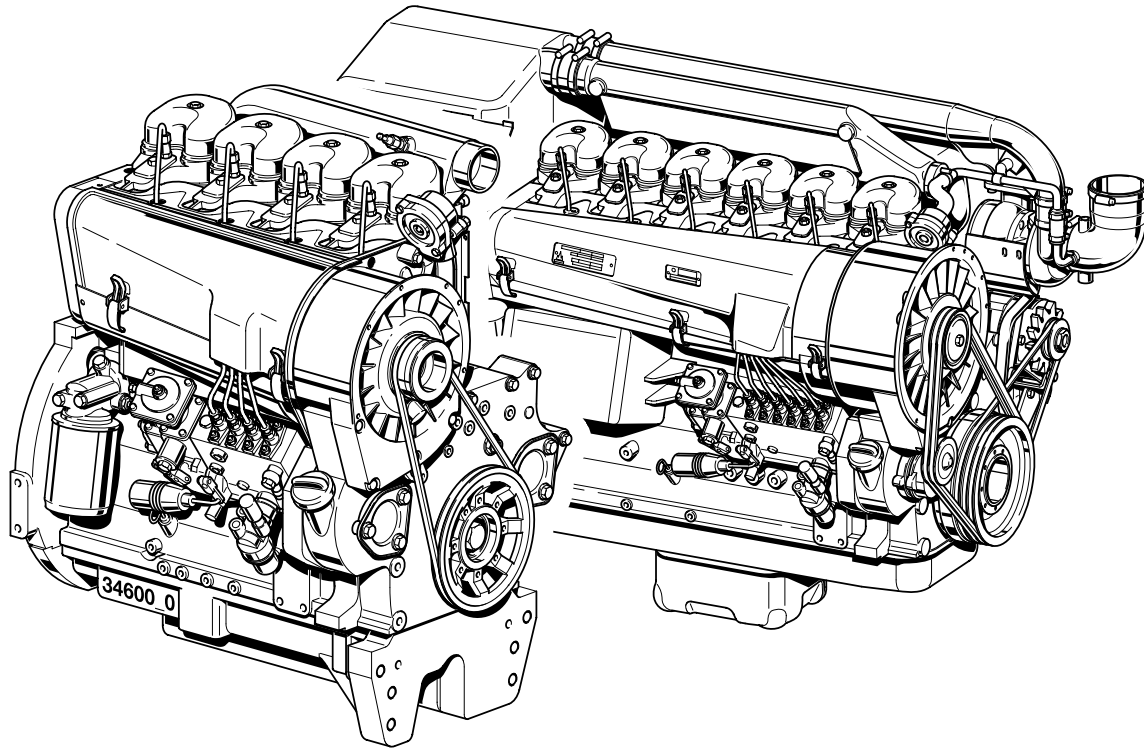


Operation Manual

914



Safety guidelines / Accident prevention



- 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.
- When the engine is running, there is a risk of injury through:
 - turning/hot components
 - engines with positive ignition
 - ignition systems (high electrical voltage)
You must avoid contact at all times!
- 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 change, convert or adjust the cooling air intake area to the blower. 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 original parts is prescribed. These are specially designed for your engine and guarantee perfect operation. Non-compliance results in the expiry of the warranty!
- Maintenance and cleaning of the engine should only be carried out when the engine is switched off and has cooled down. You must ensure that the electrical systems have been switched off and the ignition key has been removed. Accident prevention guidelines concerning electrical systems (e.g. VDE-0100/-0101/-0104/-0105 Electrical protective measures against dangerous touch voltage) are to be observed. When cleaning with fluids, all electrical components are to be covered impermeably.

Operation Manual

914

0312 0382 en

Engine Serial Number

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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.

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).



Foreword

Dear Customer,

Air / liquid-cooled Deutz engines are designed for a large number of applications. Consequently, a wide range of variants is 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 these differences relevant to your engine.

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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 - 2 Engine Description**
 - 2.1 Model**
 - 2.1.1 Rating Plate
 - 2.1.2 Position of the Rating Plate
 - 2.1.3 Engine Serial Number
 - 2.1.4 Cylinder numbering
 - 2.1.5 Direct injection
 - 2.2 Engine Illustrations**
 - 2.2.1 Operation side BF3L 914
 - 2.2.2 Air outlet side BF3L 914
 - 2.2.3 Operation side F4L 914
 - 2.2.4 Air outlet side F4L 914
 - 2.2.5 Operation side BF6L 914
Intercooler over air-intake line
 - 2.2.6 Air outlet side BF6L 914 C
Intercooler over air-intake line
 - 2.2.7 Operation side BF6L 914 C
Intercooler over flywheel
 - 2.2.8 Air outlet side BF6L 914
Intercooler over flywheel
 - 2.3 Lube Oil Circuit Schematic**
 - 2.3.1 Lube Oil Circuit Schematic
 - 2.4 Fuel System Plan**
 - 2.4.1 Fuel System
 - 2.5 Engine cooling**
 - 2.5.1 Amount of cool air regulated by exhaust thermostat
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 - 3.3 Monitoring Operation**
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 - 6.5.7 Air compressor model with dual belts
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(adjust if necessary)
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 - 6.7.3 Transportation Shackles
 - 6.8 Engine cleaning**
 - 6.8.1 Engine cleaning
 - 6.9 Additional Maintenance Work**
 - 6.9.1 Check fastenings
 - 6.9.2 Check functioning of glow plugs
- 7 Faults, Causes and Remedies**
 - 7.1 Fault Table**
- 8 Engine Preservation**
 - 8.1 Preservation**
 - 8.1.1 Preserve engine
 - 8.1.2 Remove engine preservation
- 9 Technical Specification**
 - 9.1 Engine Specifications and Settings**
 - 9.2 Screw Tightening Torques**
 - 9.3 Tools**
- 10 Service**

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.

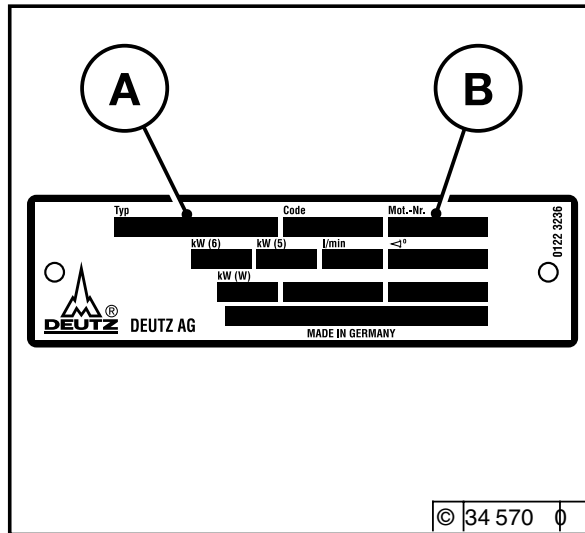
- 2.1 Model**
- 2.2 Engine Illustrations**
- 2.3 Lube Oil Circuit Schematic**
- 2.4 Fuel System Plan**
- 2.5 Engine cooling**

Engine Description

2.1 Model

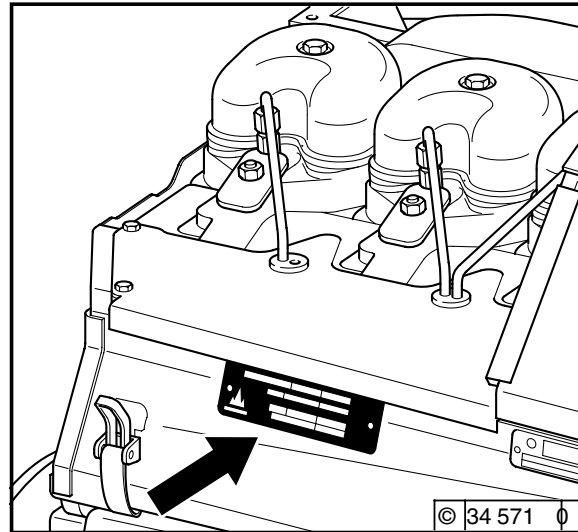
2

2.1.1 Rating Plate



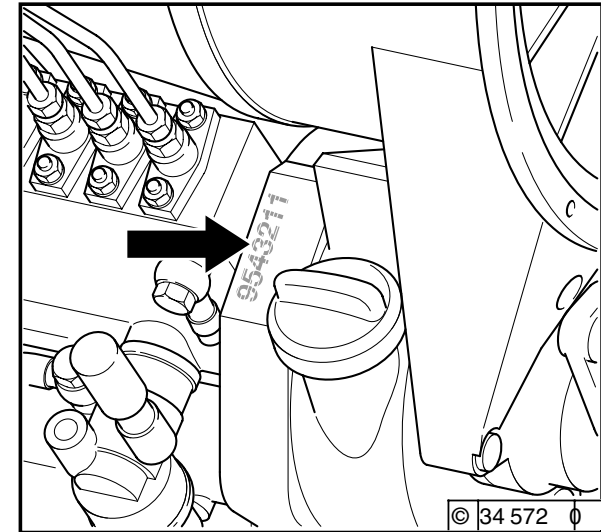
The model **A**, the engine serial number **B** and the performance data are stamped on the rating plate.
The model and engine serial number must be given when ordering parts.

2.1.2 Position of the Rating Plate



The rating plate **C** is attached to the crankcase. Depending on the model, a second rating plate may be affixed to the air duct hood.

2.1.3 Engine Serial Number

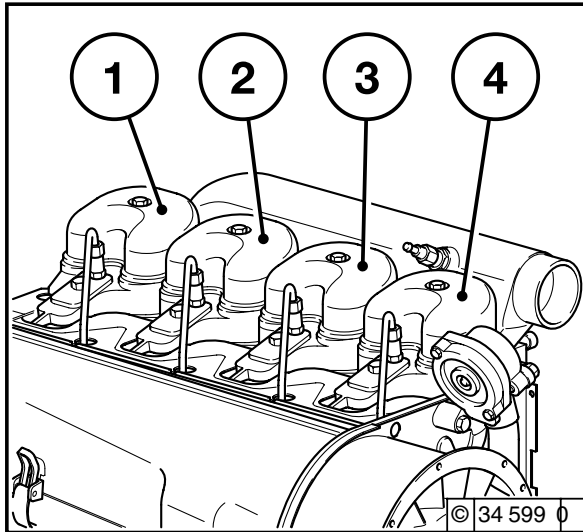


The engine serial number is stamped on the crankcase (**arrow**) as well as the rating plate.

2.1 Model

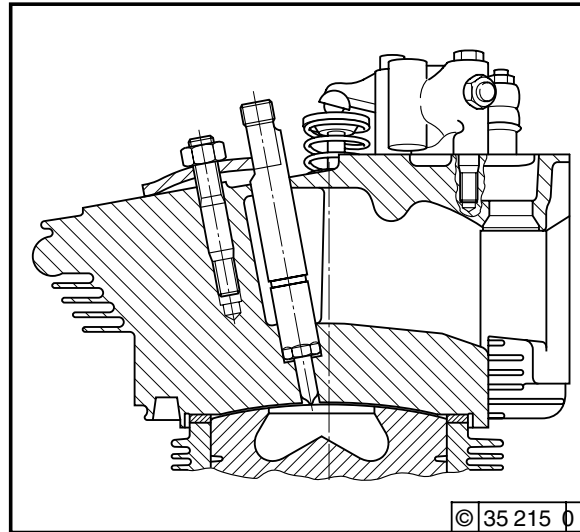
Engine Description

2.1.4 Cylinder numbering



Cylinders are numbered consecutively, beginning at the flywheel.

2.1.5 Direct injection B/FL 914



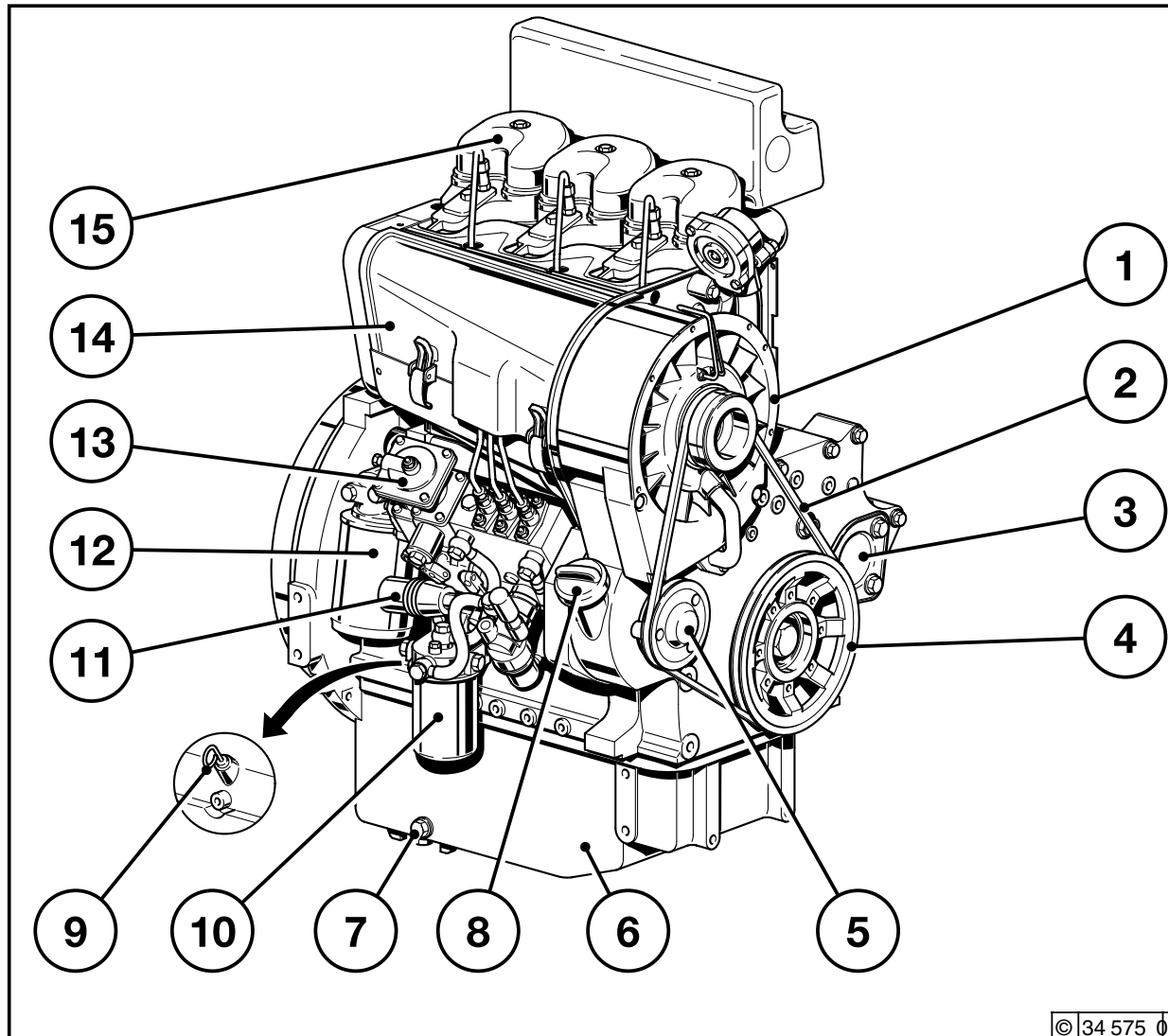
Engines with direct injection are used if high output is required.

Engine Description

2.2 Engine Illustrations

2

2.2.1 Operation side BF3L914

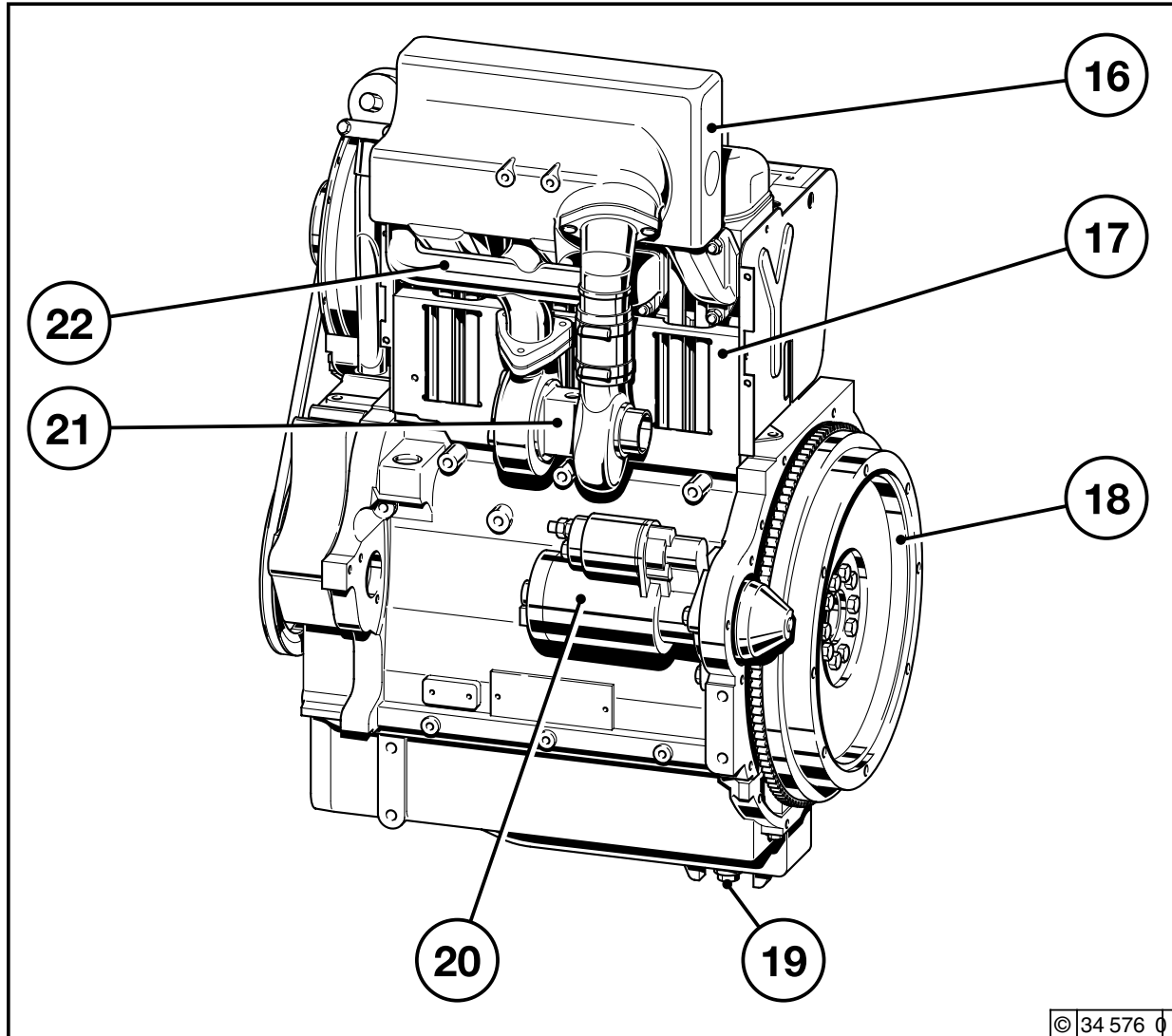


- 1 Cooling fan
- 2 V-Belts (fan)
- 3 Optional attachment of hydraulic pumps
- 4 V-belt washer
- 5 Tension roller
- 6 Oil pan
- 7 Oil drain screw
- 8 Oil filler neck
- 9 Oil dipstick
- 10 Fuel change filter
- 11 Solenoid (shut-off magnet)
- 12 Lube oil filter
- 13 Full-stop depending on charge air pressure
- 14 Air duct hood
- 15 Cylinder head cover

2.2 Engine Illustrations

Engine Description

2.2.2 Exhaust side BF3L914



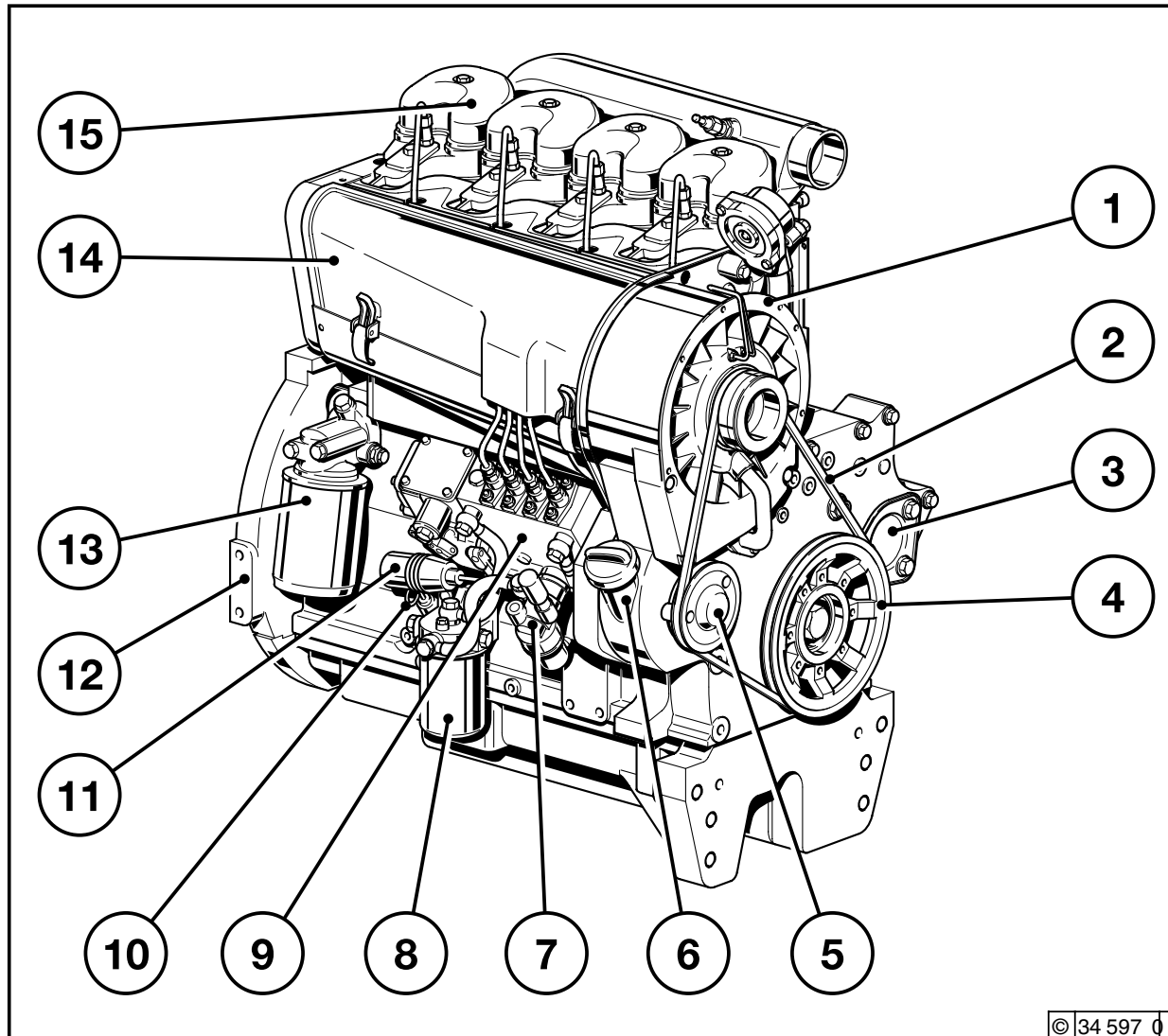
- 16 Air-intake line
- 17 Shielding plate
- 18 Flywheel
- 19 Oil drain screw
- 20 Starter
- 21 Exhaust turbocharger manifold

