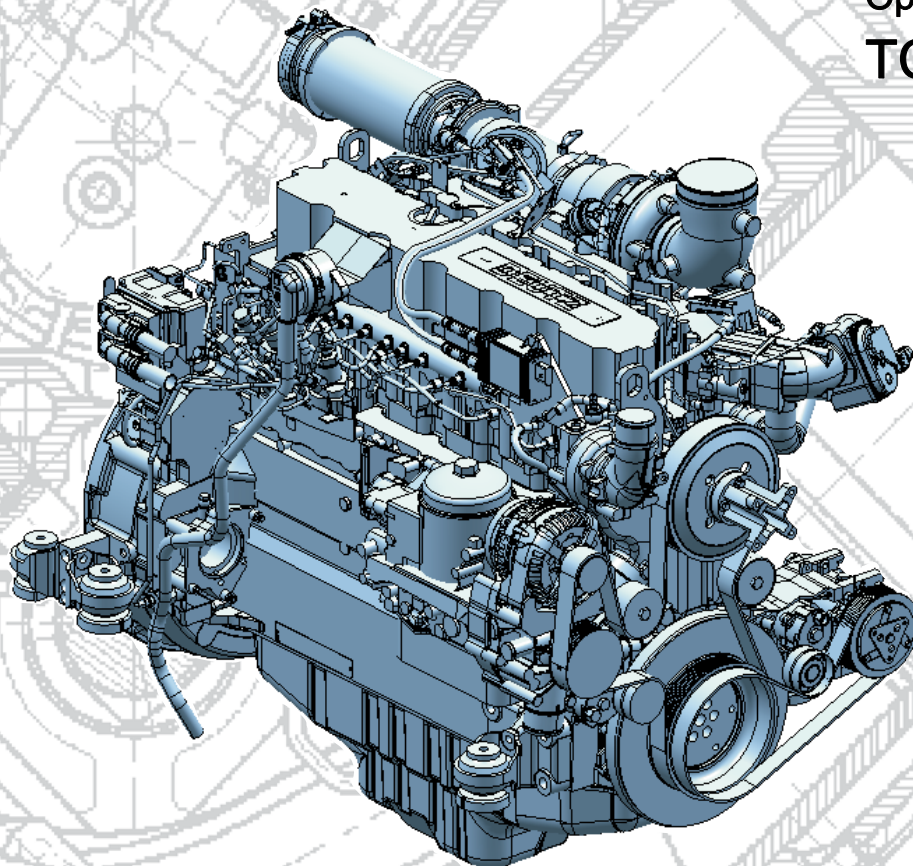


Operation Manual
TCD 7.8 L6



Notes

Notes

- This engine is defined exclusively for purpose according to the scope of delivery and built by the equipment manufacturer (use for the intended purpose). Any other use above and beyond this will be considered as misuse. The manufacturer will not accept any liability for damages resulting from this. The user bears the sole risk.
- Use for the intended purpose also includes observance of the operating, maintenance and repair conditions specified by the manufacturer. The engine should only be operated, serviced and repaired by personnel trained in its use and the hazards involved.

The pertinent rules for the prevention of accidents and other generally recognised safety and industrial medicine rules must be observed.
- When the engine is running there is a danger of injury caused by:
 - rotating and hot components
 - on motors with external ignition (high electrical voltage). Contact must be avoided!
- Unauthorised engine modifications will invalidate any liability claims against the manufacturer for resultant damage.
- Equally, manipulations to the injection and control system can affect the engine's performance and the exhaust characteristics. Adherence to legislation on pollution can no longer be guaranteed under such conditions.
- Do not change the cooling air feed area to the blower of fan. An unobstructed cooling air supply must be guaranteed.

The manufacturer will accept no liability for damage resulting from this.
- When carrying out maintenance work on the en-

gine, 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/cleaning work on the engine may only be carried out when the engine is not running and has cooled down.

When doing this, make sure that the electrical system is switched off (remove ignition key).

The specifications for accident prevention with electrical systems (e.g. VDE-0100/-0101/-0104/-0105 Electrical protective measures against dangerous contact voltages) must be observed.

Cover all electrical components tightly when cleaning with liquids.

- Do not work on the fuel system while the engine is running - **Danger to life!**

Wait for the pressure to drop after the engine has come to a standstill (in engines with DEUTZ Common Rail about 5 minutes, otherwise 1 minute) because the system is under high pressure - **Danger to life!**

During the first trial run do not stand in the danger area of the engine.

Danger due to high pressure in case of leaks - **Danger to life!**

- In case of leaks immediately contact workshop.
- When working on the fuel system, make sure that the engine is not started inadvertently during repairs - **Danger to life!**

Dear customer,

Congratulations on the purchase of your DEUTZ engine.

DEUTZ air/liquid-cooled engines are developed for a broad spectrum of applications. Consequently, a wide range of variants is offered to meet the requirements of specific cases.

The engine is equipped accordingly for the particular installation situation, i.e. not all the components described in the operating manual are installed in your engine.

