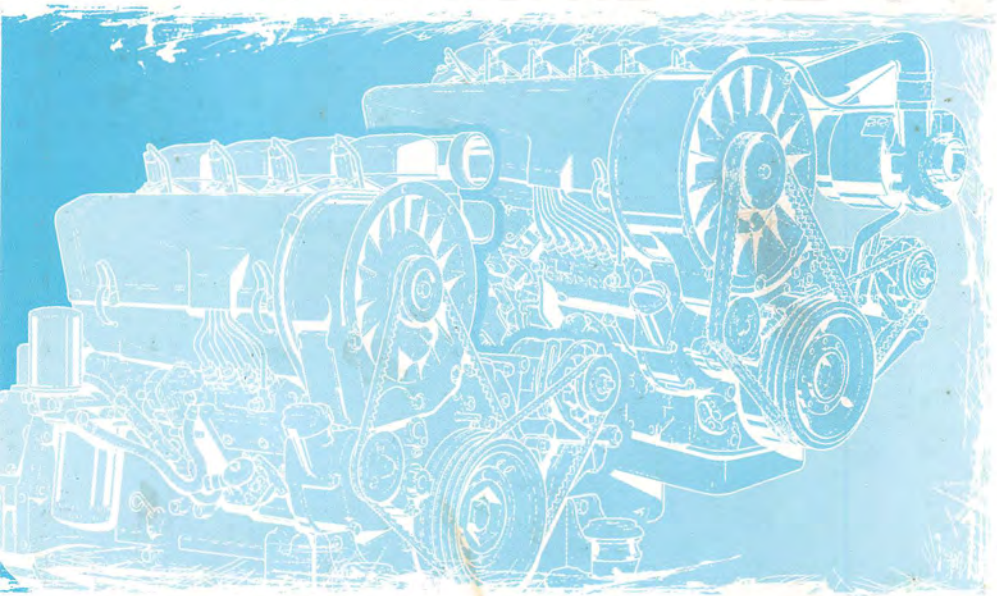


Operation Manual

912/913

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.

- Unauthorised 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 change, convert or adjust the cooling air intake area.
  The manufacturer shall not be held responsible for any damage which results from such work. Do not change, convert or adjust the cooling air intake area.
  The manufacturer shall not be held responsible for any damage which results from such work.

- When carrying out maintenance/repair operations on the engine, the use of DEUTZ genuine parts is prescribed.
  These are specially designed for your engine and guarantee perfect operation.
  Non-compliance invalidates the warranty!

Operation Manual

912

913

0297 9690 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 parts of this Manual may be reproduced in any form or by any means without our written approval.

DEUTZ

Foreword

Dear Customer,

Air / 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 endeavoured 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

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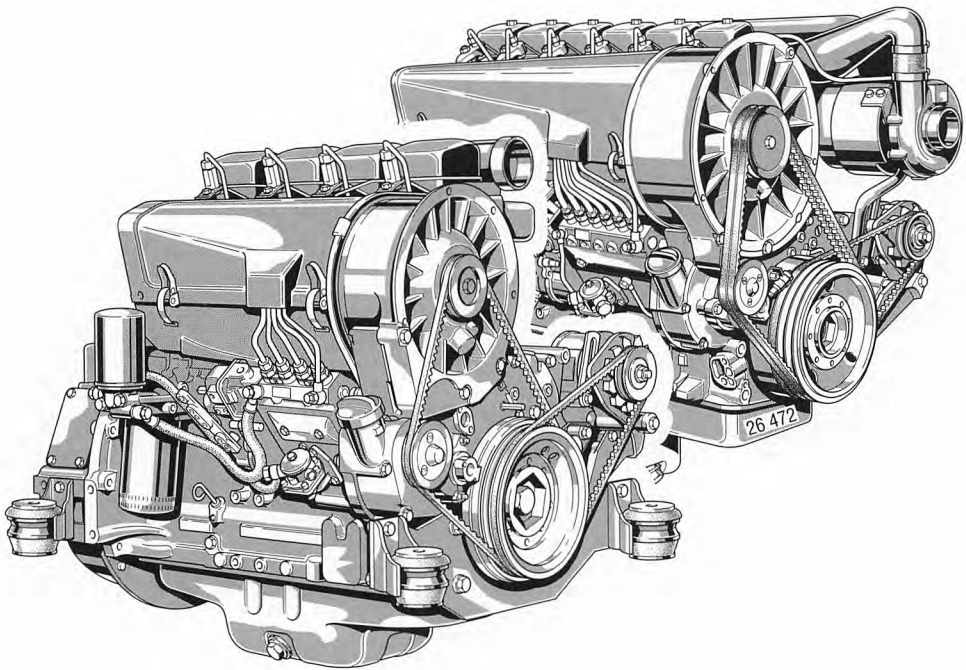
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10 Service


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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.

Beware of Running Engine

Shut the engine down before carrying out maintenance or repair work. Ensure that the engine cannot be accidentally started. Risk of accidents.
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.

Care and Maintenance

Sound care and maintenance practices will ensure that the engine continues to meet the requirements placed on it. Recommended service intervals must be observed and service and maintenance work carried out conscientiously.
Special care should be taken under abnormally demanding operating conditions.

Safety



This symbol is used for all safety warnings. 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



DEUTZ original parts are asbestos-free.

Service

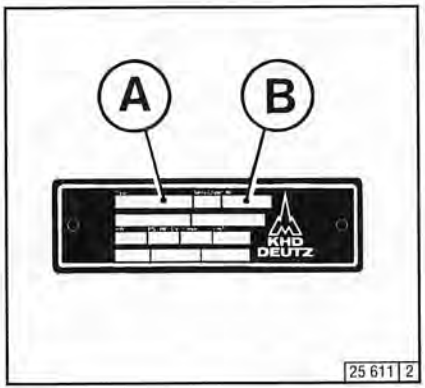
Please contact one of our authorized service representatives in the event of breakdowns or for spare parts inquiries. Our trained specialists will carry out repairs quickly and professionally, using only genuine spare parts.
Original parts from DEUTZ AG are always produced in accordance with state-of-the-art technology.
Please turn to the end of this manual for further service information.

California
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

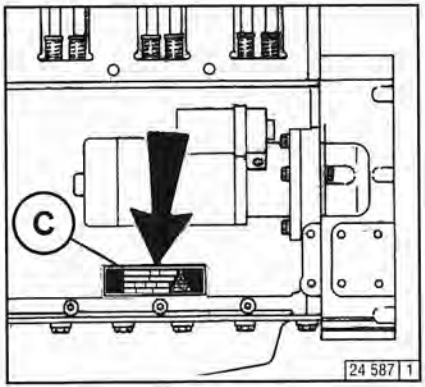
2.1 Model
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2.1.1 Rating Plate



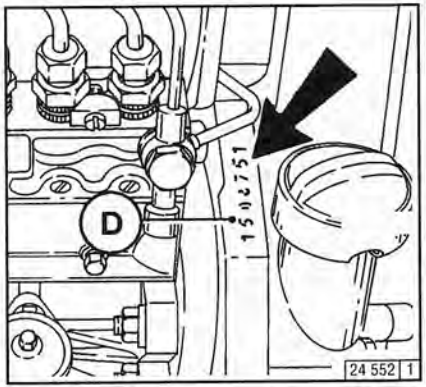
The model **A**, the engine serial number **B** and the performance data are stamped on the rating plate. The model and engine serial number must be given when ordering parts.

2.1.2 Rating Plate Location



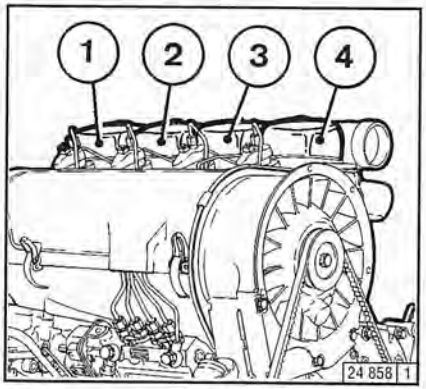
The rating plate **C** is attached to the crankcase; depending on the design, a second rating plate may be attached to the air duct.

2.1.3 Engine Serial Number



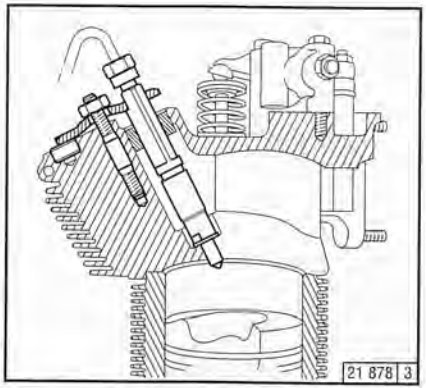
The engine serial number **D** is stamped on the crankcase as well as the rating plate.

2.1.4 Cylinder Numbering



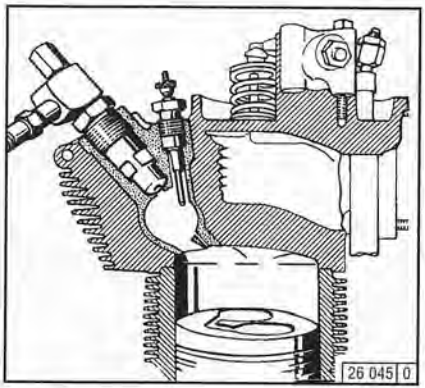
Cylinders are numbered consecutively, beginning at the flywheel end.

2.1.5 Direct Injection FL 912



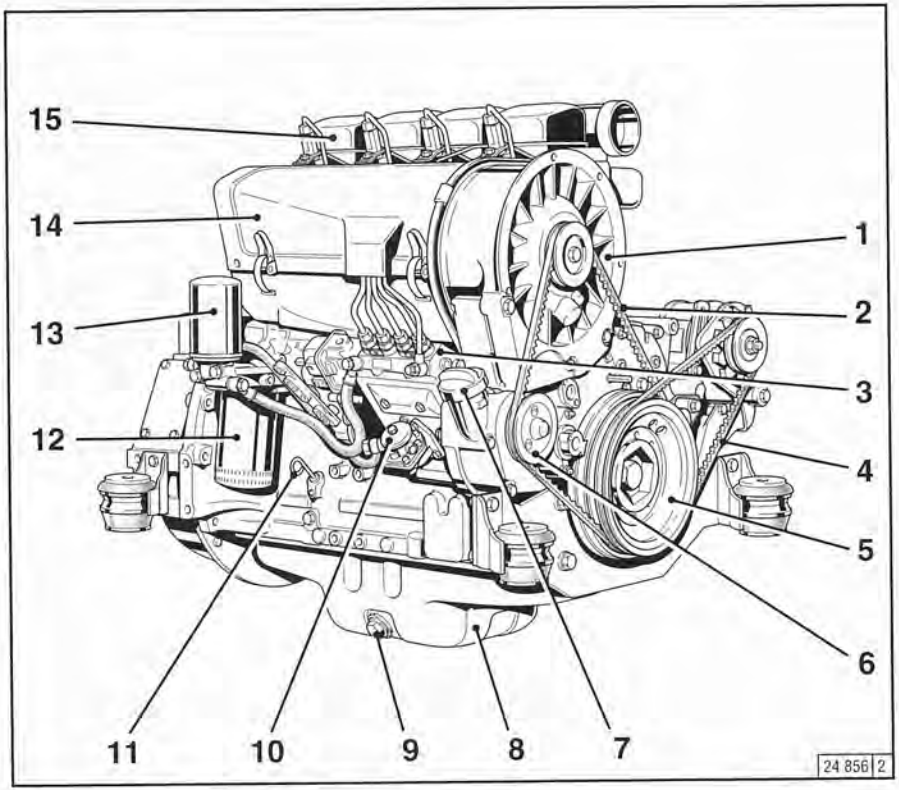
Engines with direct injection are used where high performance is required.

2.1.6 Two-stage Combustion FL 912W



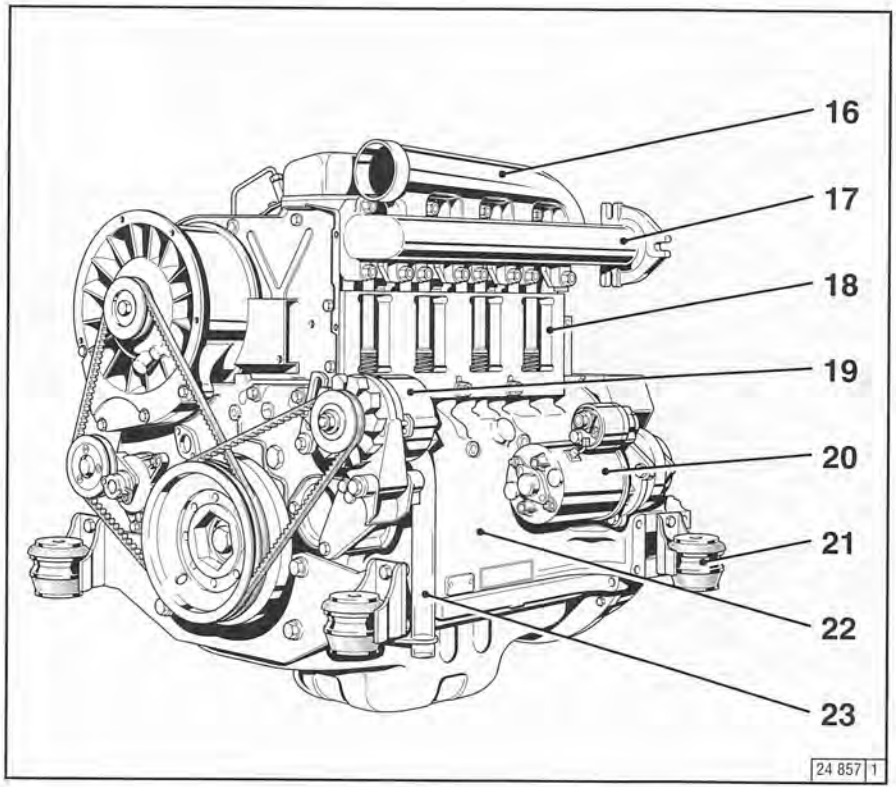
Engines with two-stage combustion are used where it is particularly important to keep exhaust emissions to an absolute minimum.