Engine Description

2.2 Engine Illustrations

2

2.2.3 Operation side F4L 914



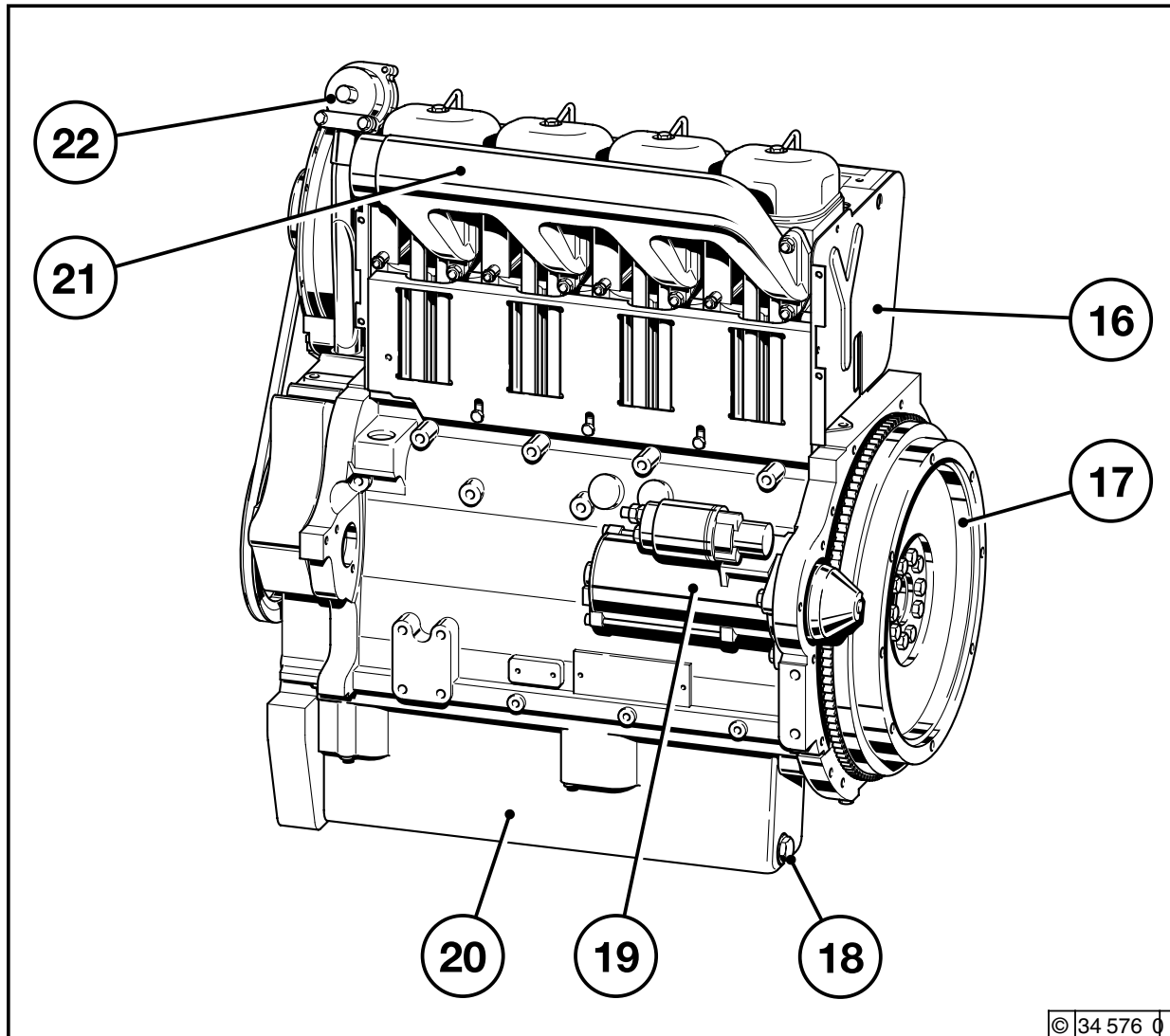
- 1 Cooling fan
- 2 V-Belts (fan)
- 3 Optional attachment of hydraulic pumps
- 4 V-belt washer
- 5 Tension roller
- 6 Oil filler neck
- 7 Fuel pump
- 8 Fuel change filter
- 9 Injection pump
- 10 Oil dipstick
- 11 Shut-off magnet
- 12 SAE housing
- 13 Lube oil filter
- 14 Air duct hood
- 15 Cylinder head cove

2.2 Engine Illustrations

Engine Description

2.2.4 Exhaustside F4L914

2



- 16 Date plate
- 17 Flywheel
- 18 Oil drain screw
- 19 Starter
- 20 Oil pan
- 21 Air-intake manifold
- 22 Crankcase ventilation

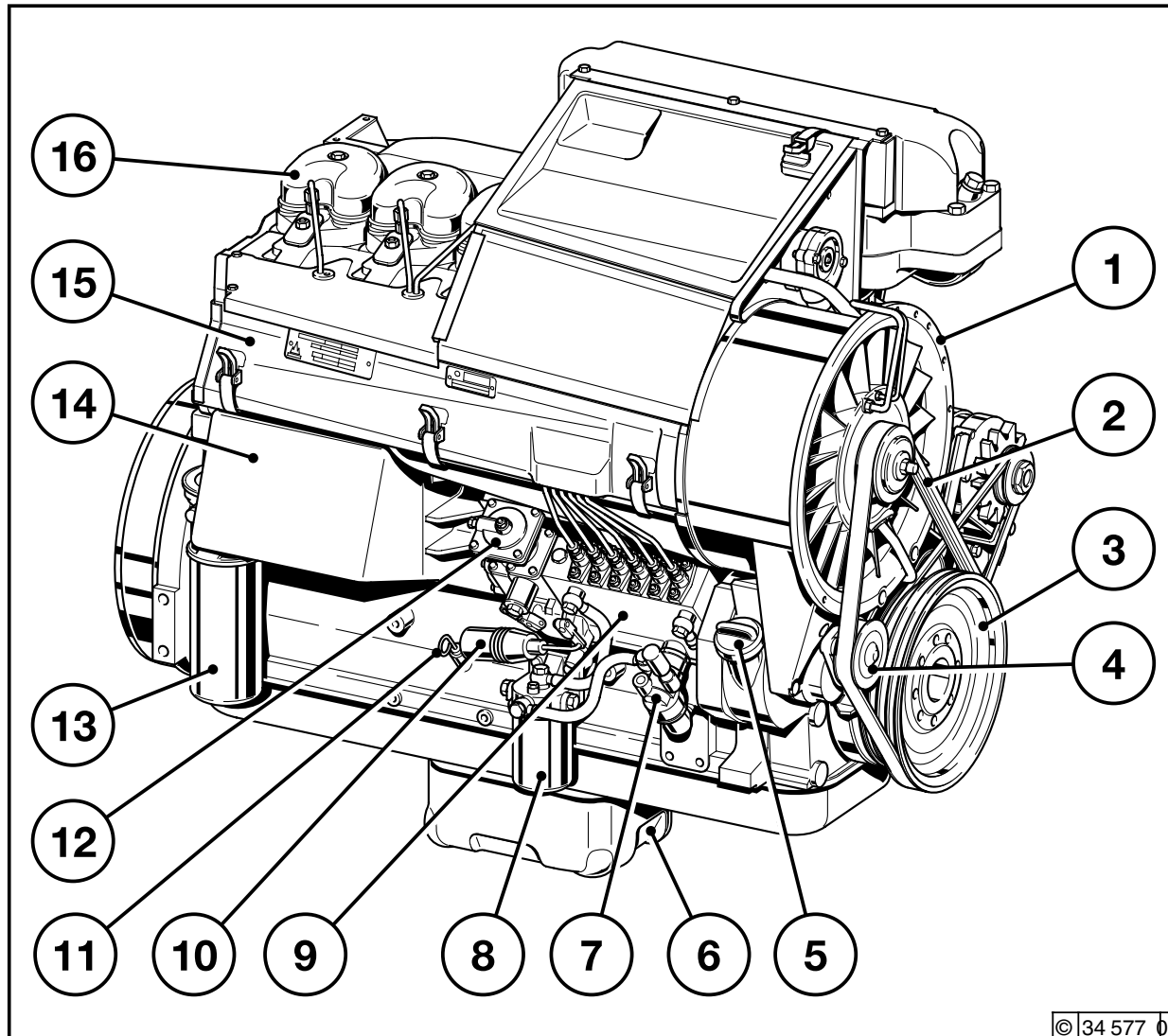
© 34 576 0

2.2 Engine Illustrations

Engine Description

2

2.2.5 Operation side BF6L 914 C- intercooler over air-intake line

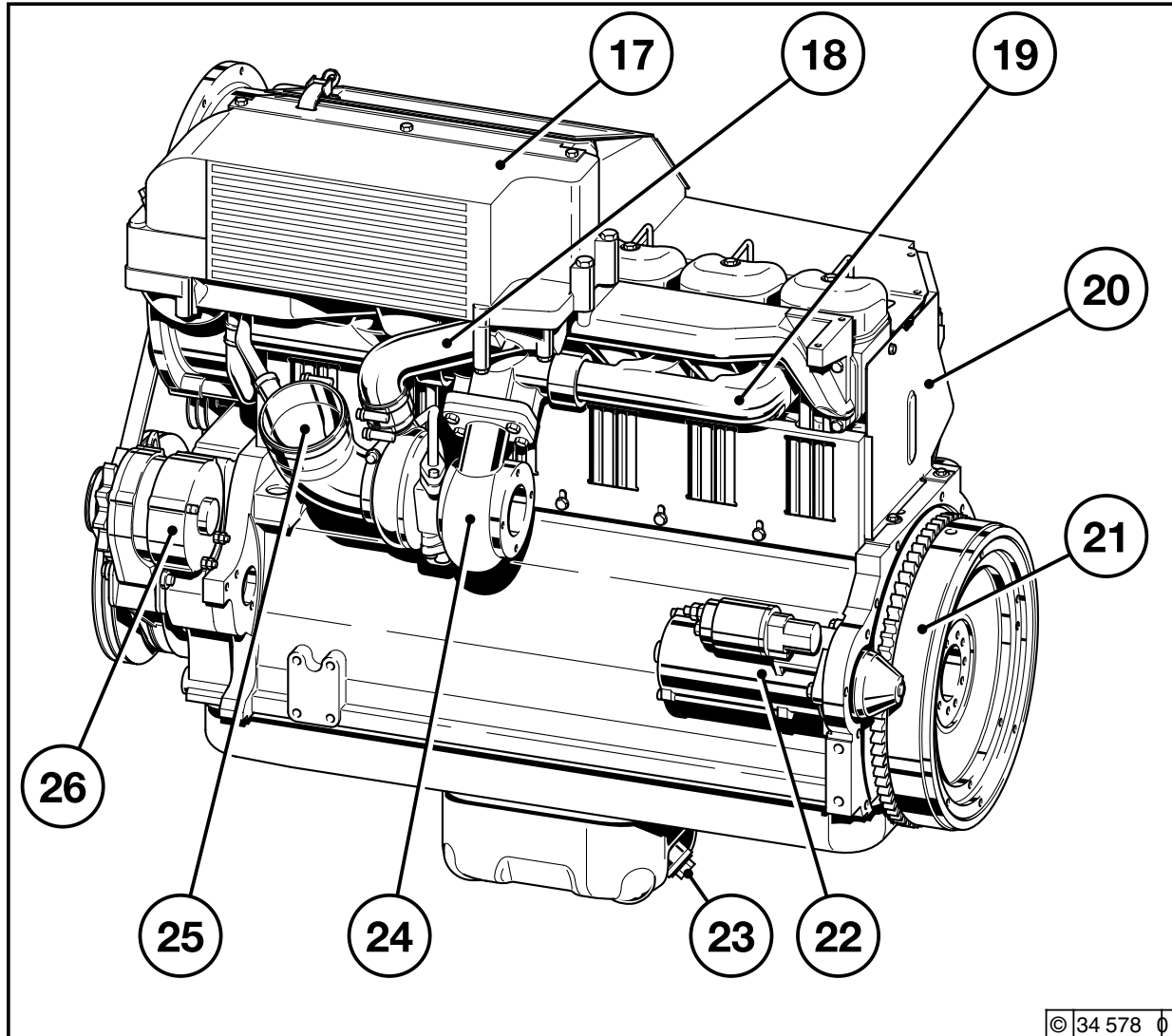


- 1 Cooling fan
- 2 V-Belts (fan)
- 3 V-belt pulley on crankshaft
- 4 Tension roller
- 5 Oil filler neck
- 6 Oil drain screw
- 7 Fuel pump with fuel precleaning
- 8 Fuel filter cartridge
- 9 Injection pump
- 10 Shut-off lifting magnet
- 11 Oil dipstick
- 12 LDA
- 13 Lube oil filter cartridge
- 14 Engine oil cooler
- 15 Air duct hood
- 16 Cylinder head cover

2.2 Engine Illustrations

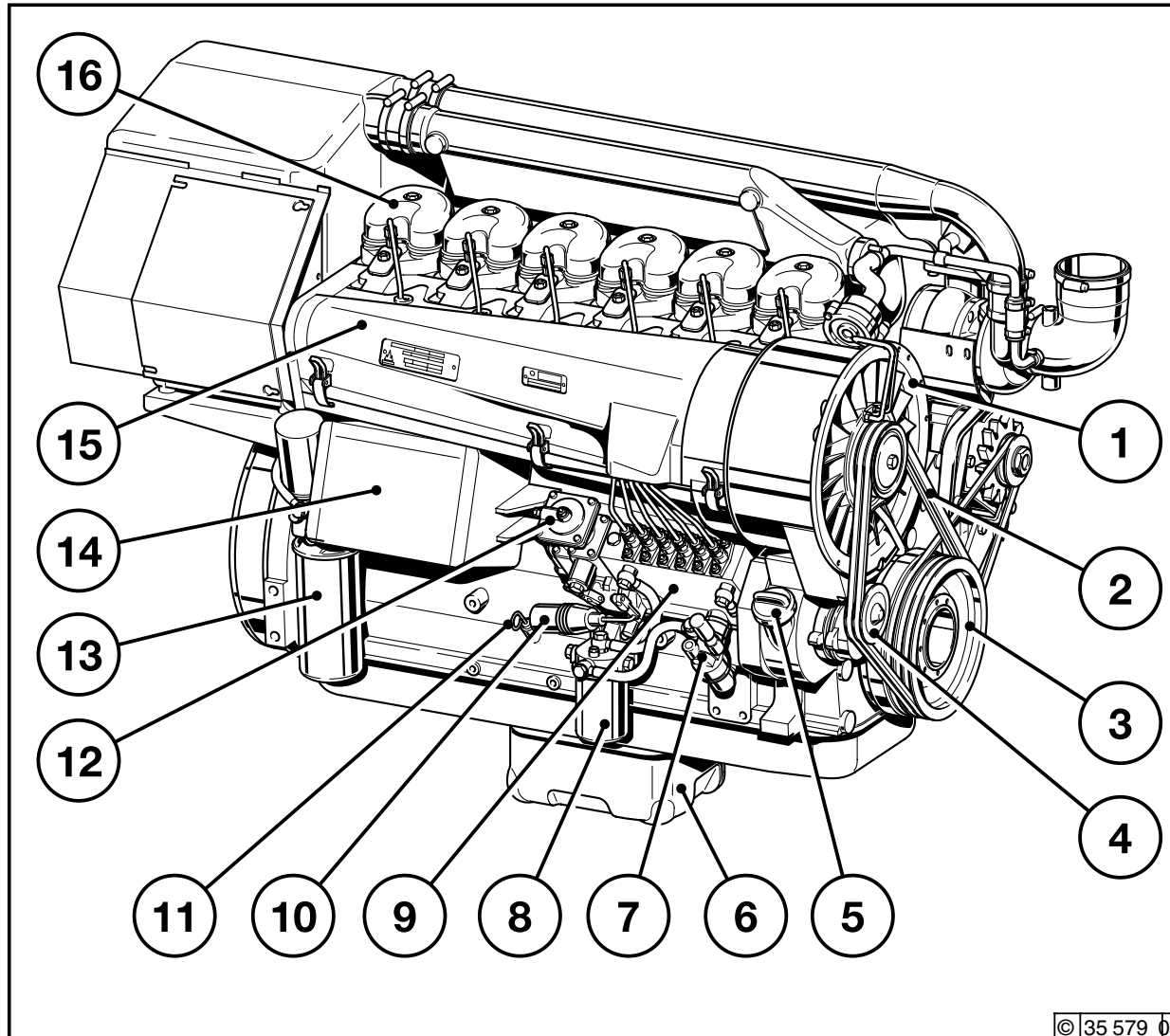
Engine Description

2.2.6 Exhaustside BF6L 914 C- intercooler over air-intake line



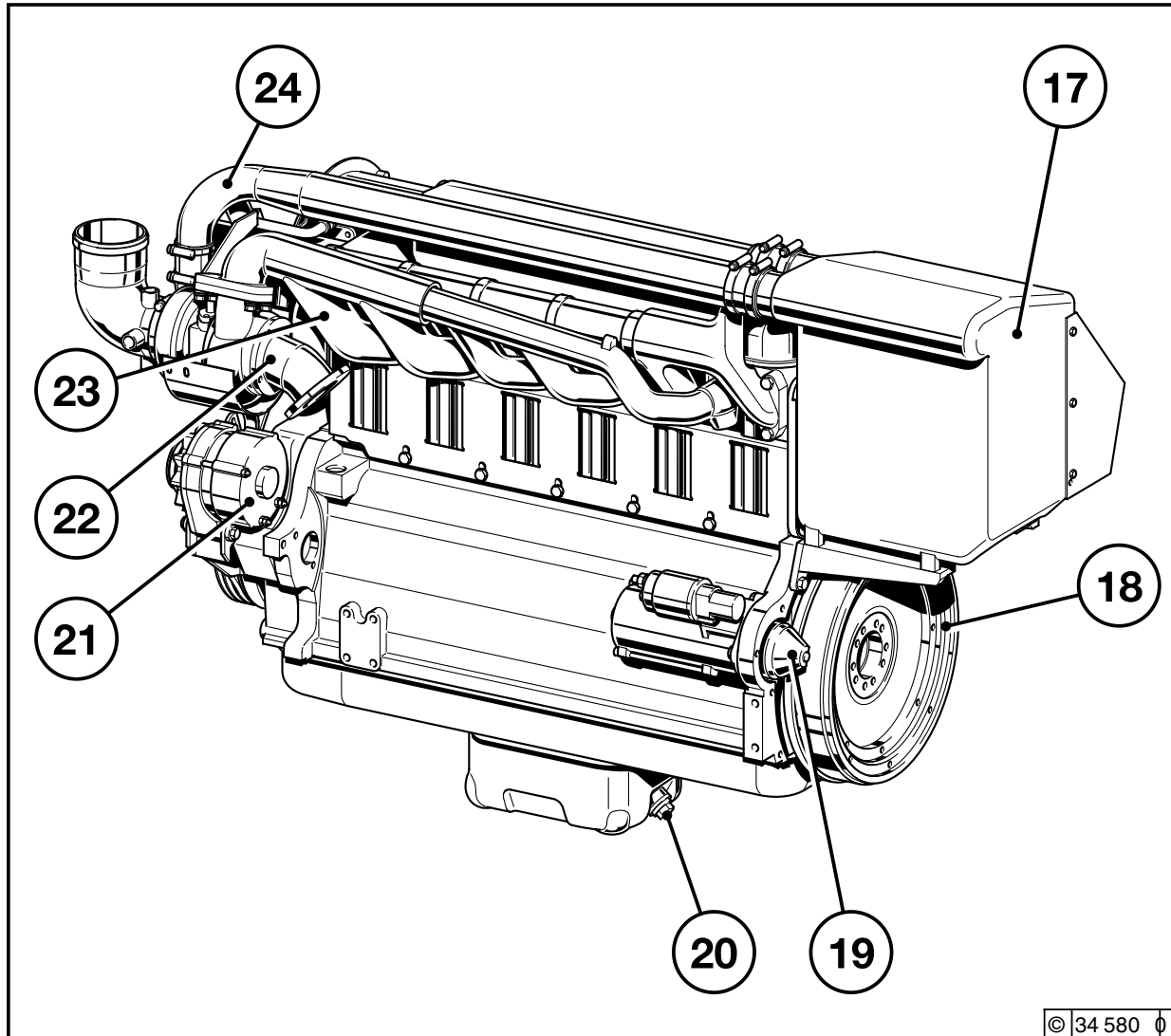
- 17 Intercooler
- 18 Air-intake line
- 19 Exhaust manifold line
- 20 Date plate
- 21 Flywheel
- 22 Starter
- 23 Oil drain screw
- 24 Turbocharger
- 25 Air-intake manifold to exhaust turbocharger
- 26 Alternator

