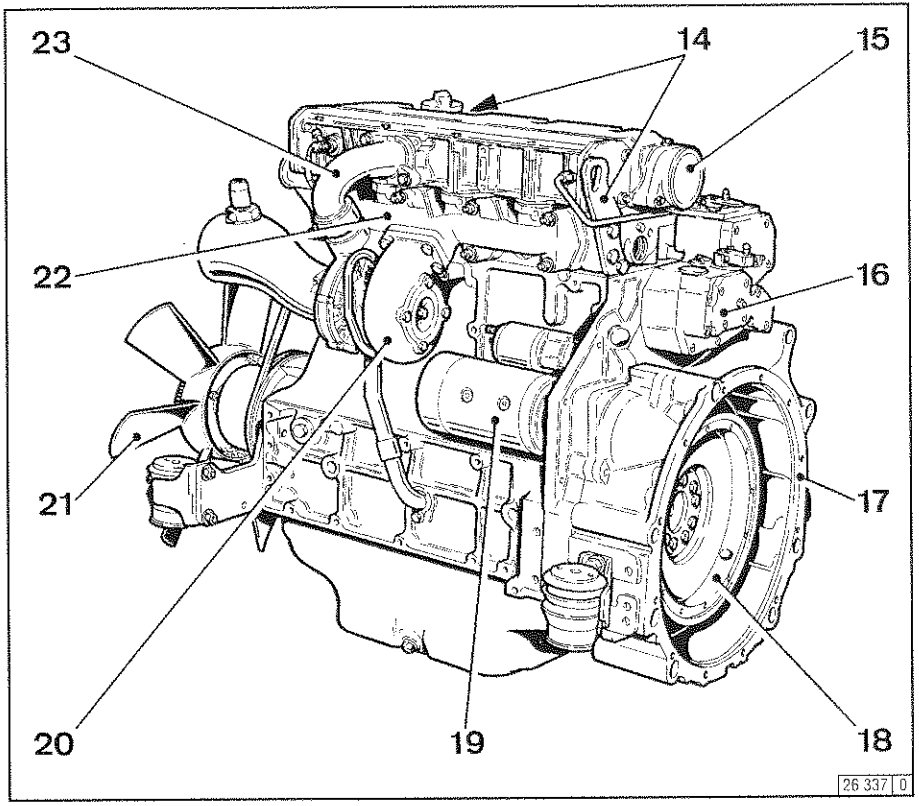
19 Lifting points
20 Exhaust turbocharger
21 Speed governor
22 SAE housing
23 Flywheel
24 Starter motor
25 Coolant level gauge
26 Bleeder valve
27 Coolant filler cap

2.2.7 Service Side 1013 E



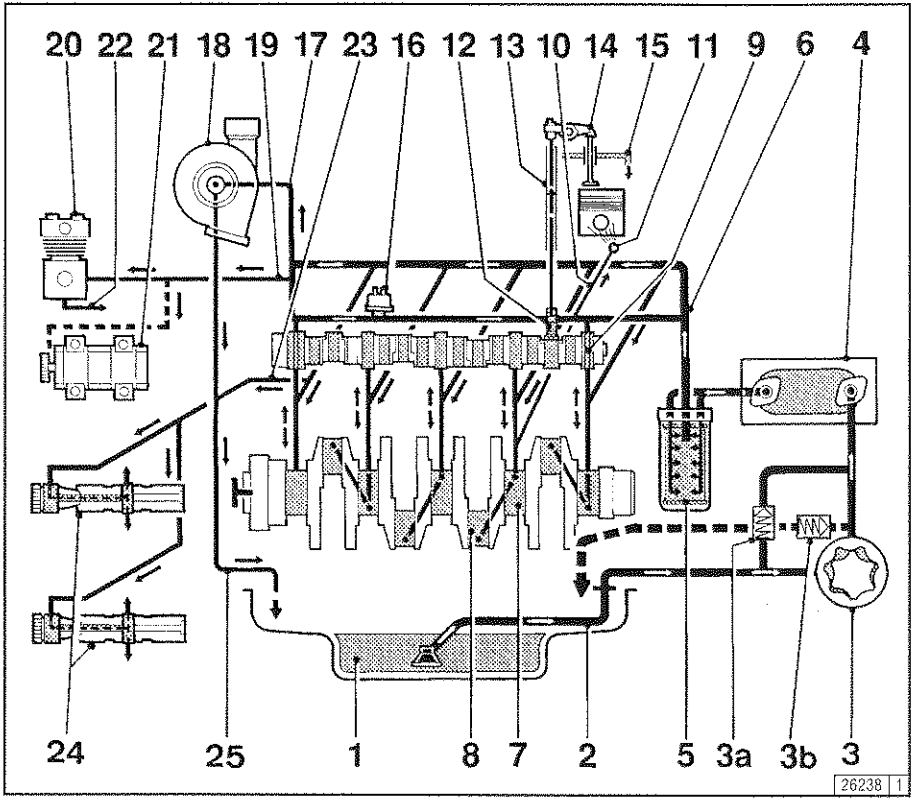
1 Oil filler
2 Coolant pump
3 Fuel pump
4 Vibration damper
5 Lube oil filter
6 Engine mount
7 Fuel filter
8 Oil pan
9 Dipstick
10 Lube oil cooler
11 Mounting facility for hydraulic pump
12 Back leak fuel pipe with pressure-regulating valve
13 Cylinder head
A Coolant inlet

2.2.8 Starter Side 1013 E



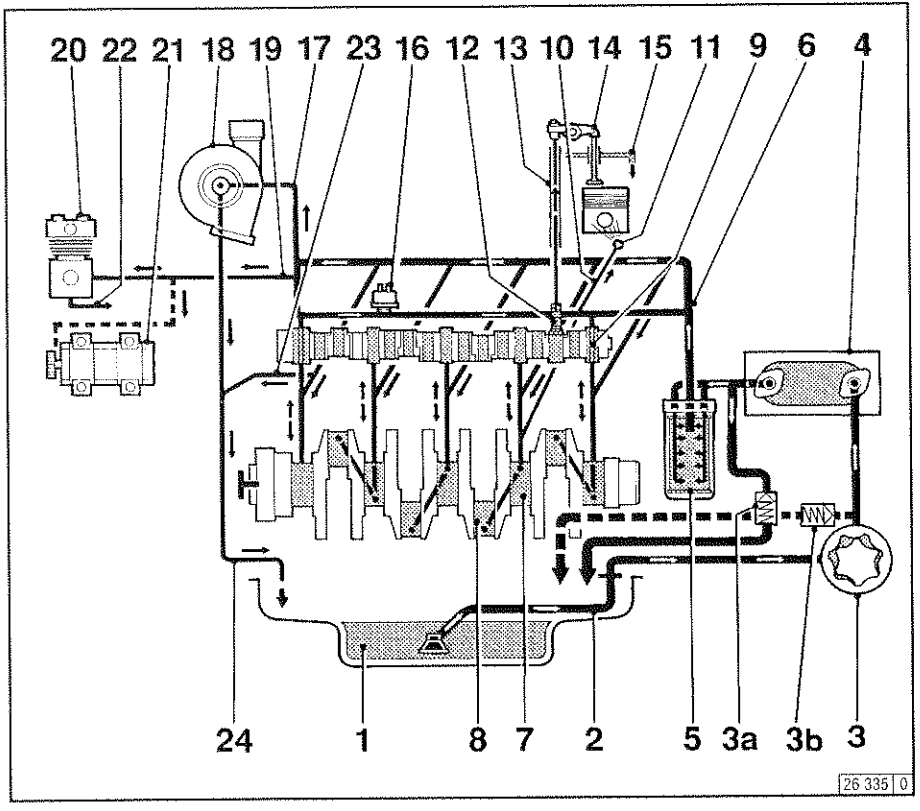
14 Lifting points
15 Crankcase breather valve
16 Speed governor
17 SAE housing
18 Flywheel
19 Starter motor
20 Exhaust turbocharger
21 Fan
22 Exhaust manifold
23 Air intake manifold

2.3.1 Lube Oil Circuit Schematic 1012 / 1012 E



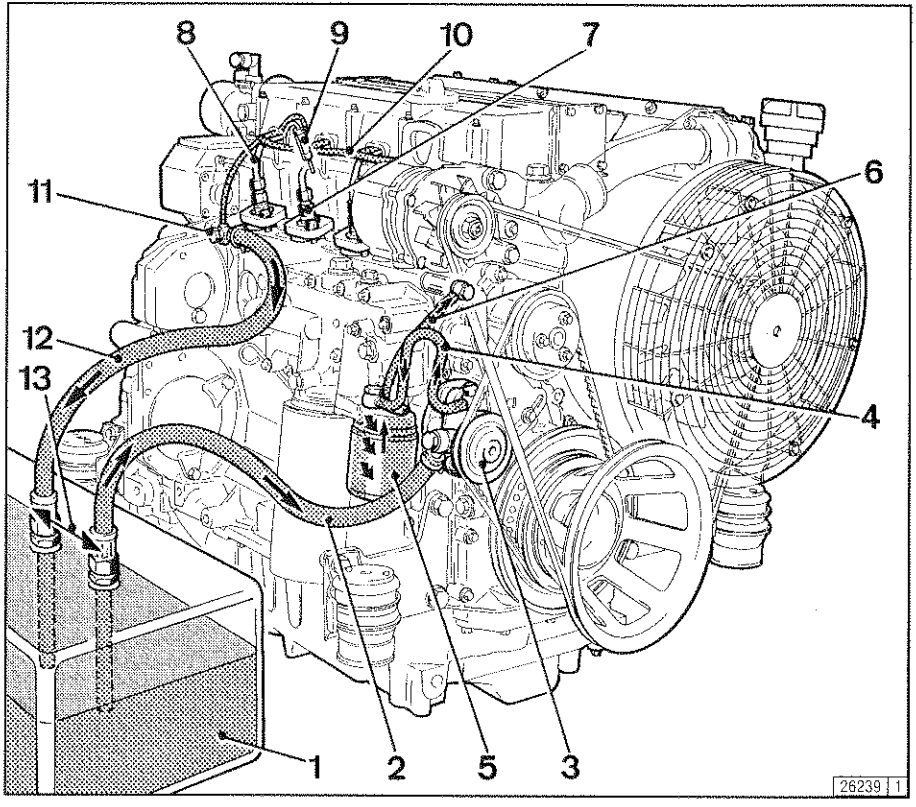
1 Oil pan
2 Air intake manifold
3 Lube oil pump
3a Back leak fuel valve
3b Pressure-relief valve
4 Lube oil cooler
5 Lube oil filter
6 Main oil gallery
7 Crankshaft bearing
8 Conrod bearing
9 Camshaft bearing
10 Line to spray nozzle
11 Spray nozzle for piston cooling
12 Tappet w/ control bore for pulse lubrication of rocker arms
13 Pushrod (designed for lube oil supply of rocker arms)
14 Rocker arm
15 Return line to oil pan
16 Oil sensor
17 Oil line to exhaust turbocharger
18 Exhaust turbocharger
19 Oil line to compressor or hydraulic pump
20 Compressor
21 Hydraulic pump
22 Return line to compressor or hydraulic pump
23 Line to mass balancing gear (2x)
24 Counterbalancing shafts
25 Exhaust turbocharger return to crankcase

2.3.2 Lube Oil Circuit Schematic 1013 / 1013 E



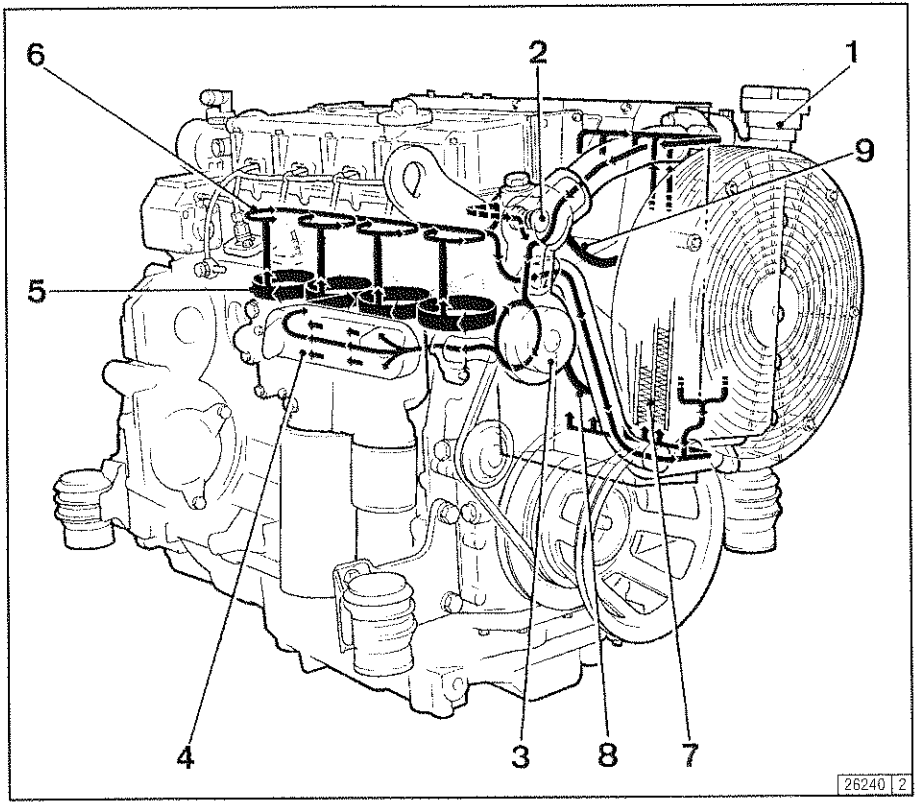
1 Oil pan
2 Air intake manifold
3 Lube oil pump
3a Back leak fuel valve
3b Pressure-relief valve
4 Lube oil cooler
5 Lube oil filter
6 Main oil gallery
7 Crankshaft bearing
8 Conrod bearing
9 Camshaft bearing
10 Spray nozzle line
11 Spray nozzle for piston cooling
12 Tappet w/ control bore for pulse lubrication of rocker arms
13 Pushrod (designed for lube oil supply of rocker arms)
14 Rocker arm
15 Return line to oil pan
16 Oil sensor
17 Oil line to exhaust turbocharger
18 Exhaust turbocharger
19 Oil line to compressor or hydraulic pump
20 Compressor
21 Hydraulic pump
22 Return line to compressor or hydraulic pump
23 Return to oil pan
24 Exhaust turbocharger return to crankcase

2.4.1 Fuel System Schematic



1 Fuel tank
2 Line to fuel pump
3 Fuel pump
4 Line to fuel filter
5 Fuel filter
6 Line to injection pumps
7 Injection pump
8 Line to injector
9 Injector
10 Back leak fuel pipe
11 Banjo bolt with pressure-regulating valve
12 Return line to fuel tank
13 Keep this spacing as wide as possible