2.2.1 Service Side
F4L 912



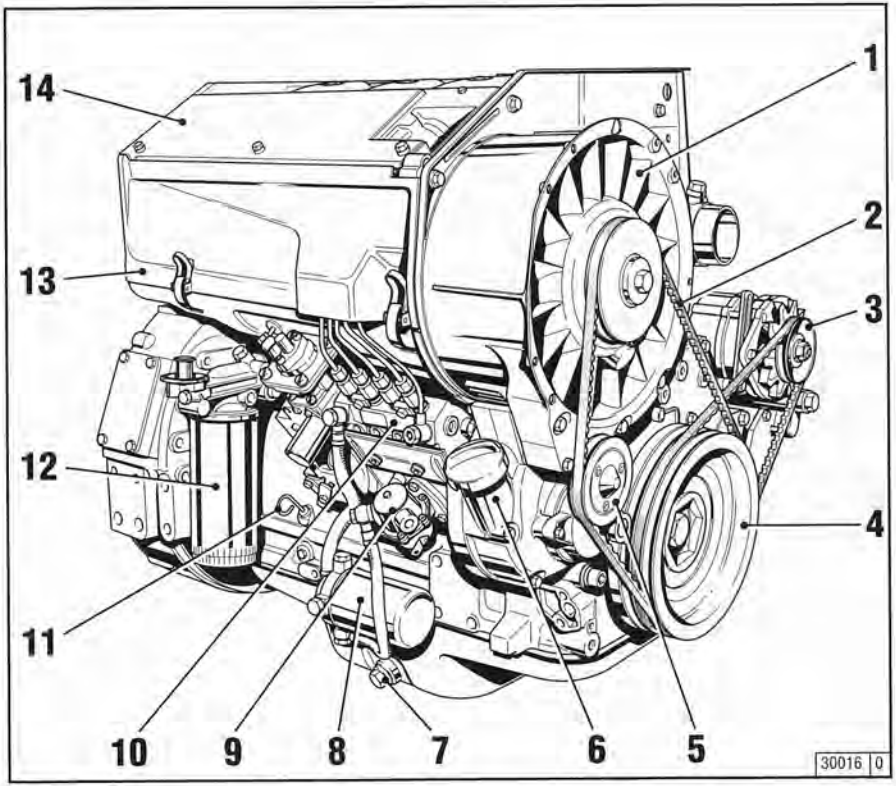
1 Fan
2 V-belt (fan)
3 Injection pump
4 V-belt (alternator)
5 V-belt pulley
6 Tension roller
7 Oil fill point
8 Oil pan
9 Oil drain plug
10 Fuel pump
11 Oil dipstick
12 Lube oil filter
13 Easy-change fuel filter
14 Air duct cover
15 Cylinder-head cover

2.2.2 Exhaust Side
F4L 912



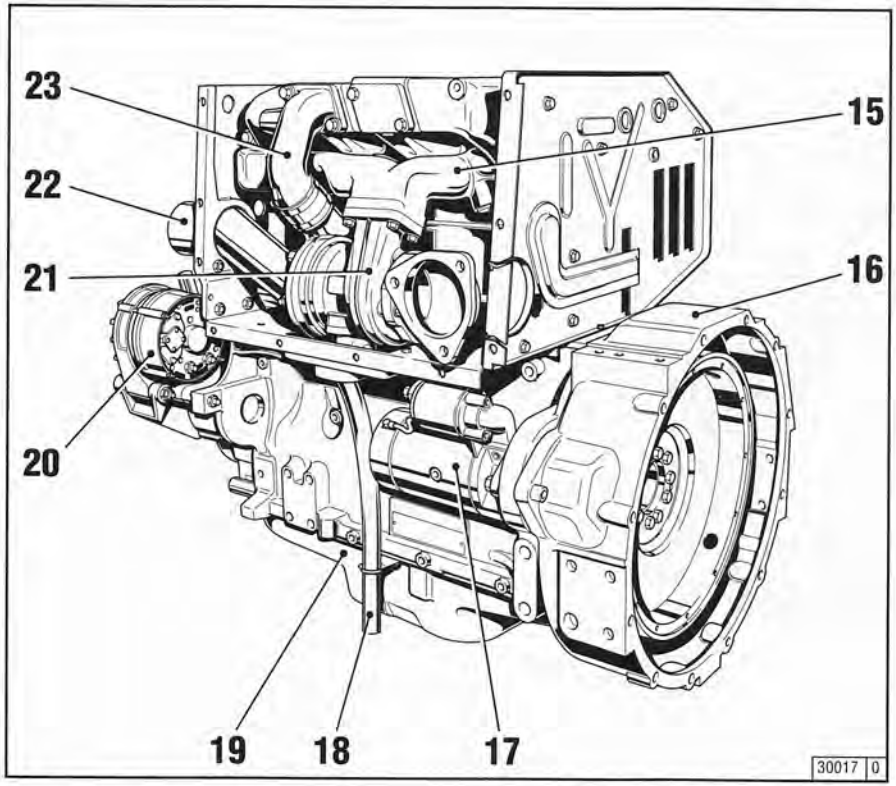
16 Air-intake pipe
17 Exhaust manifold pipe
18 Screen
19 Alternator
20 Starter
21 Engine mounting
22 Crankcase
23 Crankcase ventilation

2.2.3 Service Side BF4L 913



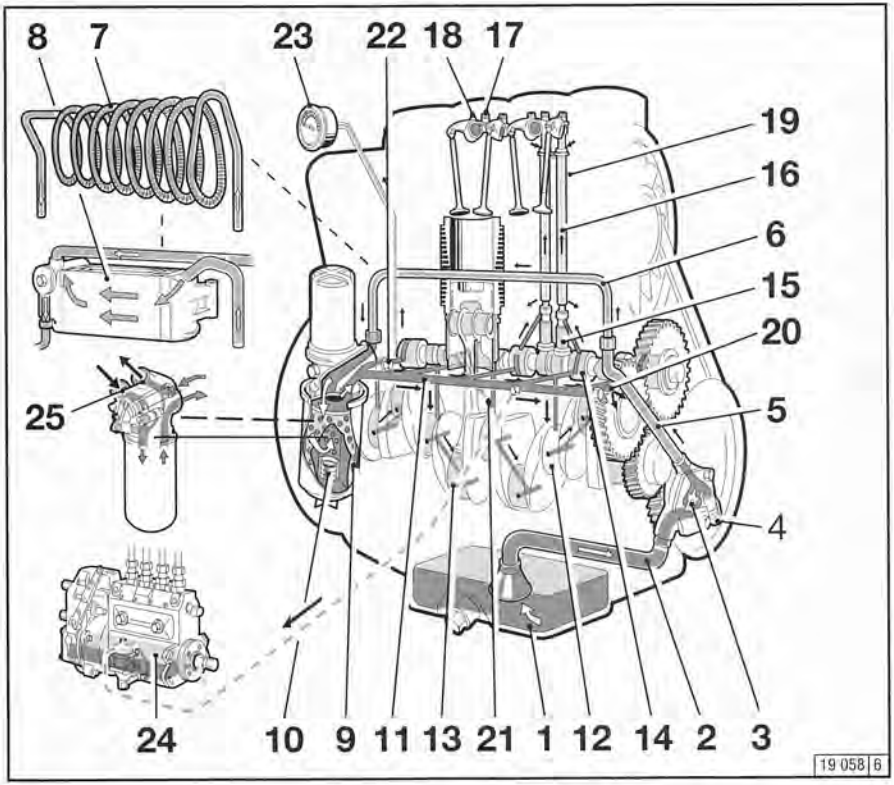
1 Fan
2 V-belt (fan)
3 V-belt (alternator)
4 V-belt pulley on crankshaft
5 Tension roller
6 Oil fill point
7 Oil drain plug
8 Fuel filter cartridge
9 Fuel pump with fuel precleaner
10 Injection pump
11 Oil dipstick
12 Lube oil filter cartridge
13 Air duct cover
14 Engine oil radiator cover

2.2.4 Exhaust Side
BF4L 913



15 Exhaust manifold line
16 Terminal housing
17 Starter
18 Crankcase ventilation
19 Oil pan
20 Alternator
21 Exhaust turbocharger
22 Air-intake pipe-exhaust turbocharger
23 Charge-air line

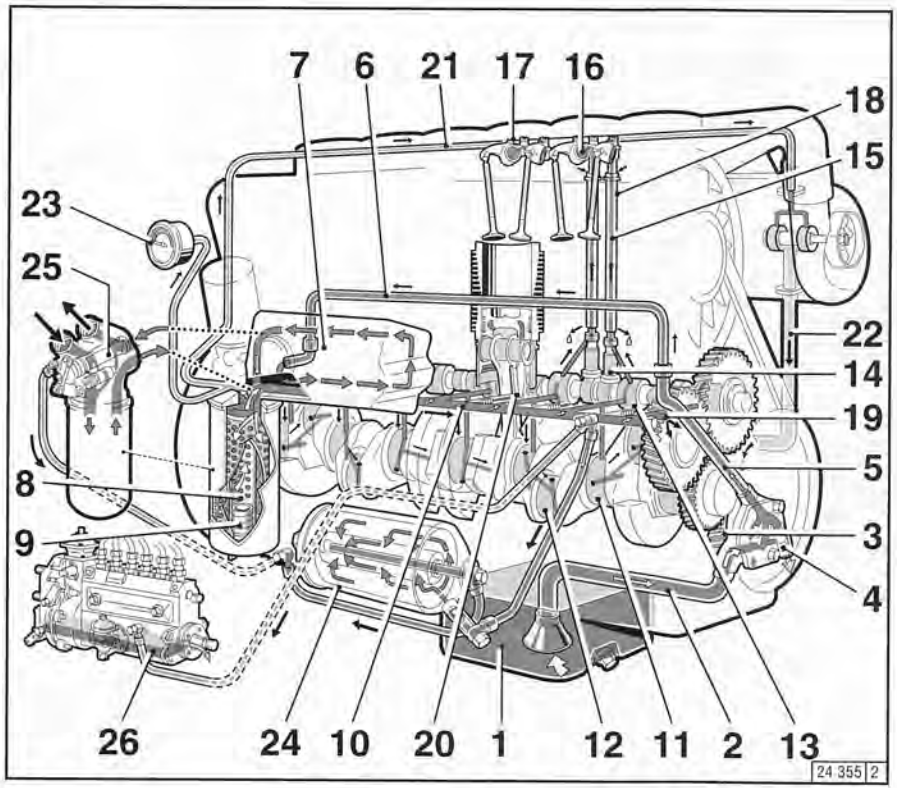
2.3.1 Lube Oil Circuit FL 912 / 913



1 Oil pan
2 Intake manifold
3 Oil pump
4 Oil pressure control valve
5 Pressure-oil line
6 Bypass line or selectively
7 Finned pipe spiral or selectively
8 Frame oil cooler
9 Lube oil filter
10 Safety valve
11 Main oil gallery
12 Crankshaft bearing
13 Con-rod bearing
14 Camshaft bearing
15 Tappets
16 Push rod (hollow, for oil feed to rocker arm lubrication)
17 Rocker arm bearing
18 Metering plug (r. arm lubrication)*
19 Protective sleeve for push rod
20 Throttle bore (for lubrication of the gear wheels)
21 Injection jet for cooling the pistons
22 Connection for oil pressure gauge
23 Oil pressure gauge
24 Injection pump connected to lube oil circuit
25 Connection point for oil heating**

* only for inclined engines
** in this instance the filter holder must be replaced. Please contact our service representative for this alteration.

2.3.1 Lube Oil Circuit BF6L 913

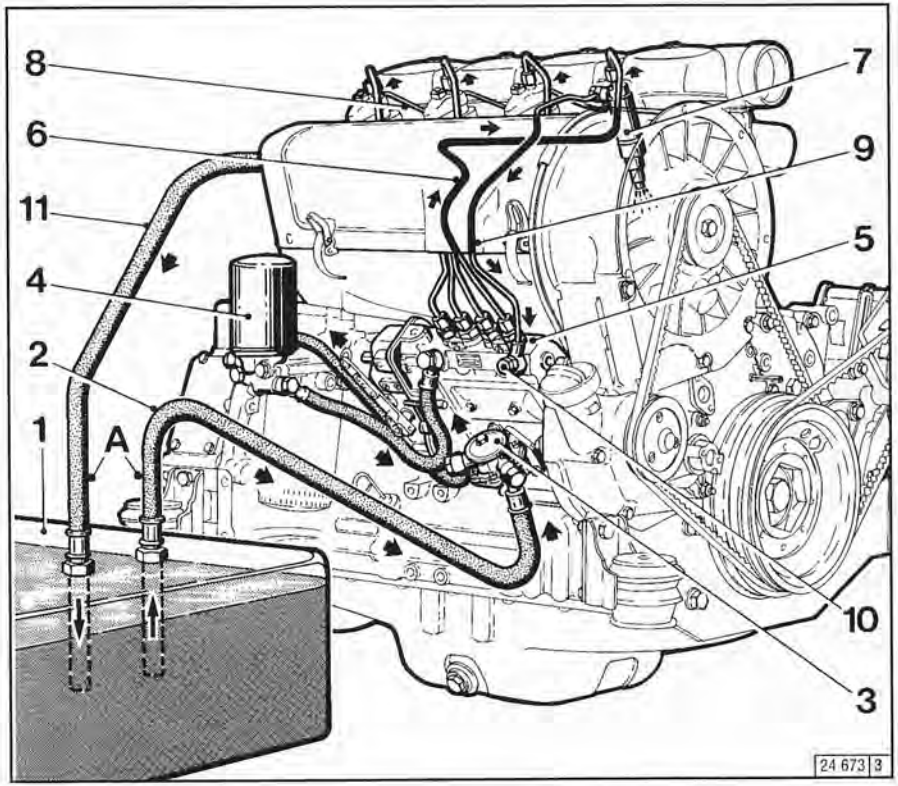


1 Oil pan
2 Intake manifold
3 Oil pump
4 Oil pressure control valve
5 Pressure-oil line
6 Connecting line to oil cooler
7 Frame oil cooler
8 Lube oil filter
9 Safety valve
10 Main oil gallery
11 Crankshaft bearing
12 Con-rod bearing
13 Camshaft bearing
14 Tappets (with impulse lubrication of the rocker arm)
15 Push rod (hollow, for oil feed to r. arm lubrication)
16 Rocker arm bearing
17 Metering plug (r. arm lubrication) *
18 Protective sleeve for push rod (oil return from cylinder head to crankcase)
19 Throttle bore (for lubrication of the gear wheels)
20 Injection jet for cooling the pistons
21 Oil line for lub. of the exhaust turbocharger
22 Oil ret. line from exhaust turboc. to the crankcase
23 Oil pressure gauge
24 Partial-flow lube oil filter
25 Connection point for oil heating **
26 Injection pump connected to lube oil circuit