2.2.7 Operation side BF6L 914 C- intercooler over flywheel



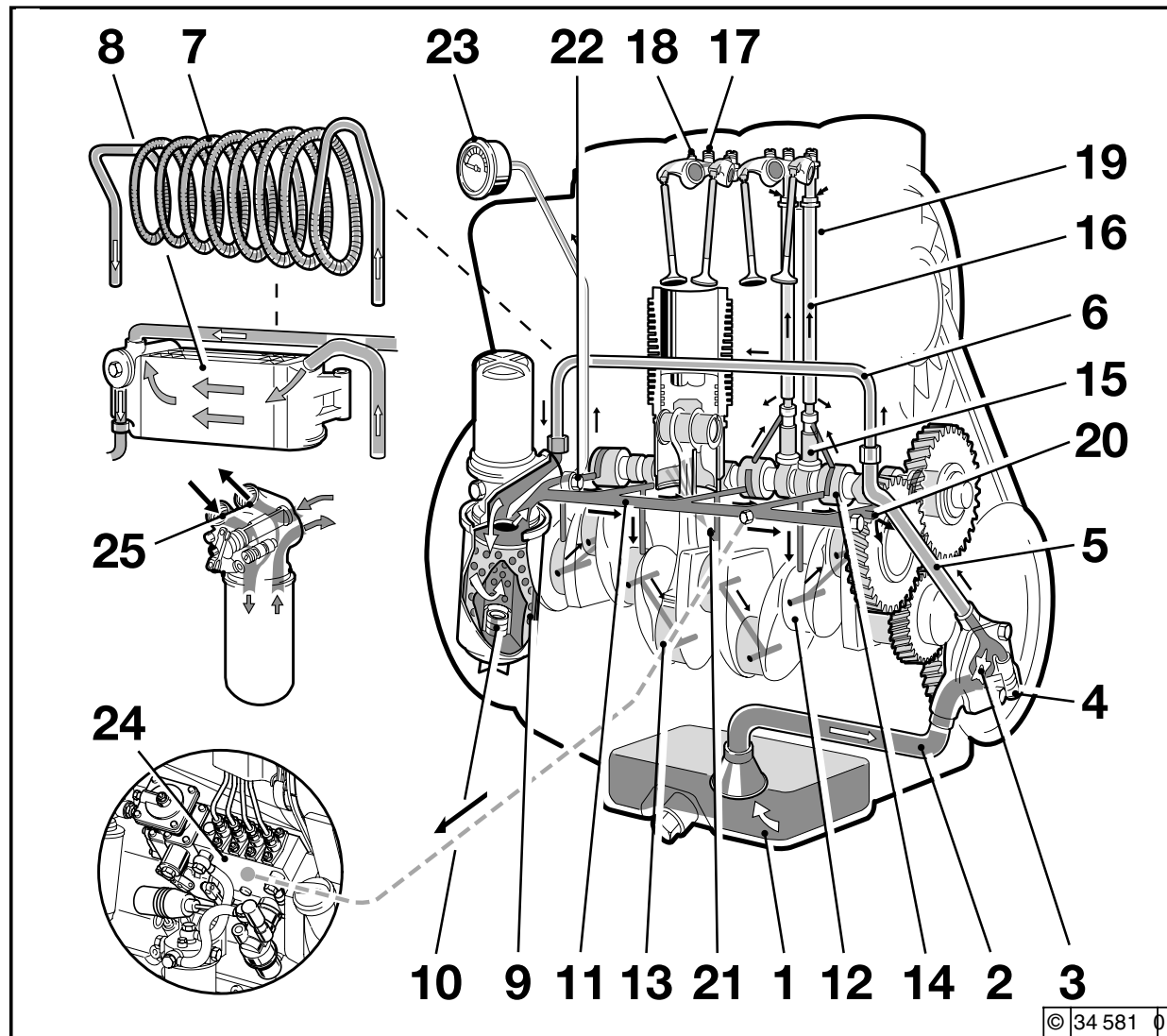
- 1 Cooling fan
- 2 V-Belts (fan)
- 3 V-belt pulley on crankshaft
- 4 Tension roller
- 5 Oil filler neck
- 6 Oil drain screw
- 7 Fuel pump with fuel precleaning
- 8 Fuel filter cartridge
- 9 Injection pump
- 10 Shut-off lifting magnet
- 11 Oil dipstick
- 12 LDA
- 13 Lube oil filter cartridge
- 14 Engine oil cooler
- 15 Air duct hood
- 16 Cylinder head cover

2.2.8 Exhaust side BF6L 914 - intercooler over flywheel



- 17 Intercooler
- 18 Flywheel
- 19 Starter
- 20 Oil drain screw
- 21 Alternator
- 22 Exhaust connection supports
- 23 Exhaust manifold line
- 24 Air-intake manifold to exhaust turbocharger

2.3.1 Lube Oil Circuit Schematic FL 914



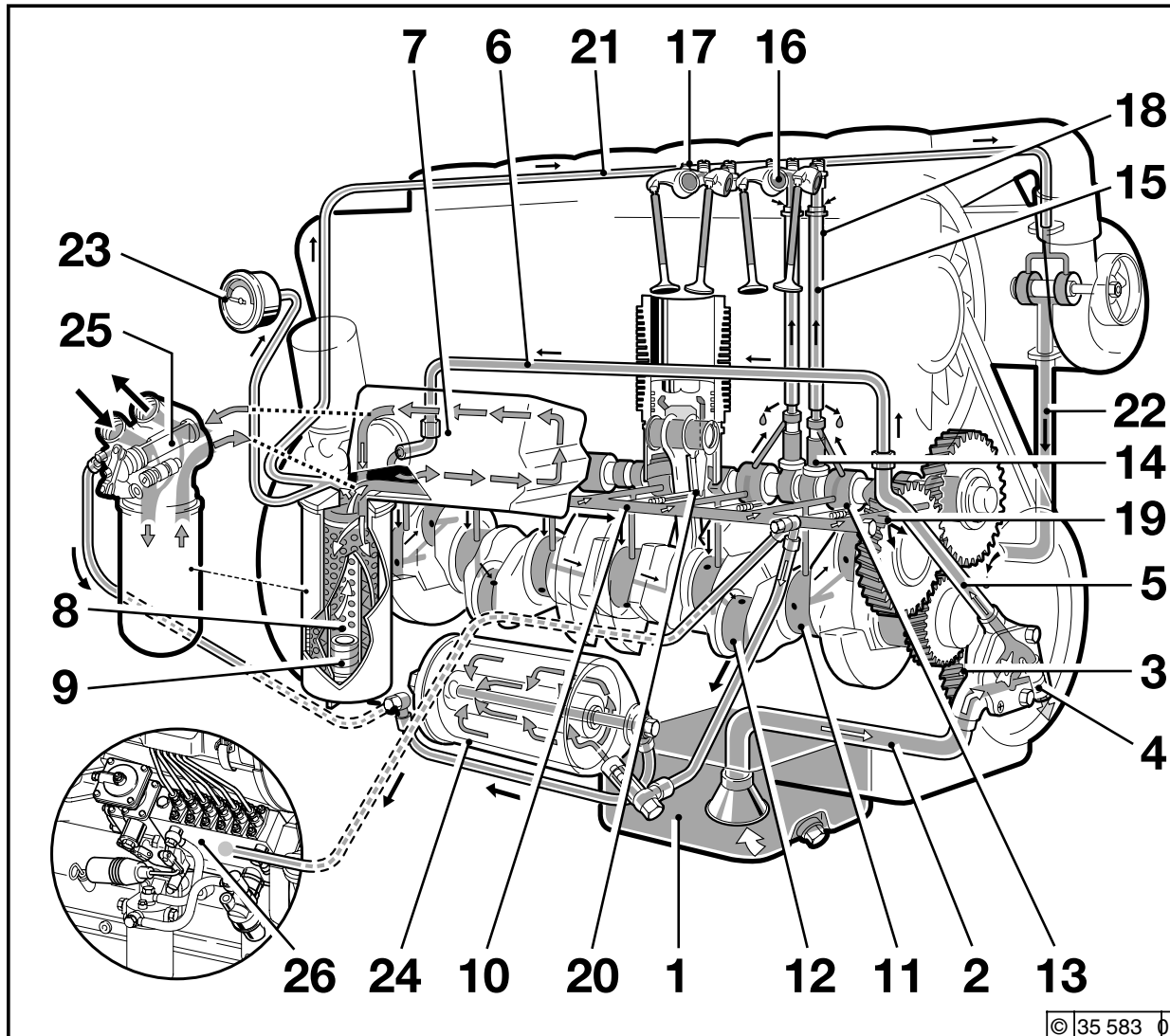
- 1 Oil pan
- 2 Intake manifold
- 3 Oil pump
- 4 Oil pressure regulating valve
- 5 Pressure oil line
- 6 Short-circuit line or alternative
- 7 Ribbed tube coil or alternative
- 8 Block oil cooler
- 9 Lube oil filter
- 10 Safety valve
- 11 Main oil channel
- 12 Crankshaft bearing
- 13 Con-rod bearing
- 14 Camshaft bearing
- 15 Tappet
- 16 Pushrod (hollow, for oil intake to lubricate rocker arm)
- 17 Rocker arm bearings
- 18 Rocker arm lubrication
- 19 Pushrod protective tube
- 20 Throttle bore (to lubricate cogwheels)
- 21 Spray nozzle for piston cooling
- 22 Connection for oil pressure gauge
- 23 Oil pressure gauge
- 24 Injection pump connected to lube oil circuit schematic
- 25 Connection option for oil heater **

** here the filter carrier must be exchanged. Please contact DEUTZ Service when changing-over.

2.3 Lube Oil Circuit Schematic

Engine Description

2.3.2 Lube Oil Circuit Schematic BFL 914



- 1 Oil pan
- 2 Intake line
- 3 Oil pump
- 4 Oil pressure regulating valve
- 5 Pressure oil line
- 6 Connection line to oil cooler
- 7 Block oil cooler
- 8 Lube oil filter
- 9 Safety valve
- 10 Main oil channel
- 11 Crankshaft bearing
- 12 Con-rod bearing
- 13 Camshaft bearing
- 14 Tappet (with impulse lubrication of rocker arm)
- 15 Pushrod (hollow, for oil intake to lubricate rocker arm)
- 16 Rocker arm bearings
- 17 Rocker arm lubrication
- 18 Pushrod protective tube (oil return from the cylinder head to crankcase)
- 19 Throttle bore (to lubricate cogwheels)
- 20 Spray nozzle for piston cooling
- 21 Oil line to lubricate turbocharger
- 22 Oil return line from exhaust turbocharger to crankcase
- 23 Oil pressure gauge
- 24 Bypass lube oil fine filter
- 25 Connection option for oil heater **
- 26 Injection pump connected to lube oil circuit schematic

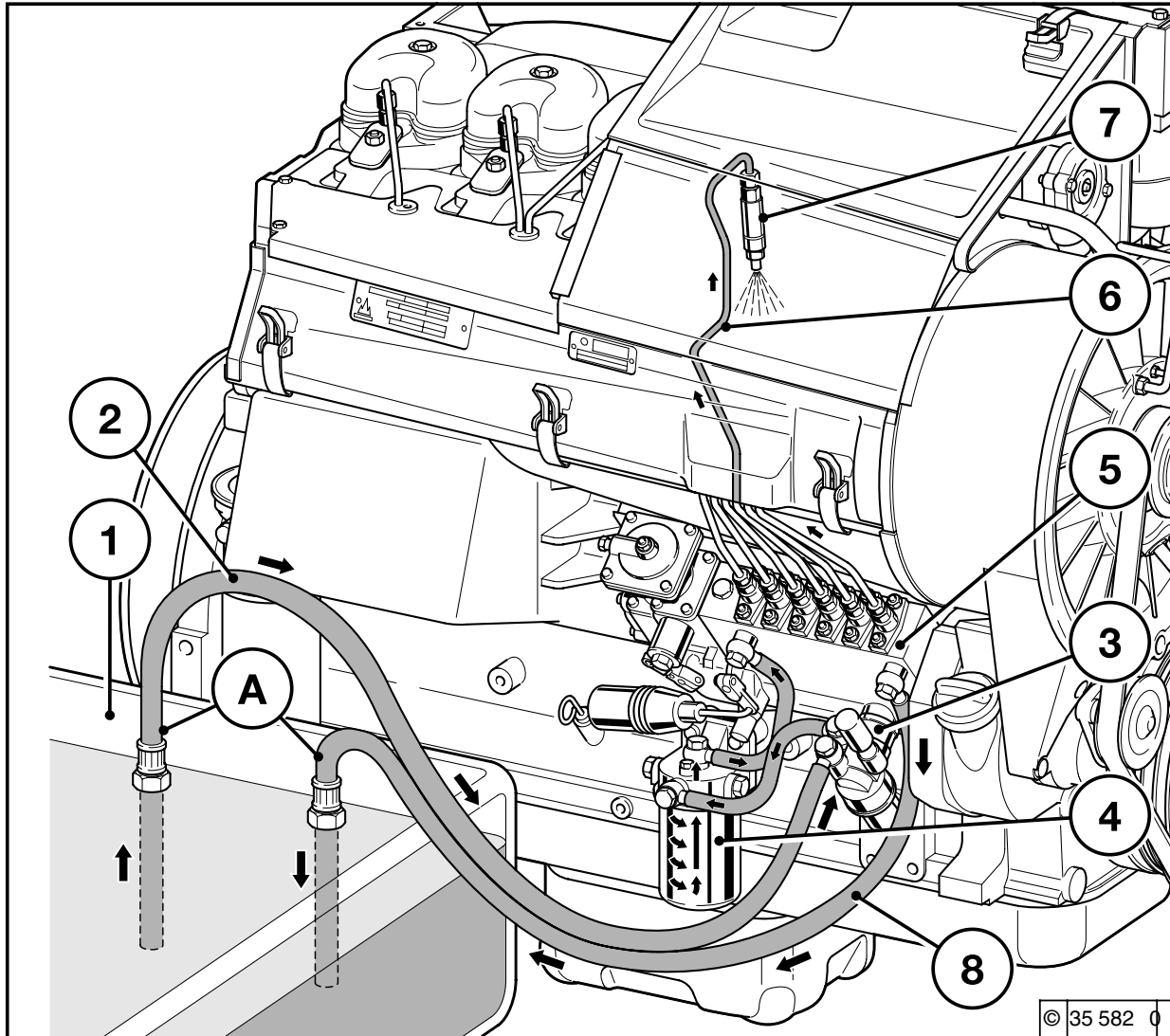
** here the filter carrier must be exchanged. Please contact DEUTZ Service when changing-over.

Engine Description

2.4 Fuel System Schematic

2

2.4.1 Fuel System



- 1 Fuel tank
- 2 Fuel line from tank to fuel pump
- 3 Fuel pump
- 4 Fuel change filter
- 5 Injection pump
- 6 Injection line
- 7 Injection valve
- 8 Fuel overflow pipe

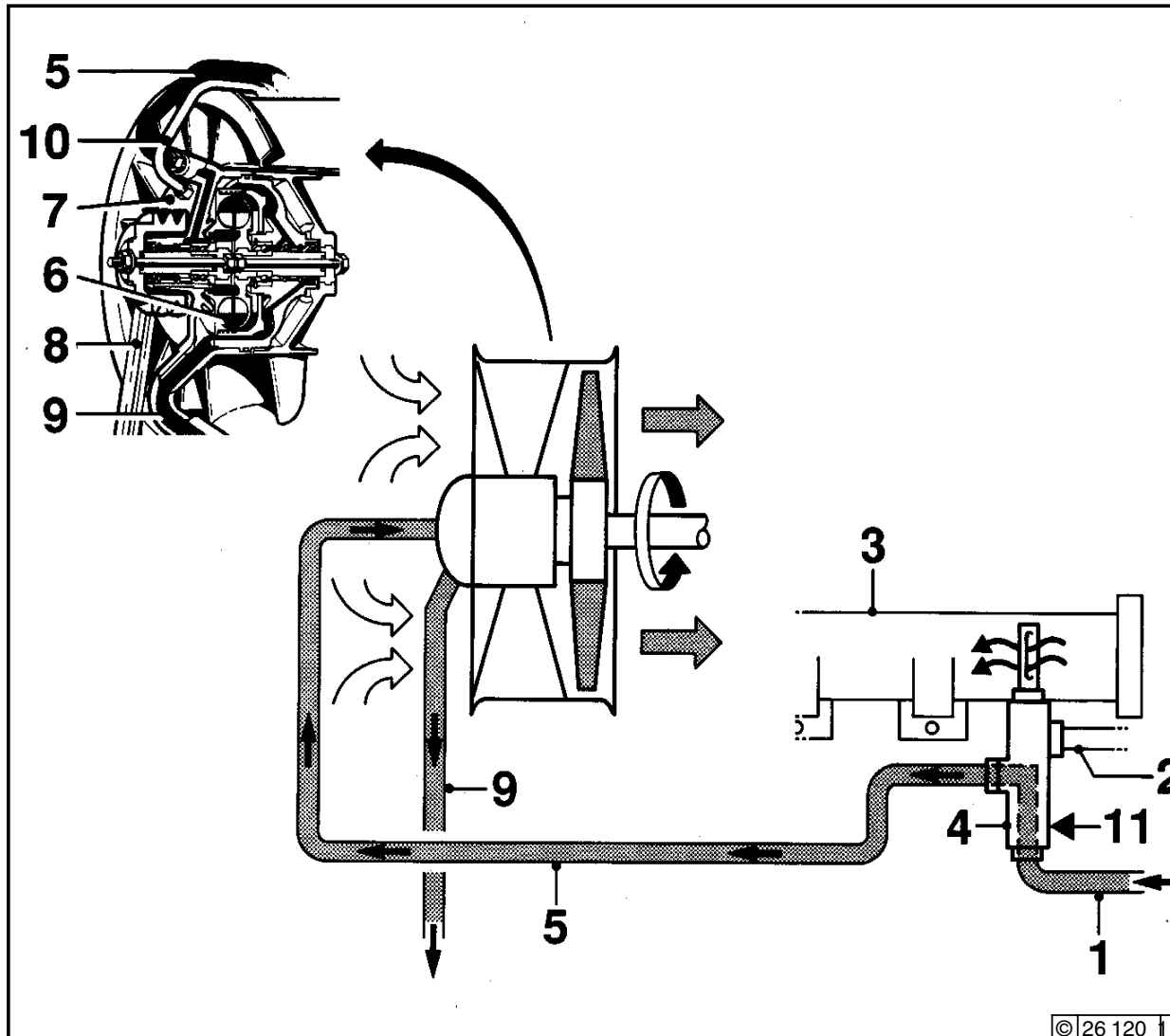
A Distance: must be routed as far away from each other as possible

2.5 Engine cooling

Engine Description

2

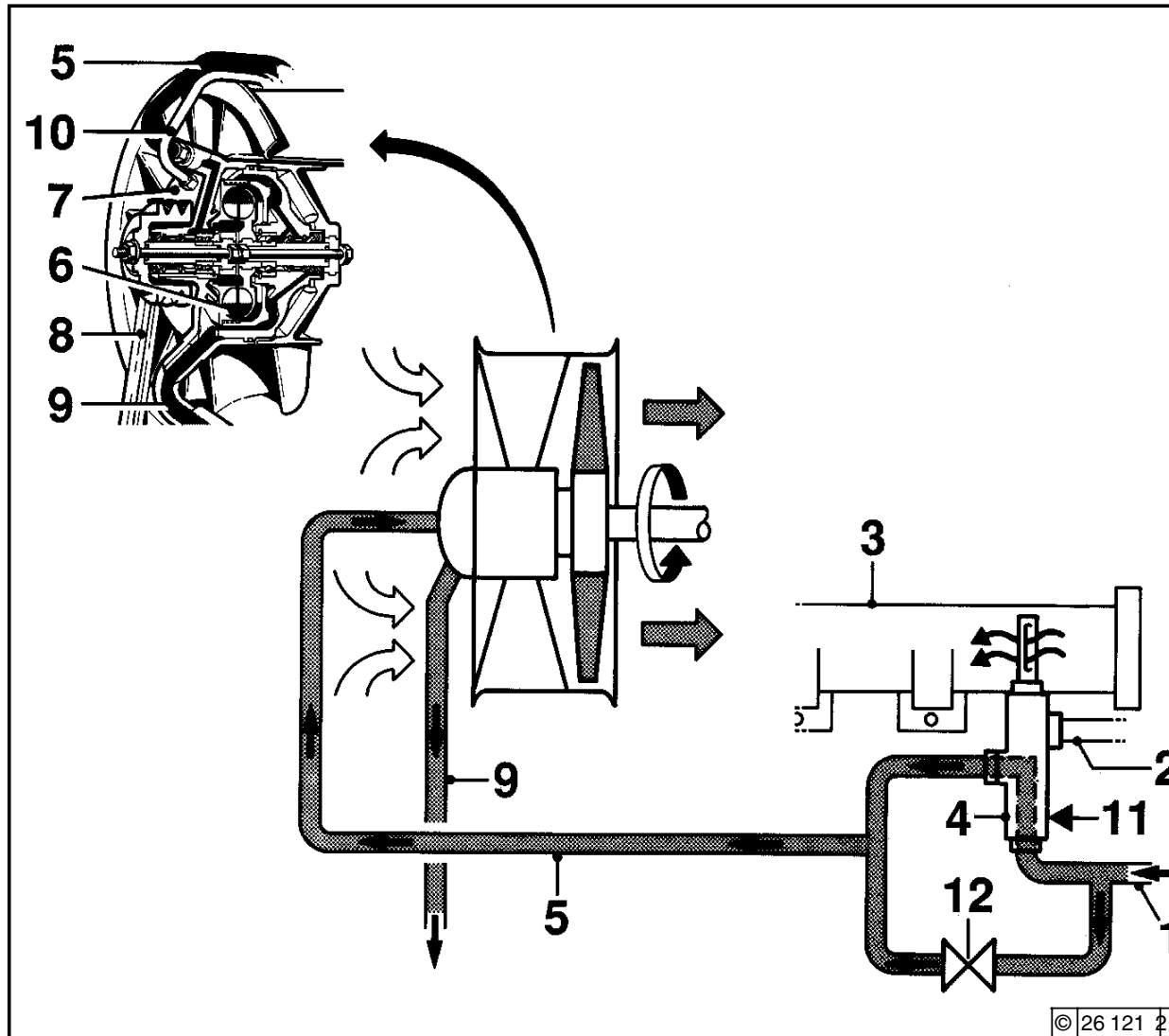
2.5.1 Amount of cool air regulated by exhaust thermostat