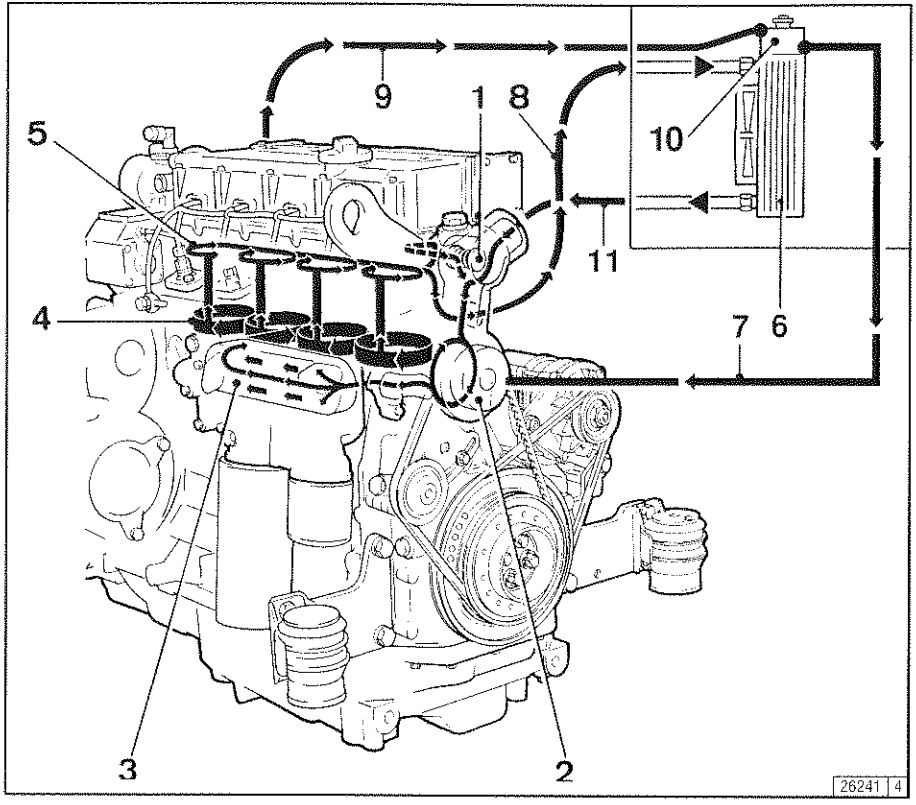
2.5.1 Cooling System Schematic 1012



1 Coolant filler
2 Thermostat housing
3 Coolant pump
4 Lube oil cooler
5 Cylinder cooling
6 Cylinder head cooling
7 Heat exchanger
8 Return line from coolant pump to heat exchanger
9 Vent connection from cylinder head to heat exchanger

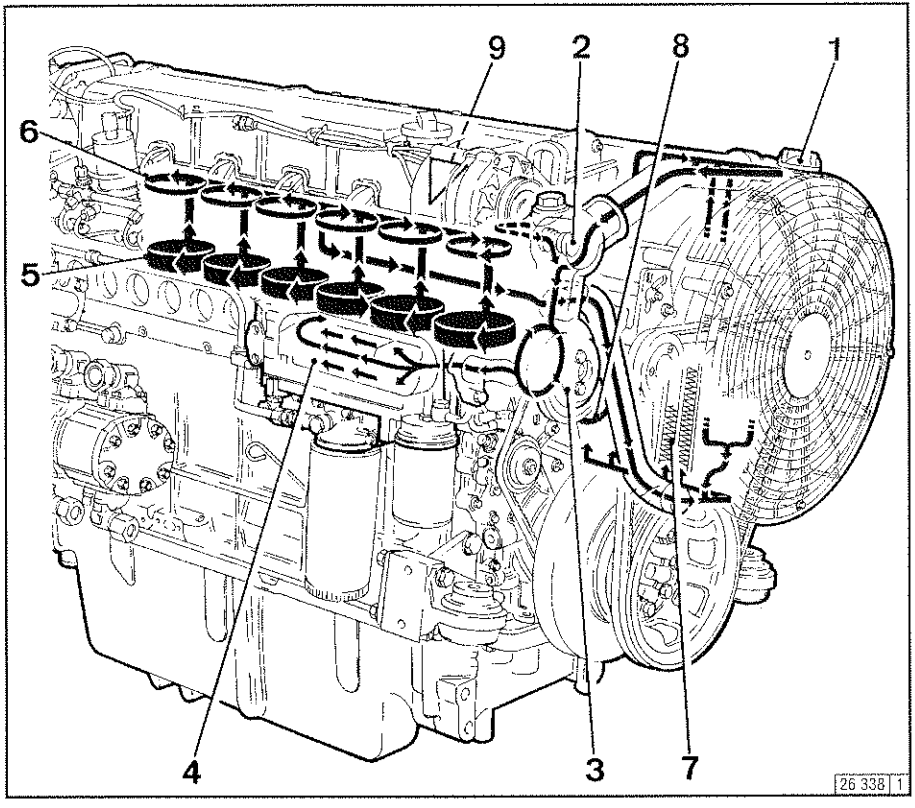
2

2.5.2 Cooling System Schematic 1012 E



1 Thermostat housing
2 Coolant pump
3 Lube oil cooler
4 Cylinder cooling
5 Cylinder head cooling
6 Heat exchanger
7 Vent connection for compensator reservoir-coolant pump
8 line from engine to compensator reservoir
9 Vent connection from cylinder head to heat exchanger (compensator reservoir)
10 Compensator reservoir
11 Return line from compensator reservoir to Thermostat housing

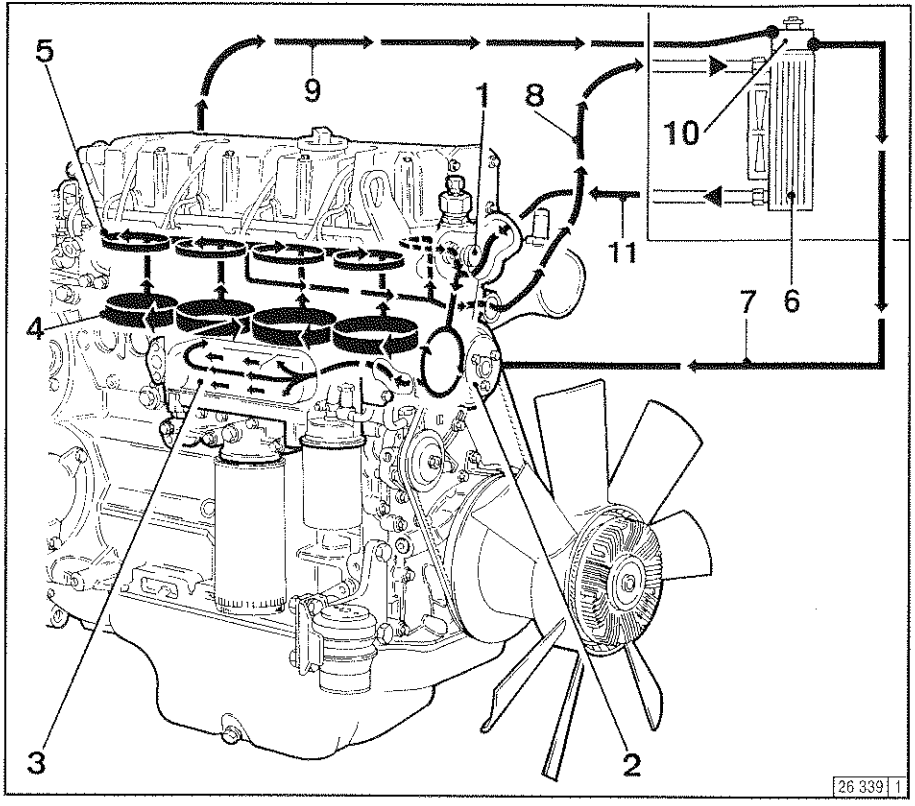
2.5.3 Cooling System Schematic 1013



1 Coolant filler
2 Thermostat housing
3 Coolant pump
4 Lube oil cooler
5 Cylinder cooling
6 Cylinder head cooling
7 Heat exchanger
8 Compensator line for coolant pump/compensator reservoir
9 Vent connection from cylinder head to heat exchanger (compensator reservoir)

2

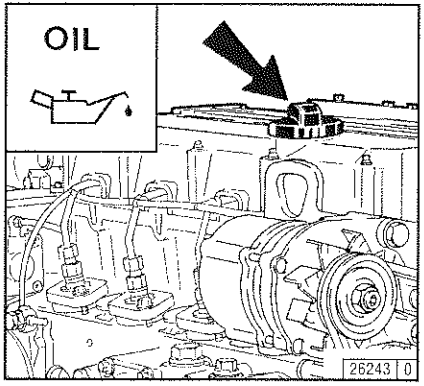
2.5.4 Cooling System Schematic 1013 E



1 Thermostat housing
2 Coolant pump
3 Lube oil cooler
4 Cylinder cooling
5 Cylinder head cooling
6 Heat exchanger
7 Vent connection for compensator reservoir-coolant pump
8 line from engine to compensator reservoir
9 Vent connection from cylinder head to heat exchanger (compensator reservoir)
10 Compensator reservoir
11 Return line from compensator reservoir to Thermostat housing

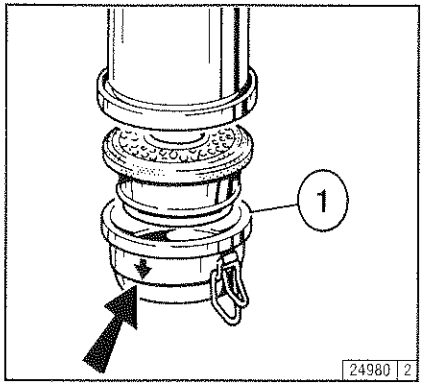
3.1 Commissioning
3.2 Starting
3.3 Monitoring Systems
3.4 Stopping
3.5 Operating Conditions

3.1.1 Adding Engine Oil



As a rule, engines are delivered empty of oil.
Pour lube oil into the oil filler neck (arrow).
For oil quantities, see 9.1.
For oil grade and viscosity, see 4.1.

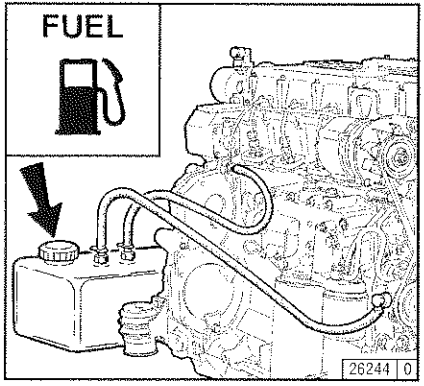
3.1.2 Filling Oil Bath Air Cleaner



Fill oil cup 1 of the oil bath air cleaner (if fitted) with oil up to the arrow.
For oil grade and viscosity, see 4.1.

Do not fill the precleaner dust collector (if fitted) with oil.

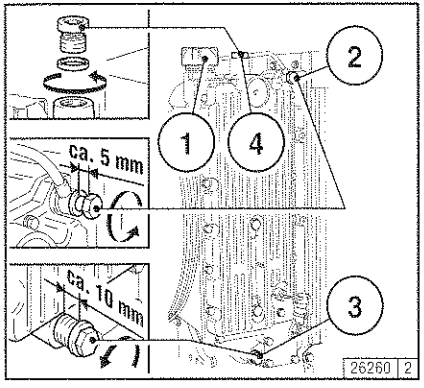
3.1.3 Adding Fuel



Only use clean commercially approved diesel fuel. For fuel grade, see 4.2. If required, install a preliminary fuel filter. In case of doubt, contact your local service representative for clarification. Depending on the ambient temperature, use summer or winter fuel.

Never fill the fuel tank while the engine is running. Keep the filler cap area clean and do not spill fuel.

3.1.4 Filling / Bleeding Cooling System 1012 / 1013



- Unscrew filler cap 1.
- Undo bleeder screws 2 and 4.
- Unscrew plug 3 up to the first groove (arrow).
- Fill with coolant up to upper edge of filler neck. Be sure coolant flows from bleeder plug 2 (heater valve must be open). Tighten screws 2 and 4.
- Tighten plug 3.
- Replace filler cap 1.
- Start engine and run up to normal operating temperature until thermostat opens (coolant line from fan housing to thermostat housing gets noticeably warm).
- Top up with coolant if necessary.
- After the engine has run for the first time, let it cool, then check the water level (see 3.3.3).

3.1.5 Filling / Bleeding Cooling System 1012 E / 1013 E

- In the case of external cooling systems, follow the manufacturer's instructions.

3.1.6 Other Preparations

- Check battery and cable connections (see 6.7.1).

- **Trial run**
  - After the engine has been prepared, let it run for about 10 minutes without load.

  During and after trial run
  - Check the engine for leaks.

  After the engine has been turned off
  - Check the oil level and top up if necessary (see 6.1.2).
  - Retension V-belts (see 6.5).

- **Breaking-in**
  During the break-in phase – about 200 operating hours – check the oil level twice a day.
  After the engine is broken in, checking once a day will be sufficient.

3.2.1 Electric Starting

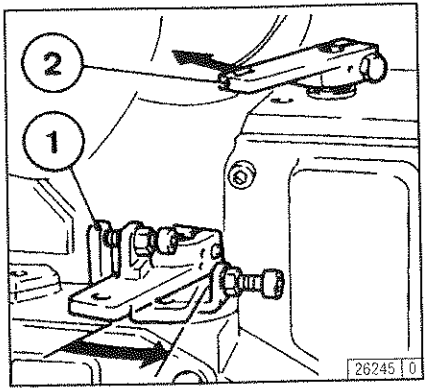
Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine.

After repair work:
Check that all guards have been replaced and that all tools have been removed from the engine.

When starting with glow plugs, do not use any other starter substance (e.g. injection with start pilot). Doing so could result in an accident.

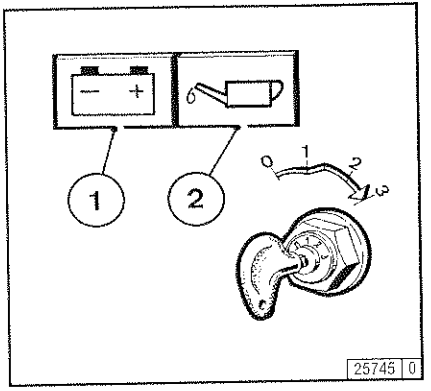
Important:
Never start the engine with speed governor removed. Disconnect battery.

Do not actuate the starter for more than 20 seconds. If the engine does not catch, wait a minute then try again.
If the engine does not catch after two attempts, refer to the Diagnosis Chart (see 7.1).



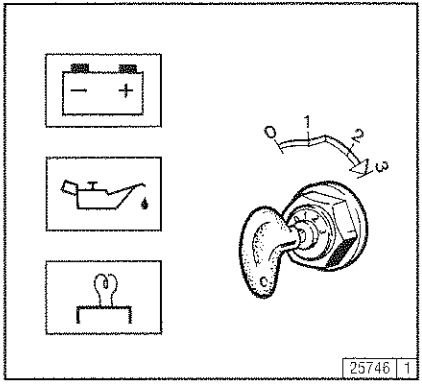
- Disengage the clutch to separate the engine from the driven equipment.
- Move speed control lever 1 in direction of arrow at least to middle speed position.
- Move shutdown lever 2 to „Run" position (in opposite direction of arrow it. 1).

Starting without Cold-Start Aid



- Insert key.
  – Position 0 = no operating voltage.
- Turn key clockwise.
  – Position 1 = operating voltage.
  – Pilot lights 1 and 2 come on.
- Push the key in and turn it further clockwise against spring pressure.
  – Position 2 = no function
  – Position 3 = start
- Release key as soon as engine fires.
  – Pilot lights go out.