* only for inclined engines

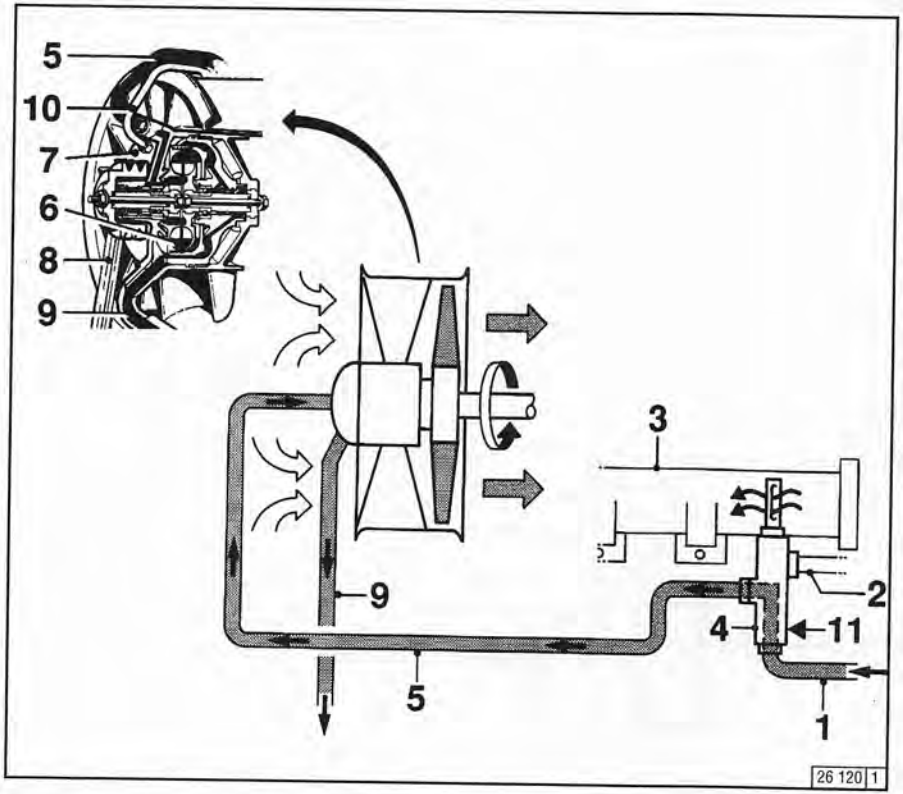
** in this instance the filter holder must be replaced. Please contact our service representative for this alteration.

2.4.1 Fuel Circuit



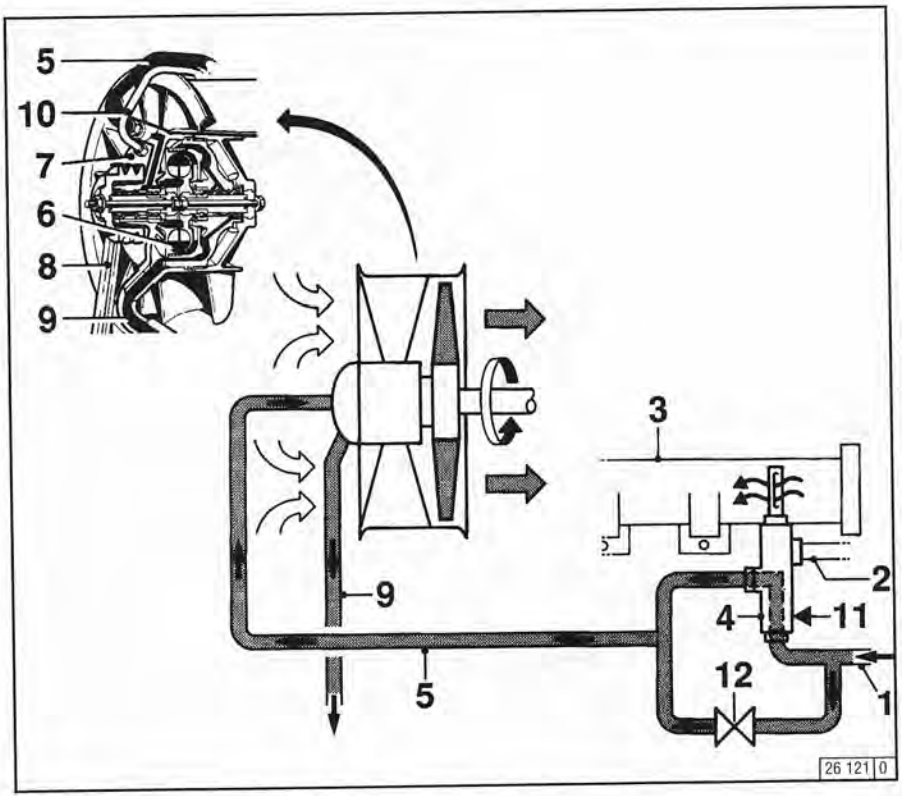
1 Fuel tank
2 Fuel line from tank to fuel pump
3 Fuel supply pump
4 Easy-change fuel filter
5 Injection pump
6 Injection lines
7 Injection valves
8 Oil leakage line
9 Fuel overflow pipe
10 Overflow valve
11 Fuel return line to tank
A Clearance: keep as far apart as possible

2.5.1 Regulation of Coolant Flow using the Exhaust Thermostat



1 Pressure-oil line from engine to exhaust thermostat
2 Air line to exhaust thermostat
3 Exhaust manifold pipe
4 Exhaust thermostat
5 Control line to hydraulic coupling
6 Hydraulic coupling
7 Cooling fan
8 Cooling fan drive
9 Oil return line to crankcase
10 Ventilation line
11 Adjusting pin with special seal

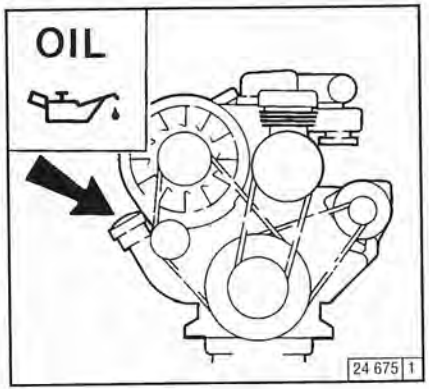
2.5.2 Regulation of Coolant Flow using the Exhaust Thermostat and Solenoid



1 Pressure-oil line from engine to exhaust thermostat
2 Air line to exhaust thermostat
3 Exhaust manifold pipe
4 Exhaust thermostat
5 Control line to hydraulic coupling
6 Hydraulic coupling
7 Cooling fan
8 Cooling fan drive
9 Oil return line to crankcase
10 Ventilation line
11 Adjusting pin with special gasket
12 Solenoid

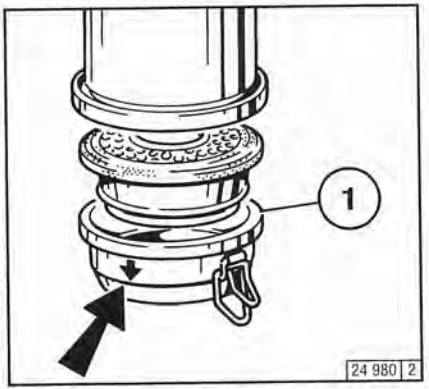
3.1 Commissioning
3.2 Starting
3.3 Monitoring Systems
3.4 Stopping
3.5 Operating Conditions

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 grade and viscosity, see 4.1

3.1.2 Filling Oil Bath Air Cleaner



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

Oil may not be filled into the dust collector of the precleaner, if this is fitted.

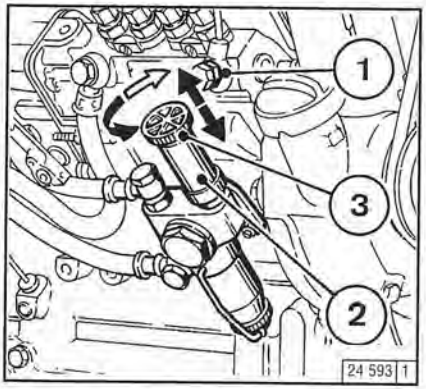
3.1.3 Adding Fuel



Use only commercial-grade diesel fuel. For fuel grade, see 4.2. Use summer or winter-grade fuel, depending on the ambient temperature.

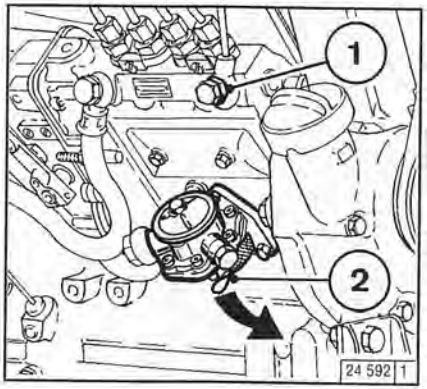
Never fill the tank while the engine is running. Keep the filler cap area clean and do not spill fuel.

3.1.4 Ventilation
Model:
"Bosch" fuel pump



- Loosen overflow valve 1 at the lower (larger) hexagon.
- Loosen hand pump 2 at the notched grip 3 by unscrewing by several turns to the left.
- Actuate hand pump 2 until bubble-free fuel is emitted at the loosened overflow valve 1.
- Tighten overflow valve 1, continuing to pump at the same time.
- Tighten grip 3.

Ventilation
Model:
"IMSA" fuel pump



- Loosen overflow valve 1 at the lower (larger) hexagon.
- Actuate preliminary pump lever 2 against the spring pressure until bubble-free fuel is emitted at the loosened overflow valve 1.
- Tighten overflow valve 1, continuing to pump at the same time.

3.1.5 Other Preparations

- Check battery and cable connections, see 6.7.1
- Transport hooks
  Remove if fitted (see 6.7.3).
- 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.

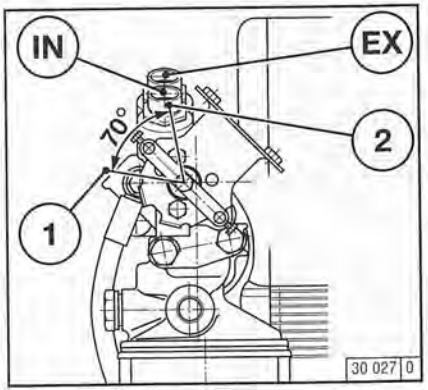
  After the engine has been turned off
  – Check the oil level, see 6.1.2
  If necessary, top up oil, see 3.1.1
  Retension V-belts, see 6.5
- Breaking in
  During the break-in phase – about 200 operating hours – check the oil level twice a day. After the engine is broken in, checking once a day will be sufficient.

3.1.6 Additional Maintenance Work

The following maintenance should be carried out after 50-150 operating hours:

- Change lube oil,
  see 6.1.2
- Change oil filter cartridge,
  see 6.1.3
- Change fuel filter cartridge,
  see 6.2.1
- Check V-belts and retension as necessary,
  see 6.5
- Check valve clearance and adjust as necessary,
  see 6.6.1
- Check the engine for leaks.
- Check the engine mount and adjust as necessary,
  see 9.2

3.1.7 Selector Switch for Oil Heater



Position of selector switch for oil filter console with oil heater connection:
Pos. 1: open
Pos. 2: closed

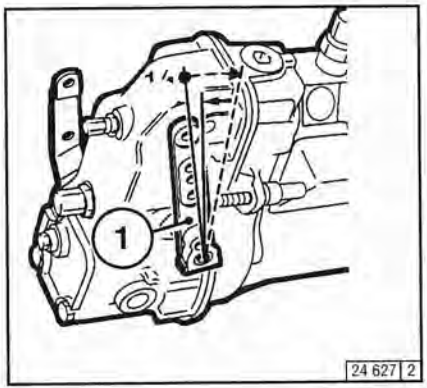
For engines without oil heating, the selector switch is always open Pos. 2: to lock closed.

3

3.2.1 Electric Starting

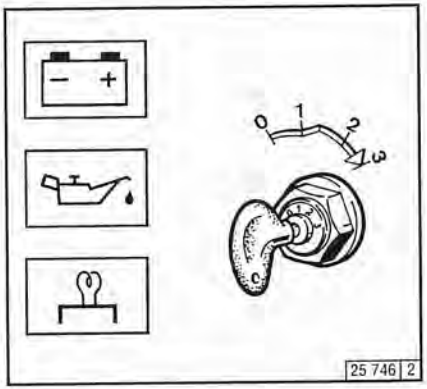
Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine.
After repair work:
Check that all guards have been replaced and that all tools have been removed from the engine.
When starting with flame glow system, do not use any other starter substance (e.g. injection with start pilot).

Caution: If the speed regulator has been removed, the engine must not be tested under any circumstances:
Disconnect the battery.



- Where possible, disengage the clutch to separate the engine from any driven parts.
- Move speed control lever 1 into idle position.