- 1 Pressure oil line from engine to exhaust thermostat
- 2 Air line to exhaust thermostat
- 3 Exhaust manifold line
- 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 screw with special seal ring

© 26 120 |

2.5.2 Amount of cool air regulated by exhaust thermostat and solenoid valve



- 1 Pressure oil line from engine to exhaust thermostat
- 2 Air line to exhaust thermostat
- 3 Exhaust manifold line
- 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 screw with special seal ring
- 12 Solenoid valve

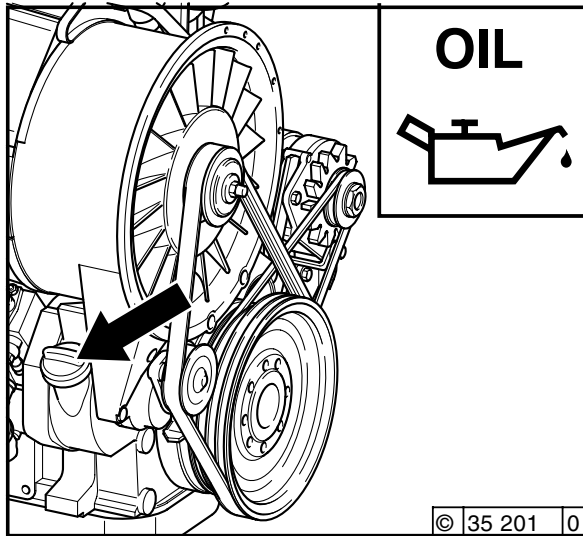
- 3.1 Commissioning**
- 3.2 Starting**
- 3.3 Monitoring Operation**
- 3.4 Shutting off**
- 3.5 Operating Conditions**

Engine Operation

3.1 Commissioning

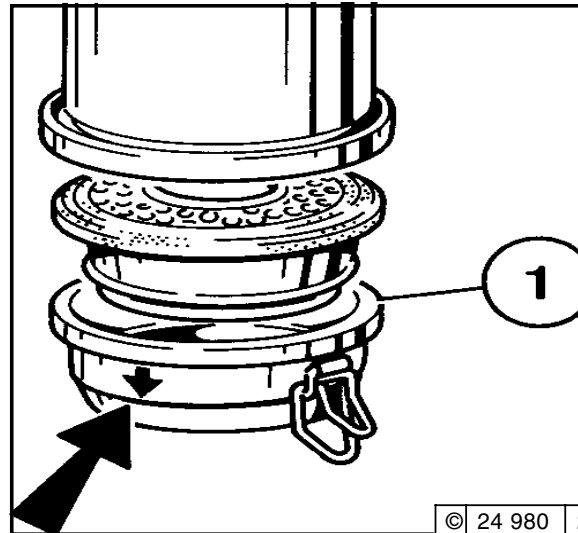
3

3.1.1 Pour in Engine Oil



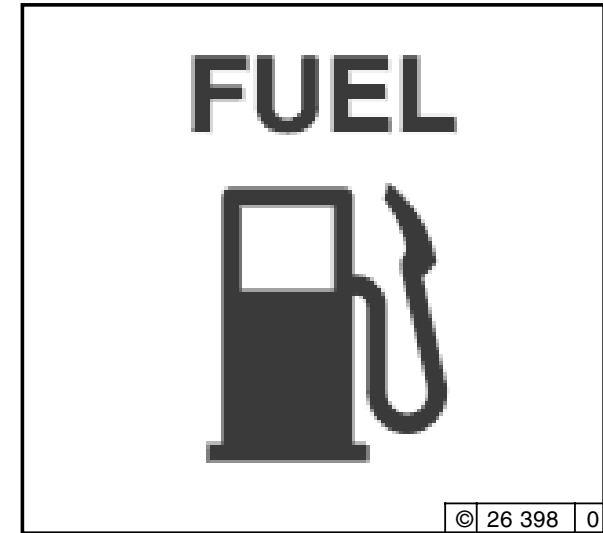
As a rule, engines are delivered without oil. Pour lube oil into the oil filler neck (arrow). For oil grade and viscosity, see 4.1.

3.1.2 Oil Bath Air Filter with Engine Oil



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

3.1.3 Pour in Fuel



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



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

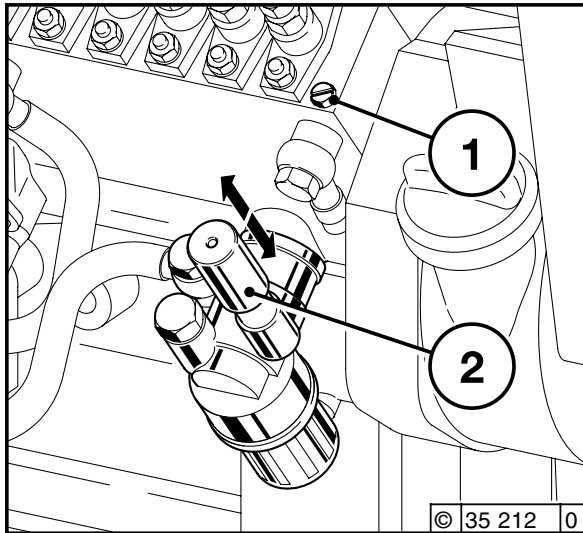


Never fill the tank while the engine is running. Ensure cleanliness! Do not spill fuel!

3.1.4 Bleed

Model:

“Motorpal” model



- Position collecting tank below the injection pump.
- Unscrew ventilation valve 1 with screwdriver.
- Move hand hump 2 in the direction of the arrow until bubble-free fuel escapes from the ventilation valve 1.
- Tighten ventilation valve 1, still pumping.
- Remove collecting tank and dispose of the fuel in an environmentally-friendly manner.

3.1.5 Other Preparations

- Checking battery and cable connectors 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.

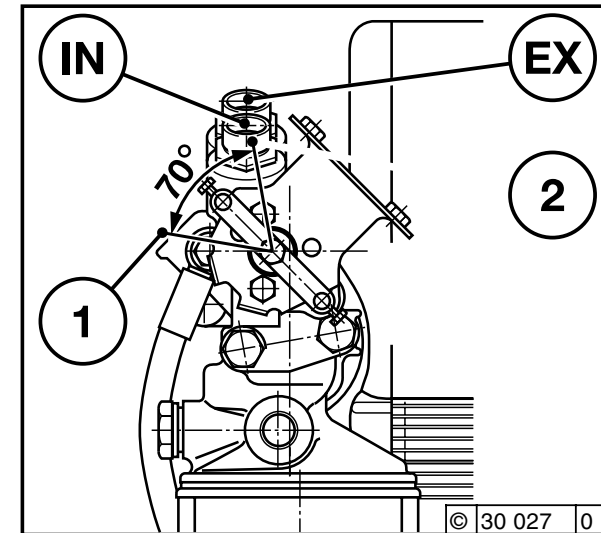
- Breaking in
During the break-in phase, about 200 operating hours, check the oil level twice a day. After the engine is broken in, checking once a day will be sufficient.

3.1.6 Additional maintenance work

After 50-150 operating hours, the following maintenance work is to be carried out:

- 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 (adjust if necessary) see 6.6.1
- Check the engine for leaks
- Check engine mounts (retighten if necessary) see 9.2.

3.1.7 Change-over switch for oil heater



Position of change-over switch for oil filter consoles with an oil heater connected:
Pos. 1: open
Pos. 2: closed



For engines without an oil heater, the change-over switch should always be fixed to Pos. 2: closed.



3.2.1 Electric Starting



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

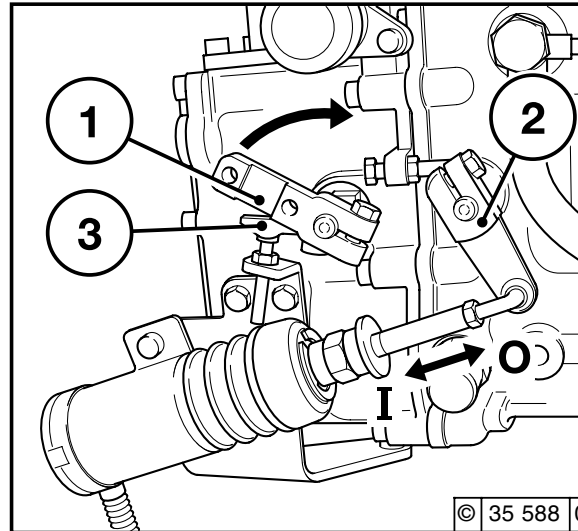
After repair work:

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). Risk of accident!

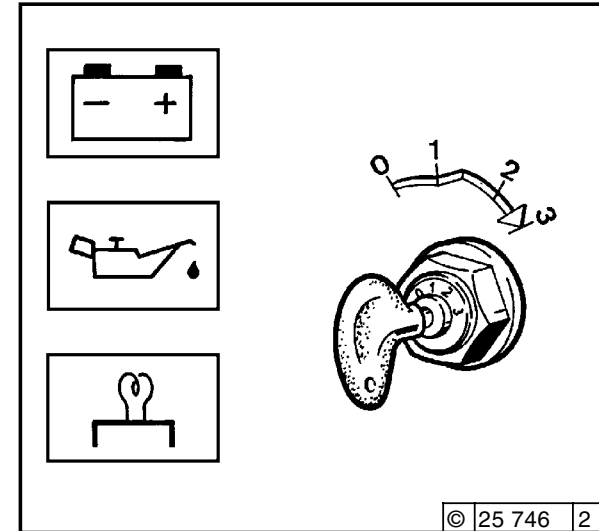
Caution:

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.
- Move cut-out handle 2 in direction of "I" and start.
- Regarding electric starting with a solenoid, the cut-out handle 2 is pulled in direction "I" and held when current is flowing. The charge pilot light and the oil pressure pilot light go out.

without cold start assistance



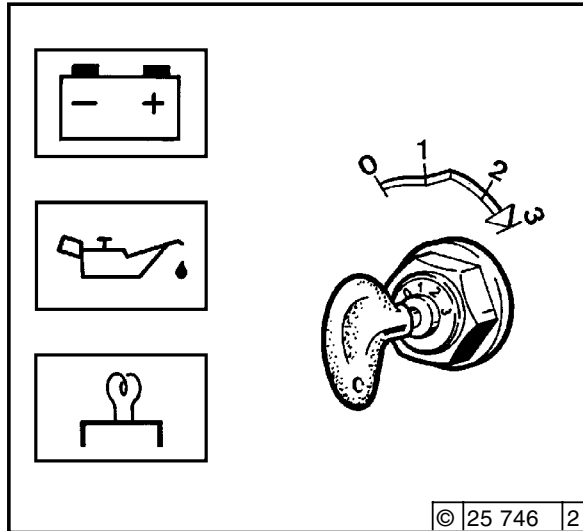
- Insert key
 - Position 0 = no operating voltage
- Turn key clockwise
 - Position 1 = operating voltage
 - Pilot lights illuminate
- Push key in and turn further clockwise against spring pressure.
 - Position 2 = no function
 - Position 3 = start
- Release key as soon as engine fires
 - The pilot lights will 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 assistance/glow lamps

FR 60 = 9,5 and 19 Volt

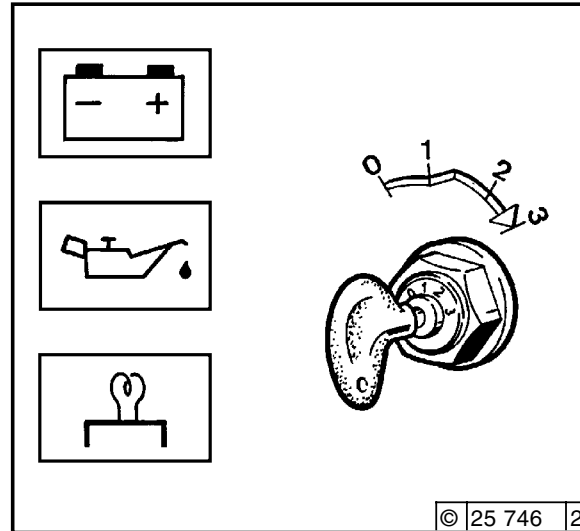


- Insert key
 - Position 0 = no operating voltage
- Turn key clockwise
 - Position 1 = operating voltage
 - Pilot lights illuminate
- Push key in and turn further clockwise against spring pressure
 - Preheat lamp comes on
 - Position 2 = preheat for approx. 60 secs. (holding key*)
 - Preheat lamp extinguishes
 - Position 3 = start
- Release key as soon as engine fires
The pilot lights will go out.

* Fuel particles not burnt during initial combustion in the cylinder are subjected to a second stage combustion process for approx. 3 minutes in order to let the exhaust gases become more transparent in the start-up phase.

with cold start assistance/glow lamps

FR 20/30 = 11 and 23 Volt

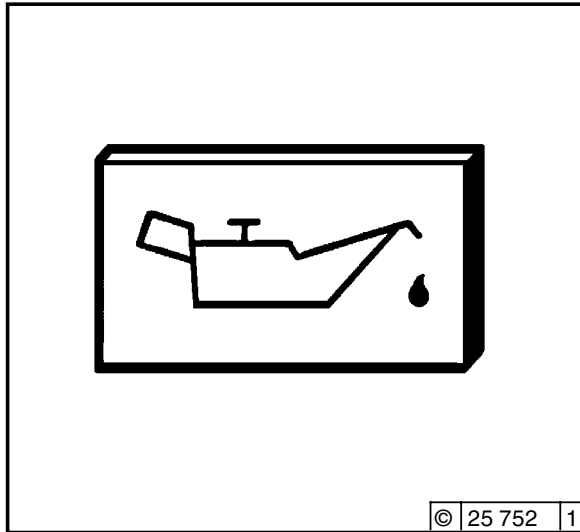


- Insert key
 - Position 0 = no operating voltage
- Turn key clockwise
 - Position 1 = operating voltage
 - Pilot lights illuminate
- Push key in and turn further clockwise against spring pressure
 - Preheat lamp comes on.
 - Position 2 = preheat for approx. 20-30 secs., (holding key*)
 - Preheat lamp extinguishes
 - Position 3 = start
- Release key as soon as engine fires
The pilot lights will go out

* Fuel particles not burnt during initial combustion in the cylinder are subjected to a second stage combustion process for approx. 3 minutes in order to let the exhaust gases become more transparent in the start-up phase.

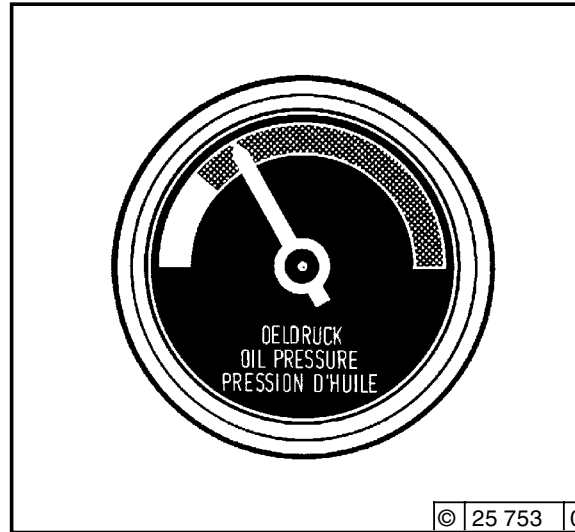
3.3.1 Engine Oil Pressure

Oil pressure pilot lights



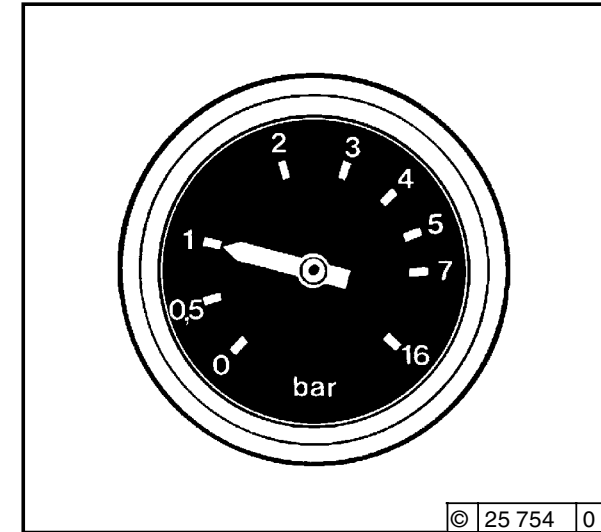
- The oil pressure pilot light comes on with operating voltage on and engine off.
- The oil pressure pilot light should go out when the engine is running.

Oil Pressure Indicator



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

Oil Pressure Gauge



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

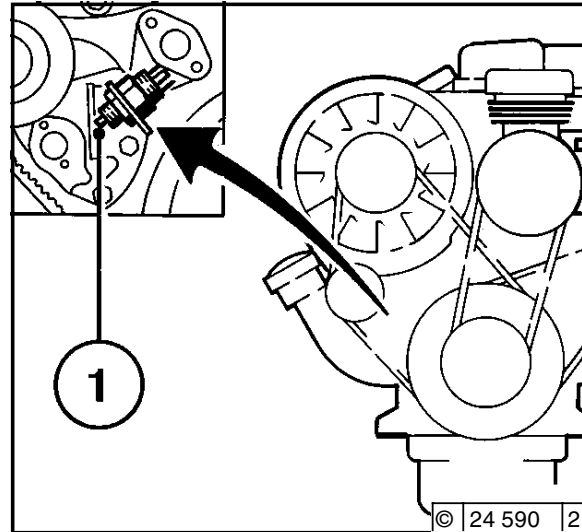
3.3.2 Engine temperature

Engine Temperature Gauge



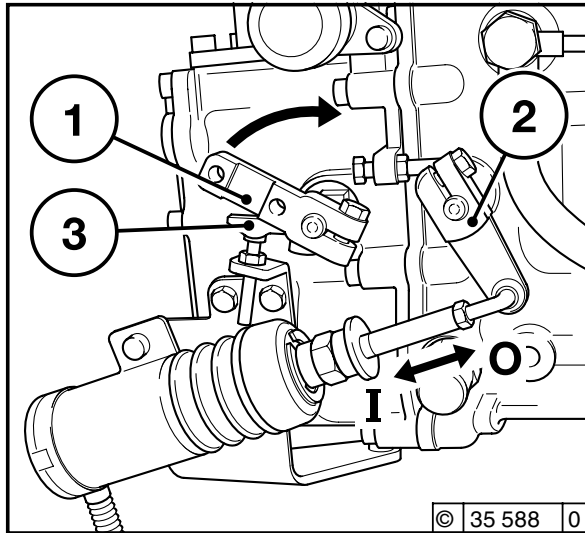
- The engine temperature gauge pointer should remain in the green sector most of the time. It should rarely enter the yellow-green sector. If the pointer enters the orange sector, the engine is overheating. Turn off and establish the cause from the Fault Table (see 7.1).

3.3.3 Cooling fan drive



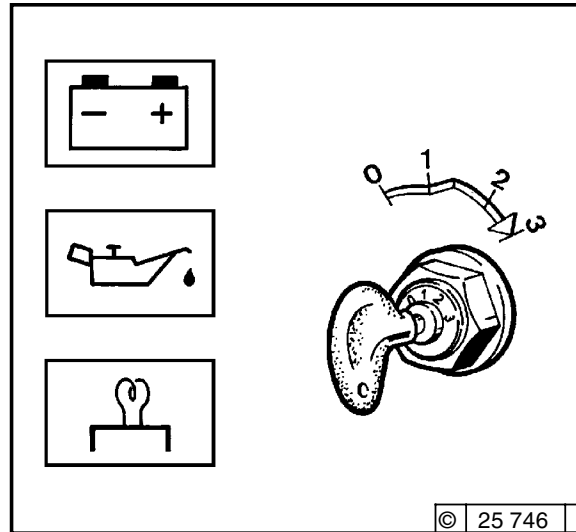
- When the V-belt is torn, the pressure pin 1 of electrical switch is actuated by the tension roller and an audio signal or a light signal is emitted. Switch off the engine immediately to avoid overheating.

3.4.1 Mechanical shut-off



- Move speed adjustment lever 1 to low idle.
- Move shut-off lever 2 in the direction of "0" 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.
- Concerning electrical shut-off or power failure, the shut-off lever 2 is disabled by the solenoids until the engine stops. The charge pilot light and the oil pressure pilot light illuminate when the engine stops.
- Turn key counterclockwise (to position 0) and remove. The pilot lights will go out.

3.4.2 Electrical shut-off Ignition key



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

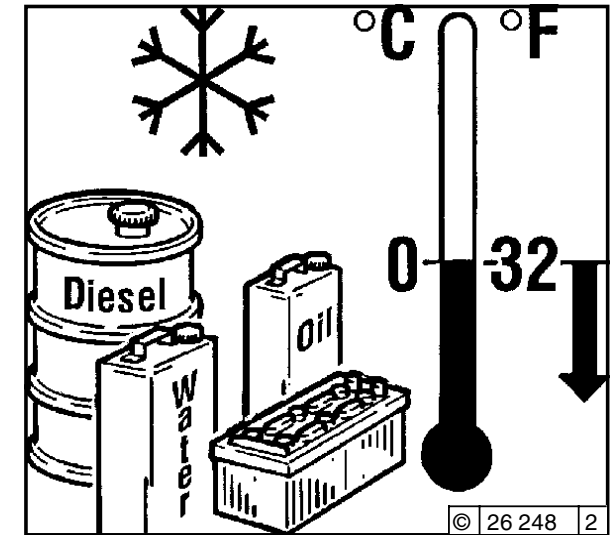
If possible, do not suddenly switch off the engine when under full load.