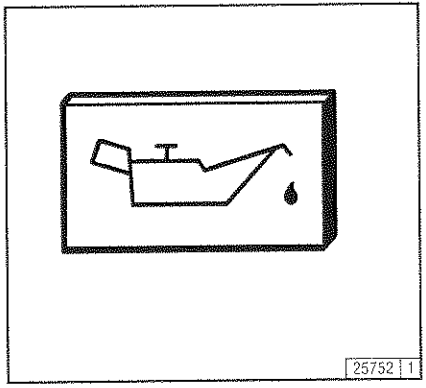
Starting with Glow Plugs



- Insert key.
  - Position 0 = no operating voltage.
- Turn key clockwise.
  - Position 1 = operating voltage.
  - Pilot lights come on. Leave to preheat until pilot lights go out.
- Push key in and turn further clockwise against spring pressure.
  - Position 2 = no function.
  - Position 3 = start.
- Release key as soon as engine fires.
  - Pilot lights go out.

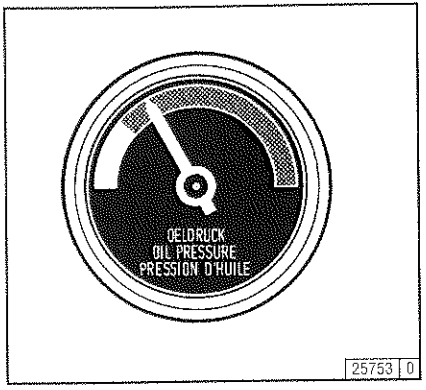
3.3.1 Engine Oil Pressure

Oil Pressure Pilot Light



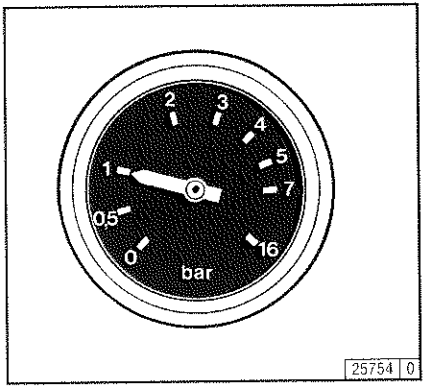
- The oil pressure pilot light comes on with operating voltage on and engine off.
- The oil pressure pilot light should go out when the engine is running.

Oil Pressure Indicator



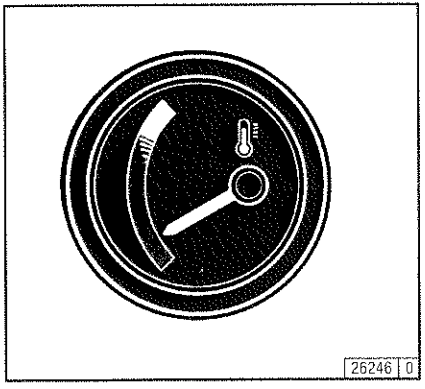
- The pointer must remain in the green sector over the entire operating range.

Oil Pressure Gauge



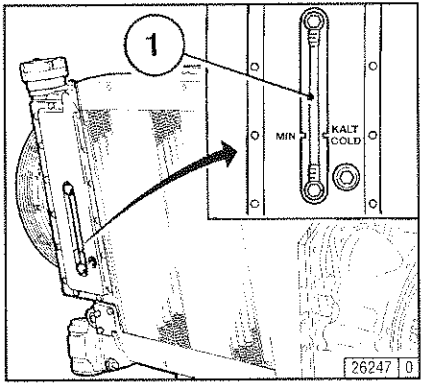
- The pointer must indicate the minimum oil pressure (see 9.1).

3.3.2 Coolant Temperature



- The coolant temperature gauge pointer should remain in the green sector most of the time. It should rarely enter the yellow-green sector. If the pointer enters the orange sector, the engine is overheating. Turn it off and establish the cause from the Diagnosis Chart (see 7.1).

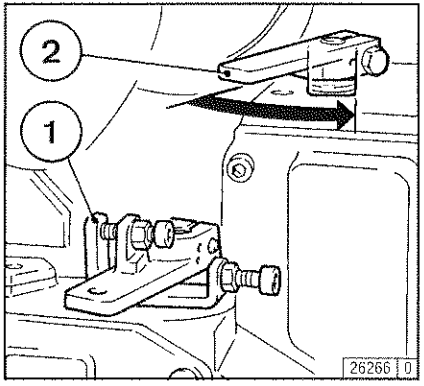
3.3.3 Coolant Level / Coolant Level Gauge



- When the engine is cold, coolant level 1 should be above the Kalt-Cold mark.

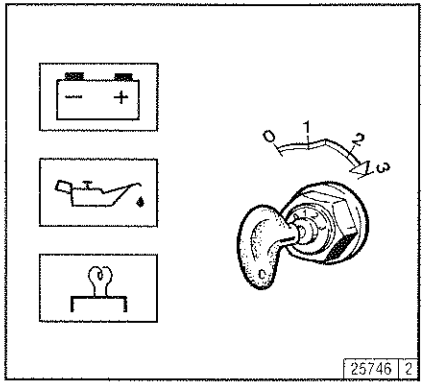
- Top up with coolant if the level falls below the minimum mark on the sight glass, or if the coolant warning switch comes on.
  - Unscrew the filler cap.
  - Top up with coolant up to the upper edge of the filler neck.
  - Tighten the filler cap
  - The system must be bled (see 6.3.4).

3.4.1 Engines with Mechanical Shutdown



- Move speed control lever 1 to low idle.
- Operate shutdown lever 2 until the engine comes to a stop. The charge pilot light and the oil pressure pilot light will come on when the engine stops.
- Turn key counterclockwise (to Position 0) and remove. The pilot lights will go out.

3.4.2 Engines with Electrical Shutdown



- Turn key counterclockwise (to Position 0) and remove. The pilot lights will go out.

3.5.1 Winter Operation

- **Lube Oil Viscosity**
  - Select the oil viscosity (SAE grade) according to the ambient temperature when the engine is started (see 4.1.2).
  - Increase oil change frequency when operating below –10°C / +14°F, see 6.1.1.

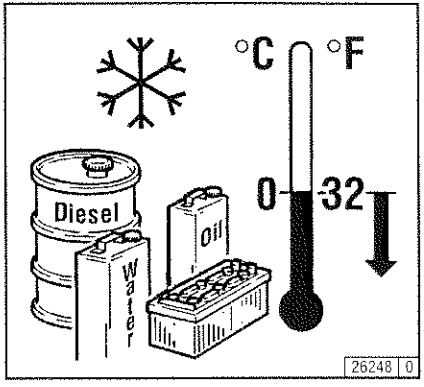
- **Diesel Fuel**
  - Use winter-grade diesel fuel for operation below 0°C/+32°F, see 4.2.2.

- **Coolant**
  - Set the water/antifreeze mix to suit the lowest likely temperature (max. –35°C / –31°F), see 4.3.1.

- **Additional Maintenance Work**
  - Drain the sludge from the fuel tank once a week by undoing the drain plug.
  - Adjust the oil level in the oil bath air cleaner (if fitted) to suit the ambient temperature.
  - At temperatures below –20°C / –4°F, lubricate the flywheel ring gear from time to time with low-temperature grease, such as Bosch FT 1 V 31. To do so, remove the starter and introduce the grease through the pinion hole.

- **Cold-Start Aids**
  - At temperatures near or below freezing point, use glow plugs if necessary (see 3.2.1). This not only lowers the starting limit temperature, but provides easier starting at temperatures normally not requiring a starting aid.

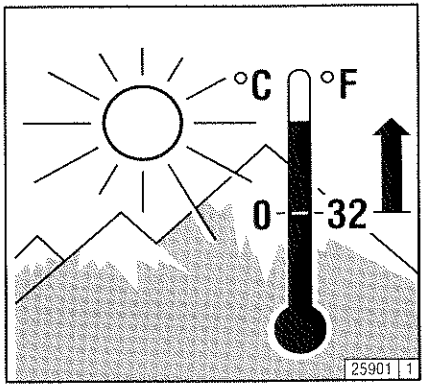
- **Battery**
  - Efficient cold starting requires a healthy battery (see 6.7.1).
  - The starting limit temperature can be lowered by 4-5°C by heating the battery up to about +20°C/+65°F. To do so, remove the battery and store in a warm place.



3.5.2 High Ambient Temperature, High Altitude

- As the altitude and ambient temperature rise, the density of the air tends to decrease, which affects the maximum power output of the engine, the exhaust gas quality and, in extreme cases, the starting behavior. Under transient conditions, the engine can be used at altitudes up to 1000 meters / 3400 feet and temperatures up to 30°C / 86°F.
  If the engine is to operate under more severe conditions (at higher altitudes or temperatures), it will be necessary to reduce the injected fuel quantity and, thus, engine power.

- If you have any doubts about engine operation under these or similar conditions, ask your engine or equipment supplier whether the engine has been derated in the interests of reliability, service life and exhaust gas quality (smoke). Otherwise, contact the nearest service representative.



4.1 Lube Oil
4.2 Fuel
4.3 Coolant

4.1.1 Quality Grade

Lube oils are differentiated according to their performance and quality class. In common use are specifications named after the **API** (American Petroleum Institute) and **ACEA** Europea Engine Oil Sequences de genoemde specificaties.

Approved API Oils:

Naturally aspirated engines:	CC
Turbocharged engines:	CD CF
	CE CF4

Approved ACEA Oils:

Naturally aspirated engines:	E2-96
Turbocharged engines:	E2-96 + E3-96#

E3-96 (sulfate ash ≥ 1.8 % by mass) corresponds to SHPD*

* SHPD (Super High Performance Diesel) oils.

If in doubt, ask the nearest service representative.

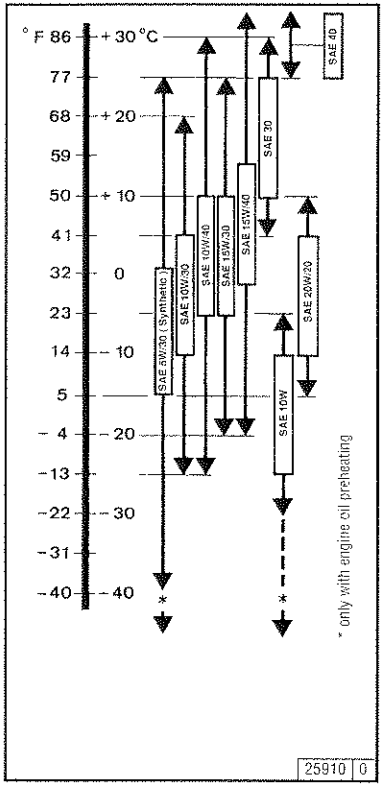
4.1.2 Viscosity

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

Should the temperature fall temporarily below the limits of the SAE grade selected, cold starting may be affected but the engine will not be damaged.

In order to keep wear to a minimum, do not exceed application limits for extended periods of time.

Oil changes dictated by the seasons can be avoided by using multi-grade lube oils. Multi-grade oils – particularly light-flowing oils – also reduce fuel consumption.



4.2.1 Quality Grade

Use commercially available diesel fuel with less than 0.5% sulfur content. If the sulfur content is higher than 0.5%, oil change intervals should be reduced (see 6.1.1).
The following fuel specifications / standards are approved:

- CEN EN 590 or DIN/EN 590
- DIN 51 601 (Feb. 1986)
- BS 2869 (1988): A1 and A2
- ASTM D975-88: 1-D and 2-D
- NATO Code F-54 and F-75

The exhaust emission levels determined during certification by the supervising authority (Technical Service/EPA) are always based on the reference fuel prescribed by law.

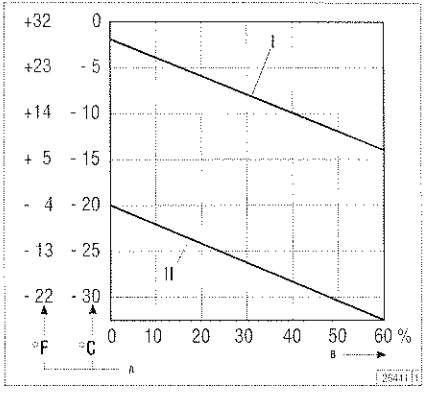
4.2.2 Winter-Grade Fuel

Waxing may occur at low temperatures, clogging the fuel system and reducing engine efficiency. If the ambient temperature is less than 0 °C, winter-grade fuel (suitable down to -20 °C) should be used. This fuel is available from the filling stations well in advance of the cold months.

- At temperatures below -20 °C, kerosene should be added to the diesel fuel. The relevant percentages are given in the adjacent diagram.
- Special diesel fuels can be used for climatic zones down to - 44 °C.

If summer-grade diesel fuel must be used at temperatures below 0 °C, up to 60% kerosene can be added (see diagram).

In most cases, adequate resistance to cold can be obtained by adding a flow improver (additive). Please inquire at your DEUTZ partner.



Legend:	
I	Summer diesel fuel
II	Winter diesel fuel
A	Ambient temperature
B	Proportion of kerosene to be added

Mix in tank only. Fill with the appropriate amount of kerosene first, then add the diesel fuel.

4.3.1 Water Quality for Coolant Preparation

The values given below must not be exceeded.
A test kit (order number 1213 0382) can be obtained from DEUTZ Service to check the quality of the water available.

Water quality		min.	max.
pH-value at 20°C /68° F		6.5	8.5
Chloride ion content	[mg/dm3]	–	100
Sulfate ion content	[mg/dm3]	–	100
Total hardness	[°dGH]	3	12

4.3.2 Coolant Preparation

The preparation and monitoring of coolant in liquid-cooled engines is especially important because corrosion, cavitation and freezing can lead to engine damage.

The coolant is prepared by admixing a cooling system protective liquid with the cooling water.

The cooling system must be monitored continuously (see 5.1). The water level and the cooling system protective liquid concentration should both be checked.

The cooling system protective liquid concentration can be checked with a tester commercially available (e.g. gefo glycomat®).

When **nitrite-based** cooling system protective liquids are mixed with **amine-based** liquids, harmful nitrosamines are formed.

4.3.3 Cooling System Protective Liquid

The cooling system protective liquid (nitrite-, amine- and phosphate-free, obtainable under order no. 0101 1490 in 5-liter containers) provides effective protection against corrosion, cavitation and freezing.
The concentration of the cooling system protective liquid in the coolant should not fall below/exceed the following limits:

Cooling system protective liquid	Water
max. 45% by vol. min. 35% by vol.	55% 65%

For the quantity, see table and section 9.1.
Other cooling system protective liquids, e.g. chemical corrosion inhibitors, can, in exceptional circumstances, be used in the coolant, in consultation with DEUTZ Service.

Order the cooling system protective liquid from:
DEUTZ Service

Cooling system protective liquids must be disposed of in accordance with environmental regulations.

Cooling System Protection

Protective liquid [% by vol.]	Antifreeze [°C]	Cooling system capacity *) [Liters]							
		8	9	10	12	14	16	18	20
		Cooling system protective liquid [Liters]							
35	–22	2,8	3,2	3,5	4,2	4,9	5,6	6,3	7,0
40	–28	3,2	3,6	4,0	4,8	5,6	6,4	7,2	8,0
45	–35	3,6	4,1	4,5	5,4	6,3	7,2	8,1	9,0
50	–45	4,0	4,5	5,0	6,0	7,0	8,0	9,0	10,0

*) For quantity of coolant in your engine, see Section 9.1.
Note: For figures in gray field, refer back to head-office.