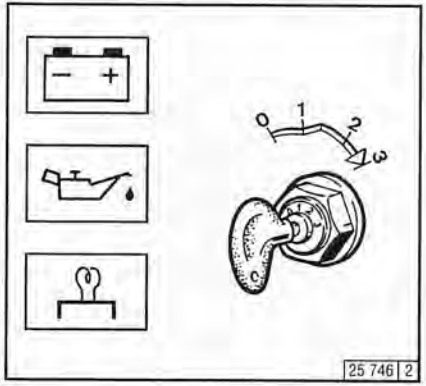
Starting without Cold-Start Aid



- Insert key.
  – Position 0 = no operating voltage
- Turn key clockwise
  – Position 1 = operating voltage
  – Pilot lights 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.

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).

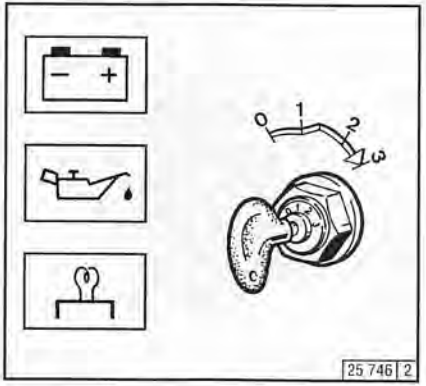
with Cold-Start Aid/Flame Glow Plug FR 60 = 9.5 and 19 volts



- Insert key.
  - Position 0 = no operating voltage.
- Turn key clockwise.
  - Position 1 = operating voltage
  - Pilot lights come on.
- Push key in and turn further clockwise against spring pressure.
  - Glow plug indicator comes on.
  - Position 2 = Preheat for approx. 60 seconds (hold key in position)*.
  - Glow plug indicator goes out.
  - Position 3 = start
- Release key as soon as engine fires.
  - Pilot lights go out.

* By afterignition in position 2 for up to approx. 3 mins, it is possible to lower further the exhaust gas opacity in the revving-up phase.

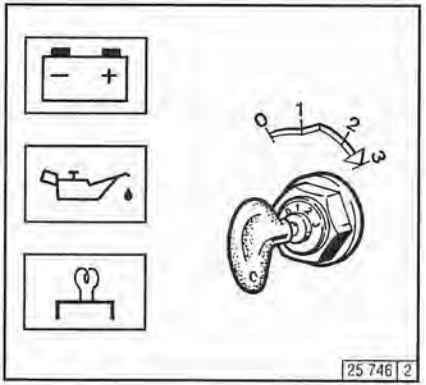
with Cold-Start Aid/Flame Glow Plug FR 20/30 = 11 and 23 volts



- Insert key.
  - Position 0 = no operating voltage
- Turn key clockwise.
  - Position 1 = operating voltage
  - Pilot lights come on.
- Push key in and turn further clockwise against spring pressure.
  - Glow plug indicator comes on.
  - Position 2 = Preheat for approx. 20 -30 seconds (hold key in position)*.
  - Glow plug indicator goes out
  - Position 3 = start
- Release key as soon as engine fires
  - Pilot lights go out.

* By afterignition in position 2 for up to approx. 3 mins, it is possible to lower further the exhaust gas opacity in the revving-up phase.

with heating pipe



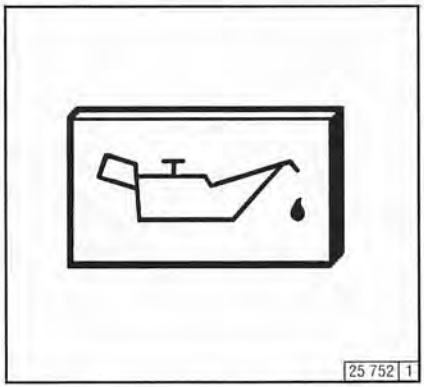
- Insert key.
  - Position 0 = no operating voltage.
- Turn key clockwise.
  - Position 1 = operating voltage
  - Pilot lights come on.
- Push key in and turn further clockwise against spring pressure.
  - Position 2 = Preheat for approx. 60 seconds (hold key in position)*.
  - Position 3 = start
- Release key as soon as engine fires
  - Pilot lights go out.

* By afterignition in position 2 for up to approx. 3 mins, it is possible to lower further the exhaust gas opacity in the revving-up phase.

3

3.3.1 Engine Oil Pressure

Oil Pressure Pilot Light



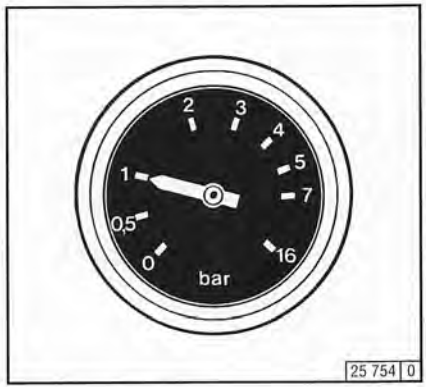
- The oil pressure pilot light comes on with operating voltage on and engine off.
- The oil pressure pilot light should go out when the engine is running.

Oil Pressure Indicator



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

Oil Pressure Gauge



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

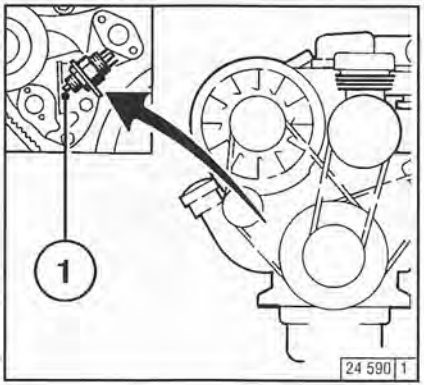
3.3.2 Engine Temperature

Temperature Gauge



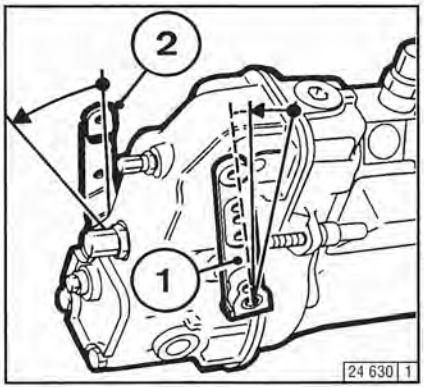
- The engine temperature gauge pointer should remain in the green sector most of the time. It should rarely enter the yellow-green sector. If the pointer enters the orange sector, the engine is overheating. Turn off and establish the cause from the Diagnosis Chart (see 7.1).

3.3.3 Cooling Fan Drive



- If the V-belt rips, pressure pin 1 of the electrical switch is actuated by the tension roller and an acoustic or light signal is given.
  Switch off the engine immediately to prevent overheating.

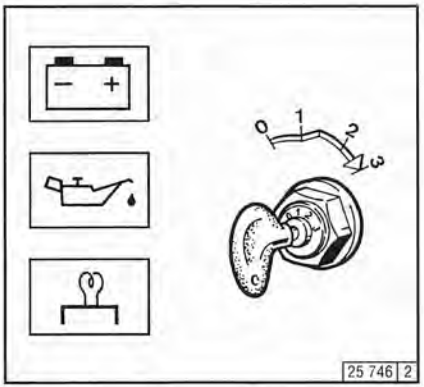
3.4.1 Mechanical Shutdown



- 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 anticlockwise (to position 0) and remove. The pilot lights will go out.

3.4.2 Electrical Shutdown

Ignition Key



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

If possible, do not suddenly switch off the engine when under full load.

3.5.1 Winter Operation

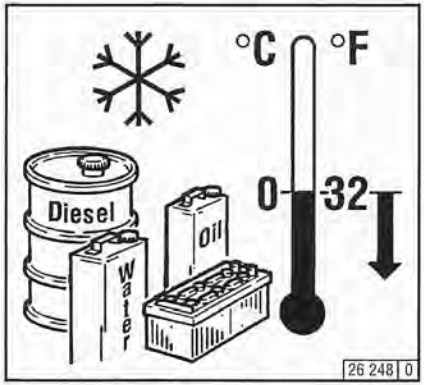
- Lube Oil Viscosity
  - Select the oil viscosity (SAE grade) according to the ambient temperature when the engine is started, see 4.1.2
  - Increase oil change frequency when operating below -10 °C, see 6.1.1

- Diesel Fuel
  - Use winter-grade diesel fuel for operation below 0 °C, see 4.2.2

- Additional Maintenance Work
  - Drain the sludge from the fuel tank once a week. (Unscrew the sludge drain plug.)
  - If necessary, allow the oil in the oil bath air cleaner and the engine oil to settle at the ambient temperature.
  - Below -20 °C, after removing the starter if necessary, smear the ring gear on the fly wheel via the pinion bore from time to time with cold-resistant grease (e.g. Bosch grease FT 1 V 31).

- Cold-Start Aid
  - 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.

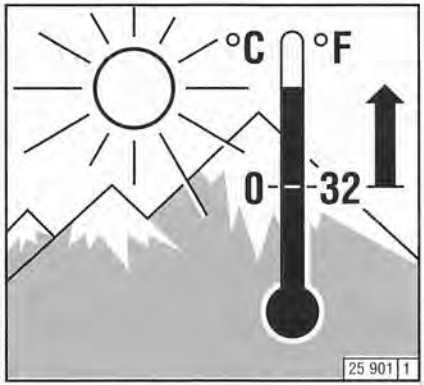
- Battery
  - Efficient cold starting requires a healthy battery, see 6.7.1
  - The starting limit temperatures can be lowered by 4-5 °C by heating the battery up to about +20 °C. (To do so, remove the battery and store in a warm place.)



3.5.2 High Ambient Temperatures, High Altitude

- As the altitude and ambient temperature rise, the density of air tends to decrease, which affects the maximum power output of the engine, the exhaust gas quality and, in extreme cases, the starting behaviour. Under transient conditions, the engine can be used at altitudes up to 1000 m and temperatures up to 30 °C. 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 DEUTZ SERVICE.



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 specifications named after the **API** (American Petroleum Institute) and **ACEA** (European Engine Oil Sequences).

Approved API Oils:

At least: CF-4

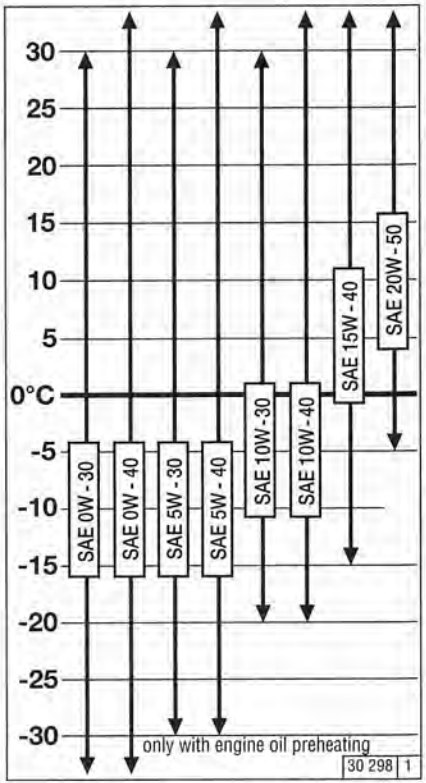
Approved ACEA Oils:

At least: E1-96

Oil change intervals, see 6.1.1
Oil capacities, see 9.1

4.1.2 Viscosity

As the viscosity of the 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 behaviour will be attained if you take the accompanying oil viscosity diagram as a guide.
Should the temperature fall temporarily below the limits of 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 % sulphur content. If the sulphur content is higher than 0.5 % oil change intervals should be reduced, see 6.1.1

The following fuel specifications / standards are approved:

- DIN EN 590
- BS 2869: A1 and A2
  (with A2, take note of the sulphur content!)
- ASTM D 975-88; 1-D and 2-D
- NATO Code F-54 and F-75

Any exhaust emission levels which may have been determined during type approval tests always refer to the reference fuel prescribed by the authorities for the type approval test.

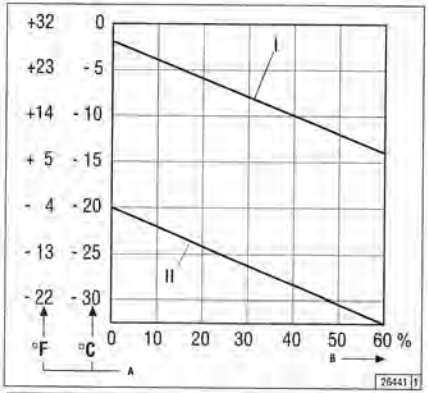
4.2.2 Winter-Grade Fuel

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 -15 °C) should be used. (This fuel is usually available from the filling stations well in advance of the cold months). Diesel fuel containing additives (Super diesel) is often on sale as well, for use down to -20 °C.

- Below -20 °C, petroleum must be added. For the required mixing ratios please refer to the adjacent diagram.
- For artic climate zones down to -44 °C special diesel fuels can be used.

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 DEUTZ-PARTNER.



Legend:	
I	Summer diesel fuel
II	Winter diesel fuel
A	Ambient
B	Proportion of Kerosene to be

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

5.1 Maintenance Schedule
5.2 Maintenance Charts
5.3 Maintenance Work Completed

Operating hours (OP)[1]									check	clean	change	Operation	See Section
Once after [2] 50-150	every 10 OH or daily	every 125	250	500	1000	2000	3000	5000					
	●								●			Oil level in engine / separate container	6.1.2
●									●			Engine leaks	
	●								●			Oil bath- and dry type air cleaners 3) 4)	6.3/6.4
		●							●			Battery and cable connectors	6.7.1
		●	●	●					●			Cooling system (depending on engine use) 3) 6)	6.3.1/6.3.2
●		●	●	●					●		●	Engine oil (depending on engine use) 5)	6.1.1/6.1.2
●				●							●	Oil filter cartridge	6.1.3
●											●	Fuel filter cartridge	6.2.1
●				●	●				●			Valve clearance (adjust if necessary)	6.6.1
●					●				●			Engine mounts (retighten if necessary)	9.2
●			●						●			V-belts (retension if necessary)	6.5
			●						●			Warning system	6.5.5
●										●		Fuel precleaner	6.2.2
●					●				●			Mountings	6.8.1
					●				●			Flame glow plugs 4)	6.8.3
				●							●	Partial-flow oil filter	6.1.4
							●		●			Sheathed element heater plugs	

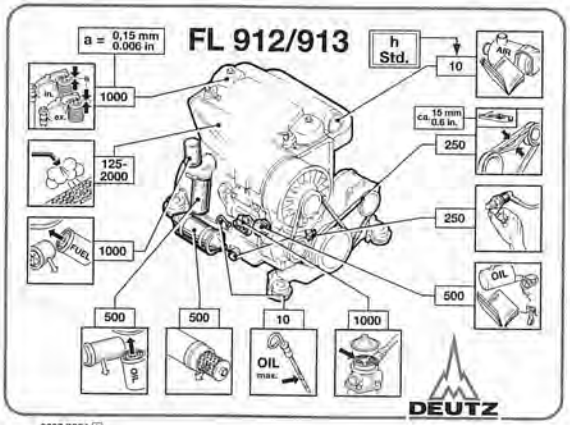
The specified engine maintenance times are maximum values. Depending on the operating environment, shorter maintenance intervals may be required. Please observe the operating instructions of the equipment manufacturer.