3.5.1 Winter Operation

- Lube Oil Viscosity
 - Select the oil viscosity (SAE grade) according to the ambient temperature when starting the engine, see 4.1.2.
 - Increase oil change frequency when operating below $-10\text{ }^{\circ}\text{C}$, see 6.1.1.
- Diesel Fuel
 - Use winter-grade diesel fuel for operation below $0\text{ }^{\circ}\text{C}$, 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 $-20\text{ }^{\circ}\text{C}$, 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 FT 1 V 31 grease).
- Cold Start Assistance

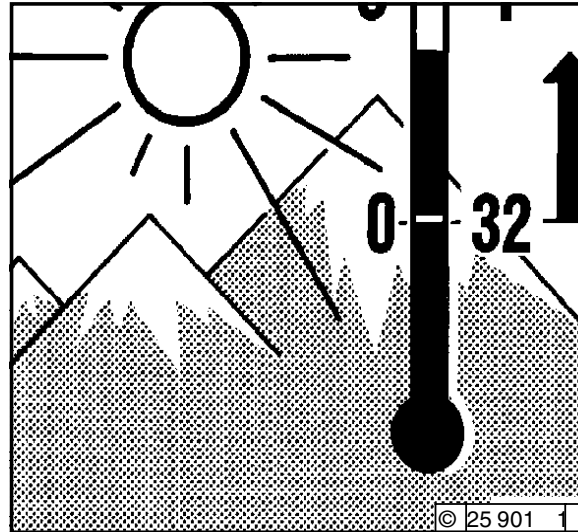
At temperatures near or below freezing point, use sheathed glow plugs if necessary, see 3.2.1. This not only lowers the starting limit temperature, but provides easier starting at temperatures normally not requiring a starting aid.

- Battery
 - Efficient cold starting requires the battery to be well-charged, see 6.7.1.
 - The starting limit temperatures can be lowered by $4\text{--}5\text{ }^{\circ}\text{C}$ by heating the battery up to about $+20\text{ }^{\circ}\text{C}$. (To do so, remove the battery and store in a warm place).



3 3.5.2 High Ambient Temperature, High Altitude

- Air density decreases as altitude or ambient temperature increase. As a result of this, the engine's maximum output, the quality of the exhaust gas, the temperature level and, in extreme cases, starting behaviour, are impeded. 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

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

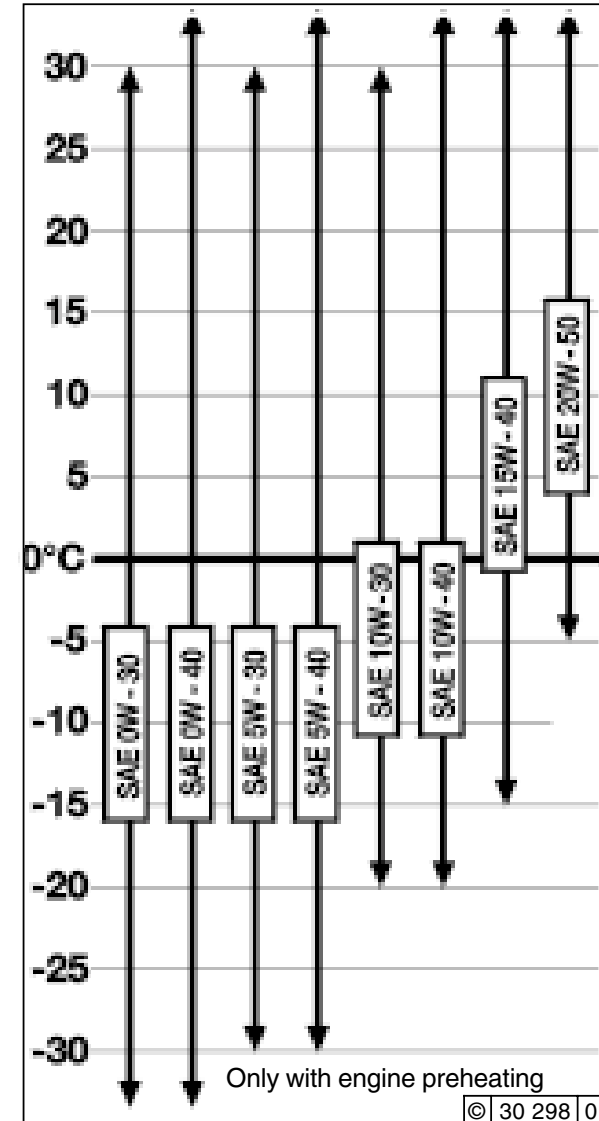
It is recommended to operate the engines with **Deutz Oil TLX10W-40FE Europe**. If this is not available, use the appropriate oil as described above.

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.



* Oil change intervals, see 6.1.1
Oil capacities, see 9.1

4.1.2.1 Specific lube oil definitions

Turbocharged engines with increased output and engines with high capacity.

For the following engines, or applications:

- for engines with an output >141kW the oils listed in the following table are to be used.

Firstly, these oils are of high quality in accordance with ACEA or API. Additionally, these oils are mainly partly synthetic, some even fully synthetic (5W-40) and thus achieve thermal stability if required for the application and sediments are less likely if the crankcase ventilation is closed in the turbocharger and in the air-intake lines.

Emission optimised engines for commercial vehicles from EURO II and mobile driven machines from position 2, corresponding to the following emission requirements:

- a) from EURO II, the 88/77/EEC and 91/542/EEC guidelines for commercial vehicles in Europe,
- b) from position 2, the 97/68/EC guidelines for mobile driven machines in Europe
- c) from position 2, the US non-road engines guidelines, only the following oil qualities are permitted:
 - ACEA E3-96 and ACEA E4-98 for requirements a) and b)
 - API CG-4 and API CH-4 for the requirements c)

Lube oil for engines with increased output and engines with high output			
Manufacturer	Lube oil type	SAE Class	Availability
DEUTZ	Deutz TLX Oil	10W-40FE	Europe
AGIP	Agip Sigma Ultra TFE	10W-40	worldwide
AGIP	Autol Valve Ultra FE	10W-40	Germany
ARAL GmbH	Aral MegaTurboral	10W-40	worldwide
ARAL GmbH	Aral SuperTurboral	5W-30	worldwide
BAYWA	BayWa Super Truck 1040 MC	10W-40	South Germany
BAYWA	BayWa Turbo 4000	10W-40	South Germany
Castrol GmbH	Castrol SYNTRUCK	5W-40	Europe, North America, Brazil, Argentina, Australia, South Africa,
Castrol GmbH	Castrol DYNAMAX	7,5W-40	Europe, North America, Brazil, Argentina, Australia, South Africa
CHEVRON	Chevron Delo 400 Synthtic	5W-40	North America
ESSO	Essolube XTS 501	10W-40	Europe
FINA	FINA KAPPA FIRST	5W-30	Europe
FINA	FINA KAPPA ULTRA	10W-40	Europe
FUCHS DEA	DEA Cronos Synth	5W-40	Germany, Europe
FUCHS DEA	DEA Cronos Premium LD	10W-40	Germany, Europe
FUCHS DEA	Fuchs Titan Cargo MC	10W-40	worldwide
FUCHS DEA	DEA Cronos Premium FX	10W-40	Europe
FUCHS DEA	Fuchs Titan Unic Plus MC	10W-40	worldwide
MOBIL OIL	Mobil Delvac 1 SHC	5W-40	Europe, South East Asia, Africa
MOBIL OIL	Mobil Delvac 1	5W-40	worldwide
MOBIL OIL	Mobil Delvac XHP Extra	10W-40	Europe, South East Asia
BP OIL International	BP Vanellus HT Extra	10W-40	Europe
Shell International	Shell Myrina TX / Shell Rimula Ultra	5W-30	Europe, label country-specific, various
Shell International	Shell International Shell Myrina TX / Shell Rimula Ultra	10W-40	Europe, label country specific, various
TOTAL	TOTAL RUBIA TIR 86000	10W-40	worldwide
lube oil refinery Salzbergen GmbH	Wintershall TFG	10W-40	Europe

The table can be extended if required.

4.2.1 Quality

Use commercially available diesel fuel with less than 0.5 % sulphur content. If the sulphur content is higher, oil change intervals should be reduced (see 6.1.1).

The following fuel specifications / standards are approved: (also see TR 0199-3002)

● Diesel fuel

- 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
- ISO 8217 DMX
- ISO 8217 DMA

● Light fuel oils

in accordance with DIN 51603
ASTM D 396; 1 and 2
BS 2869 Class D

● Jet fuel

- F34/F35/F44 (Kerosene)
- F54 (corresponds to diesel fuel in accordance with DIN EN 590)
- XF 63 (corresponds to F34+F35 with additives)

● Bio diesel fuel

- in accordance with DIN 51606- FAME
Exhaust emission values which may be determined in the case of type approval tests always refer to the reference fuel prescribed by the authorities for the type approval test.

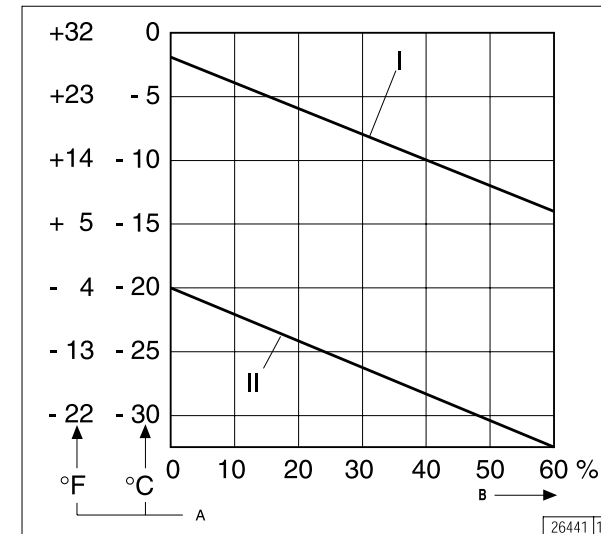
4.2.2 Winter Fuel

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).

- Kerosene must be added at temperatures below -20 °C. The relevant percentages are given in the adjacent diagram.
- Special diesel fuels may be used in arctic climatic zones up 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 ask your DEUTZ partner.



Legend:

I	Summer-grade diesel fuel
II	Winter-grade diesel fuel
A	Ambient temperature
B	Percentage of kerosene added



diesel fuel should never be mixed with petrol (normal or super petrol)



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

- 5.1 Maintenance Plan**
- 5.2 Maintenance Schedules**
- 5.3 Maintenance Work Completed**

Routine Maintenance

5.1 Maintenance Schedule

5

check = ● adjust = ○ clean = ◆ replace = ■										<p>Industrial engines</p> <p>The specified engine maintenance values are permissible recommended maximums. Depending on usage, reduced maintenance intervals may be necessary, comply with the unit manufacturer's operating instructions.</p> <p># Maintenance must only be carried out by authorised service personnel</p>					
prior to or during 1st trial run, check 2x daily during the breaking in phase or when commissioning new and overhauled engines												<p>Operation</p>		<p>Section</p>	
every 10 hours of operation or daily															
E10	E20	In hours of operation (HO) every					years		<p>Operation</p>		<p>Section</p>				
		E30 125	E40 250	E50 500	E60 1000	E70 12000	1	2							
●	●										Top up lube oil if necessary (also with separate container)	6.1.2/3.3.4			
		■	■	■							Lube oil (oil change intervals depending on engine use), see TR 0199-99-3002	6.1.1/6.1.2			
		■	■	■							Oil filter cartridge (at each lube oil change)				
	●										Oil bath air filter	6.3			
				■							Bypass – oil filter	6.1.4			
					■						Fuel filter cartridge	#			
					◆						Fuel pre-cleaner	4.2/ 6.2.2			
	●				◆						Intake air cleaner/dry type air cleaner (If available, maintain according to maintenance indicator)	6.4.3 /6.4.4			
		●									Battery and cable connectors	6.7.1			
			●								Engine monitoring system, warning system	3.3 #			
				○	○						Valve clearance (set if necessary, earlier if noises occur)	6.6.1#			
		●								■	V-belts (retension or replace if necessary)	6.5.1			
				●						■	Sheathed glow lamps	6.9.3			
●											Check engine for leaks (visual inspection)	–			
					●						Engine suspension (replace if damaged)	9.2			
					●						Fastenings, hose connections / clamps	6.9.1			
						■					Basic overhaul	#			

5.1 Maintenance Schedule

Routine Maintenance

check = ● adjust = ○ clean = ◆ replace = ■ max. recommended standard times in operating hours (HO) of all prior to or during 1st trial run, check 2x daily during the breaking in phase or when commissioning new and overhauled engines every 10 hours of operation or daily In hours of operation (HO) every											<p style="text-align: center;">Additions and modifications for engines with EPA approval</p> The specified engine maintenance values are permissible recommended maximums. Depending on usage, reduced maintenance intervals may be necessary, comply with the unit manufacturer's operating instructions. # Maintenance must only be carried out by authorised service personnel
E10	E20	E30 250	E40 500	E50 1000	E60 2000	E70 3000	E70 4000	years 1 2		Operation	
						■				Injection valve	#
						◆				Intercooler (drain lube oil/condensation)	#
						◆				CPD compressor outlet	#
							■			Basic overhaul of emission related parts	#

5.2.1 Routine maintenance work plan

Intervals with/after	Maintenance	Activity levels	Plan executed by:	Comments
50 [OH]	E 10	after operation and E 50 - E 70	authorised specialised staff	
daily	E 20	daily inspection	the user	
250 [OH]	E 25	Inspection	authorised specialised staff	
500 [OH]	E 30	further inspection	authorised specialised staff	
1000 [OH]	E 40	intermediate repair	authorised specialised staff	
3000 [OH]	E 50	further intermediate repair	authorised specialised staff	
6 000 [OH]	E 60	partial repair	authorised specialised staff	
12 000 [OH]	E 70	major repair	authorised specialised staff	

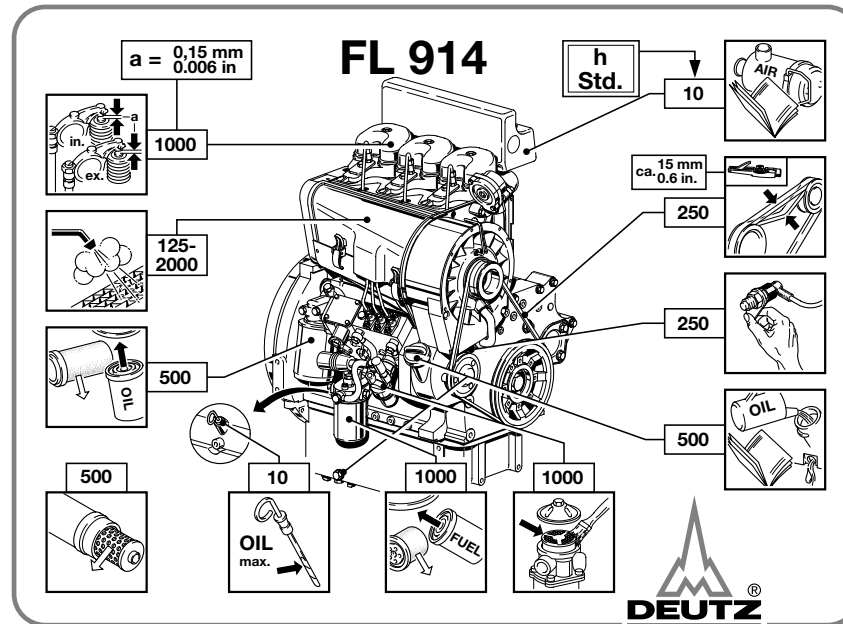
5.2 Maintenance Charts

Routine Maintenance

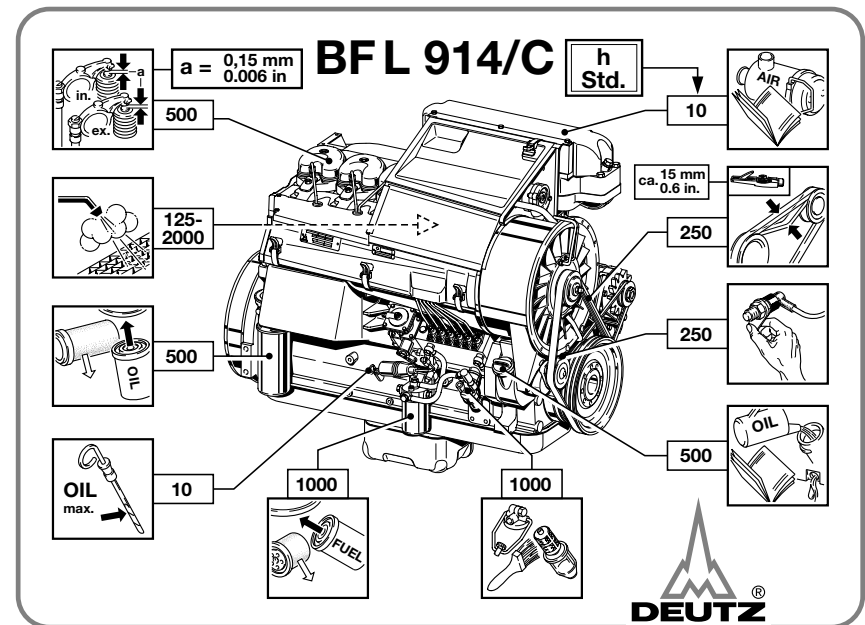
The maintenance charts shown on this page are supplied as self-adhesive labels with each engine. They should be affixed where they can be seen clearly on the engine or driven equipment.

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 (see chapter 5.1).



0312 0360 0



0132 0359 0



Stop the engine before carrying out any maintenance work.

Routine Maintenance

5.3 Maintenance Work Completed

5

Op. hours	Date	Signature/stamp	Op. 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		

* following commissioning of new and overhauled engines.
 Duly completed maintenance jobs can be recorded and signed off in the above chart.

5.3 Maintenance Work Completed

Routine Maintenance

Op. hours	Date	Signature/stamp	Op. hours	Date	Signature/stamp
2875			3000		
3125			3250		
3375			3500		
3625			3750		
3875			4000		
4125			4250		
4375			4500		
4625			4750		
4875			5000		
5125			5250		
5375			5500		
5625			5750		

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

Routine Maintenance

5.3 Maintenance Work Completed

5

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

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

5.3 Maintenance Work Completed

Routine Maintenance

- 6.1 Lubrication System**
- 6.2 Fuel System**
- 6.3 Cooling system**
- 6.4 Combustion Air Filter**
- 6.5 Belt Drives**
- 6.6 Adjustments**
- 6.7 Accessories**
- 6.8 Engine cleaning**
- 6.9 Additional Maintenance Work**

Service and Maintenance

6

6.1.1 Oil change intervals

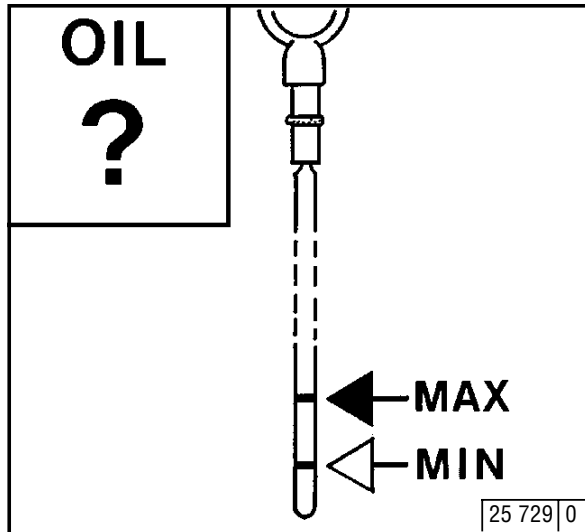
- The oil change intervals are dependent on the engine application and the quality of the lube oil.
- If the engine runs fewer hours during the year than stated in the table, the oil should be changed at least **once a year**.
- The table refers to the following conditions:
 - For diesel fuel: sulphur 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 the oil change intervals must be halved.
- In the case of fuels with a sulphur content higher than 1%, contact your Service representative.

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

Engines for installation			Lube oil change intervals in HO		
Lube oil quality	API specification		Naturally aspirated engines	Turbocharged engines	
	ACEA-spezifikation		CF-4/CH-4/ CG-4	CF-4	CG-4 / CH-4
Normal oil requirement, e.g.:			500	250	500
Road vehicles, cranes, construction machines, ships electrical modules, pumps, railway vehicles.					
High oil requirement, e.g.:			250	125	250
Combines, emergency pumps, underground mining units, sweeping machines, winter service vehicles, emergency power units.					
Vehicle engines			Lube oil change intervals in km		
Lube oil quality	API specification		Naturally aspirated engines	Turbocharged engines	
	ACEA-spezifikation		CF-4/CH-4/ CG-4	CF-4	CG-4 / CH-4
Service group	Year's kilometrage km	medium driving 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

6.1.2 Checking Oil Level / Changing Engine Oil

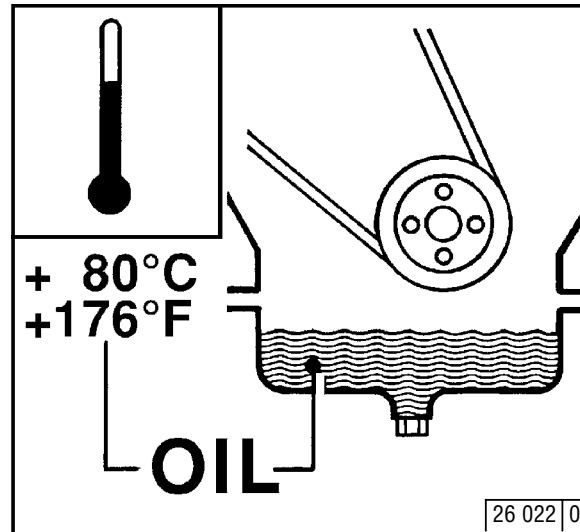
6.1.2.1 Checking Oil Level



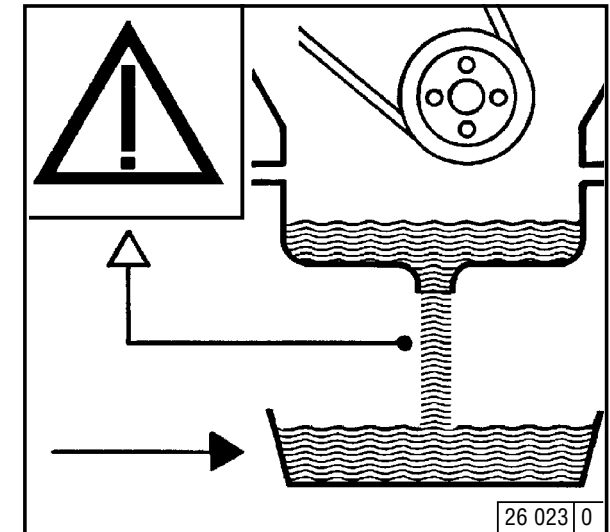
- Ensure that the engine or vehicle is on a level surface.
- – **Warm engine**
- Switch off engine, wait 5 minutes and check the oil level
- – **Cold engine**
- Check the oil level
- Remove the dipstick
- Wipe off with a non-fibrous, clean cloth.
- Insert up to the stop and pull out again.
- Check oil level, if required top up to the “MAX” level
 - If the oil level is just above the “MIN” mark, it should be topped up.