5.1 Maintenance Schedule
5.2 Maintenance Chart
5.3 Maintenance Record

In running hours (h)[1]									check / clean / renew	Job	Section
once after [2] 50-150	Every 10 h and daily resp	every 125	250	500	1000	1500	2000	3000			
	●								●	Oil level [2] [10]	6.1.2/ 3.1.6
●									●	Engine for leakages	
	●								●	Oil bath- and dry type air cleanersr [3] [4]	6.3 / 6.4
		●							●	Battery and lead connections	6.7.1
		●	●	●	●		●		●	Cooling system (dep. on engine use) [3] [8]	6.3.1/ 6.3.2
●				●					●	Engine oil (dep. on engine use) [5]	6.1.1/ 6.1.2
●				●					●	Oil filter cartridge	6.1.3
●									●	Fuel filter cartridge	6.2.1
●					●				●	Fuel prefilter	6.2 / 6.3
●							●		● ●	Fuel system(leakage line,change defective lines) [7]	4.2 / 6.2
●						●			●	Valve clearance and rocker arm clearance (readjust if nec.)	6.6.1
●				●					●	Engine mounts (retighten if necessary)	9.2
●				●					●	V-belts (retension if nec.)	6.5
●									●	Alarm system	3.3
●									●	Fastenings	9.3
					●				●	Glow plugs [4]	
							● 7)		●	Coolant [6]	6.3.3/ 6.3.4
				●					●	Coolant , Additive-concentration	4.3.2/ 4.3.3
	● 9)								●	Coolant level	3.3.3
					●				●	Hoses/clamps on air intake side	

The specified engine maintenance times are maximum values. Depending on the operating environment, shorter maintenance intervals may be required. Please observe the operating instructions of the equipment manufacturer.

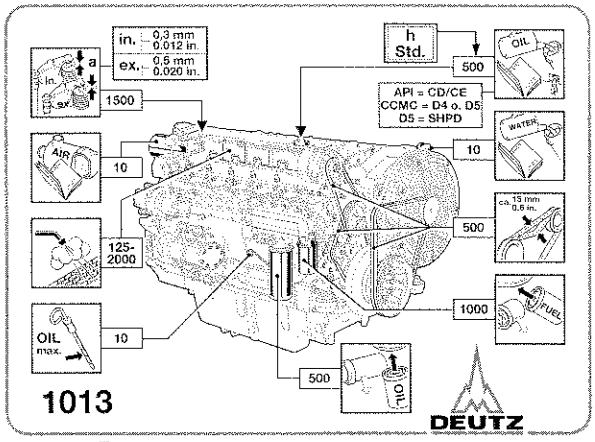
1) Max. perm. guide intervals
2) Commissioning new and overhauled engines
3) Clean if nec.: see Section 6.3
4) change if required
5) Oil change intervals: see Section 6.1.1
6) Check additive concentration every 500 OH (antifreeze or chemical corrosion inhibitor)
7) every two yearschange.
8) system cleaning
9) not necessary with integrated cooling system ith level monitor
10) During run-in period, check 2x daily

The maintenance chart shown here is supplied as self-adhesive label with each engine. It should be affixed where it can be seen clearly on the engine or driven equipment.

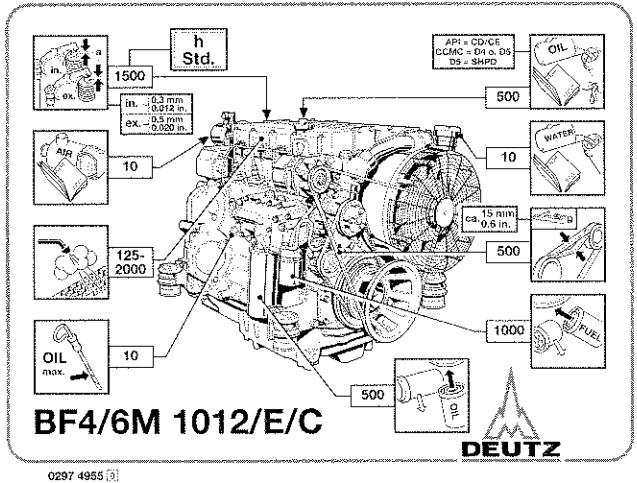
Check that this is the case.

If necessary, ask your engine or equipment supplier for a fresh supply of labels.

Routine work should be carried out according to the schedule in 5.1.



0297 4961 E



0297 4955 D

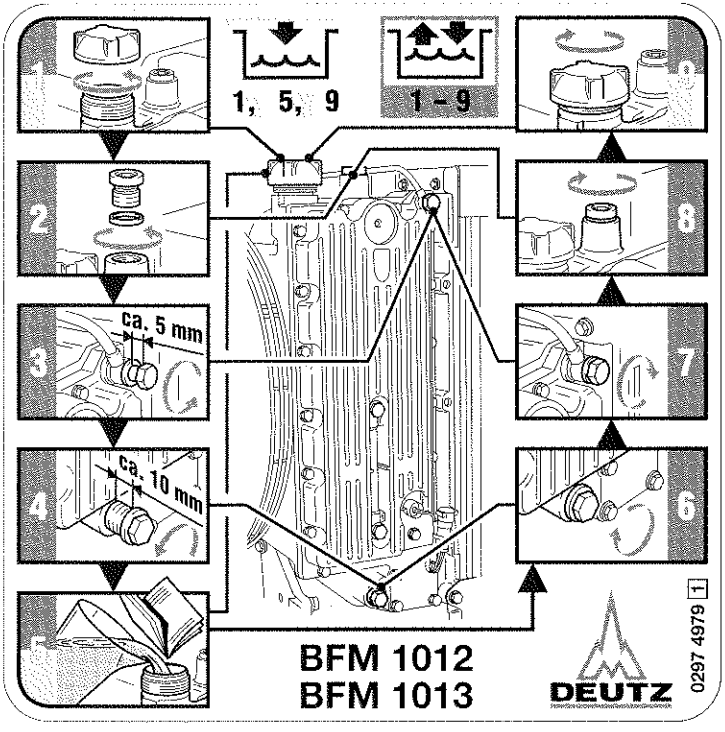
Stop the engine before carrying out any maintenance work.

The service diagram for series 1012/1013 (filling the cooling system, venting, bleeding) featured on this page is stuck on the engine as a servicing aid.

Check that this is the case!

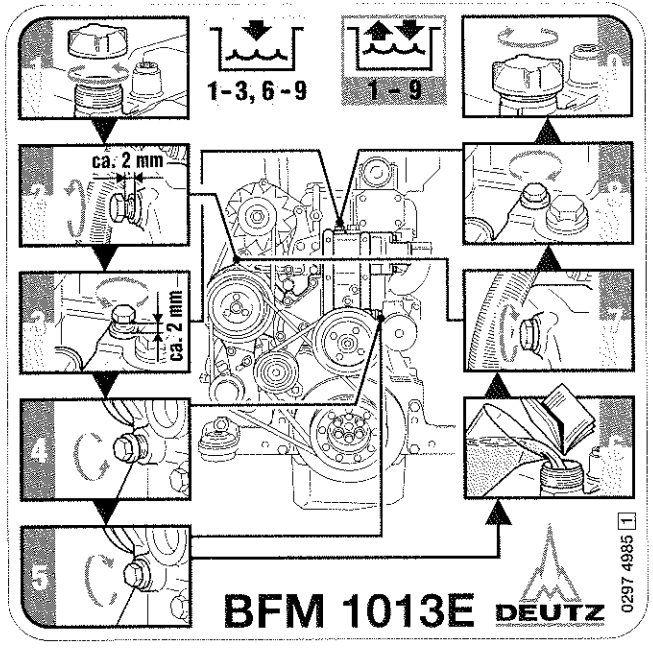
If the sticker is not on the engine, ask for a replacement from your engine or vehicle supplier.

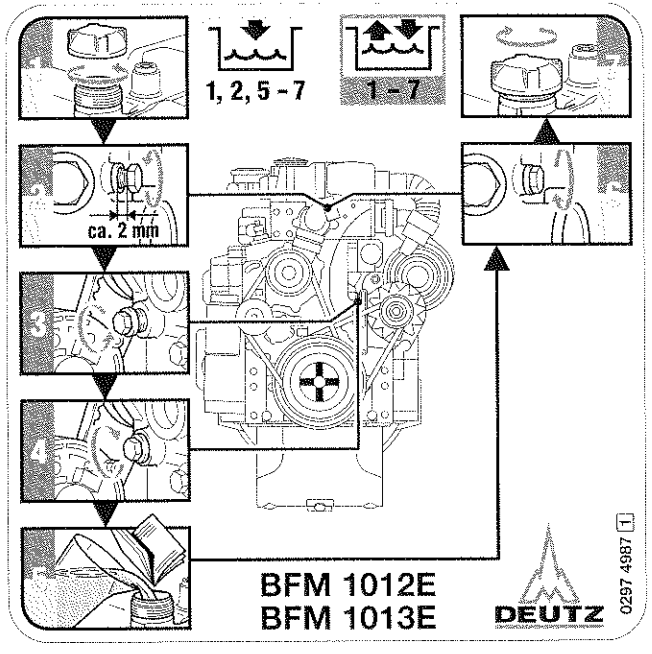
For a full description regarding servicing, see Sections 3.1.4, 6.3.3 and 6.3.4.



The service diagram for series 1012/1013 (filling the cooling system, venting, bleeding) featured on this page is stuck on the engine as a servicing aid. Check that this is the case!

If the sticker is not on the engine, ask for a replacement from your engine or vehicle supplier.
For a full description regarding servicing, see Sections 3.1.4, 6.3.3 and 6.3.4.





Hours.	Date	Signaure / Stamp	Hours	Date	Signaure / Stamp
50-150*			-		
125			250		
375			500		
625			750		
875			1000		
1125			1250		
1375			1500		
1625			1750		
1875			2000		
2115			2250		
2375			2500		
2625			2750		

* Commissioning new and overhauled engines
The maintenance jobs duly completed can be recorded in the above table.

Hours	Date	Signaure / Stamp	Hours	Date	Signaure / 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		

The maintenance jobs duly completed can be recorded in the above table.

Hours.	Date	Signaure / Stamp	Hours	Date	Signaure / Stamp
5875			6000		
6125			6250		
6375			6500		
6625			6750		
6875			7000		
7125			7250		
7375			7500		
7625			7750		
7825			8000		
8125			8250		
8375			8500		
8625			8750		

The maintenance jobs duly completed can be recorded in the above table.

Hours	Date	Signaure / Stamp	Hours	Date	Signaure / Stamp
8875			9000		
9125			9250		
9375			9500		
9625			9750		
9875			10000		
10125			10250		
10375			10500		
10625			10750		
10825			11000		
11125			11250		
11375			11500		
11625			11750		

The maintenance jobs duly completed can be recorded in the above table.

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 lube oil.
- If the engine runs fewer hours during the year than stated in the table, the oil should be changed at least **once a year.**
- The table refers to the following conditions:
  - For diesel fuel: sulfur content max. 0.5% by weight.
  - Continuous ambient temperatures down to –10°C / +14°F
- If the sulfur content is > 0.5 to 1% or the continuous ambient temperature below –10°C/ +14°F, the intervals between oil changes should be halved.
- In the case of fuels containing more than 1% sulfur, contact your **service representative.**

Oil Grade	NA Engines	TC Engines
API Classification	CC [1]	CD [1] CF CE [1] CF-4
ACEA Classification	E2-96	E2-96 + E3-96 [2] (SHPD) [3]

Oil Change Intervals	Service Group	Average Speed [km]	[OH]	[km]
Equipment Engines	–	–	500	–
Automotive Engines	I II III	25 40 60	– – –	10 000 20 000 30 000

[1] Lube oils having **both** a C- **and** an S classification (e.g.CD/SE) can be used. Oils with **only** a C classification (e.g. CE) generally perform very well in diesel engines and are to bepreferred.

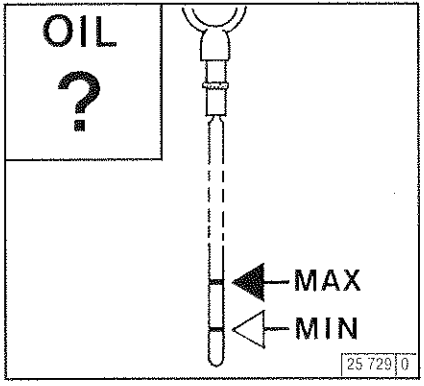
[2] E3-96 grade oil with sulfate ash content > 1.8 % by mass.

[3] SHPD lube oils can be used.
These are the equivalent of D5 grade.

Change the oil with the engine off but still warm (lube oil temperature approx. 80°C / 176°F.

6.1.2 Checking Oil Level / Changing Engine Oil

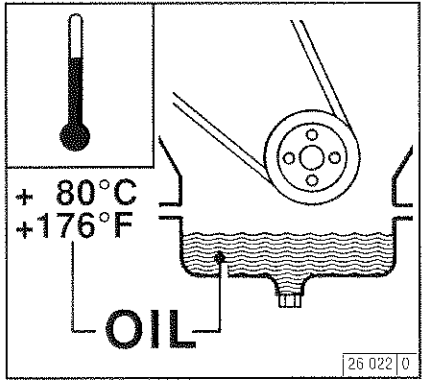
6.1.2.1 Checking Oil Level



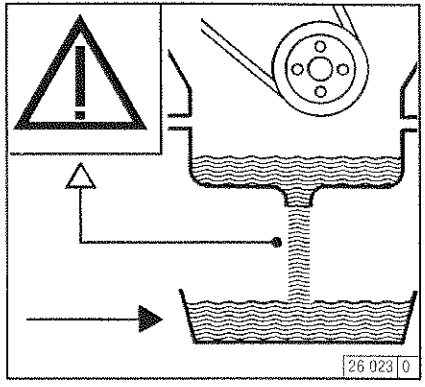
- Ensure that the engine or vehicle is in a horizontal position.
- – **Warm engine:**
  Switch off engine, wait 5 minutes and check the oil level.
- – **Cold engine:**
  Check oil level.
  To this end:
- Remove the oil dipstick.
- Wipe the dipstick with a non-fibrous, clean cloth.
- Insert it to the stop and remove again.
- Check the oil level, and if necessary, top up to the "**MAX**" mark.
  – If the oil level is only just above the "**MIN**" mark, more oil must be added.

The oil level must not drop below the "**MIN**" mark.

6.1.2.2 Changing Engine Oil



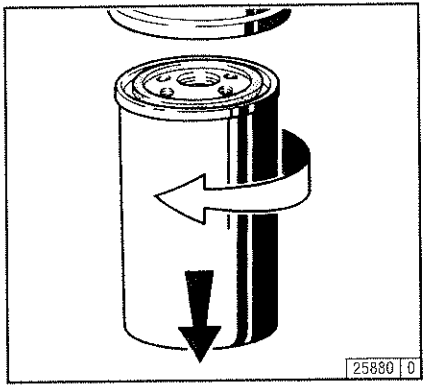
- Allow the engine to warm up.
- Ensure that the engine or vehicle is in a level position.
  – Lube oil temperature approx. 80 °C.
- Turn the engine off.



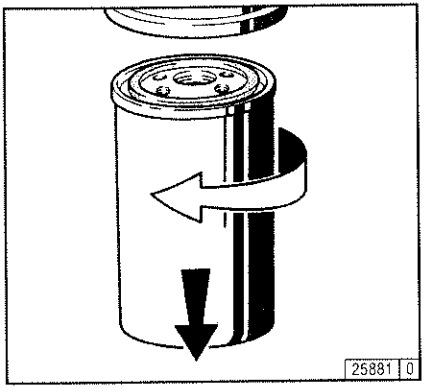
- Place oil tray under the engine.
- Unscrew drain plug.
- Drain oil.
- Fit oil drain plug, with the new gasket and tighten firmly (for torque, see 9.2).
- Pour in lube oil.
  – For grade / viscosity, see 4.1.
  – For quantity, see 9.1.
- Check oil level, see 6.1.2.1.