1) Recommended maximum
2) Commissioning new or reconditioned engines
3) Clean if needed, see Section 6.3
4) Change if necessary. If fitted, service after service indicator.
5) Oil change interval, see Section 6.1.1
6) Clean system / cooling fins.

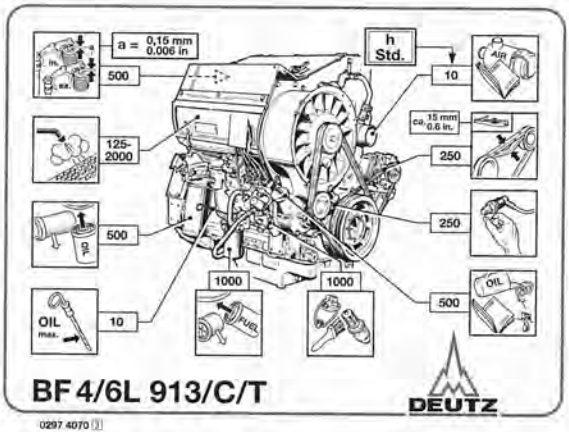
The maintenance charts shown here are supplied as self-adhesive labels with each engine. They should be affixed where they can be seen clearly on the engine or driven equipment.

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 7224 [1]



0297 4070 [3]

Stop the engine before carrying out any maintenance work.

Hours	Date	Signature / Stamp	Hours	Date	Signature / 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	Signature / Stamp	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		

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

Hours	Date	Signature / Stamp	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		

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 System
6.5 Belt Drives
6.6 Adjustments
6.7 Accessories
6.8 Engine Cleaning
6.9 Additional Maintenance

6

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: sulphur content max. 0.5% by weight.
  - Continuous ambient temperatures down to -10 °C (+14 °F).
- If the sulphur 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% sulphur, contact your **service representative.**

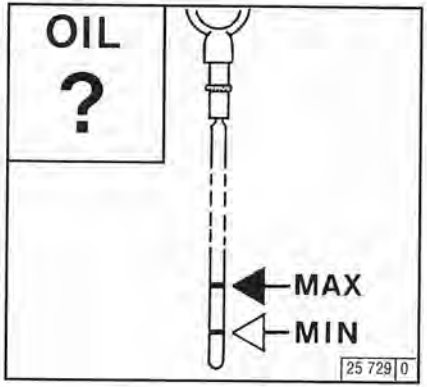
Installed engines		Lube oil intervals in OH		
		Naturally aspirated engines	Turbocharged engines	
Lube oil quality	API classification	CF-4/CH-4/CG-4	CF-4	CH-4/CG-4
	ACEA classification	E1-E3/96+ E4-98	E1-E2/96	E3-96+ E4-98
Normal oil usage, e.g.:				
Road vehicles, cranes, construction machinery, ships, electrical units, pumps, rail-run vehicles		500	250	500
Heavy-duty oil usage, e.g.:				
Combine harvesters, emergency pumps, underground equipment, sweeping machines, winter operation equipment, emergency power generating units		250	125	250

Vehicle engines			Lube oil intervals in km		
			Naturally aspirated engine	Turbocharged engine	
Lube oil quality	API classification		CF-4/CH-4/CG-4	CF-4	CH-4-/CG-4
	ACEA classification		E1-E3/96+ E4-98	E1-E2/96	E3-96+ E4-98
Service group	Annual kilome trage km	average speed approx km/h			
I	> 30 000	20	10 000	5 000	10 000
II	30 000 – 100 000	40	20 000	10 000	20 000
III	< 100 000	60	30 000	15 000	30 000

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

6.1.2 Checking Oil Level / Changing Engine Oil

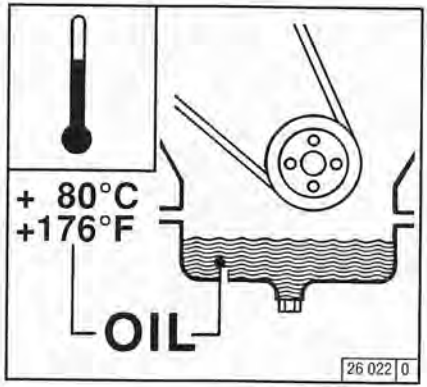
6.1.2.1 Checking Oil Level



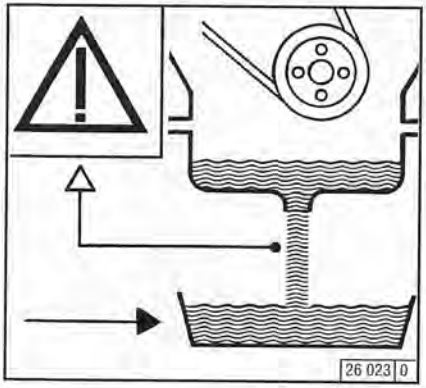
- Ensure that the engine or vehicle is in a horizontal position.
- – **Warm engine:**
  Switch off engine, wait 5 minutes and check the oil level.
- – **Cold engine:**
  Check oil level.
  To this end:
- Remove the oil dipstick.
- Wipe the dipstick with a non-fibrous, clean cloth.
- Insert it to the 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 fall below the "**MIN**" marking.

6.1.2.2 Engine Oil Change



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

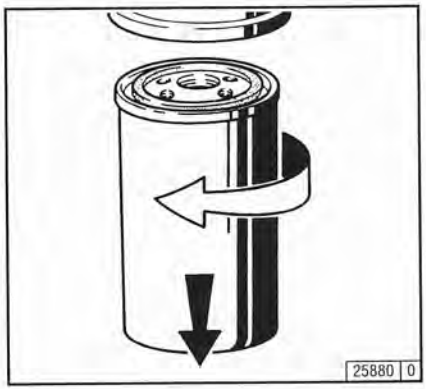


- Place oil tray under the engine.
- Unscrew drain plug.
- Drain oil.
- Fit oil drain plug, with the new gasket and tighten firmly (for torque, see 9.2).
- Fill with lube oil.
  – For grade / viscosity, see 4.1
  – For quantity, see 9.1
- Check oil level, see 6.1.2.1

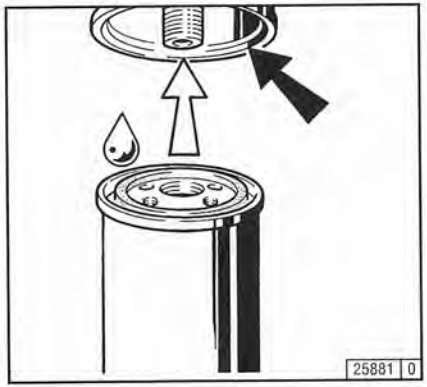


Be careful when draining hot oil – danger of scalds! Do not let used oil run into the soil but catch it in a container ready for proper disposal.

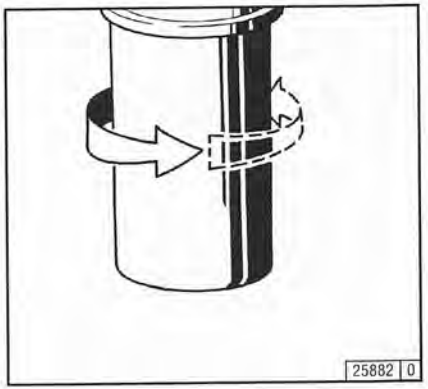
6.1.3 Changing Oil Filter



- Undo the filter cartridge using a 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.

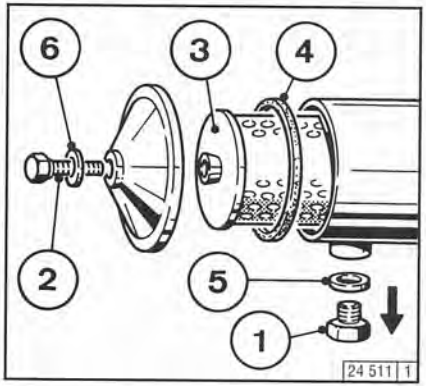


- Tighten the oil filter cartridge with another half-turn.
- Check oil level, see 6.1.2
- Check oil pressure, see 3.3.1
- Check cartridge seal for leaks.



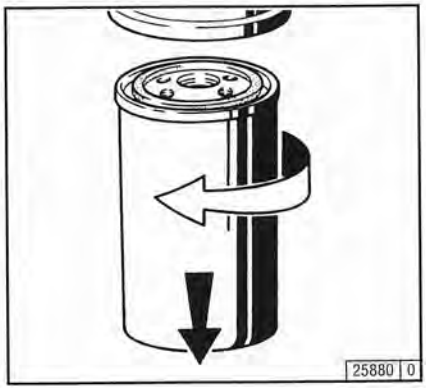
Beware of burns from hot oil.

6.1.4 Changing the Partial-Flow Oil Filter Insert

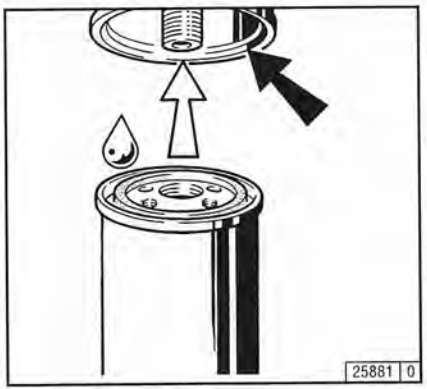


- Unscrew oil drain plug 1 and drain off oil.
- Unscrew tension screw 2. Remove the cover.
- Unscrew the dirtied filter insert 3. Clean the filter housing.
- Check and if necessary replace cover seal 4.
- Screw in oil drain plug 1 with new seal 5.
- Fit new filter insert.
- Screw on cover with sealing ring 6.
- Check for leaks and check the oil pressure during a test run.

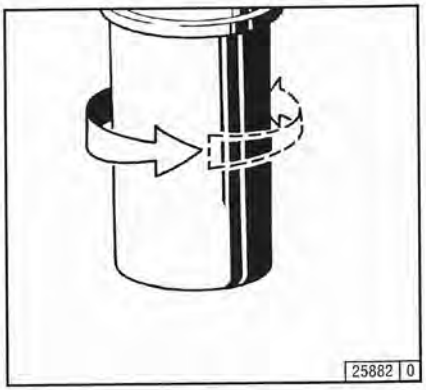
6.2.1 Changing Fuel Filter



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



- Clean any dirt from the filter cartridge with a final half-turn.
- 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.



- Tighten the fuel filter cartridge with a final half-turn.
- Open fuel stopcock.
- Check for leaks.

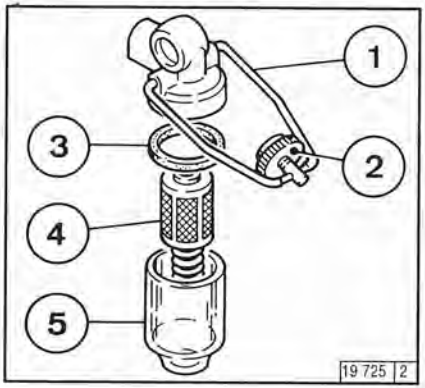


Keep naked flames away when working on the fuel system. Do not smoke.

The fuel system does not need to be bled.

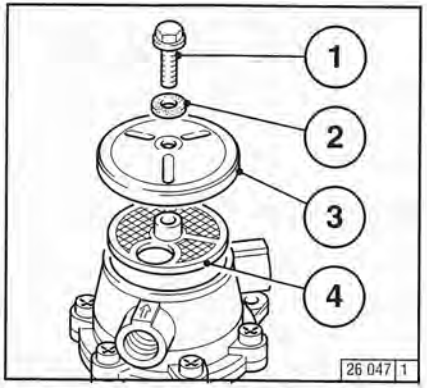
6.2.2 Fuel Precleaner

Cleaning the Fuel Filter "Bosch" model



- Close the fuel shut-off valve.
- Loosen tensioning nut 2.
- Swing wire clip 1 to the side.
- Remove filter cone 5 with strainer 4 and clean in fuel.
- Use a new seal 3 for filter cone 5.
- Bleed the fuel system, see 3.1.4
- Check for leaks.

Cleaning the Fuel Filter "IMSA" model



- Close the fuel shut-off valve.
- Loosen hexagonal nut 1 and unscrew with sealing ring 2.
- Remove cover 3.
- Remove fuel strainer 4.
- Clean the fuel strainer 4 in fuel. Replace if necessary.
- Refit in the reverse order.
- Bleed fuel system, see 3.1.4
- Check for leaks.



No naked flames when working on the fuel system.
No smoking!

6

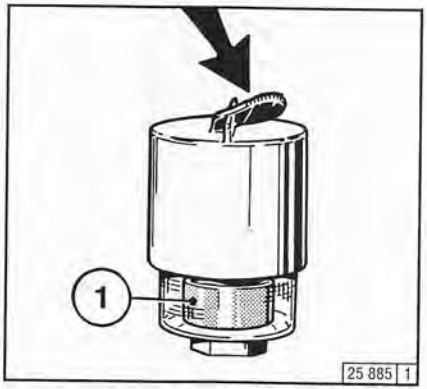
6.3.1 Cleaning Intervals

- 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 on the right can be used as a guide.