The oil level must not drop below the “MIN” mark.

6.1.2.2 Changing Engine Oil



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

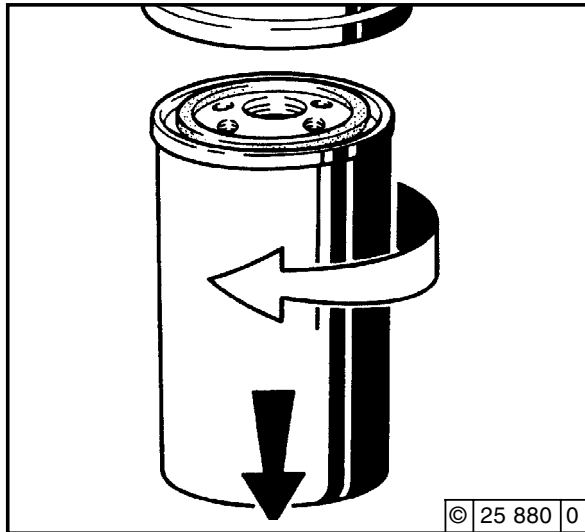


- Place an oil tray beneath the engine
- Unscrew drain plug.
- Drain oil.
- Fit oil drain plug with new gasket and tighten firmly (for torque, see 9.2).
- Fill with lube oil
 - For grade/viscosity, see 4.1.
 - For quantity, see 9.1.
- Check oil level, see 6.1.2.1

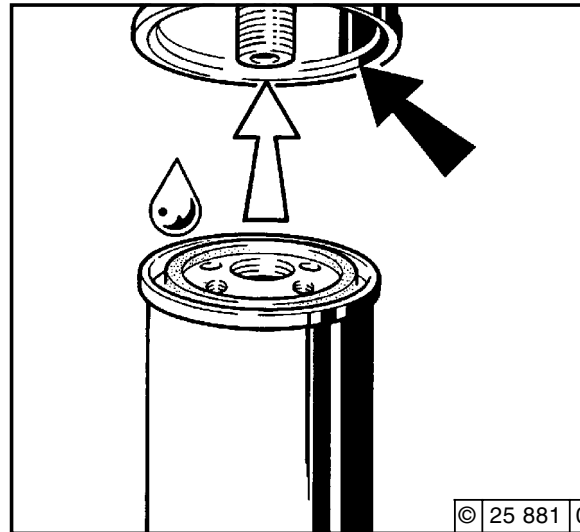


Be careful when draining hot oil - danger of scalds! Do not let used oil run into the soil but catch it in a container ready for proper disposal.

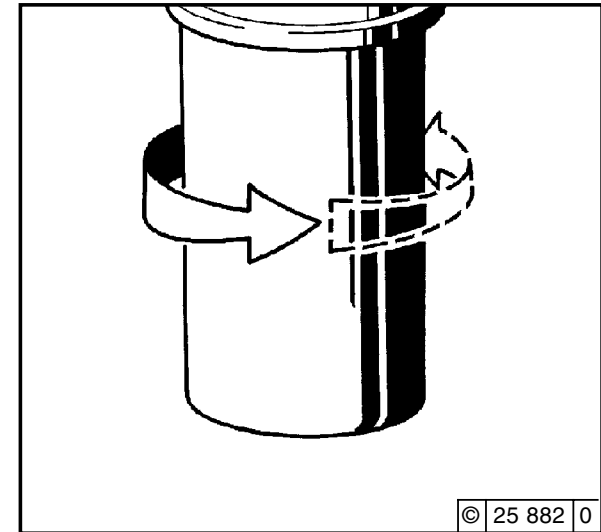
6.1.3 Replace Oil Filter



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



- Clean any dirt from the filter carrier sealing surface.
- Lightly oil the rubber gasket of the new lube oil filter cartridge.
- Manually screw in the new cartridge until the gasket is flush.

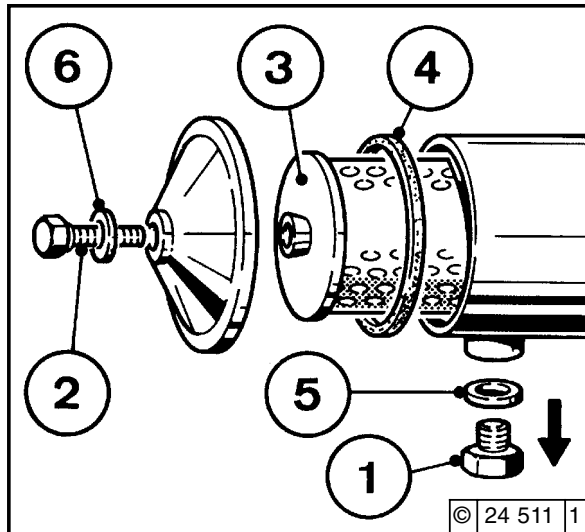


- Tighten the lube oil filter cartridge with another half-turn.
- Check the oil level, see 6.1.2
- Check oil pressure, see 3.3.1.
- Check lube oil filter cartridge seal for leaks.



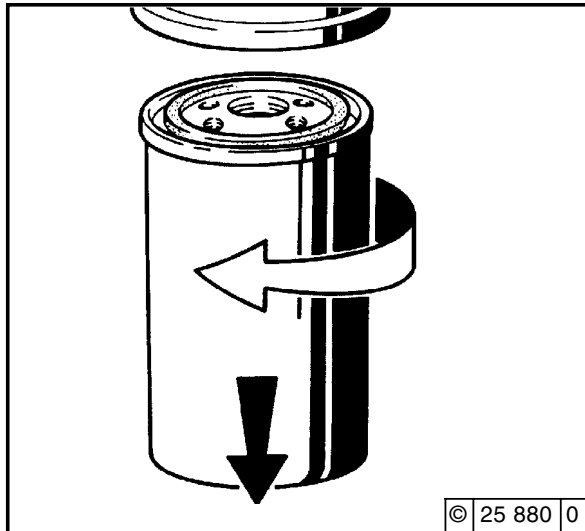
Caution is required in the case of hot oil: Risk of scalding! Please dispose of oil in an environmentally-friendly manner!

6.1.4 Change bypass-oil filter use

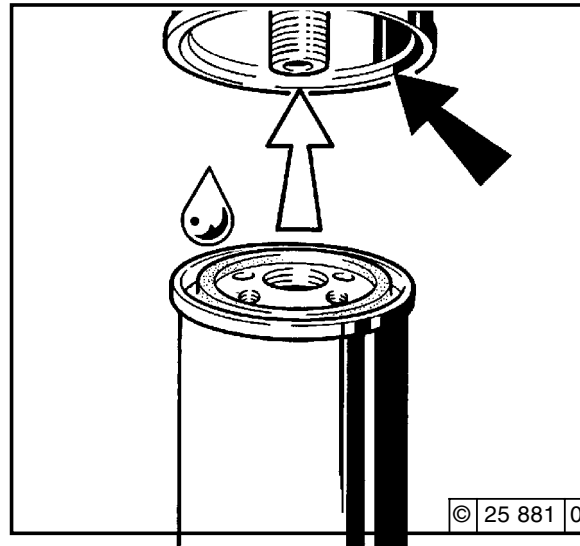


- Remove oil drain screw 1 and let the oil run out.
- Catch any escaping oil.
- Remove tensioning screw 2. Remove cover.
- Remove soiled filter 3. Clean filter casing.
- Check cover 4 for leaks, and replace if necessary.
- Screw in oil drain screw with a new seal ring 5.
- Insert new filter.
- Screw on cover with seal ring 6.
- During trial, observe oil pressure and check for leaks.

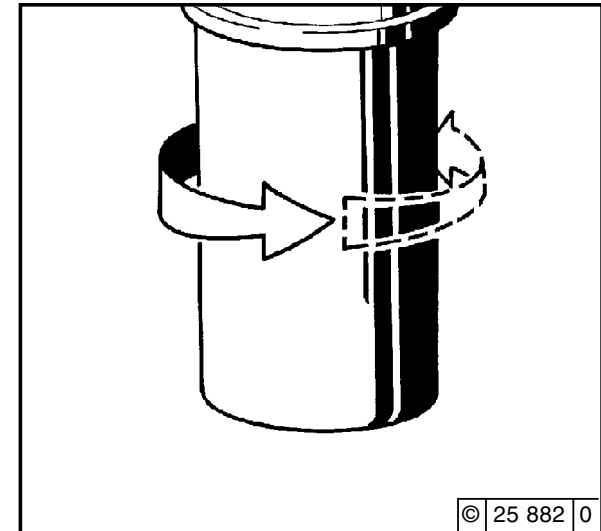
6.2.1 Replace Fuel Filter



- Close the fuel shut-off valve.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any escaping fuel.



- Clean any dirt from the filter carrier sealing surface.
- Apply light film of oil or diesel fuel to the rubber gasket of the new fuel filter cartridge.
- Manually screw in the new cartridge until the gasket is flush.



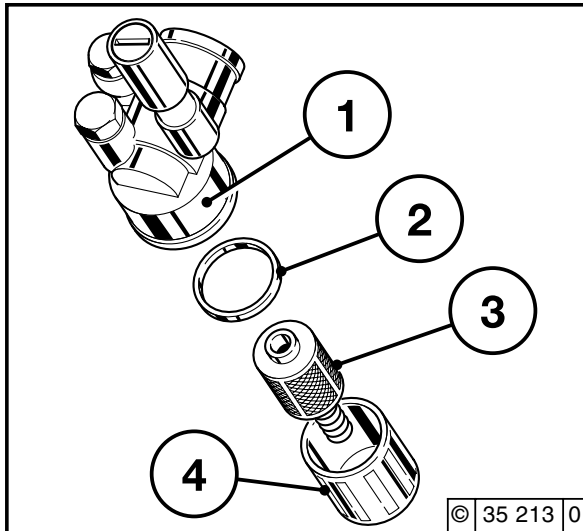
- Tighten the fuel filter cartridge with a final half-turn.
- Open fuel shutoff valve.
- Check for leaks.



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 precleaning Clean fuel filter “Motorpal” model



- Close the fuel shut-off valve.
- Screw out and remove filter cap 4.
- Catch any escaping fuel.
- Remove strainer 3 and clean with fuel.
- Remove seal ring 2.
- Clean filter casing 1 with fuel.
- Screw on filter cap 4 and strainer 3 with new seal 2.
- Bleed fuel system (see 3.1.4).
- Open fuel shutoff valve.
- Check for leaks.



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

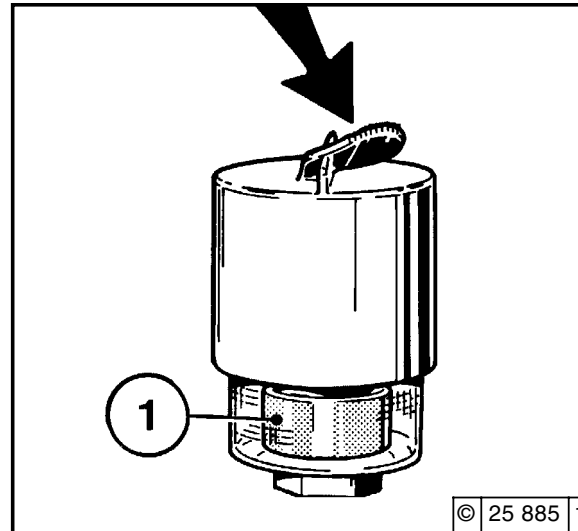
6.3.1 Cleaning Intervals

- The amount of contamination in the cooling system depends on the engine application.
- Oil and fuel residues on the engine increase the risk of contamination. Therefore pay special attention to leaks 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.

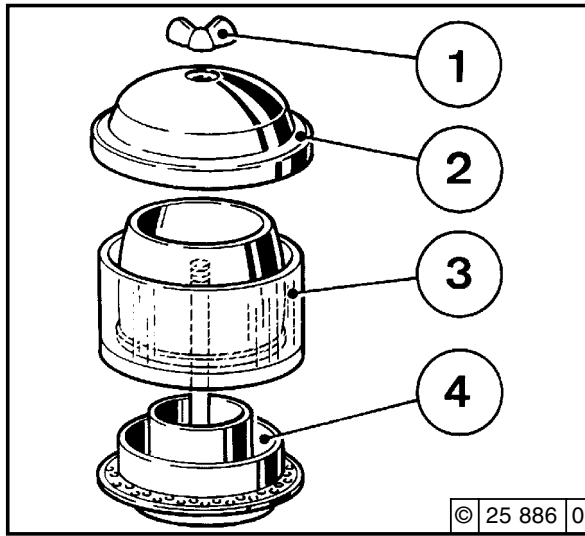
Checking or cleaning intervals	Engine application
Standard values OH	
2000	Ships, electrical modules in enclosed areas, pumps
1000	Vehicles on paved roads
500	Tractors, fork-lift trucks, drivable electric units.
250	Vehicles on construction sites and unpaved roads, construction machines compressors, underground mining units
125	Agricultural machines, tractors in harvesting application

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 filters are used, cleaning should only be carried out according to the service indicator or 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. The service indicator is now ready for operation again.

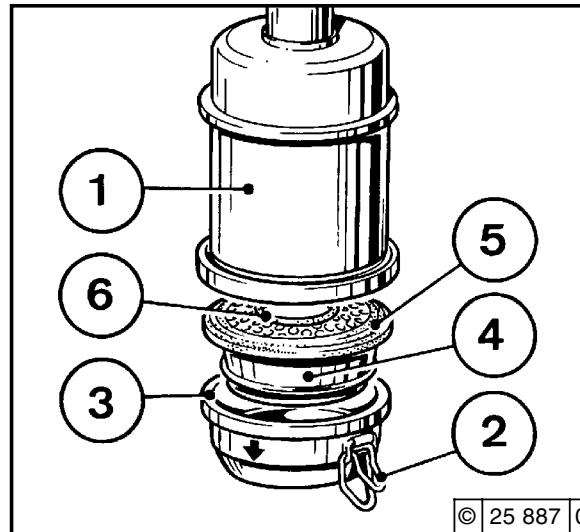


6.4.2 Emptying Cyclone Type Precleaner



- 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 pre-cleaner.
- Reposition collector bowl 3 onto lower section 4, fasten cover 2 in place by tightening wing nut 1.

6.4.3 Clean Oil Bath Air Filter

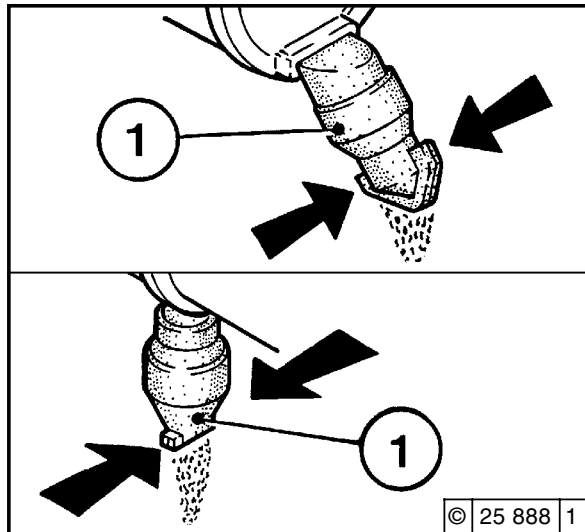


- Turn engine off and wait about 10 minutes for the oil to drain from filter housing 1.
- Loosen quick fasteners 2 and remove oil cup 3 with filter element 4; if necessary, loosen filter element with the aid of a screwdriver at the separating point. Do not damage rubber gasket 5!
- Remove dirty oil and 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.

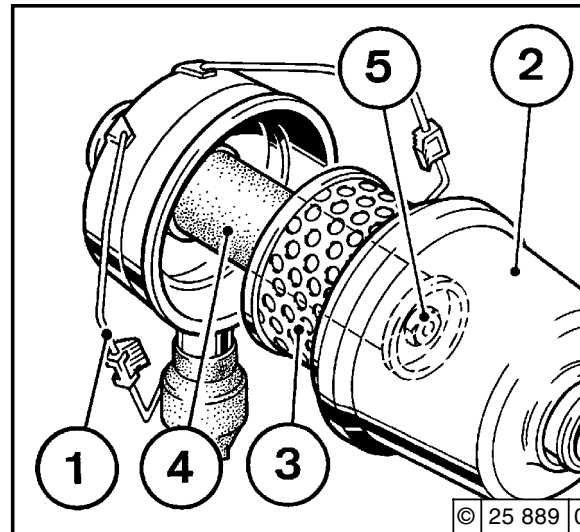


6.4.4 Dry type air cleaner Dust discharge valve



- 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



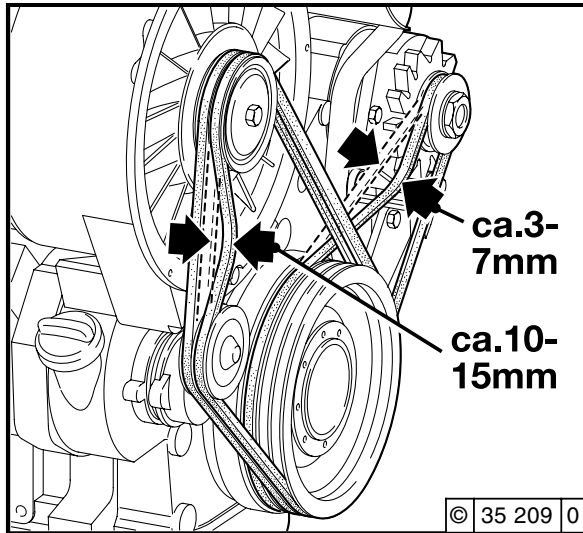
- Undo clip fasteners 1.
- Take off hood 2 and remove cartridge 3.
- Clean cartridge (replace at least once a year).
- Clean cartridge 3.
Blow out using dry compressed air (max. 5 bar), (or in difficult cases, tap out, taking care not to damage the cartridge, or wash according to manufacturer's instructions).
- 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.

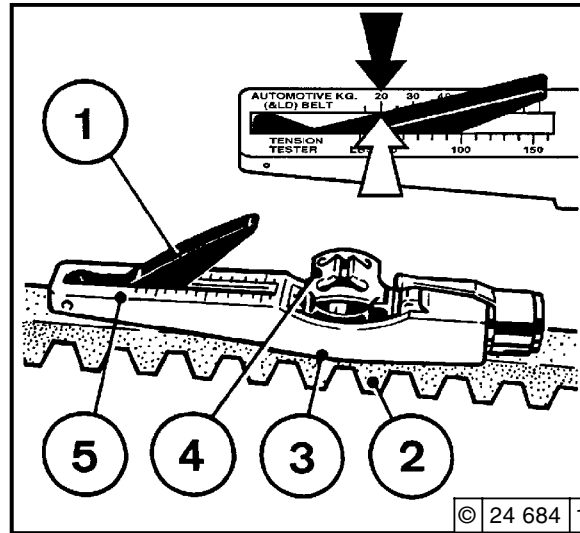


Never clean filter cartridge with gasoline or hot fluids.

6.5.1 Check V-belts



- Visually 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 guide 3 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 V-belt 2 until the spring is heard or felt to trigger.
 - Carefully remove the gauge without altering the position of the indicator arm 1.



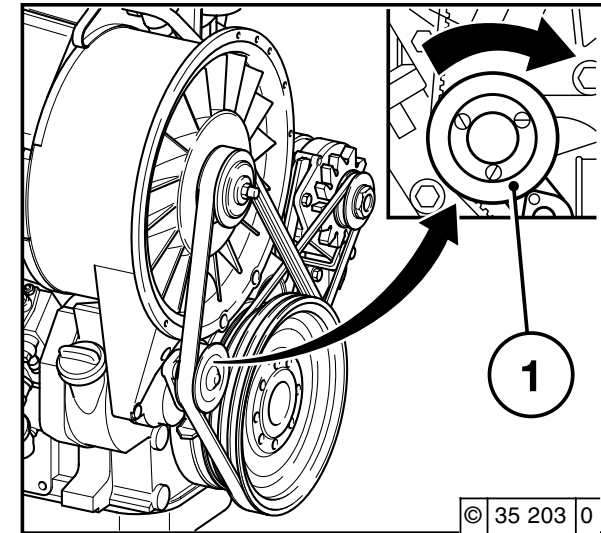
Read off the value where the indicator arm 1 intersects scale 5 (arrow). For settings, see 9.1.

- If necessary, retension belt and measure again.



Check, tension and change belts only with the engine off. Reinstall V-belt guard

6.5.2 Fan V-belt

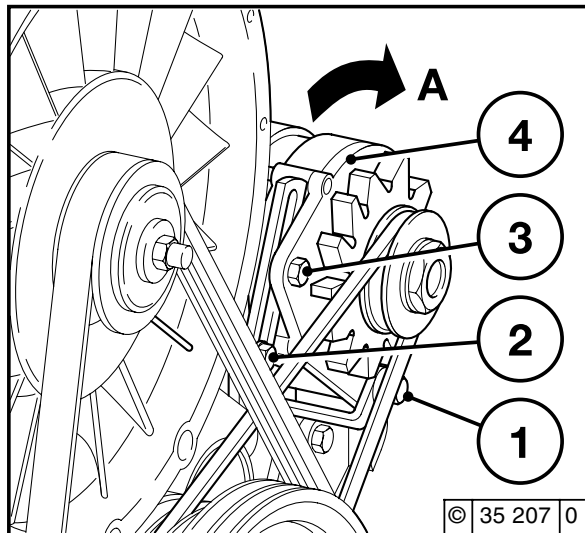


- To replace the tension roller 1, press inwards with a commercial tool and remove the V-belt.