Be careful when draining hot oil – danger of scalds! Do not let used oil run into the soil but catch it in a container ready for proper disposal!

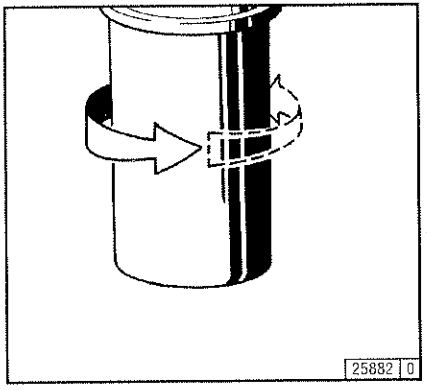
6.1.3 Changing Oil filter



- With fitted torsion lock:
  Loosen screws and slide clamps downwards.
- Undo the filter cartridge with commercial tool and spin off.
- Catch any dripping oil.



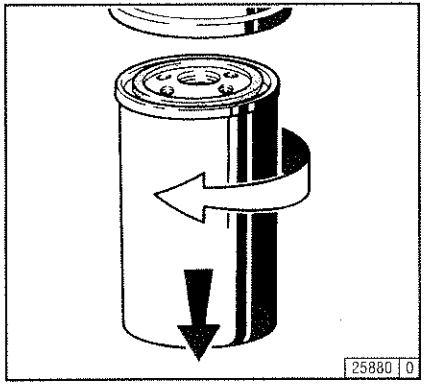
- Clean any dirt from the filter carrier rim.
- Lightly oil the rubber gasket of the new oil filter cartridge.
- Screw in the new cartridge finger tight against the gasket.
- Check that the cartridge is correctly seated against the gasket and tighten with a final half-turn.



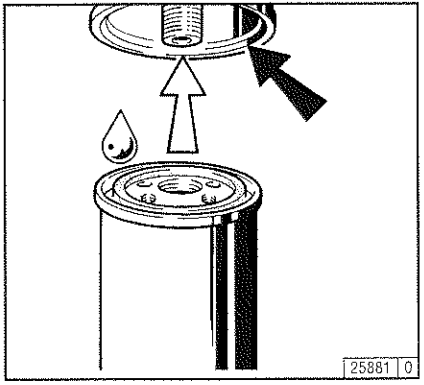
- If a torsion lock is fitted:
  Slide clamps up into position and tighten screws.
- Check oil level (see 6.1.2).
- Check oil pressure (see 3.3.1).
- Check cartridge seal.

Beware of burns from hot oil.

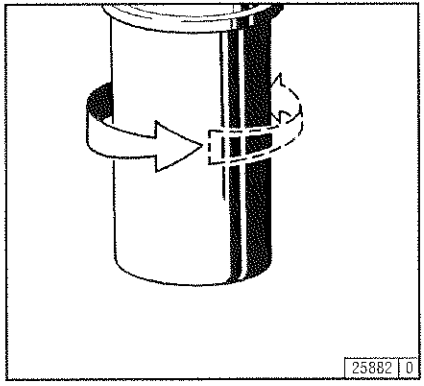
6.2.1 Changing Fuel Filter



- Close fuel stopcock.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any fuel.



- Clean any dirt from the filter carrier rim.
- Apply light film of oil or diesel fuel to the rubber gasket of the new fuel filter cartridge.
- Screw in the new cartridge finger tight against the gasket.

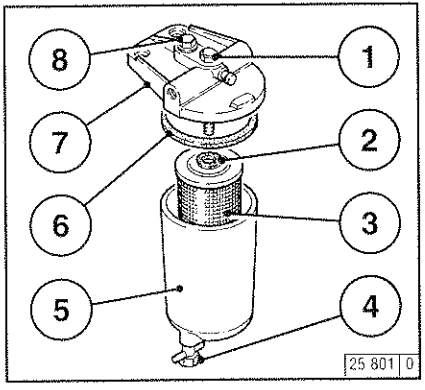


- Check that the cartridge is seated correctly against the gasket and tighten with a final half-turn.
- Open fuel stopcock.
- Check for leaks.

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

The fuel system does not need to be bled.

6.2.2 Cleaning or replacing the primary fuel filter and filter element



cleaning:

- Close the fuel shutoff cock.
- Place a fuel collecting container below the primary fuel filter.
- Loosen the drain screw 4 and drain the fuel.
- Unscrew the clamping screw 1 and remove the filter housing 5 with the filter element 3.
- Clean any dirt which might be present off the sealing surface of the filter carrier 7 and the filter element housing 5.
- Insert a new O-ring seal 6 and the filter element 3 (replace if necessary)
  - Push the filter element on the guide into the filter housing until approx. 3 cm are projecting above the rim of the housing.
- Press the filter housing 5 with the filter element 3 and the O-ring seal 6 against the filter bracket 7 and screw in position with clamping screw 1(tightening torque 25 Nm)
  Note: It must be possible to push the upper sealing ring 2 on the filter element 3 over the guide pipe connection on the filter bracket 7.
- Tighten the drain screw 4.
- Open the fuel shutoff cock.
- After the engine has been started, check for leaks.

replacing:

- Replace defective filter element 3 with a new filter element 3.

6.2.3 Draining water from the primary fuel filter / venting the primary fuel filter

draining water:

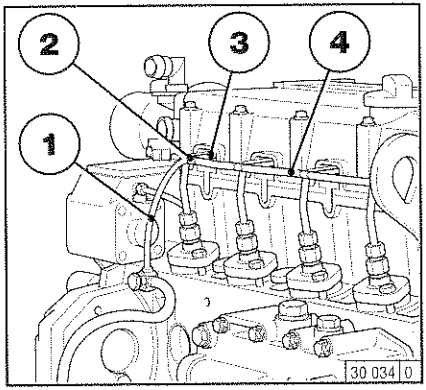
- Place a fuel collecting container below the primary fuel filter.
- Loosen the drain screw 4 and observe the liquid which flows out. When liquid flowing out is no longer water but fuel, tighten drain screw 4.
- After the engine has been started, check for leaks.

venting:

- The fuel system must be vented when the engine is started up for the first time, or if the tank has been run empty.
- Open the fuel shutoff cock.
- Start the engine and run it for approx. 2 minutes.
  - The system is filled.
- Place a fuel collecting container below the fuel filter.
- Loosen the vent screw 8 until bubble-free fuel runs out.
- Tighten the vent screw 8 (tightening torque 15_{-2} Nm).
- After the engine has been started, check for leaks.

When you are working on the fuel system, avoid open flames! Do not smoke!
Dispose of waste fuel in an environmentally friendly manner!

6.2.3 Change Fuel Leakage Line



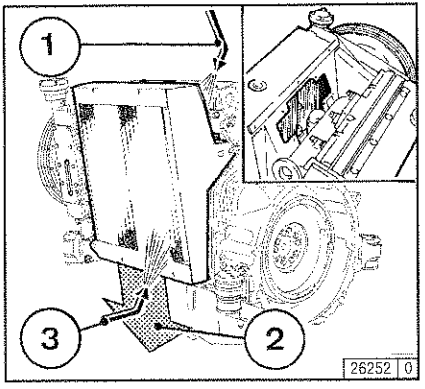
- Close the fuel shutoff valve.
- Disconnect rubber hoses 3 from the injection valves.
- Disconnect rubber hose 1 from fuel tank.
- Disconnect rubber hoses 4, 3 and 1 from unions 2 and dispose of in an environmentally friendly manner.
- Connect new rubber hoses 4, 3 and 1 to unions 2.
- Connect rubber hoses 3 to injection valves.
- Connect rubber hose 1 to fuel tank.
- Open fuel shutoff valve.
- Check for leaks after start-up.

6.3.1 Cleaning Intervals

- The amount of contamination in the cooling system depends on the engine application.
- Spilled oil or fuel on the engine increases the risk of contamination. Be especially careful if the engine is used in dusty environments.
- Serious contamination can occur, for example:
  - on construction sites where there is a high level of air-borne dust.
  - in harvesting application where there are high concentrations of chaff and chopped straw in the vicinity of the machine.
- Because applications vary, cleaning intervals have to be determined from case to case. The cleaning intervals given in the table below can be used as a guide.

Checking / Cleaning Intervals	
Suggested OH	**Application**
2000	Ships, gensets in enclosed spaces, pumps
1000	Vehicles on paved roads
500	Tractors, forklift trucks, mobile gensets
250	Vehicles on construction sites and unpaved roads, construction equipment, compressors,underground mining equipment
125	Agricultural machinery, harvester tractors

6.3.2 Cleaning Cooling System



Series 1012/1013

- Place a cleaning bath under the heat exchanger (it. 2).
- Remove the service flap on the heat exchanger (see insert).

Compressed Air

- Blow out heat exchanger with compressed air (first from it. 3, then from it. 1). Be careful not to damage the cooling fins.
- Wash out loosened dirt with a hose.

Cold Cleansing Agent

- Spray the heat exchanger with a commercial cold cleansing agent and let stand for about 10 minutes.
- Hose clean from it. 3, then from it. 1 with a strong jet of water (do not spray water directly onto the alternator, wiring or electronic components).

- Refit service flap.
- Run the engine up to normal operating temperature to evaporate any remaining water.

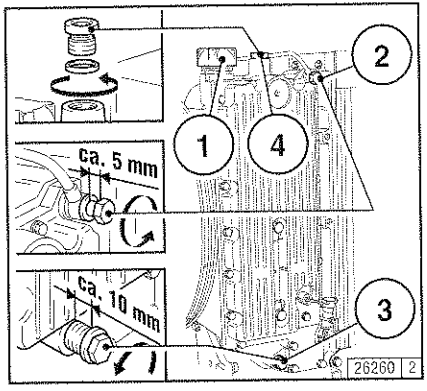
Series 1012E/1013E

- If an external cooling system is fitted, follow the manufacturer's instructions.

Hose pressure: max. 100 bar

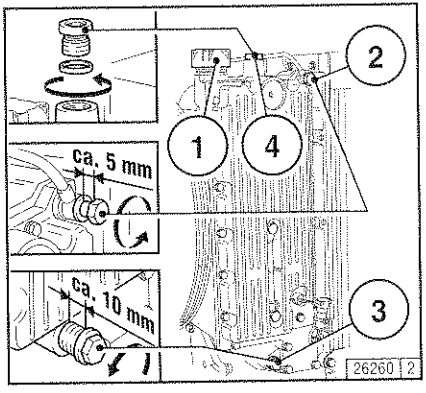
6.3.3 Draining Cooling System

1012 / 1013



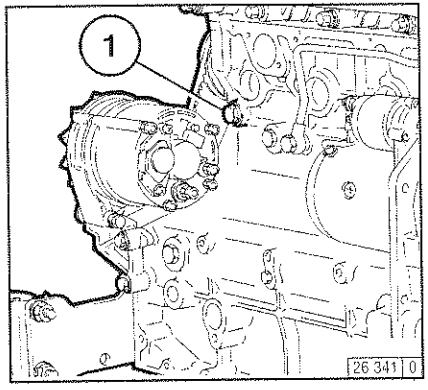
- Place container under drain plug 3.
- Unscrew cap 1.
- Unscrew drain plug 3 fully.
- Drain coolant.
- Screw drain plug 3 in up to first groove (arrow).
- Proceed to 6.3.4: Filling/Bleeding Cooling System.

6.3.4 Filling / Bleeding Cooling System 1012 / 1013



- Screw off cap 1.
- Relax screw plug 2.
- Turn out bleed screw 4.
- Top up coolant to filler neck top edge (heating valve of system, if so equiped, must be open).
- Tighten screw plug 2 (to 18 Nm).
- Tighten bleed screw 4 (to 40 Nm).
- Screw on cap 1.
- After the first engine run, check coolant level on cold engine (see Section 3.3.3).

6.3.5 Draining / Filling / Bleeding Cooling System 1012 E / 1013 E



- Place container under drain plug 1.
- Remove drain plug 1 on crankcase.
- Drain coolant.
- Tighten drain plug 1.

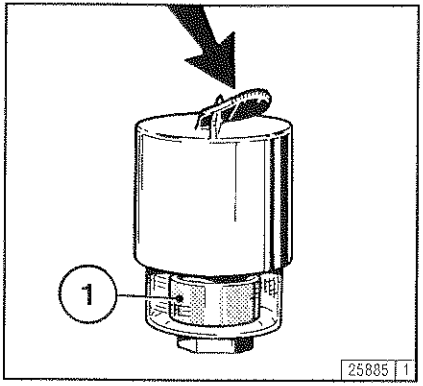
Filling / Bleeding

- Fill with coolant and bleed cooling system according to manufacturer's instructions.

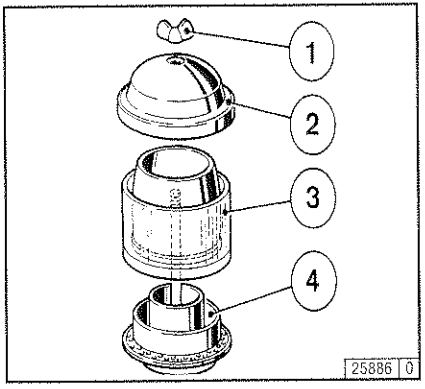
Be careful when draining hot coolant – danger of scalds! Collect drained coolant and dispose of according to environmental regulations.

6.4.1 Cleaning Intervals

- The amount of dirt in the air cleaner depends on the amount of dust in the air and the size of the air cleaner used. If a high level of dust is anticipated, a cyclone-type precleaner can be fitted to the air cleaner.
- Cleaning intervals will have to be determined from case to case.
- If a dry type air cleaner is used, clean when indicated by the service indicator or switch.
- Air cleaner servicing is needed when:
  - **Service Indicator**
    the red signal 1 is fully visible when the engine is off.
  - **Service Switch**
    the yellow pilot light comes on when the engine is running.
- After carrying out service work, reset the signal by pressing the button on the service indicator.



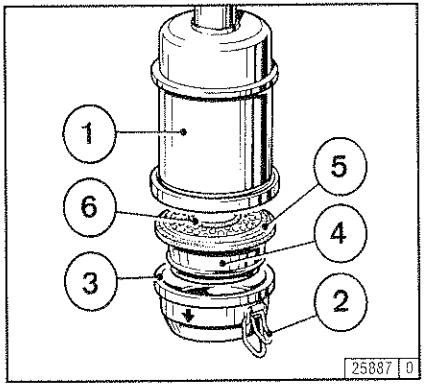
6.4.2 Emptying Cyclone Type Precleaner



- Undo wing nut 1 and remove cover 2.
- Remove collector bowl 3 from lower section 4 and empty. Clean leaves, straw and other foreign matter from lower section of precleaner.
- Reposition collector bowl 3 onto lower section 4, fasten cover 2 in place by tightening wing nut 1.

Never fill collector bowl with oil. Replace collector bowl if damaged.