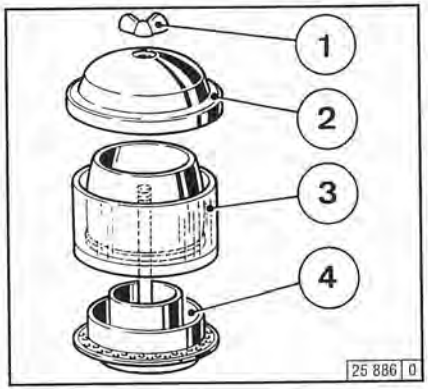
Inspection and cleaning intervals Recommended OH	Engine application
2000	Ships, Electrical units in enclosed areas, pumps
1000	Vehicles on reinforced highways
500	Tractors, fork-lift trucks, mobile electrical units
250	Vehicles on construction sites and on roads with loose surfaces, constrution machinery, compressors, mining equipment
125	Agricultural machinery, tractors used for harvesting purposes

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 dry-type air cleaners are used, they should be cleaned only in accordance with the service indicator or the service 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.



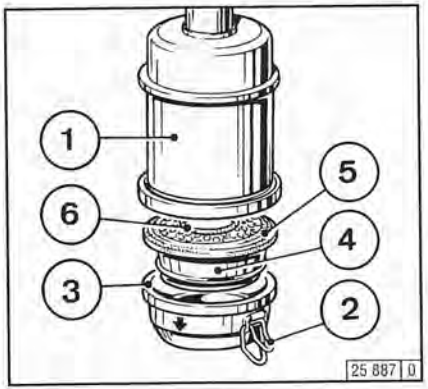
6.4.2 Emptying Cyclone Type Precleaner



- 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



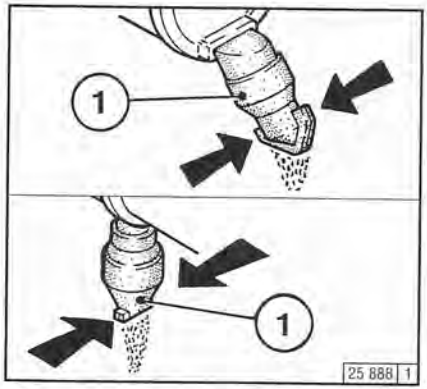
- Turn engine off and wait about 10 minutes for the oil to drain from filter housing 1.
- Release snap clips 2 and remove oil cup 3 together with filter element 4. If necessary prise element out with a screwdriver, taking care not to damage the rubber gasket 5.
- Remove dirty oil and sludge. Clean oil cup.
- Clean filter element 4 in diesel fuel and allow to drip-dry.
- Clean filter housing 1 if very dirty.
- Inspect and replace rubber gasket 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 cold oil in accordance with environmental regulations!

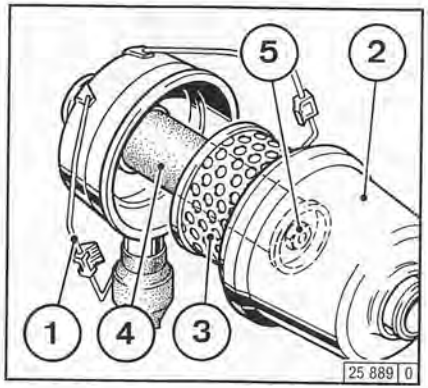
6.4.4 Dry Type Air Cleaner

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 Cartridges

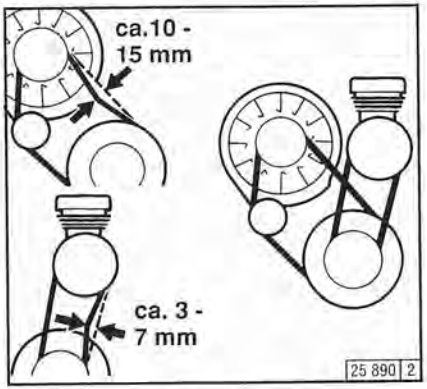


- Undo clip fasteners 1.
- Take off hood 2 and remove cartridge 3.
- Clean cartridge (replace at least once a year).
- Clean cartridge 3.
  Blow out from inside out with dry compressed air (max. 5 bar), (or in difficult cases, tap out, taking care not to damage the cartridge, or wash according to manufacturer's instructions).
- Through regular removal and replacement, the gaskets on the filter cartridge can become damaged. Check paper filter (light showing through) and gaskets for damage. Replace if necessary.
- After five 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 1.

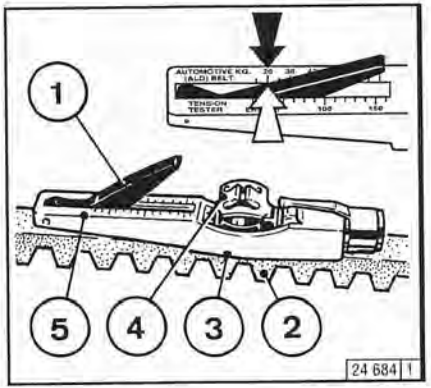


Never clean filter cartridge with gasoline or hot fluids.

6.5.1 Checking V-Belts



- Inspect entire V-belt for damage.
- Replace damaged V-belts.
- After installing new belts, run engine for 15 minutes, then check belt tension.
- To check the tension of the V-belt, use a tension gauge (see 9.3).
  - 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.

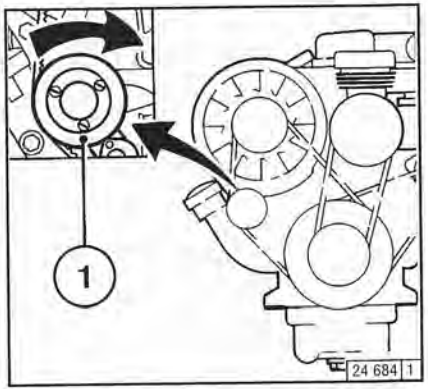


- Carefully remove the gauge without altering the position of the indicator arm 1.
  Read off the value where the black indicator arm 1 intersects scale 5 (arrow). For settings, see 9.1
- If necessary, retension belt and measure again.



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

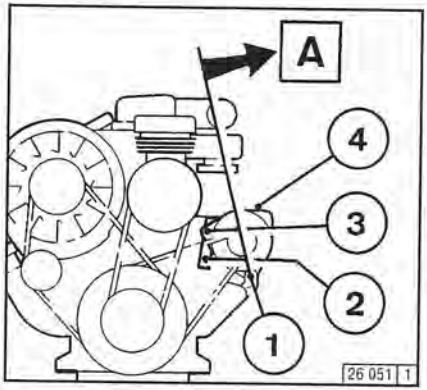
6.5.2 Changing the Fan V-Belt



- To replace, press in tension roller 1 using a commercial tool and remove the V-belts.
- Fit new V-belts.

When new V-belts are fitted, check the belt tension after ca. 15 minutes running time.

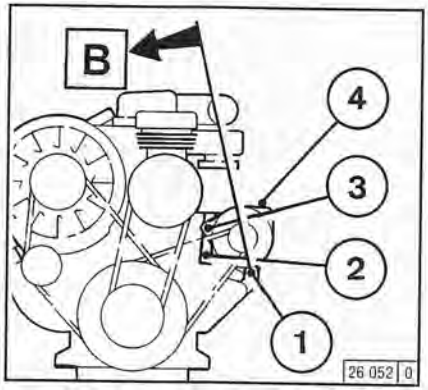
6.5.3 Tensioning Alternator Belts



- Loosen bolts 1, 2 and 3.
- Press alternator 4 outwards in direction of arrow A until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.

Only check/tension/replace V-belts when the engine is at a standstill. If necessary, replace V-belt cover.

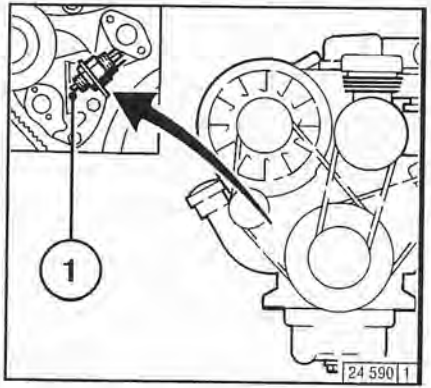
6.5.4 Changing Alternator Belts



- Remove fan V-belts as described under 6.5.2
- Loosen bolts 1, 2 and 3.
- Swing alternator 4 inwards in direction of arrow B.
- Remove V-belts and place on new belt.
- Swing alternator 4 outwards in direction of arrow A until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.
- Fit fan V-belts.

Retighten new V-belts after 15 minutes running time.

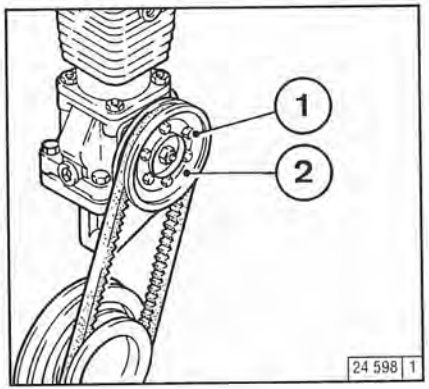
6.5.5 Checking Warning System



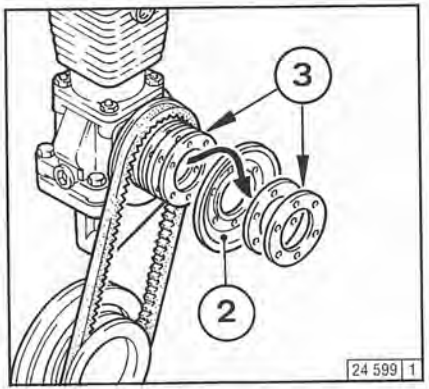
- If the V-belt rips, pressure pin 1 of the electrical switch is actuated by the tension roller and an acoustic or light signal is given.
- Functional check by pressing in pin 1.

Only carry out a check when the engine is at a standstill.

6.5.6 Tensioning and Changing Air Compressor V-Belts



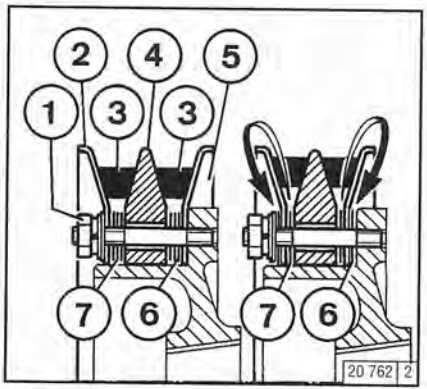
- Unscrew hexagonal bolts 1.
- Remove outer half of belt pulley 2.
- If necessary replace the V-belts.



- To tighten, remove one or more of the inner intermediate discs 3. Place the removed discs on the removed half of the V-belt pulley 2.
- Retighten bolt 1. Whilst tightening, simultaneously rotate the engine to prevent the V-belt from being crushed.

When new V-belts are fitted, check the belt tension after ca. 15 minutes running time.

6.5.7 Air Compressor Design with Double V-Belt

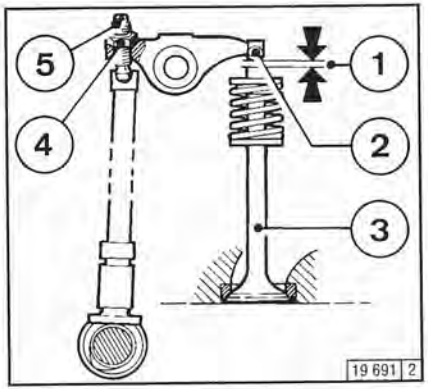


- Screw off hexagonal nut 1, remove V-belt pulley half 2, V-belt 3 and intermediate disc packet 7.
- Remove intermediate disc 4, rear V-belt 3, intermediate disc packet 6 and V-belt disc half 5.
- To tighten, remove one or more of the intermediate discs from packet 6 or 7. Place the removed discs in front of or behind V-belt pulley halves 2, so that the V-belt remains aligned. Always take the same number of discs from each packet.
- Fit in the reverse order. Whilst tightening nut 1, the engine must be rotated to prevent the V-belts from being crushed.

If a V-belt is worn or damaged, both belts in the set must be replaced. The difference in the length of the new V-belts may not exceed 0.15%.

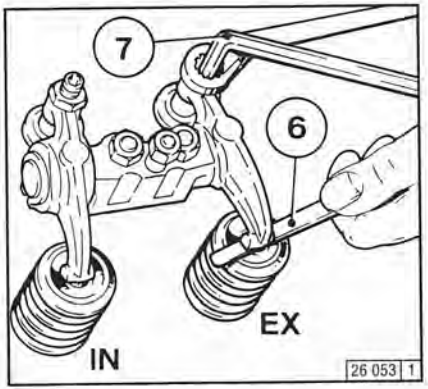
Only check or replace the V-belts when the engine is at a standstill.
If necessary, replace the V-belt cover. When new V-belts are fitted, check the belt tension after approx. 15 minutes running time.