- Position new ribbed V-belt.

Retension V-belt after it has ran for 15 minutes.

6.5.3 Alternator belts

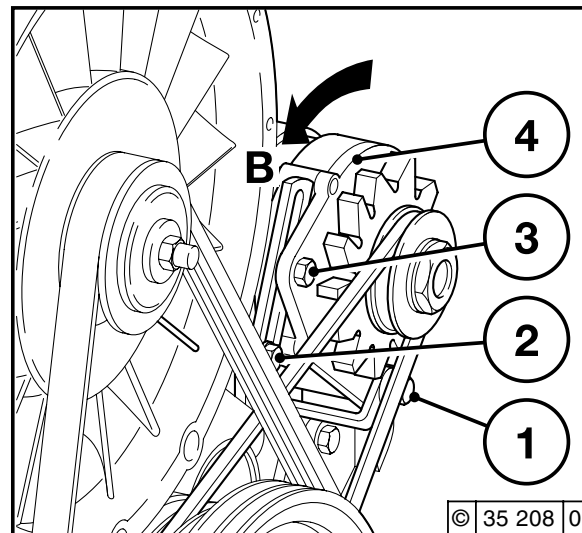


- Loosen bolts 1, 2 and 3 slightly.
- Press alternator 4 outwards in direction of arrow A until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.



Check, tension and change belts only with the engine off. Reinstall V-belt guard.

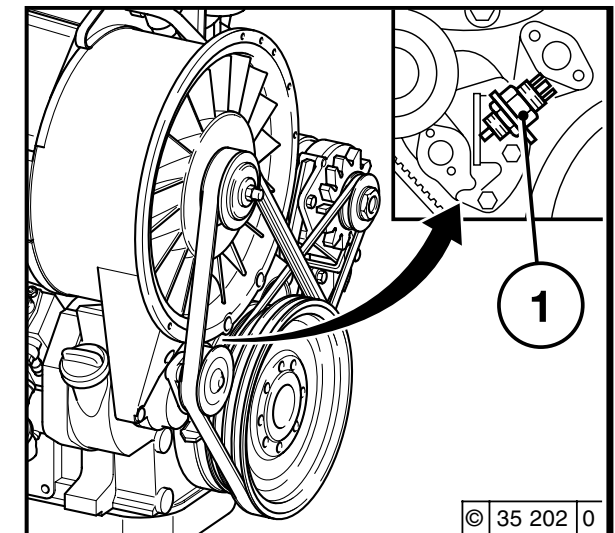
6.5.4 Change alternator belt



- Remove fan belt, as shown in 6.5.2.
- Slacken off bolts 1, 2 and 3.
- Swing alternator inwards in the direction of arrow B.
- Remove and replace belt.
- Swing alternator 4 outwards in direction of arrow A until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.
- Fit fan belt.

Retension V-belt after it has ran for 15 minutes.

6.5.5 Check warning system

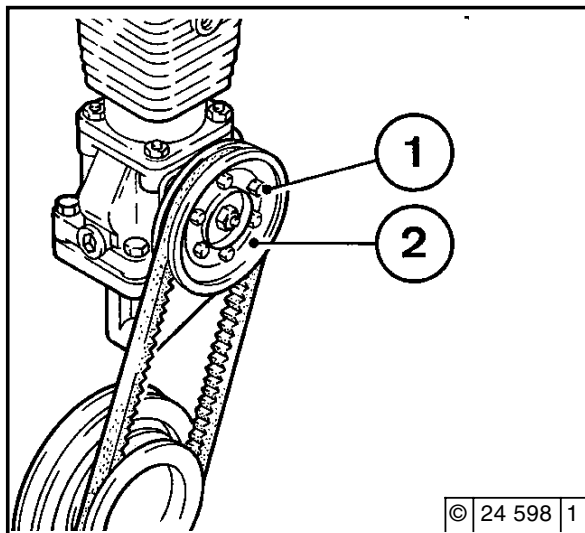


- When the V-belt is torn, the pressure pin 1 of electrical switch is actuated by the tension roller and an audio signal or a light signal is emitted.
- Check the function by pressing pin 1.

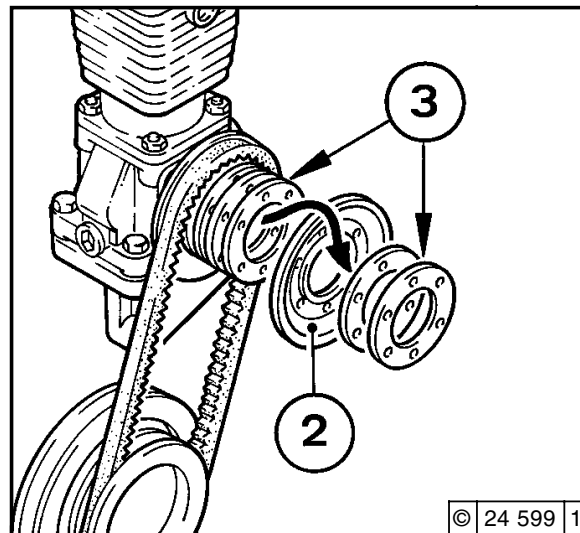


Only check function when the engine is off!

6.5.6 Tensioning or changing V-belts



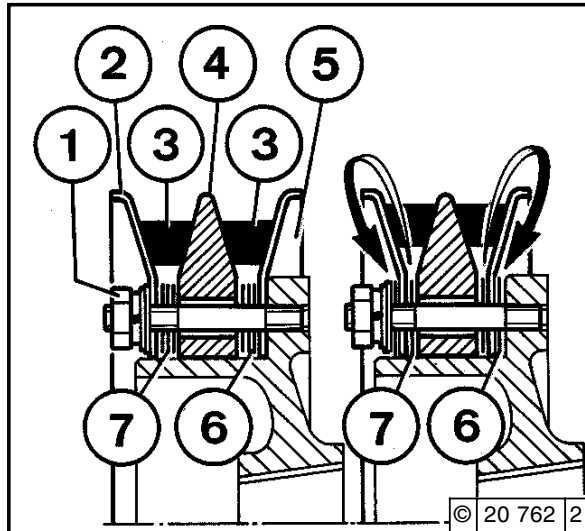
- Unscrew hex screw 1.
- Remove outer belt pulley half 2.
- Replace V-belt if necessary.



- In order to retension, remove one or more inner washers 3. Place the removed washers on the outside on the removed belt pulley half 2.
- Tighten screw 1 again. Whilst tightening, turn engine over simultaneously in order to prevent crushing the V-belt.

After installing new belts, run engine for 15 minutes, then check belt tension.

6.5.7 Air compressor model with dual belts

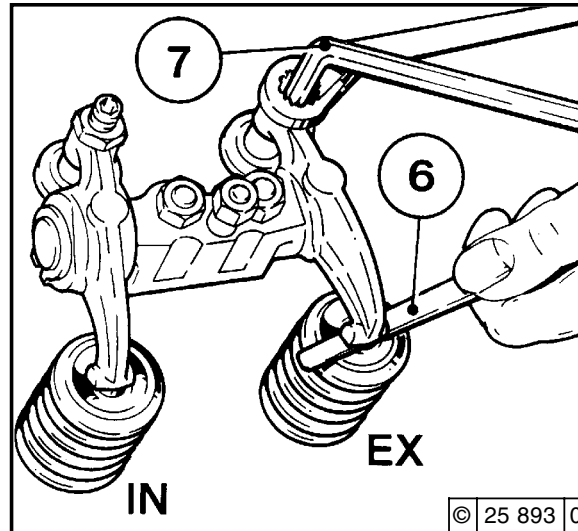
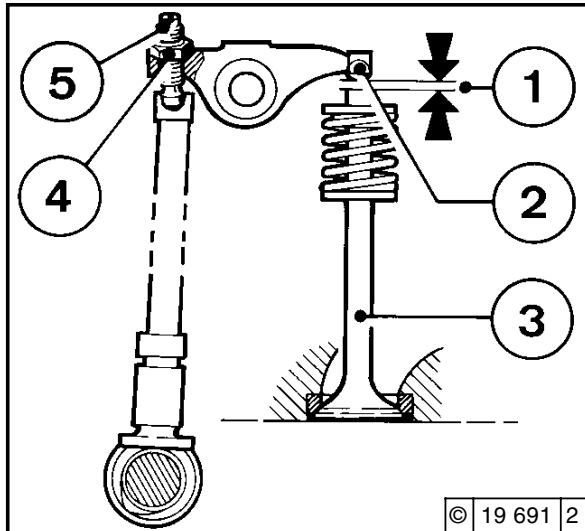


- Undo hex nut 1, remove V-belt pulley half 2, V-belt 3 and inner washer kit 7.
- Remove inner washers 4, posterior V-belt 3, inner washer kit 6 and pulley half 5.
- To retension, remove one or more inner washers from kits 6 and 7. Place removed washers in front of or behind pulley half 2 to ensure belt alignments. Always remove only the same number of washers from each kit.
- For installation, now proceed in the reverse order. Whilst tightening the nut 1, turn engine over simultaneously in order to prevent crushing the V-belt.

If one belt locks or is damaged, always replace both belts. The difference of length between the new belts may not exceed 0.15%.

Check and change belts only with the engine off.
Reinstall V-belt guard, if necessary. Retension V-belt after it has ran for 15 minutes.

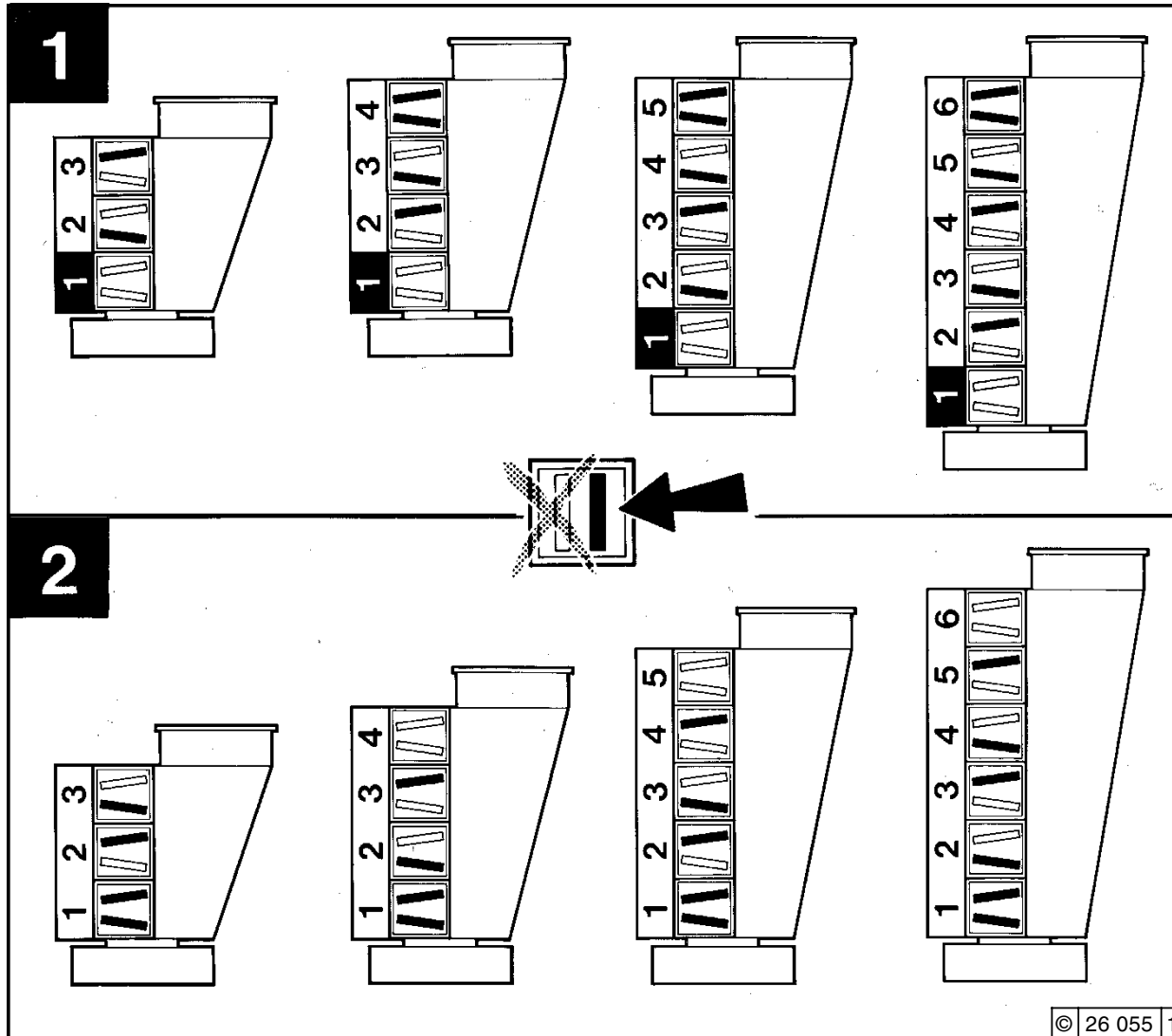
6.6.1 Check valve clearance, adjust if necessary



- Remove the cylinder head cover.
 - Position crankshaft as per schematic, see 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.

- Adjust valve clearance if necessary:
 - Release locknut 4.
 - Use allen key 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 cylinders.
- Reinstall cylinder head cover with new gasket if necessary.

6.6.1.1 Schematic for Valve Clearance Adjustments

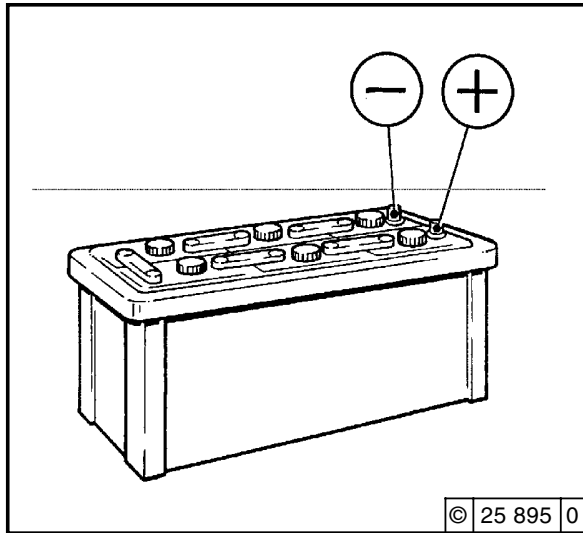


● **Crankshaft Position 1:**
 Turn crankshaft until both valves in cylinder 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearance of valves **marked in black** on schematic. Mark respective rocker arm with chalk to show that adjustment has been carried out.

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

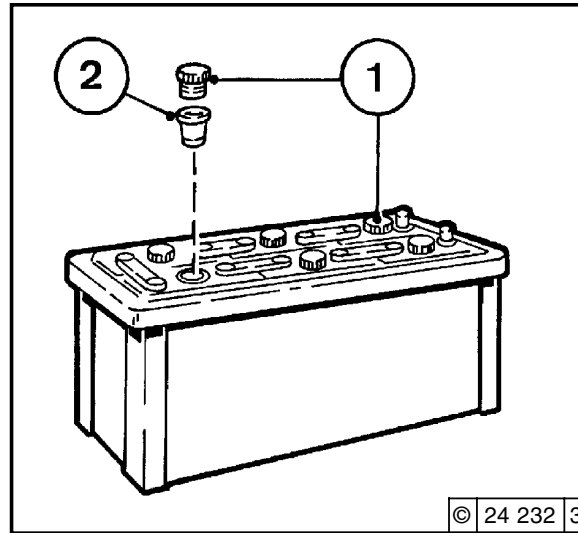
6.7.1 Battery

6.7.1.1 Checking battery and cable connectors



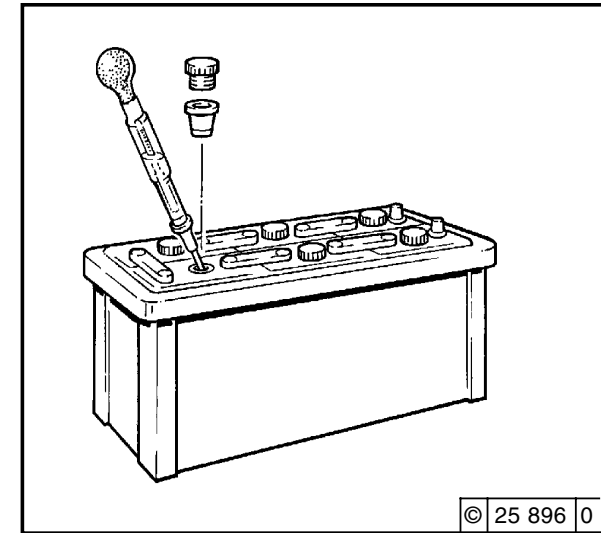
- Keep battery clean and dry.
- Undo dirty clamps.
- Clean terminal posts (+ and -) and clamps of the battery, and grease with acid-free and acid-resistant grease.
- When reassembling, ensure that clamps make good contact. Tighten clamp bolts hand-tight.

6.7.1.2 Check Electrolyte Level



- Remove sealing caps 1.
- If testers 2 are present: Electrolyte level should reach the base of these.
- Without testers: The electrolyte level should be 10-15 mm above the top of the plates.
- If necessary, top up with distilled water.
- Screw sealing caps back in.

6.7.1.3 Check electrolyte density



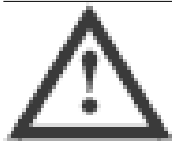
- Measure the electrolyte density of individual cells with a commercial hydrometer.

The hydrometer reading (see table on following page) indicates the battery's state of charge.

During measurement, the temperature of the electrolyte should preferably be +20 °C.

in [kg/ l]		in [°Bé (Baumé scale)*]		Charge status
Normal	Tropical	Normal	Tropical	
1,28	1,23	32	27	well charged
1,20	1,12	24	16	semi-charged, re-charge
1,12	1,08	16	11	discharged, immediately charge

* Measurement of electrolyte density in ° Bé (Baumé-scale) is out of date and rarely used today.



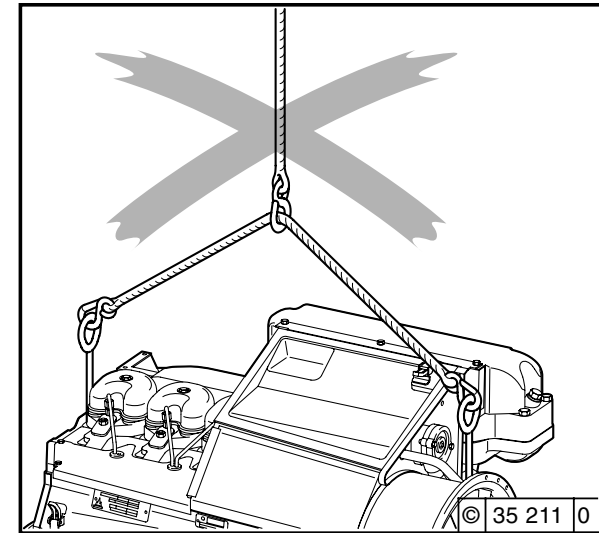
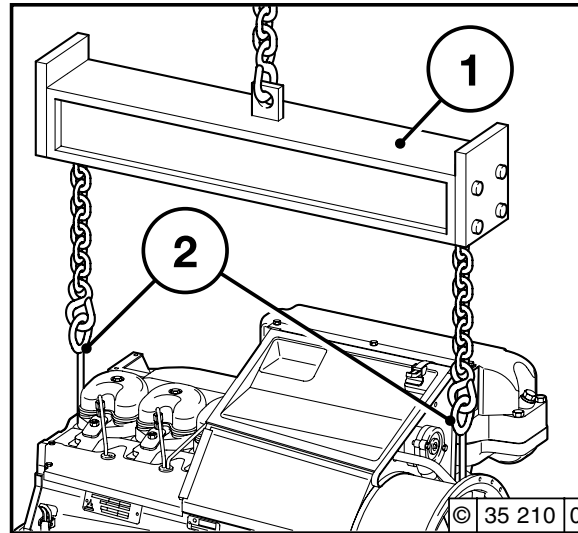
The gases emitted by the battery are explosive! Keep sparks and naked flames away from the battery! Do not allow battery acid to come into contact with skin or clothing! Wear protective goggles! Do not rest tools on the battery!

6.7.2 Rotary Current 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 charge pilot lamp bulb 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 exercised 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 Transportation Shackles



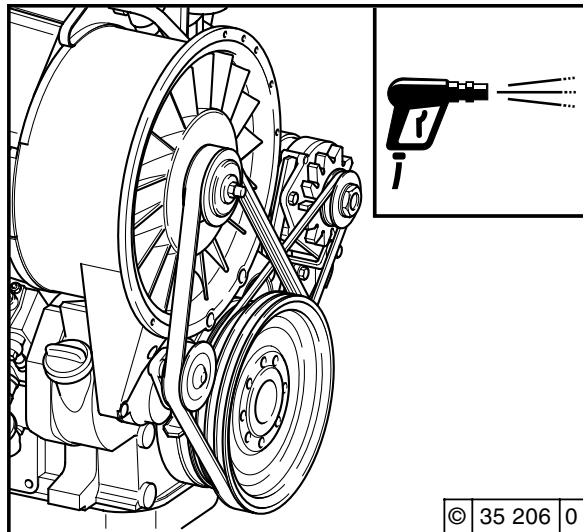
- Always use proper lifting tackle 1 when transporting the engine.
- After transportation and before commissioning of the engine: Remove attachment eyes 2.



Use only the correct lifting gear!