6.4.3 Cleaning Oil Bath Air Cleaner

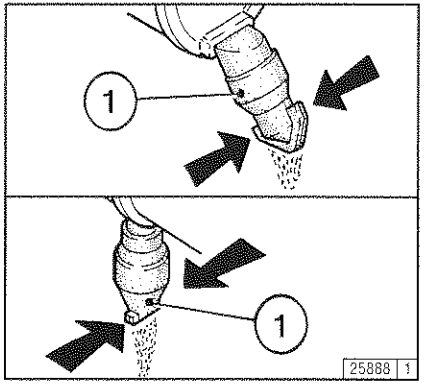


- Turn engine off and wait about 10 minutes for the oil to drain from filter housing 1.
- Release snap clips 2 and remove oil cup 3 together with filter element 4. If necessary prize element out with a screwdriver, taking care not to damage the rubber gasket 5.
- Remove dirty oil and sludge. Clean oil cup.
- Clean filter element 4 in diesel fuel and allow to drip-dry.
- Clean filter housing 1 if very dirty.
- Inspect and replace rubber gaskets 5 and 6 if necessary.
- Fill oil cup with engine oil up to the mark (arrow) (for viscosity, see 4.1.2).
- Refit oil cup and element to filter housing and secure with snap clips.

Never clean air cleaner with gasoline. Dispose of old oil in accordance with environmental regulations.

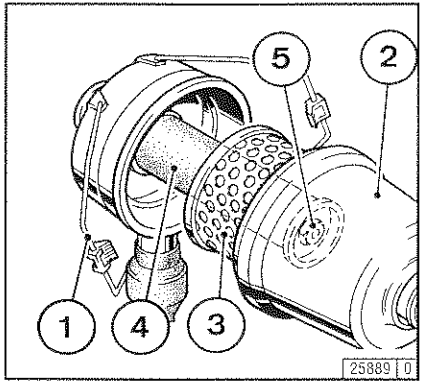
6.4.4 Dry Type Air Cleaner

Dust Discharge Valve



- Empty dust discharge valve 1 by pressing apart lips of discharge slot as indicated by arrows.
- Clean discharge slot from time to time.
- Remove any caked dirt by pressing together the upper section of the valve.

Filter Cartridge

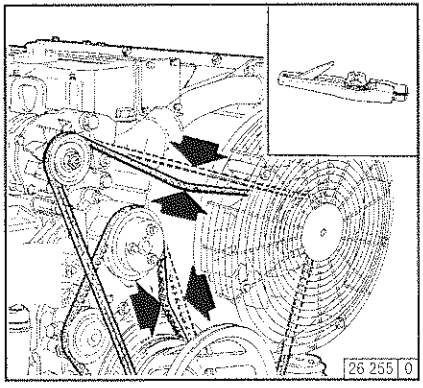


- Undo clip fasteners 1.
- Take off hood 2 and remove cartridge 3.
- Clean cartridge (replace at least once a year).
- Clean cartridge 3:
  - Blow out from inside out with dry compressed air (max. 5 bar), or
  - in difficult cases, tap out, taking care not to damage the cartridge, or
  - wash according to manufacturer's instructions.
- Check paper filter (light showing through) and gaskets for damage. Replace if necessary.
- After five air cleaner services or after two years at the latest, replace safety cartridge 4 (never clean).
  To do so:
  - Undo hex. nut 5 and remove cartridge 4.
  - Install new cartridge, insert and tighten hex. nut.
- Install cartridge 3, replace hood 2 and do up clip fasteners.

Never clean filter cartridge with gasoline or hot fluids.

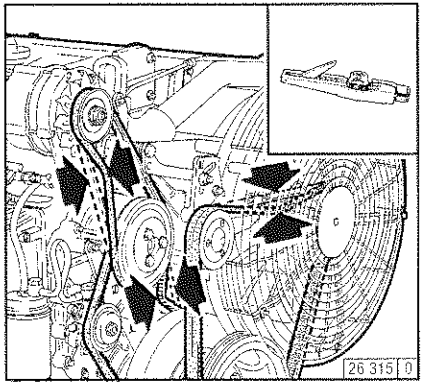
6.5.1 Checking V-Belts

1012

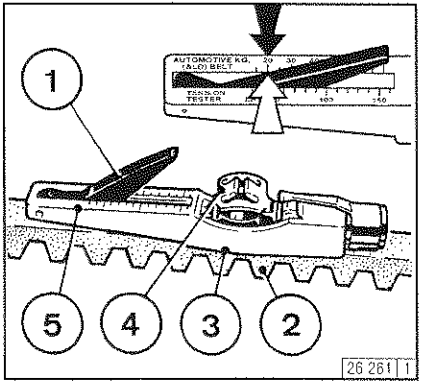


- Inspect entire V-belt for damage.
- Replace damaged V-belts.
- After installing new belts, run engine for 15 minutes, then check belt tension.
- Use a V-belt tension gauge (see 9.3) to check belt tension.
  - Place indicator arm 1 into gauge.
  - Position gauge on V-belt 2, midway between the pulleys, with flange 3 on bottom of gauge against the edge of belt.
  - Push slowly on the black pad 4 at right angles to belt 2 until the spring is heard or felt to trigger.

1013

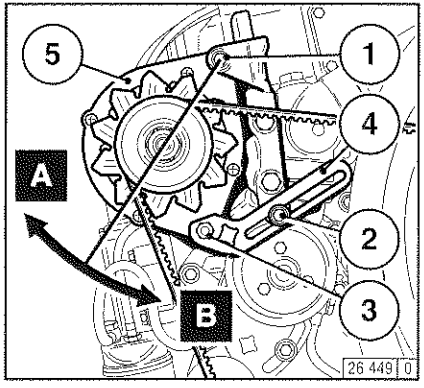


- Carefully remove the gauge without altering the position of the indicator arm.
- Read off the value: Turn the gauge sideways to see the exact spot where the top of the black indicator arm 1 intersects scale 5 (arrow). For settings, see 9.1.
- If necessary, retension belt and measure again.



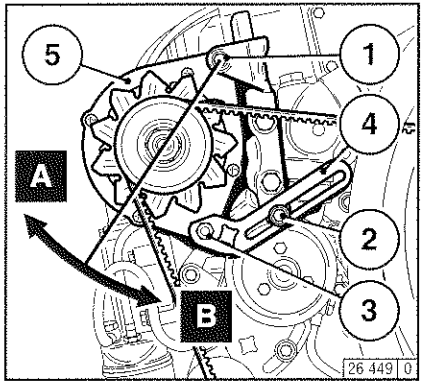
Check, tension and change belts only with the engine off. Refit belt guard, if provided.

6.5.2 Tensioning Fan / Alternator Belts 1012



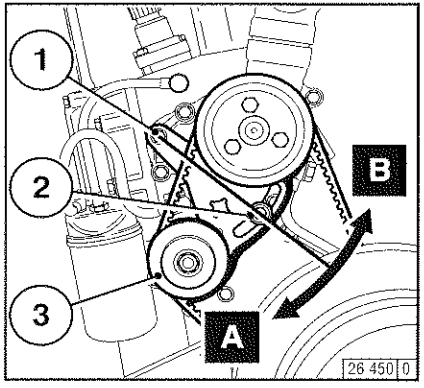
- Slacken off bolts 1, 2 and 3.
- Lift alternator 5 in direction A of arrow correct belt tension is achieved.
- Tighten bolts 1, 2 and 3.

6.5.3 Changing Fan / Alternator Belts 1012



- Slacken off bolts 1, 2 and 3.
- Turn bolt 2 to lower alternator 5 in direction B of arrow.
- Remove and replace belt.
- Tension belt in direction A of arrow until correct tension is achieved.
- Tighten bolts 1, 2 and 3.

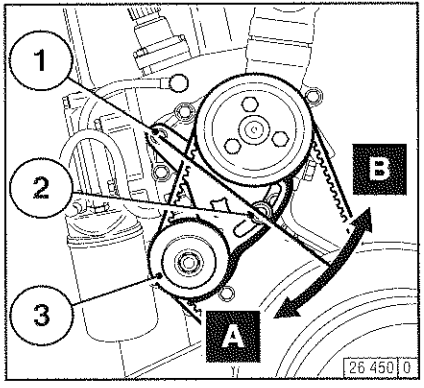
6.5.4 Tensioning Coolant / Fuel Pump Belts 1012



- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction (A) of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

Check, tension and change belts only with the engine off. Refit belt guard, if provided.

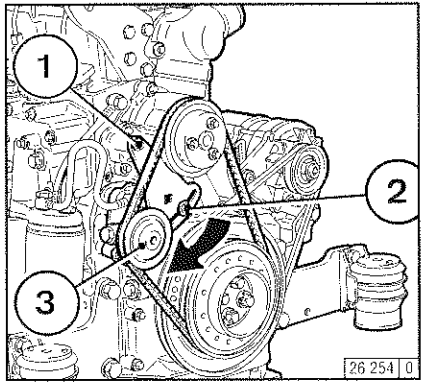
6.5.5 Changing Coolant / Fuel Pump Belts 1012



- Remove fan belt as described in 6.5.3.
- Slacken off bolts 1 and 2.
- Push fuel pump in direction B of arrow.
- Remove and replace belt.
- Push fuel pump in direction A of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.
- Reinstall fan belt and tension as described in 6.5.2.

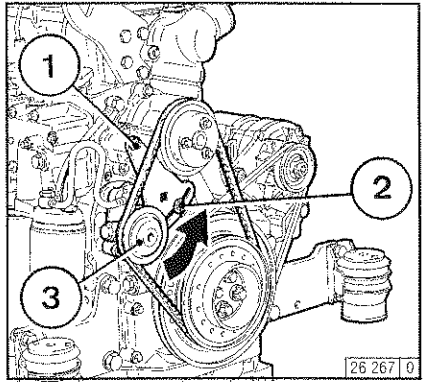
Check, tension and change belts only with the engine off. Refit belt guard, if provided.

6.5.6 Tensioning Coolant / Fuel Pump Belts 1012 E



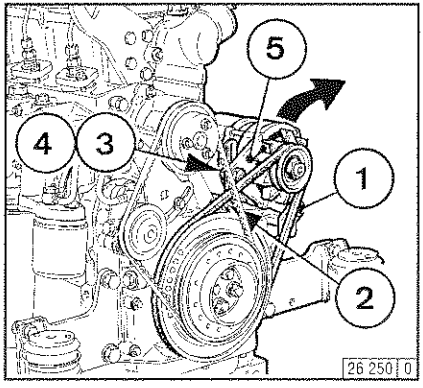
- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

6.5.7 Changing Coolant / Fuel Pump Belts 1012 E



- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction of arrow.
- Remove and replace belt.
- Push fuel pump in opposite direction of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

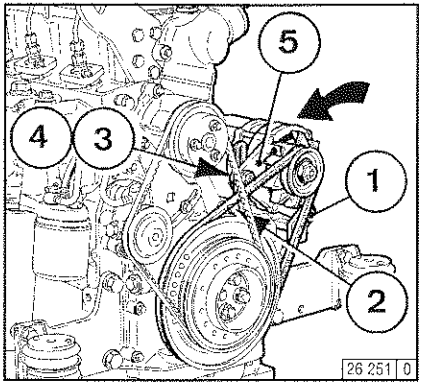
6.5.8 Tensioning Alternator Belt 1012 E



- Slacken off bolts 1, 2 and 4.
- Move alternator 5 in direction of arrow by turning bolt 3 until correct belt tension is achieved.
- Tighten bolts 1, 2 and 4.

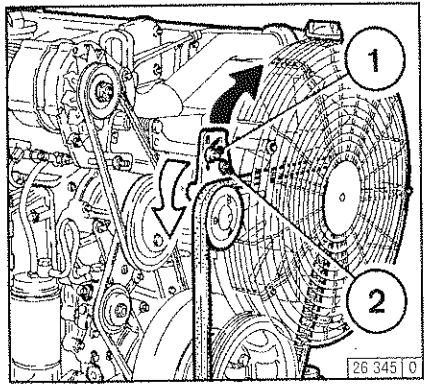
Check, tension and change belts only with the engine off. Refit belt guard, if provided.

6.5.9 Changing Alternator Belt 1012 E



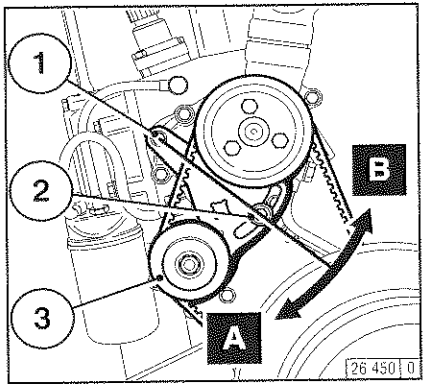
- Remove fuel pump belt as described in 6.5.7.
- Slacken off bolts 1, 2 and 4.
- Move alternator 5 in direction of arrow by turning bolt 3.
- Remove and replace belt.
- Move alternator 5 in opposite direction of arrow by turning bolt 3 until correct belt tension is achieved.
- Tighten bolts 1, 2 and 4.
- Reinstall fuel pump belt and tension as described in 6.5.6.

6.5.10 Tensioning / Changing Fan Belt 1013



- Slacken off bolts 1 and 2.
  - Tensioning:
    Insert square wrench in square and pull in direction of arrow until correct belt tension is achieved.
  - Changing:
    Insert square wrench in square and loosen in opposite direction of arrow. Tension new belt as described above.
- Tighten bolts 1 and 2.

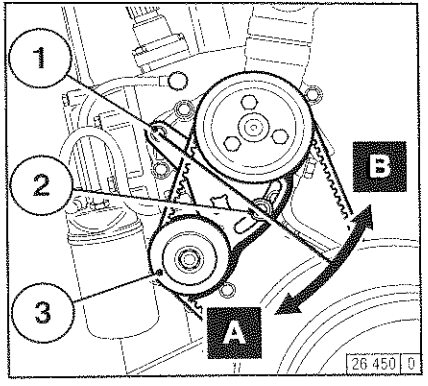
6.5.11 Tensioning Coolant / Fuel Pump belts 1013



- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction (A) of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

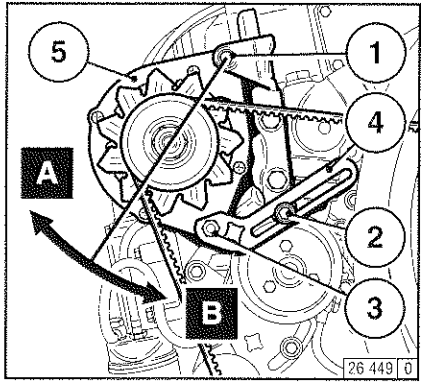
Check, tension and change belts only with the engine off. Refit belt guard, if provided.

6.5.12 Changing Coolant / Fuel Pump Belts 1013



- Remove fan / alternator belt as described in 6.5.10 and 6.5.13.
- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction (B) of arrow.
- Remove and replace belt.
- Push fuel pump in direction (A) of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.
- Reinstall fan / alternator belt and retension as described in 6.5.10 and 6.5.13.

6.5.13 Tensioning /Changing Alternator Belt 1013



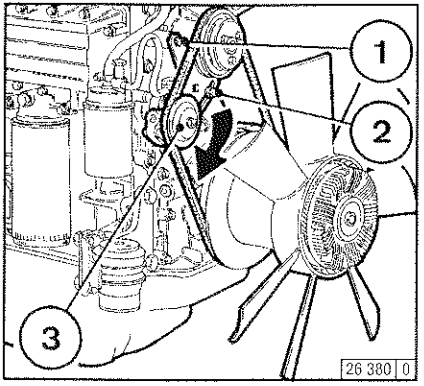
Tensioning:

- Slacken off bolts 1, 2 and 3.
- Move alternator 3 in direction (A) of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

Changing:

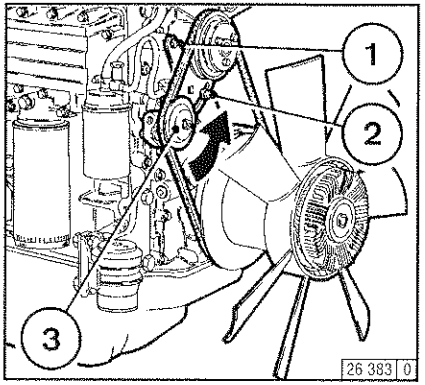
- Slacken off bolts 1 and 2.
- Move alternator in direction (B) of arrow until belt is exposed.
- Remove and replace belt, tension (see above).
- Tighten bolts 1, 2 and 3.