6.6.1 Checking / Adjusting Valve Clearances



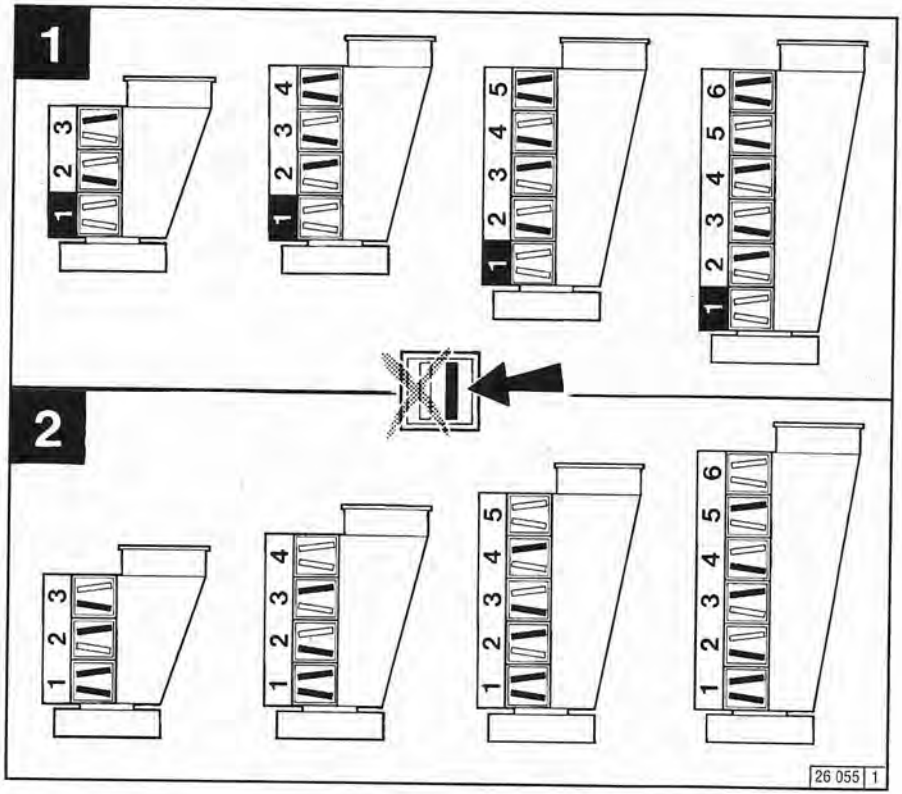
- Remove the cylinder head cover.
- Position crankshaft as per schematic 6.6.1.1
- Before adjusting valve clearance, allow engine to cool down for at least 30 minutes. The oil temperature should be below 80 °C.
- Check valve clearance 1 between rocker arm / tappet contact face 2 and valve stem 3 with feeler gauge 6 (there should be only slight resistance when feeler blade is inserted).
  For permissible valve clearance, see 9.1

Only inclined engines are fitted with an additional oil jet for lubrication of the bearing. Any adjustments must be carried out in an authorised specialist workshop.



- 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 cylinder head cover (use new gasket if needed).

6.6.1.1 Valve Clearance Adjustments Schematic

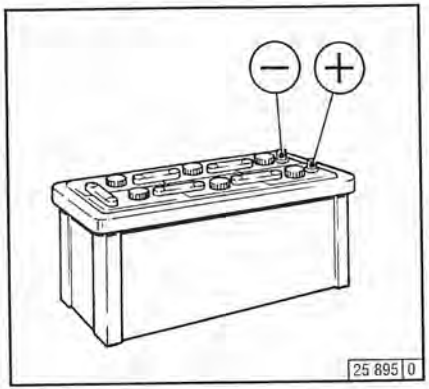


- **Crankshaft Position 1:**
  Turn crankshaft until both valves in cylinder 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearance of valves **marked in black** on schematic. Mark respective rocker arm with chalk to show that adjustment has been done.

- **Crankshaft Position 2:**
  Turn crankshaft one full revolution (360°). Adjust clearance of valves **marked in black** on schematic.

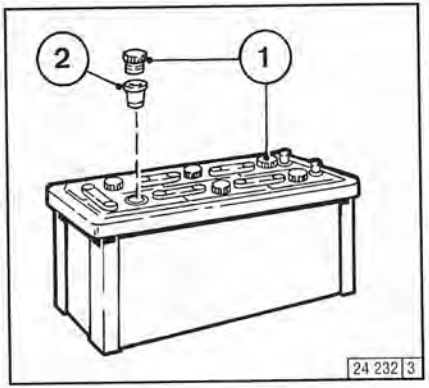
6.7.1 Battery

6.7.1.1 Checking Battery and Cable Connectors



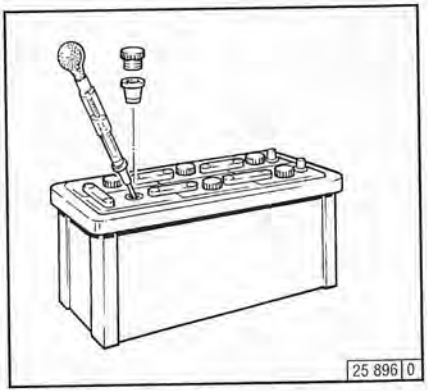
- Keep battery clean and dry.
- Undo dirty clamps.
- Clean terminal posts (+ and -) and clamps of the battery, and grease with acid-free and acid-resistant grease.
- When reassembling, ensure that clamps make good contact. Do up clamp bolts finger tight.

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 Electrolyte Density



- Measure the electrolyte density 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.

in [kg/ l]		in[°Bé (Baumégrad)*]		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 electrolyte density in ° Bé (Baumégrad) is out of date and rarely used today.



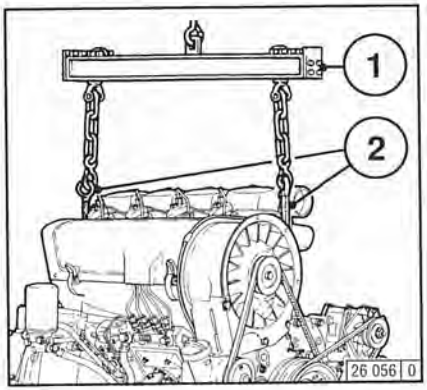
The gases emitted by the battery are explosive! Keep sparks and naked flames away from the battery. Do not allow battery acid to come into contact with skin or clothing. Wear protective goggles. Do not rest tools on the battery.

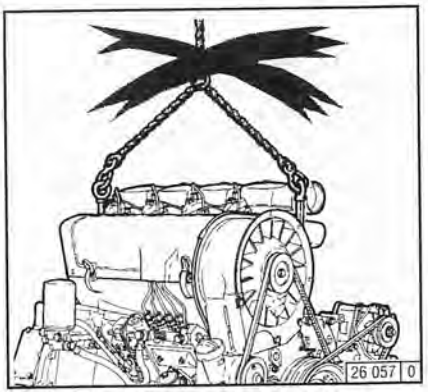
6.7.2 Three-Phase Alternator

Notes on the three-phase system:

- 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.
- When washing the engine, cover up the alternator and regulator.
- 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 case of electric welding, connect the ground terminal on the welder directly to the piece being welded.

6.7.3 Lifting Tackle





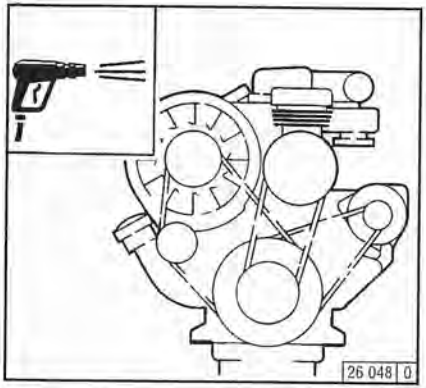
- Always use proper lifting tackle 1 when transporting the engine.
- After transportation and before commissioning of the engine: Remove transport eyes 2.



Use only the correct lifting tackle.

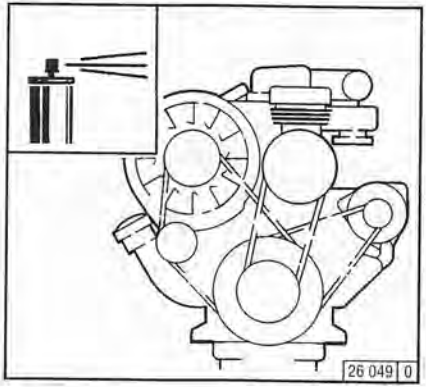
6.8.1 Cleaning the Engine

With Compressed Air



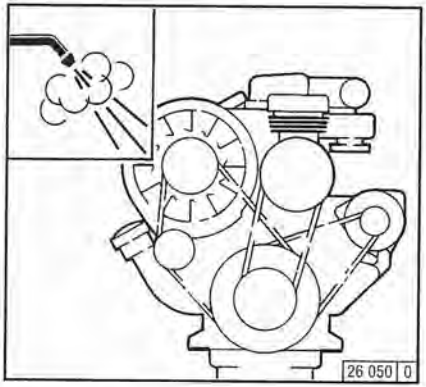
- Switch off the engine.
- Remove engine covers, cooling-air hoods. Replace following cleaning and before test run.
- Cover electrical / electronic components / connections (e.g. alternator, starter, regulator, solenoid).
- Pass compressed air through the engine, being careful with the cooler and cooling fins (start at the exhaust side)
  Remove dirt which has been blown into the inner compartment.

With Cold-Cleaning Compound



- Switch off the engine.
- Remove engine covers, cooling-air hoods. Replace following cleaning and before test run.
- Cover electrical / electronic components / connections (e.g. alternator, starter, regulator, solenoid).
- Spray engine with commercial cold-cleaning compound and leave to work for approx. 10 minutes.
- Spray engine clean with water jet and if necessary repeat procedure.
- Drive the engine warm so that remaining water evaporates.

With High-Pressure Equipment

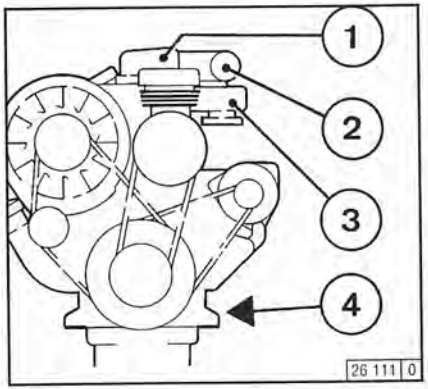


- Switch off the engine.
- Remove engine covers, cooling-air hoods. Replace following cleaning and before test run.
- Cover electrical / electronic components / connections (e.g. alternator, starter, regulator, solenoid).
- Clean engine with steam jet (max. spray pressure 60 bar, max. steam temperature 90 °C)
- Drive the engine warm so that remaining water evaporates.



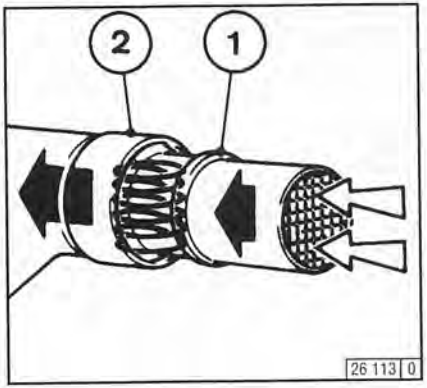
The engine may only be cleaned when it is at a standstill.

6.9.1 Checking the Mountings



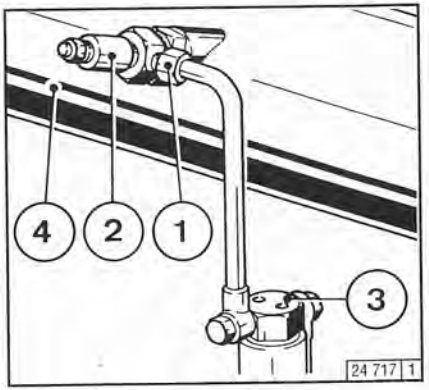
- Cylinder head cover 1
- Air-intake pipe 2
- Coupling sleeves
- Exhaust line 3
- Engine mounting 4

6.9.2 Checking the Function of the Heating Pipe

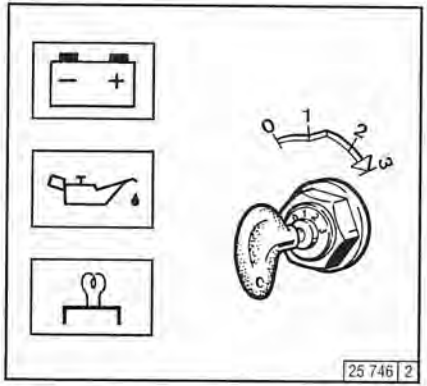


- When functioning correctly, the heating pipe heats up via the integrated heating coil when starting with preheating.
  – 1 heating pipe
  – 2 air intake pipe

6.9.3 Checking the Function of the Flame Glowing System

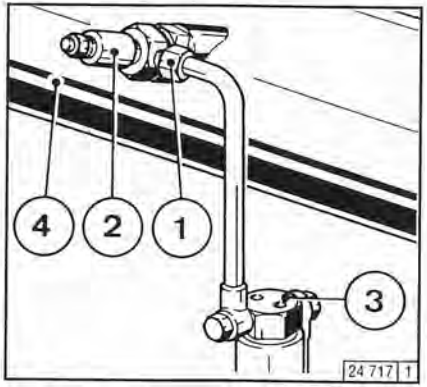


- When functioning correctly, intake pipe 4 heats up in the vicinity of flame glow plug 2 when starting with preheating.



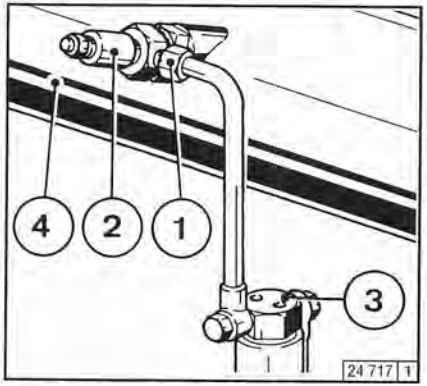
Test stage 1:

- Move speed adjustment lever and shut-off lever to "stop" position.
- Insert key
  - Position 0 = no operating voltage
- Turn key clockwise.
  - Position 1 = operating voltage
  - Pilot lights come on.
- Press in key and turn further clockwise against the spring pressure.
  - Position 2 = preheat, hold for approx. 1 minute.
  - Preheat lamp lights up.
- Otherwise flame glow plug defective or power interrupted.



Test stage 2:

- Loosen pipe connection 1.
- Rotate engine with starter, key on switch position 3.
- Fuel must be emitted at loosened pipe connection. Otherwise have the system, solenoid 3, checked by a specialist.