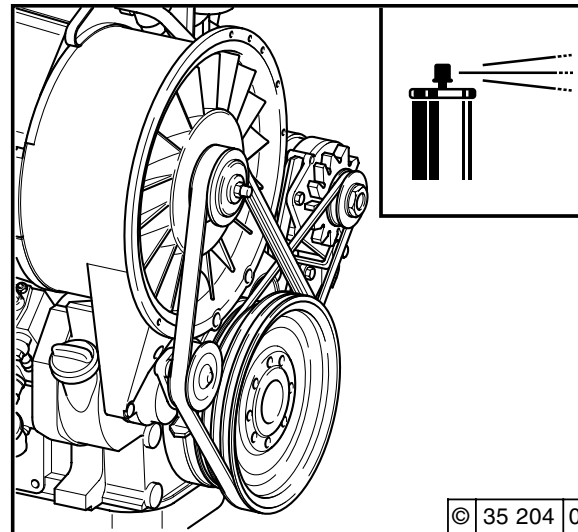
6.8.1 Engine cleaning

Using compressed air



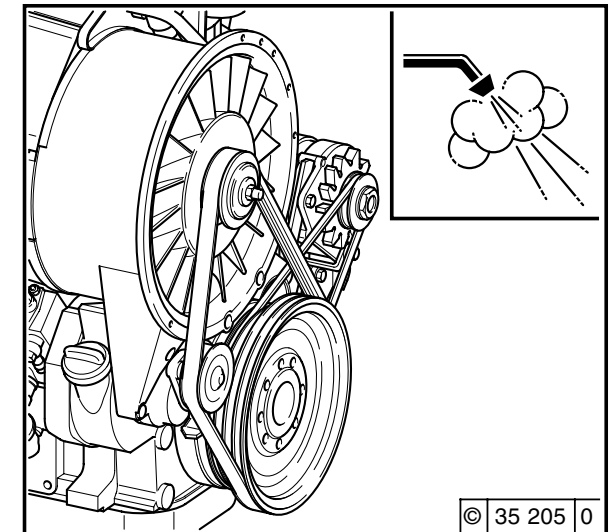
- Switch off the engine.
- Remove engine covers and cooling air hood. Replace them after cleaning and before the test run.
- Cover electrical / electronic components / connections (e.g. generator, starter, governor, solenoid).
- Blow air through the engine, taking particular care not to damage the cooler and cooling fins (begin to blow through air from the exhaust side). Remove the dirt which has blown into the interior space.

Using cold-cleaning compound



- Switch off the engine.
- Remove engine covers and cooling air hood. Replace them after cleaning and before the test run.
- Cover electrical / electronic components / connections (e.g. generator, starter, governor, solenoid).
- Spray the engine with the commercial cold-cleaning compound and allow to react for approx. 10 mins.
- Spray clean the engine with a strong water jet, repeat if necessary.
- Allow the engine to run warm so that the remaining water evaporates.

Using high pressure device

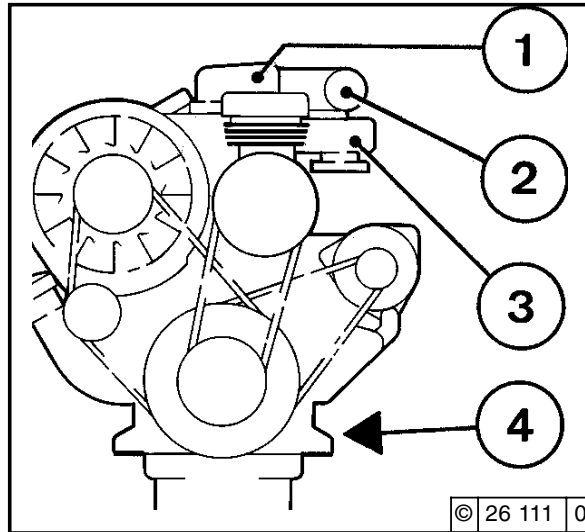


- Switch off the engine.
- Remove engine covers and cooling air hood. Replace them after cleaning and before the test run.
- Cover electrical / electronic components / connections (e.g. generator, starter, governor, solenoid).
- Clean the engine with a steam jet (max. spray pressure of 60 bar, max. steam temperature of 90°C).
- Allow the engine to run warm so that the remaining water evaporates.



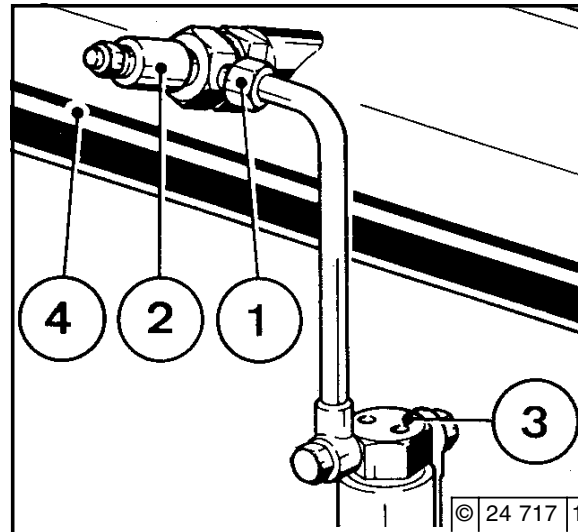
Clean the engine only when the engine is switched off!

6.9.1 Checkfastenings

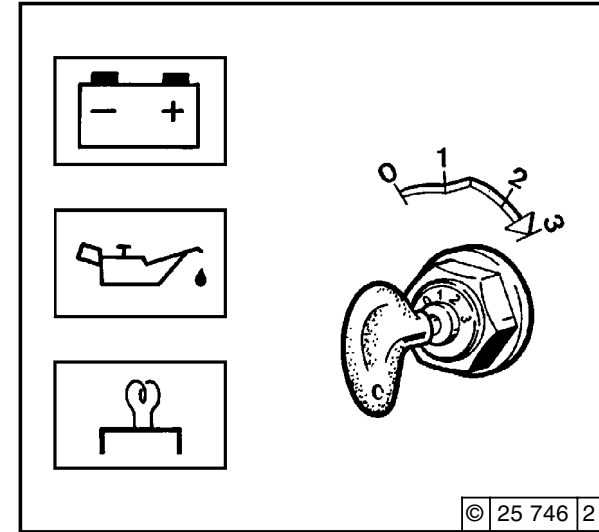


- Cylinder head cover 1
- Air intake manifold 2
- Connection sockets
- Exhaust line 3
- Engine mounts 4

6.9.2 Checking the function of the glow plugs

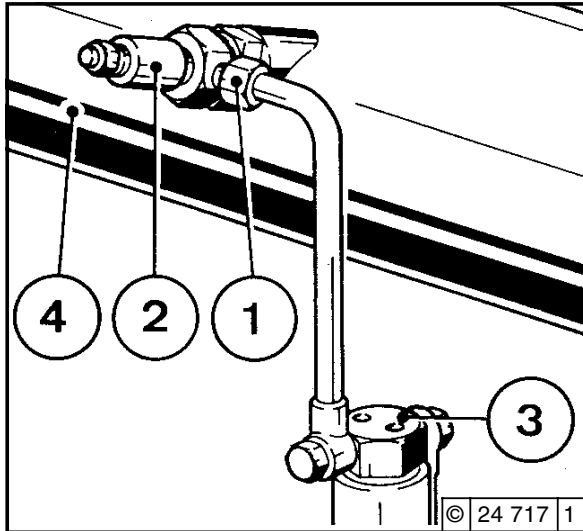


- With perfect function, the air-intake pipe 4 warms up near the glow lamps 2 from pre-glowing.

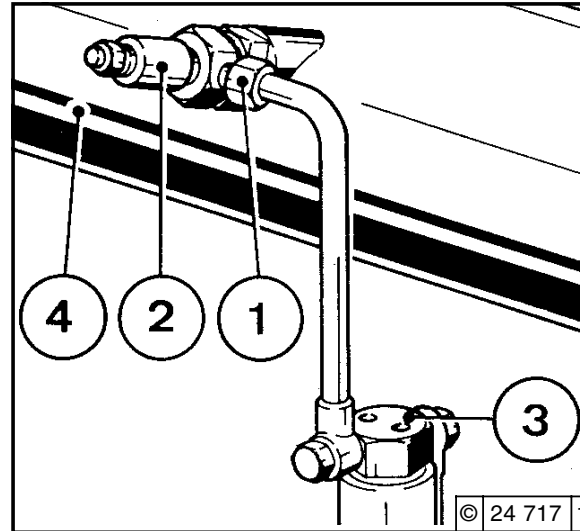


Test step 1

- Place speed control lever or shut-off lever in "stop" position.
- Insert key
 - Position 0 = no operating voltage
- Key clockwise
 - Position 1 = operating voltage
 - Pilot lights illuminate
- Push key in and turn further clockwise against spring pressure.
 - Position 2 = Preheat, hold for approx. 1 minute.
 - Preheat lamp comes on
- Otherwise the glow lamps are defective or the transmission line interrupted.

**Test step 2**

- Loosen screw 1.
- Turn engine over with starter, key in switching position 3.
- Fuel must be present on the loosened pipe connection. Otherwise, the system and solenoid valve should be checked by a specialist!

**Test step 3**

- Loosen screw 1.
- Remove glow lamps 2
- Turn engine over with starter, key in switching position 3.
- Fuel must be present on the glow lamps 2, or replace glow lamps 2 if necessary.
- When fitting glow lamps 2, use DEUTZ DW 47 sealants.
- Reinstall glow lamps to fuel line.



Keep away from moving parts!
Collect any escaping fuel and dispose of this in an environmentally-friendly manner.

7.1 Fault Table

Faults, Causes and Remedies

7.1 Fault Table

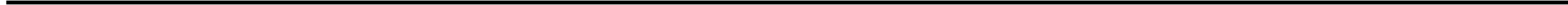
7

Faults										Measures		
Engine does not start or is difficult to start										Check	P	
Engine starts, but runs irregularly or fails										Adjust	E	
Engine overheats, temperature warning system responds										Replace	W	
Engine output is deficient										Clean	R	
Engine does not run on all cylinders										Top up	A	
Engine oil pressure is non-existent or excessively low										Reduce	S	
Engine oil consumption excessive												
Engine smokes - blue												
- white												
- black												
Cause										Section		
●										Not declutched (where possible)	Engine Operation	P
●							●			Below starting limit temperature		P
●			●							Engine shut-off lever still in stop position (shut-off magnet defective)		P
		●			●					Oil level too low		A
		●	●			●	●			Oil level too high		S
					●	●	●			Excessive inclination of engine		P/E
						●	●			Engine runs mainly with low load		P
●		●	●			●	●		●	Air cleaner clogged / turbocharger defective	Combustion air	W
		●	●						●	Air cleaner service switch / indicator defective		P/W
			●							CPD defective (connection line leaks) only with turbocharged engines		P/W
		●	●						●	Exhaust gas backpressure too high		P
			●						●	Charge air line leaking, only with supercharged engines		P/E
		●								Cooling fins soiled	Cooling system	P/R
		●	●						●	Intercooler soiled		P/R
		●			●					Oil cooler soiled on the air and/or the oil side		P/R
		●								Cooling fan or exhaust tension defective, torn or loose V-belt		P/W
		●								Cooling air temperature rise / heating short circuit		P
		●								Cooling air guide loose, torn or missing		P

7.1 Fault Table

Faults, Causes and Remedies

Faults										Measures		
Engine does not start or is difficult to start										Check	P	
Engine starts, but runs irregularly or fails										Adjust	E	
Engine overheats, temperature warning system responds										Replace	W	
Engine output is deficient										Clean	R	
Engine does not run on all cylinders										Top up	A	
Engine oil pressure is non-existent or excessively low										Reduce	S	
Engine oil consumption excessive												
Engine smokes - blue												
- white												
- black												
Cause										Section		
●										Battery defective or discharged	Electrics	P
●										Cable connections, starter, electrical circuit loose or oxidised		P
●										Starter defective or pinion does not engage		P
					●					Oil pressure switch / gauge defective		P/W
●	●	●	●	●				●	●	Incorrect valve clearance	Engine	P/E
●	●		●	●						Injection line leaks		P/R
		●								Ventilation line blocked		P/R
●	●							●		Glowplugs		P/W
●	●	●	●	●				●	●	Injection valve defective		P/W
●	●		●	●						Air in the fuel system		P/W
●	●		●	●						Fuel filter / fuel pre-cleaner soiled		P/R/W
		●				●				Oil filter defective		W
●					●	●				Incorrect engine lube oil SAE class or quality		W
●	●		●	●				●	●	Compression too low		P
							●			Oil in combustion chamber		P/R



8.1 Preservation

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 the formation of corrosion. The preservative measures described here will protect the engine for up to approx. 6 months. 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 cleaning agent to remove preservatives:
 - Petroleum benzine (hazardous materials class A3)

8.1.1 Preserve engine

- Clean engine (with cold cleansing agent if preferred) using high pressure equipment (see 6.8.1).
- 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 tank.
- Make up a mixture of 90 % diesel fuel and 10 % anti-corrosion oil, and refill fuel tank.
- Allow the engine to run for approx. 10 mins.
- Switch off the engine.
- Turn engine over manually several times to preserve the cylinders and combustion chamber.
When turning over with starter, set shut-off lever to stop position.
- Remove V-belts and store wrapped, dry and recumbent.
- Spray grooves on V-belt pulleys with anti-corrosion spray.
- Close off intake ports and exhaust ports, possibly with plugs.

8.1.2 Remove engine preservation

- Remove anti-corrosion agent from grooves in V-belt pulleys.
- Install V-belt, retension after brief operation if necessary (see 6.5).
- Remove covers from intake port and exhaust ports.
- Commission engine.

9.1 Engine Specifications and Settings

9.2 Screw Tightening Torques

9.3 Tools

Model	F3L 914	F4L 914	F5L 914	F6L 914
Number of cylinders	3	4	5	6
Cylinder arrangement	vertical in line			
Bore [mm]	102			
Stroke [mm]	132			
Total displacement [cm ³]	3236	4314	5393	6472
Compression ratio [ε]	20			
Working cycle	4-stroke naturally aspirated diesel engine			
Combustion system	Direct injection			
Direction of rotation seen on flywheel	counter-clockwise			
Weight including cooling system to DIN 70020-A without starter or alternator [approx. kg]	270 ⁵⁾	300 ⁵⁾	380 ⁵⁾	410 ⁵⁾
Engine output [kW]	1)			
Speed [rpm]	1)			
Lubrication	Pressure lubrication			
SAE oil	15W 40			
Oil temperature in oil pan [°C]	135			
Min. oil pressure when warm (120 °C) and low idle [bar]	0,4 ⁴⁾			
Oil plate filling quantity without filter [approx. litres]	9,0 ³⁾	12,0 ³⁾	13,5 ³⁾	14,5 ³⁾
Oil plate filling quantity with filter [approx. litres]	9,6 ³⁾	13,0 ³⁾	15,0 ³⁾	16,0 ³⁾
Valve clearance with cold engine [mm]	Inlet 0,15 + 0,05 / exhaust 0,15 + 0,05			
Injector opening pressure [bar]	200 + 10			
Start of feed [°KW of TDC]	1)			
Firing order of the engine	1-2-3	1-3-4-2	1-2-4-5-3	1-5-3-6-2-4
V-Belt tension:	Pre-tension / re-tension ²⁾			
Alternator fan [N]	450 / 300 ± 20			
Compressor [N]	550 / 400 ± 20			

1) Engine output, speed, start of delivery are stamped on engine rating plate, etc., (see also 2.1).

2) Re-tension 15 minutes after the engine has been operated under load.

3) Approx. values may vary depending on version. The upper oil dipstick mark is always authoritative.

4) Values for engines without engine oil heating.

5) Approx. values may vary depending on version.

9.1 Engine Specifications and Settings

Technical Specification

914/C/CT Model	BF3L 914	BF4L 914	BF6L 914	BF6L 914 C
Number of cylinders	3	4	6	6
Cylinder arrangement	vertical in line			
Bore[mm]	102			
Stroke[mm]	132			
Total displacement [cm ³]	3236	4314	6472	6472
Compression ratio [ε]	18			
Working cycle	4-stroke turbocharged diesel engine			
Combustion system	Direct injection			
Direction of rotation seen on flywheel	counter-clockwise			
Weight including cooling system to DIN 70020-A without starter or alternator [approx. kg]	320 ⁵⁾	360 ⁵⁾	485 ⁵⁾	510 ⁵⁾
Engine output [kW]	1)			
Speed [rpm]	1)			
Lubrication	Pressure lubrication			
SAE oil	15W 40			
Oil temperature in oil pan [°C]	135			
Min. oil pressure when warm (120 °C) and low idle [bar]	0,5 ⁴⁾			
Oil plate filling quantity without filter [approx. litres]	9 ³⁾	12 ³⁾	16,0 ³⁾	16,0 ³⁾
Oil plate filling quantity with filter [approx. litres]	9,6 ³⁾	13 ³⁾	17,5 ³⁾	17,5 ³⁾
Valve clearance with cold engine [mm]	Inlet 0,15 + 0,05 / exhaust 0,15 + 0,05			
Injector opening pressure [bar]	200 + 10			
Start of feed [°KW of TDC]	1)			
Firing order of the engine	1-2-3	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4
V-Belt tension: Pretension / Retension	Pretension / Retension ²⁾			
Alternator fan [N]	400 / 250 ± 20			
Compressor [N]	500 / 350 ± 20			

1) Engine output, speed, start of delivery are stamped on engine rating plate, etc., (see also 2.1).

2) Re-tension 15 minutes after the engine has been operated under load.

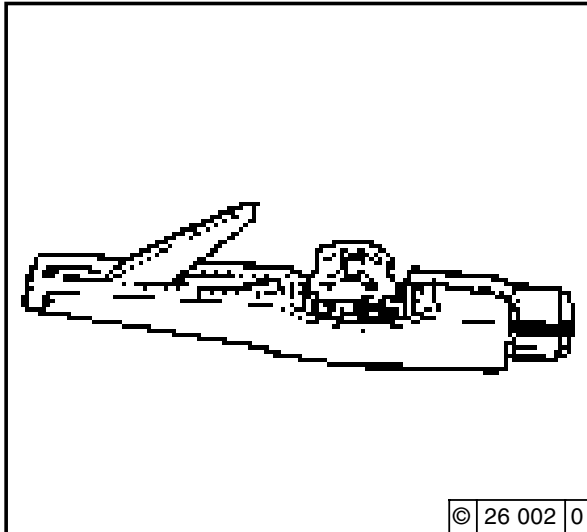
3) Approx. values may vary depending on version. The upper oil dipstick mark is always authoritative.

4) Values for engines without engine oil heating.

5) Approx. values may vary depending on version.

Installation	Pretension [Nm]	Retension				Total	Comments
		1 st position	2 nd position	3 rd position	4 th position		
Securing the alternator	20	180°	–	–	–	180°	M10 x 180
	30	180°	–	–	–	180°	M14 x 230
Cylinder head cover	–	–	–	–	–	12 ± 1,2 Nm	–
Valve clearance adjusting screw Foot	–	–	–	–	–	22 ± 2 Nm	–
	30	60°	15°	–	–	75°	M14 x 100
	30	60°	45°	–	–	105°	M14 x 110
	30	60°	45°	–	–	105°	M14 x 125
Intake manifold	–	–	–	–	–	21 ± 2 Nm	–
Exhaust manifold	–	–	–	–	–	40 ± 4 Nm	–
Oil drain screw	–	–	–	–	–	150 ± 10 Nm	M30 x 1,5
Oil drain screw	–	–	–	–	–	80 ± 10 Nm	M22 x 1,5
Injection valve attachment	–	–	–	–	–	25–30 Nm	–

V-belt tension gauge



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

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Postfach 14 05 80
D-42826 Remscheid

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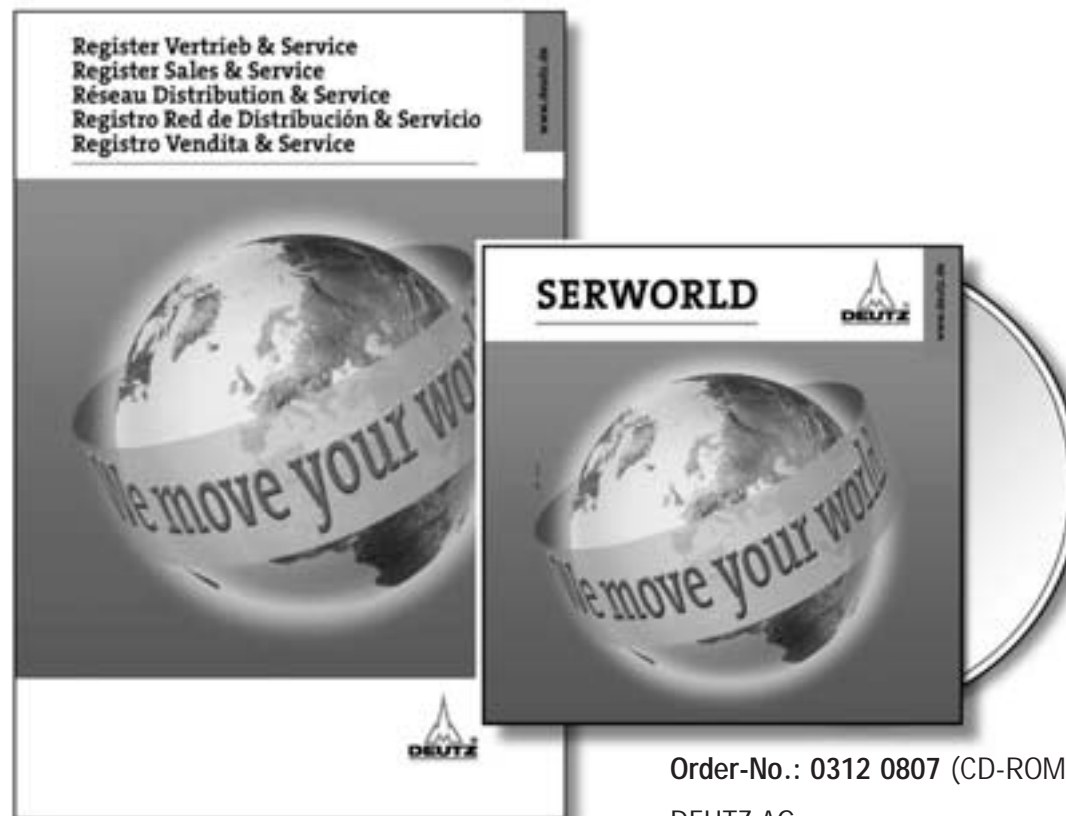
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