6.5.14 Tensioning Coolant /Fuel Pump Belts 1013 E



- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

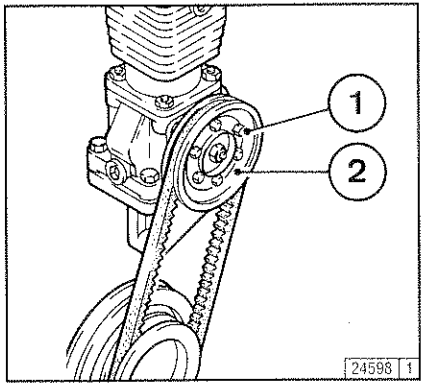
6.5.15 Changing Coolant / Fuel Pump Belts 1013 E



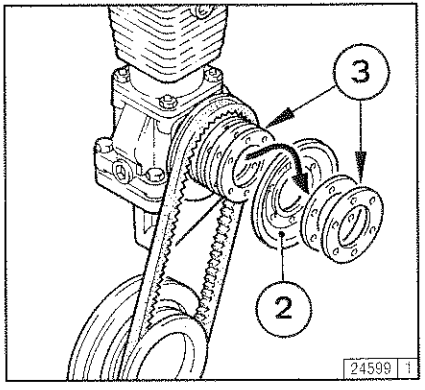
- Slacken off bolts 1 and 2.
- Push fuel pump 3 in direction of arrow.
- Remove and replace belt.
- Push fuel pump 3 in opposite direction of arrow until correct belt tension is achieved.
- Tighten bolts 1 and 2.

Check, tension and change belts only with the engine off. Refit belt guard, if provided.

6.5.16 Tensioning / Changing Compressor Belt



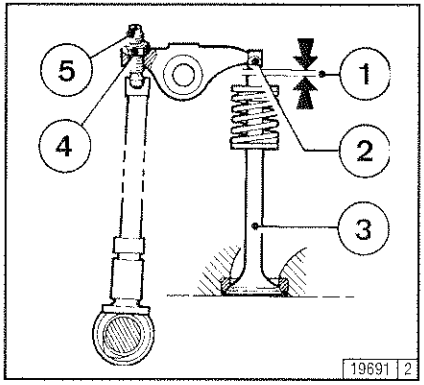
- Remove hex. bolts 1.
- Take off outer half-pulley 2.
- Replace belt if necessary.

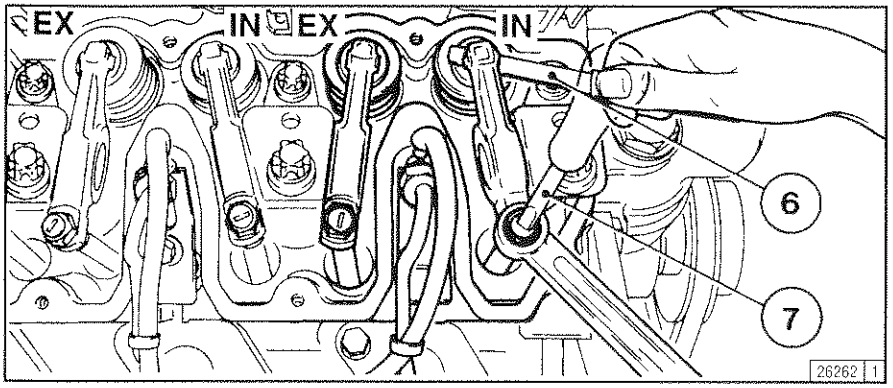


- To retension belt, remove one or more shims 3 – as may be required – from inside. Place removed shim(s) outside on removed half-pulley 2.
- Turn engine over while tightening bolts 1 to prevent belt being pinched.

Check, tension and change belts only with the engine off. Refit guard, if provided.

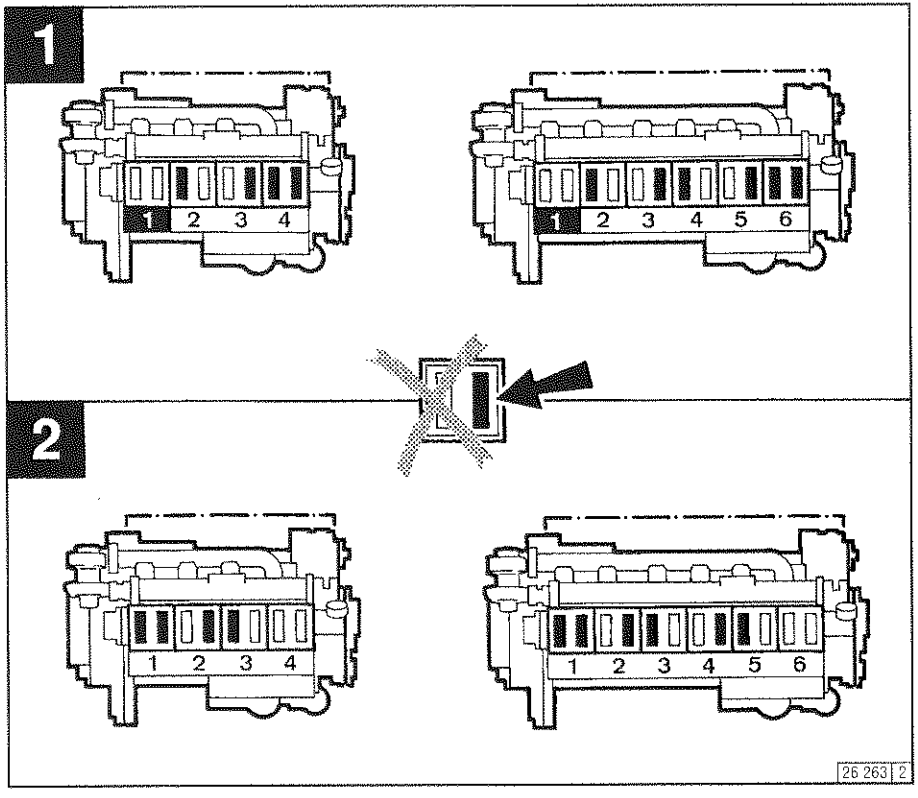
6.6.1 Checking / Adjusting Valve Clearances





- Slacken off breather valve and swing to one side.
- Remove rocker cover.
- Position crankshaft as per schematic 6.6.1.1
- Before adjusting valve clearance, allow engine to cool down for at least 30 minutes. The oil temperature should be below 80 °C / 176 °F.
- Check valve clearance between rocker arm / tappet contact face 2 and valve stem 3 with feeler gauge 6 (there should be only slight resistance when feeler blade is inserted). For permissible valve clearance, see 9.1.
- Adjust valve clearance if necessary:
  - Release locknut 4.
  - Use screwdriver 7 to turn setscrew 5 so that the correct clearance is attained after locknut 4 has been tightened.
- Check and adjust valve clearance on all remaining cylinders.
- Replace rocker cover (use new gasket is needed).
- Swing breather valve back into position and secure.

6.6.1.1 Valve Clearance Adjustment Schematic



- **Crankshaft Position 1:**

  Turn crankshaft until both valves in cylinder 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearance of valves **marked in black** on schematic. Mark respective rocker arm with chalk to show that adjustment has been done.

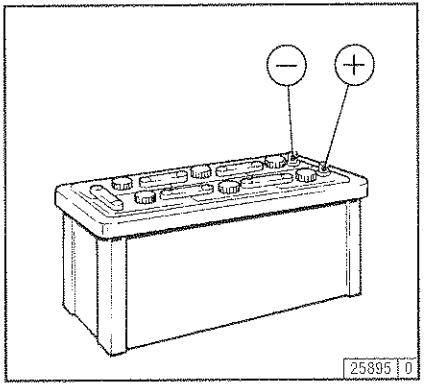
- **Crankshaft Position 2:**

  Turn crankshaft one full revolution (360°).

  Adjust clearance of valves **marked in black** on schematic.

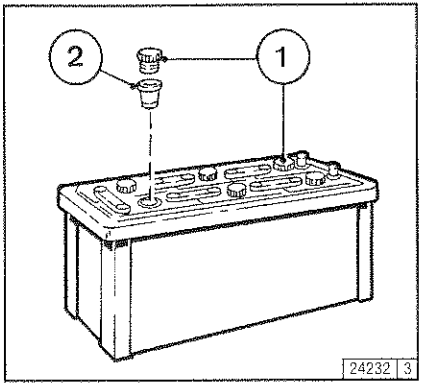
6.7.1 Battery

6.7.1.1 Checking Battery and Cable Connectors



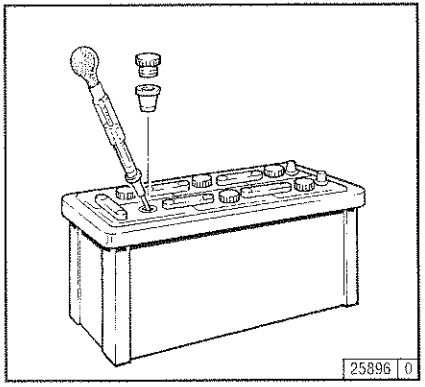
- Keep battery clean and dry.
- Undo dirty clamps.
- Clean terminal posts (+ and –) and clamps of the battery, and grease with acid-free and acid-resistant grease.
- When reassembling, ensure that clamps make good contact. Do up clamp bolts finger tight.

6.7.1.2 Checking Electrolyte Level



- Remove caps 1.
- If testers 2 are used, the electrolyte should come up to their base.
- If testers are not used, the electrolyte level should be 10-15 mm above the top of the plates.
- If necessary, top up with distilled water.
- Replace caps.

6.7.1.3 Checking Specific Gravity of Electrolyte



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

  The hydrometer reading (see table on following page) indicates the state of charge. During measurement, the temperature of the electrolyte should preferably be 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, recharge immediately

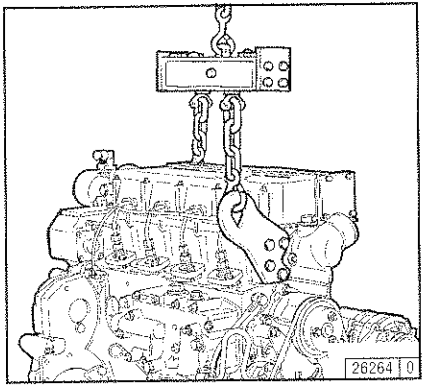
* Measurement of specific gravity in °Bé is out of date and rarely used today.

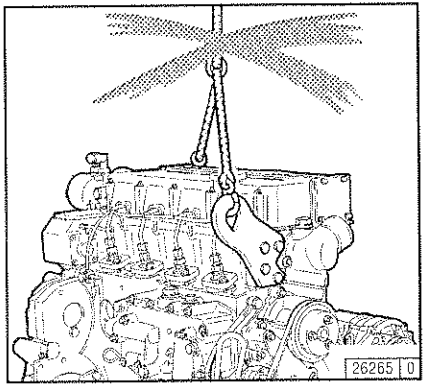
The gases emitted by the battery are explosive. Keep sparks and naked flames away from the battery.
Do not allow battery acid to come into contact with skin or clothing.
Wear protective goggles.
Do not rest tools on the battery.

6.7.2 Three-Phase Alternator

- Never disconnect the cables between battery, alternator and regulator while the engine is running.
- If, however, it is necessary to start and operate the engine without the battery, disconnect the regulator from the alternator before starting.
- Be sure not to confuse the battery terminals.
- Replace defective bulb of the charge pilot lamp immediately.
- Cleaning the engine: Do not spray water/steam directly onto the alternator. Run the engine up to normal operating temperature to evaporate any remaining water.
- The habit of touching a lead against the frame to check whether it is live must under no circumstances be used with three-phase electrical systems.
- In the case of electric welding, connect the ground terminal on the welder directly to the piece being welded.

6.7.3 Lifting Tackle





- Always use proper lifting tackle when transporting the engine.

Use only the correct lifting tackle.

7.1 Diagnosis Chart

- If engine problems occur, they frequently have their cause in improper operation or engine maintenance.
- If problems do occur, always check first that the operating and maintenance instructions have been followed.
- A diagnosis chart is given on the facing page.
- If you cannot identify the cause of the problem or are unable to rectify it yourself, contact the nearest service representative.

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

Important:

When carrying out repair work, never start the engine with speed governor removed.

Disconnect battery.

Fault											Cause	Remedy	
Engine fails or is difficult to start												Check	P
Engine starts but runs unevenly or stalls												Adjust	E
Engine overheats. Temperature monitor gives warning												Replace	W
Engine gives poor performance												Clean	R
Engine not firing on all cylinders												Top up	A
Engine has little or no oil pressure												Lower level	S
Engine oil consumption excessive													
Engine smokes											- blue		
											- white		
											- black		
											Not declutched (where possible)	Operation	P
●											Below starting limit temperature		P
●									●		Engine shutdown lever in stop position (faulty solenoid)		P
●			●								Oil level too low		A
		●			●						Oil level too high		S
		●	●			●	●				Excessive inclination of engine		P / E
					●	●	●				Speed control lever set to middle position		P / E
●											Dirty air cleaner/Faulty turbocharger	Combustion air	P / W
		●	●							●	Air cleaner service switch/indicator defective		P
		●	●							●	LDA* defective (leaking line)		P
			●							●	Charge air line leaking		P / W
		●	●							●	Coolant pump defective	Cooling system	P / R
			●							●	Charge air cooler contaminated		P / R
		●									Coolant heat exchanger dirty		P / R
●	●	●	●	●							Cooling fan defective, split or loose V-belt (belt-driven fuel pump)		P / W
	●	●									Cooling air temperature rise/ hot air recirculation		P
●											Battery defective or discharged	Electrics	P

*LDA = Aneroid device

Fault											Remedy	
Engine fails or is difficult to start											Check	P
Engine starts but runs unevenly or stalls											Adjust	E
Engine overheats. Temperature monitor gives warning											Replace	W
Engine gives poor performance											Clean	R
Engine not firing on all cylinders											Top up	A
Engine has little or no oil pressure											Lower level	S
Engine oil consumption excessive												
Engine smokes - blue												
- white												
- black												
Cause											Section	
●											Electrics	**P**
Electrics Cable connections to starter, electrical system loose or oxidized												
●												**P**
Starter defective or pinion does not engage												
●	●		●					●	●		Engine	**E**
Incorrect valve clearance												
●	●		●	●								**P**
Leaking injection line												
		●										**P / R**
Vent pipe blocked (coolant heat exchanger)												
●								●				**P**
Glow plugs defective												
●	●	●	●	●				●	●			**P / W**
Injector defective												
●	●		●	●								**P / W**
Air in fuel system												
●	●		●	●								**P/ R /W**
Fuel filter/prefilter dirty												
		●										**W**
Oil filter defective												
●					●	●					Operating media	**W**
Incorrect lube oil SAE class or quality												
●	●		●					●				**P/ W**
Fuel quality not as per Operation Manual												
		●										**P/ A**
Coolant level too low												

Table 2 of 2

8.1 Preservation

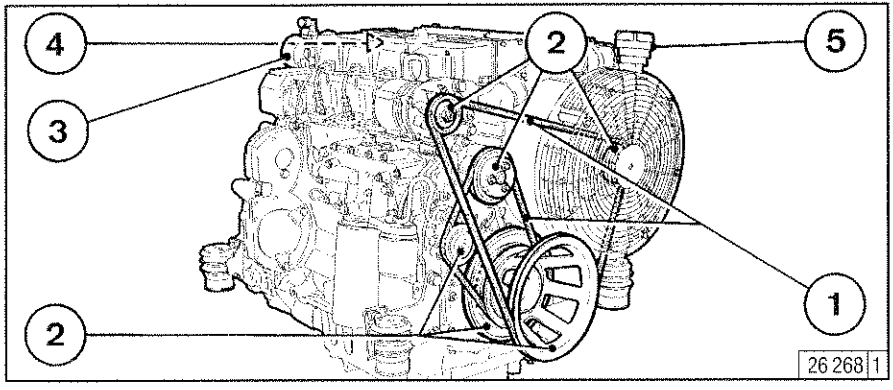
8

8.1 Preservation

If the engine is to remain idle for an extended period of time, it is necessary to take protective measures to prevent rust formation. The preservative measures described here will protect the engine for up to 6 months. The procedure will have to be reversed before the engine is re-commissioned.