Test stage 3:

- Loosen pipe connection 1.
- Remove flame glow plug 2.
- Rotate engine with starter, key in switch position 3.
- Fuel must be emitted at flame glow plug 2, replace plug 2 as necessary.
- Use sealant DEUTZ DW 47 when fitting flame glow plug 2.
- Refit flame glow plug 2 on fuel line.

Keep clear of rotating parts.



Collect any leaked fuel and dispose of in an environmentally friendly fashion.

7.1 Diagnosis Chart

Faults, Causes and Remedies

7.1 Diagnosis Chart

Fault: Engine fails or is difficult to start	Engine starts but runs unevenly or stalls	Engine overheats. Temperature monitor gives warning	Engine gives poor performance	Engine not firing on all cylinders	Engine has little or no oil pressure	Engine oil consumption excessive	Engine smokes – blue	– white	– black	Cause	Section	Remedy
												Inspect I
												Adjust A
												Replace R
												Clean C
												Top up T
												Lower level L
●										Not declutched (where possible)	Operation	I
●								●		Below starting limit temperature		I
●			●							Engine shut-off lever not in stop position (shut-off magnet defective)		I
		●			●					Oil level too low		T
		●	●			●	●			Oil level too high		L
					●	●	●			Excessive inclination of engine		I/A
						●	●			Engine predominantly operated at lower load		I
●		●	●			●	●		●	Air cleaner clogged / turbocharger defective	Combustion air	R
		●	●						●	Air cleaner service switch / indicator defective		I/R
			●							LDA defective (leak in connecting line) only with charged engines		I/R
		●	●						●	Exhaust counter pressure too high		I
			●						●	Charge-air line leaking, only with charged engines		I/A
		●								Charge-air line leaking, only with charged engines	Cooling system	I/C
		●	●						●	Charge air cooler clogged		I/C
		●			●					Oil cooler air and/or oil side clogged		I/C
		●								Cooling fan or exhaust thermostat defective, V-belts ripped or loose		I/R
		●								Cooling air temperature rise / heating short circuit		I
		●								Cooling air fins loose, cracked or missing		I

Fault: Engine fails or is difficult to start	Engine starts but runs unevenly or stalls	Engine overheats. Temperature monitor gives warning	Engine gives poor performance	Engine not firing on all cylinders	Engine has little or no oil pressure	Engine oil consumption excessive	Engine smokes – blue	– white	– black	Cause	Section	Remedy
												Inspect I
												Adjust A
												Replace R
												Clean C
												Top up T
												Lower level L
●										Battery defective or discharged	Electrics	I
●										Electric cable connections to starter electrical system loose or oxidised		I
●										Starter defective or pinion does not engage		I
					●					Oil pressure switch/oil pressure gauge defective		I/R
●	●	●	●	●				●	●	Incorrect valve clearance	Engine	A
●	●		●	●						Leaking injection line		I/C
		●								Vent line clogged		I/C
●	●							●		Flame glow system/heating pipe defective		I/R
●	●	●	●	●				●	●	Injection valve defective		I/R
●	●		●	●						Air in fuel system		P/R
●	●		●	●						Fuel filter/fuel precleaner clogged		I/C/R
		●				●				Oil filter defective		R
●					●	●				Incorrect SAE class or grade of engine lube oil		R
●	●		●	●				●	●	Compression pressure too low		I
							●			Oil in combustion chamber		I/C

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 month. The procedure will have to be reversed before the engine is recommissioned.

- 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)

8.1.1 Preserving Engine

- Clean engine (with cold cleansing agent if preferred) using high pressure equipment.
- Run engine until warm, then turn off.
- Drain engine oil, see 6.1.2, and fill with anti-corrosion oil.
- If necessary, clean oil bath cleaner, see 6.4.3, and fill with anti-corrosion oil.
- Drain fuel from 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 to preserve the cylinders and combustion chamber. When rotating with starter, place shut-off lever in stop position.
- Remove V-belts and store dry in wrapped condition.
- Spray grooves on V-belt pulleys with anti-corrosion spray.
- Close off intake ports and exhaust ports.

8.1.2 Removing Engine Preservatives

- Remove anti-corrosion agent from grooves in V-belt pulleys.
- Install V-belts. Retension after brief operation if necessary, see 6.5
- Remove plugs from intake port and exhaust port.
- Set the engine in operation.

9.1 Engine Specifications and Settings
9.2 Torque Wrench Settings
9.3 Tools

Model		F3L 912	F4L 912	F5L 912	F6L 912
Numbers of cylinders		3	4	5	6
Cylinder arrangement		vertical in line			
Bore	[mm]	100			
Stroke	[mm]	120			
Total displacement	[cm³]	2827	3770	4712	5655
Compression ratio	[ε]	19			
Working cycle		4-stroke diesel induction engine			
Combustion system		direct injection			
Direction of rotation		counterclockwise			
Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator)	[ca. kg]	270 [5]	300 [5]	380 [5]	410 [5]
Engine power	[kW (PS)]	1)			
Speed	[1/min]	1)			
Lubrication		pressure lubrication			
SAE oil		15W 40			
Oil temperature in oil pan	[°C]	125			
Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed	[bar]	0,4 [4]			
Oil change quantity without filter	[ca. ltr.]	9,0 [3]	12,0 [3]	13,5 [3]	14,5 [3]
Oil change quantity with filter	[ca. ltr.]	9,5 [3]	12,5 [3]	14,0 [3]	15,5 [3]
Valve clearance with cold engine	[mm]	inlet 0.15 + 0.05 / exhaust 0.15 + 0.05			
Opening pressure of the injection valve	[bar]	250 +8			
Start of delivery	[°crank angle b TDC]	1)			
Firing order		1–2–3	1–3–4–2	1–2–4–5–3	1–5–3–6–2–4
V-belt pressure: pretension / tighten		preload / torquing load [2]			
Alternator fan	[N]	450 / 300 ± 20			
Compressor	[N]	550 / 400 ± 20			

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1

2) Tighten after 15 minutes, after the engine has been driven under load.

3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**

4) Values for engines without engine oil heating.

5) Ca. value can vary depending on oil pan design.

Model		F3L 913	F4L 913	F6L 913
Numbers of cylinders		3	4	6
Cylinder arrangement			vertical in line	
Bore	[mm]		102	
Stroke	[mm]		125	
Total displacement	[cm^3]	3064	4086	6128
Compression ratio	[ε]		19	
Working cycle			4-stroke diesel induction engine	
Combustion system			direct injection	
Direction of rotation			counterclockwise	
Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator)	[ca. kg]	277 4)	320 4)	420 4)
Engine power	[kW (PS)]		1)	
Speed	[1/min]		1)	
Lubrication			pressure lubrication	
SAE oil			15W 40	
Oil temperature in oil pan	[°C]		125	
Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed	[bar]		0,4 4)	
Oil change quantity without filter	[ca. ltr.]	8,0 3)	12 3)	16,5 3)
Oil change quantity with filter	[ca. ltr.]	9,5 3)	13,5 3)	18,5 3)
Valve clearance with cold engine	[mm]		inlet 0.15 + 0.05 / exhaust 0.15 + 0.05	
Opening pressure of the injection valve	[bar]		250 + 8	
Start of delivery	[°crank angle b TDC]		1)	
Firing order		1–2–3	1–3–4–2	1–5–3–6–2–4
V-belt pressure: pretension / tighten			preload / torquing load 2)	
Alternator fan	[N]		450 / 300 ± 20	
Compressor	[N]		550 / 400 ± 20	

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1

2) Tighten after 15 minutes, after the engine has been driven under load.

3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**

4) Ca. value can vary depending on oil pan design.

Model 913/C/CT		F3L 913W	F4L 912W	F6L 912W
Numbers of cylinders		3	4	6
Cylinder arrangement			vertical in line	
Bore	[mm]		102	
Stroke	[mm]		125	
Total displacement	[cm³]	3064	4086	6128
Compression ratio	[ε]		22	
Working cycle			4-stroke diesel induction engine	
Combustion syst			direct injection	
Direction of rotation			counterclockwise	
Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator)	[ca. kg]	270 4)	300 4)	410 4)
Engine power	[kW (PS)]		1)	
Speed	[1/min]		1)	
Lubrication			pressure lubrication	
SAE oil			15W 40	
Oil temperature in oil pan	[°C]		125	
Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed	[bar]		0,4 4)	
Oil change quantity without filter	[ca. ltr.]	8,0 3)	12 3)	16,5 3)
Oil change quantity with filter	[ca. ltr.]	9,5 3)	13,5 3)	18,5 3)
Valve clearance with cold engine	[mm]		inlet 0.15 + 0.05 / exhaust 0.15 + 0.05	
Opening pressure of the injection valve	[bar]		120 + 10	
Start of delivery	[°crank angle b TDC]		1)	
Firing order		1–2–3	1–3–4–2	1–5–3–6–2–4
V-belt pressure: pretension / tighten			preload / torquing load 2)	
Alternator fan	[N]		450 / 300 ± 20	
Compressor	[N]		550 / 400 ± 20	

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1

2) Tighten after 15 minutes, after the engine has been driven under load.

3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**

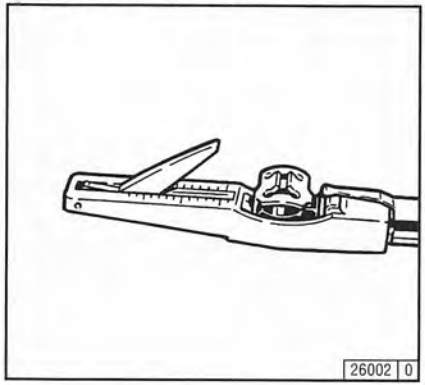
4) Ca. value can vary depending on oil pan design.

Model 913/C/CT		BF4L 913	BF6L 913	BF6L 913 C
Numbers of cylinders		4	6	6
Cylinder arrangement			vertical in line	
Bore	[mm]		102	
Stroke	[mm]		125	
Total displacement	[cm³]	4086	6128	6128
Compression ratio	[ε]	18	18	17
Working cycle			supercharged 4-stroke diesel induction engine	
Combustion syst			direct injection	
Direction of rotation			counterclockwise	
Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator)	[ca. kg]	360 [5]	485 [5]	510 [5]
Engine power	[kW (PS)]		1)	
Speed	[1/min]		1)	
Lubrication			pressure lubrication	
SAE oil			15W 40	
Oil temperature in oil pan	[°C]		125	
Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed	[bar]		0,5 [4]	
Oil change quantity without filter	[ca. ltr.]	9,5 [3]	16,0 [3]	16,0 [3]
Oil change quantity with filter	[ca. ltr.]	11,5 [3]	18,2 [3]	18,2 [3]
Valve clearance with cold engine	[mm]		inlet 0.15 + 0.05 / exhaust 0.15 + 0.05	
Opening pressure of the injection valve	[bar]		250 + 8	
Start of delivery	[°crank angle b TDC]		1)	
Firing order		1–3–4–2	1–5–3–6–2–4	1–5–3–6–2–4
V-belt pressure: pretension / tighten			preload / torquing load [2]	
Alternator fan	[N]		450 / 300 ± 20	
Compressor	[N]		550 / 400 ± 20	

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1
2) Tighten after 15 minutes, after the engine has been driven under load.
3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**
4) Values for engines without engine oil heating.
5) Ca. value can vary depending on oil pan design.

Location	Preload [Nm]	Torquing load 1st stage	2nd stage	3rd stage	4th stage	Total	Remarks
Alternator mounting	20	180°	–	–	–	180°	M10 x 180
	30	180°	–	–	–	180°	M14 x 230
Cylinder head cover	–	–	–	–	–	12 ± 1,2 Nm	–
Rocker arm set screw	–	–	–	–	–	22 ± 2 Nm	–
Support foot	30	15°	60°	–	–	75°	M14 x 100
	30	45°	60°	–	–	105°	M14 x 110
	30	45°	60°	–	–	105°	M14 x 125
Air intake manifold	–	–	–	–	–	22 ± 2 Nm	–
Exhaust manifold	–	–	–	–	–	40 ± 4 Nm	–
Oil drain plug – cast iron oil pan	–	–	–	–	–	150 ± 10 Nm	M22 x 1,5
Oil drain plug – sheet metal oil pan	–	–	–	–	–	100 ± 10 Nm	M30 x 1,5
Injection valve mounting	–	–	–	–	–	25–30 Nm	–

V-belt Tension Gauge



The V-belt tension gauge can be obtained under order number **8115** from:

COMPANY WILBÄR
Postfach 14 05 80
D-42826 Remscheid

California Proposition 65 Information

To California customers and to customers selling diesel engine equipment into or for use in California.

Proposition 65, a California law, requires warnings on products which expose individuals in California to chemicals listed under that law, including certain chemicals in diesel engine exhaust.

Obligations of Manufactures of Diesel-Powered Off-Road Equipment. The California Superior Court has approved either of the following two methods of compliance with Proposition 65 requirements by manufactures of off-road equipment containing diesel engines. (The court order containing these provisions is attached.)

1. **On-Equipment Warning.** Place the warning pictured in attachment 1 on all equipment shipped by you into or for sale in California after January 1, 1996. The warning must be in a location where it is easily visible to the operator of the equipment when (s)he is operating the equipment. The warning must be secured to the equipment. If warnings or operating instructions are provided through a digital display, you may usee that method of providing warning.
2. **Operator Manual Warning.** When the operator manual is next revised or by December 31, 1995 whichever is earlier, place the warning in attachment 2 in the operator manual. The warning may be either printed in the manual or on a sticker.

The warning must appear in one of the following locations:

- Inside The front cover
- Inside the back cover
- Outside the front cover
- Outside the back cover
- As the first page of text

Under either alternative, the warning must appear in the same size, print and format as the attachment selected or be of an equally conspicuous size and format. If the warning is provided in an on-screen display, the warning must contain the language in the attachment and must be provided at the time of or in connection with ignition in the same manner as other safety warnings electronically communicated on screen.

Obligation of Resellers of Diesel Engines. This letter must accompany any loose diesel engine sold in California.
Should you have any questions, please call Deutz Corporation Product Support Department.

Warnings to Place on Equipment

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Warning in the Manual

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

or

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Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Notes

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