- Anti-corrosion oils to specification:
  - MIL-L-21260B
  - TL 9150-037/2
  - NATO code C 640/642

- Recommended cleansing agent to remove preservatives when recommissioning engine:
  - Petroleum benzine (hazardous materials class A3)



Preserving Engine:

- Clean engine (with cold cleansing agent if preferred). See 6.3.2.
- Run engine until warm, then turn off.
- Drain engine oil (see 6.1.2) and fill with anti-corrosion oil.
- Drain coolant (see 6.3.3/6.3.5).
- Fill with anti-corrosion agent (see 4.3.3).
- If necessary, clean oil bath air cleaner (see 6.4.3) and fill with anti-corrosion oil.
- Drain fuel tank.
- Make up a mixture of 90% diesel fuel and 10% anti-corrosion oil, and refill fuel tank.
- Run engine for about 10 minutes.
- Turn engine off.
- Turn engine over manually several times.
- If using starter, set shutdown lever to stop position.
- Remove V-belts 1 and store in wrapped condition.
- Spray grooves of V-belt pulleys 2 with anti-corrosion agent.
- Close off intake ports 3 and exhaust ports 4.
- Lightly grease and replace coolant filler 5.
- Drain anti-corrosion agent (see 6.3.3 / 6.3.5).

Removing Engine Preservatives:

- Remove anti-corrosion agent from grooves in V-belt pulleys 2.
- Install V-belts 1. Retension after brief operation is necessary (see 6.5).
- Remove covers from intake port 3 and exhaust port 4.
- Fill with coolant (see 6.3.4 / 6.3.5).
- Start engine.

9.1 Engine Specifications and Settings
9.2 Torque Wrench Settings
9.3 Tools

9

Model BFM 1012/E		BF4M 1012 BF4M 1012 E	BF4M 1012 C BF4M 1012 EC	BF6M 1012 BF6M 1012 E	BF6M 1012 C BF6M 1012 EC
Number of cylinders		4	4	6	6
Cylinder arrangement		vertical, in line			
Bore	[mm]	94			
Stroke	[mm]	115			
Total displacement	[cm³]	3192	3192	4788	4788
Compression ratio	[ε]	17,5			
Working cycle / Combustion system		4-stroke diesel with turbocharging and direkt injection			
Charge air cooler		w/o	w/	w/o	w/
Direction of rotation		counter clockwise			
Weight 1012/C incl. cooling system	[kg approx.]	Refer to head-office			
Weight 1012E/EC without cooling system as per DIN 70020-A	[kg approx.]	330	332	435	437
Engine power	[kW]	1)			
Speed	[rpm]	1)			
Valve clearance (cold engine)	[mm]	inleete 0,3 $^{+0.1}$ / exhaust 0,5 $^{+0.1}$			
Injector opening pressure	[bar]	250 bar			
Start of delivery	[°crank angle bTDC]	1)			
Firing order		1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4
V-belt tension:		Tension / Retension 2)			
Alternator – Fan	[N]	450 / 300 $^{\pm 50}$			
Fuel pump – Coolant pump	[N]	450 / 300 $^{\pm 50}$			
Compressor	[N]	550 / 400 $^{\pm 50}$			

1) Engine power, speed, start of delivery are stamped on engine rating plate (see also 2.1)
2) Retension 15 minutes after engine has run under load.

Model BFM 1012/E		BF4M 1012 BF4M 1012 E	BF4M 1012 C BF4M 1012 EC	BF6M 1012 BF6M 1012 E	BF6M 1012 C BF6M 1012 EC
Cooling system		Liquid cooled / Cooling system protection			
Coolant quantity					
(coolant capacity of engine only) 1012E/EC[5]	[liters approx.]	5,6	5,6	7,3	7,3
1012/C with 300 OD fan	[liters approx.]	9,3	10,0	12,2	13,6
370 OD fan	[liters approx.]	9,2	9,9	12,1	13,5
Permissible continuous coolant temperature at engine outlet	[°C]	max. 110			
Temperature difference between		4 to 8			
Coolant inlet/outlet	[°C]	83			
Thermostat full open temperature	[°C]	95			
Coolant prewarming		[4]			
Coolant pump					
Delivery pressure in	[bar]	1,2	1,3	1,2	1,2
Delivery rate in	[m³/h]	6,0	12,0	12,0	12,0
Power consumption in	[kW]	1,0	1,4	1,4	1,4
Lubrication		forced-feed lubrication			
SAE oil	15 W 40	15 W 40			
Oil temperature in oil pan	[°C]	max. 125			
Min. oil pressure with engine warm (120°C) and at low idle	[bar]	0,8			
Oil capacity (first fill-up) without filter	[liters approx.]	8,5 [3]	8,5 [3]	12,5 [3]	12,5 [3]
Oil capacity (first fill-up) with filter	[liters approx.]	10,0 [3]	10,0 [3]	14,0 [3]	14,0 [3]

[3] Approximate figures can vary depending on the design. **The upper marking on the dipstick is always the maximum.**
[4] Only during winter (see 3.5.1)
[5] Model 1012E with external cooling system, depending on cooling system design.

Model BFM 1013 / E		BF4M 1013 BF4M 1013 E	BF4M 1013 C BF4M 1013 EC	BF6M 1013 BF6M 1013 E	BF6M 1013 C BF6M 1013 EC	BF6M 1013 CP BF6M 1013 ECP
Number of cylinders		4	4	6	6	6
Cylinder arrangement		vertical, in line				
Bore	[mm]	108				
Stroke	[mm]	130				
Total displacement	[cm³]	4764	4764	7146	7146	7146
Compression ratio	[ε]	17,6	17,6	17,6	17,6	17,0
Working cycle / Combustion system		4-stroke diesel with turbocharging and direkt injection				
Charge air cooler		w/o	w/	w/o	w/	w/
Direction of rotation		counter clockwise				
Weight 1012/C incl. cooling system	[kg approx.]	Refer to head-office				
Weight 1012E/EC without cooling system as per DIN 70020-A	[kg approx.]	455	455	600	600	600
Engine power	[kW]	1)				
Speed	[rpm]	1)				
Valve clearance (cold engine)	[mm]	inleete 0,3 $^{+0,1}$ / exhaust 0,5 $^{+0,1}$				
Injector opening pressure	[bar]	250 bar				
Start of delivery	[°crank angle bTDC]	1)				
Firing order		1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
V-belt tension:		Tension / Retension 2)				
Alternator – Fan	[N]	450 / 300 $^{\pm 50}$				
Fuel pump – Coolant pump	[N]	450 / 300 $^{\pm 50}$				
Compressor	[N]	450 / 400 $^{\pm 50}$				

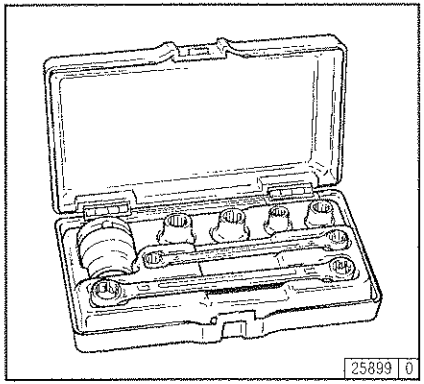
1) Engine power, speed, start of delivery are stamped on engine rating plate (see also 2.1)
2) Retension 15 minutes after engine has run under load.

Model BFM 1013/E		BF4M 1013 BF4M 1013 E	BF4M 1013 C BF4M 1013 EC	BF6M 1013 BF6M 1013 E	BF6M 1013 C BF6M 1013 EC	BF6M 1013 CP BF6M 1013 ECP
Cooling system		Liquid cooled / Cooling system protection				
Coolant quantity (coolant capacity of engine only) 1013 E / EC / ECP [5]	[liters approx.]	7,2	7,2	9,8	9,8	9,8
1013 / C / CP with 300 OD fan	[liters approx.]	12,1	13,6	–	–	–
370 OD fan	[liters approx.]	12,0	13,5	16,3	17,8	18,4
Permissible continuous coolant temperature at engine outlet	[°C]	max. 110				
Temperature difference between		4 to 8				
Coolant inlet/outlet	[°C]	83				
Thermostat full open temperature	[°C]	95				
Coolant prewarming		[4]				
Coolant pump						
Delivery pressure in	[bar]	1,2	1,2	1,4	1,8	1,8
Delivery rate in	[m³/h]	12,0	12,0	14,5	16,5	16,5
Power consumption in	[kW]	1,3	1,3	1,3	2,6	2,6
Lubrication		forced-feed lubrication				
SAE oil	15 W 40	15 W 40				
Oil temperature in oil pan	[°C]	max. 125				
Min. oil pressure with engine warm (120°C) and at low idle	[bar]	0,8				
Oil capacity (first fill-up) without filter	[liters approx.]	13,0 [3]	13,0 [3]	20,0 [3]	20,0 [3]	20,0 [3]
Oil capacity (first fill-up) with filter	[liters approx.]	14,0 [3]	14,0 [3]	21,0 [3]	21,0 [3]	21,0 [3]

[3] Approximate figures can vary depending on the design. **The upper marking on the dipstick is always the maximum.**
[4] Only during winter (see 3.5.1)
[5] Model 1013 E with external cooling system, depending on cooling system design.

Location	Preload [Nm]			Torquing Load [Nm]				Total [Nm]	Remarks
	1st Stage	2nd Stage	3rd Stage	1st Stage	2nd Stage	3rd Stage	4th Stage		
Rocker cover								8,5	
Rocker arm setscrew								21	
Mount, flywheel side								187	M 16 x 40 8.8 A4C
Mount, turbocharger side								187	M 16 x 40 8.8 A4C
Air intake manifold								8,5	
Exhaust manifold								21	
Oil drain plug								50	
Injector mounting								16	Torx
Injection line mounting								30	M 14x1.5
Oil pan (cast irón)								29	
Oil pan (sheet metal)								21	

TORX



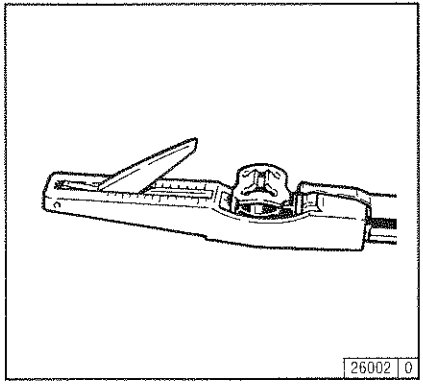
A TORX wrench set is used with engines in the 1012/E series. This system was chosen because of the many advantages it offers:

- Outstanding accessibility to bolts.
- High load transfer when loosening and tightening.
- Almost impossible for socket to slide off or break.

TORX tools can be ordered from:

FA. WILBÄR
Postfach 14 05 80
D-42826 Remscheid

V-belt Tension Gauge



The V-belt tension gauge can be obtained under order number **91 107** from:

FA. WILBÄR
Postfach 14 05 80
D-42826 Remscheid

Notes

Notes

The **DEUTZ AG service organization** is represented in 150 countries throughout the world.
Around 15,000 specialists provide competent servicing of DEUTZ and DEUTZ MWM engines at approximately 3,000 service bases.

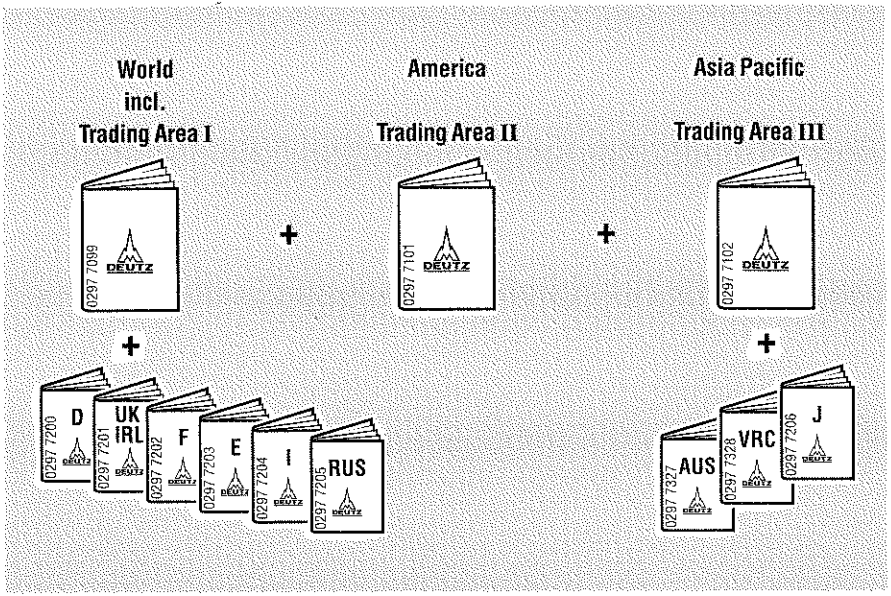
For control purposes, the service network is divided into three trading areas with coordinated logistics. The structure generally provides every country with a comprehensive dealer network which is coordinated by country-specific DEUTZ companies and agencies. If necessary, specific support is provided by the Original Manufacturer's Service (Service Centers).
For the purpose of trouble-shooting and rapid assistance in the event of accidents, emergency services are available around-the-clock by the local service offices and in the headquarters in Cologne.

The service registers are adapted to the structure of the trading area or the regional situation. As a result, quick updating is possible in the event of regional changes.

In detail, the following registers are available (see also the diagram opposite):

- **"World"**
  Total overview of the service network and survey of Trading Area **I**.
  The following supplementary reginal registers are available for the Trading Area **I**.
  - Germany
  - Italy
  - Spain
  - UK and Ireland
  - France
  - Russia
- **"America"**
  Trading Area **II**
- **"Asia Pacific"**
  Trading Area **III**
  The following supplementary reginal registers are available for the Trading Area **III**:
  - Japan
  - Australia
  - China

All of the service registers can be obtained from your local service agent or from headquarter in Cologne.



Knowing it's a DEUTZ.

DEUTZ AG
Service-Technik
Servicedokumentation
Deutz-Mülheimer Str. 147-149
D-51057 Köln
Telefon: 02 21-8 22-0
Fax: 02 21-8 22-53 58
http://www.deutz.de

Printed in Germany
All rights reserved
1st Edition, 11/97
Order No.: 0297 7380 en
(05.98)