We have endeavoured to highlight any differences so that you will be able to locate the operating and maintenance instructions applicable to your engine more quickly and easily.

Please make sure that this operating manual is available to everyone involved in the operation, maintenance and repair of the engine and that they have understood the contents.

If you have any queries, please contact us, we'll be happy to advise you.

Sincerely,
DEUTZ AG

Engine serial number

Please enter the engine serial number here. This will simplify the handling of customer service, repair and spare parts queries.

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

Components of the exhaust aftertreatment system

Please enter the serial numbers of the exhaust aftertreatment components.

Diesel oxidation catalytic converter

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

Diesel particle filter

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

SCR module

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

Notes

We reserve the right to make technical changes to the descriptions and data in this operating manual in the interest of further development of the engines.

This document may only be reprinted and reproduced, even in part, with our express permission.

Contents

| | | | |
|---|-----------|--|-----------|
| Notes | 2 | Fuel system. | 46 |
| Foreword. | 3 | SCR. | 51 |
| 1 General. | 5 | Cooling system | 52 |
| 2 Engine description | 7 | Engine cleaning. | 54 |
| Model | 7 | Aspiration system. | 55 |
| Engine illustrations | 10 | Belt drives | 57 |
| Lubricating oil diagram | 14 | Adjustment work | 58 |
| Fuel diagram | 15 | Electrical system | 60 |
| Coolant diagram | 16 | 7 Faults. | 62 |
| Exhaust gas return | 18 | Fault table | 62 |
| Exhaust gas aftertreatment. | 19 | Engine management | 67 |
| Electrics/Electronics | 21 | 8 Transport and storage | 69 |
| 3 Operation | 23 | Transport | 69 |
| Ambient conditions | 23 | Engine corrosion protection | 70 |
| Initial start-up | 24 | 9 Technical data | 72 |
| Start procedure | 27 | Engine and setting data | 72 |
| Operation monitoring | 29 | Tools | 74 |
| Regeneration | 33 | | |
| Stop procedure | 34 | | |
| 4 Operating Media. | 35 | | |
| Lubricating oil. | 35 | | |
| Fuel | 37 | | |
| Coolant | 38 | | |
| SCR reduction agent | 39 | | |
| 5 Maintenance | 40 | | |
| Maintenance schedule | 40 | | |
| 6 Servicing and maintenance work | 43 | | |
| Lubricating oil system. | 43 | | |

DEUTZ diesel engines

DEUTZ diesel engines and the appropriate exhaust aftertreatment components are the result of years of research and development. The detailed know-how gained by this in connection with the high quality demands are the guarantee for production of engines with a long life, high reliability and low fuel consumption. Naturally the high demands for protection of the environment are also met.

Safety precautions when the engine is running

Maintenance work or repairs may only be performed on the shut-down engine. Make sure that the engine cannot be started inadvertently - **Danger of accident!**

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

Observe industrial safety regulations when running the engine in an enclosed space or underground.

When working on the running engine, work clothing must be close fitting.

Never fill the fuel tank while the engine is running.

Service and Maintenance

Service and maintenance are also decisive for whether the engine satisfactorily meets the set demands. Recommended service intervals must therefore be observed and service and maintenance work must be carried out conscientiously.

Special care should be taken under abnormally demanding operating conditions.

Original DEUTZ parts

Original DEUTZ parts are subject to the same strict quality demands as the DEUTZ engines. Further de-

velopments for improving the engines are also introduced in the original DEUTZ parts of course. Only the use of original DEUTZ parts manufactured according to the state-of-the-art can guarantee perfect functioning and high reliability.

DEUTZ Xchange components

DEUTZ replacement parts are a low-cost alternative. Of course, the quality standards here are just as high as for new parts. DEUTZ replacement parts are equal to the original DEUTZ parts in function and reliability.

Asbestos

The gaskets used in this engine contain no asbestos. Please use the appropriate original DEUTZ parts for maintenance and repair work.

Service

We want to preserve the high performance of our engines, and with it the confidence and satisfaction of our customers. We are therefore represented worldwide by a network of service branches.

The DEUTZ name does not merely stand for engines that are the products of extensive development work, DEUTZ also stands for complete service packages that ensure optimum operation of our engines, and for customer services operations that you can count on.

Please contact your DEUTZ-partner in case of malfunctions and spare parts inquiries. Our specially trained personnel will ensure fast, professional repairs using original DEUTZ spare parts in case of damage.

The DEUTZ home page gives you a continuously up-to-date overview of the service partners in your vicin-

ity with notes on product responsibilities and services. Or you can use another fast, convenient way via the Internet under www.deutzshop.de. The DEUTZ P@rts Online parts catalogue gives you a direct contact to your nearest local service partner.

California

Proposition 65 Warning

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

Masthead

DEUTZ AG

Ottostraße 1

51149 Köln

Germany

Phone: +49 (0) 221-822-0

Fax: +49 (0) 221-822-3525

E-Mail: info@deutz.com

www.deutz.com

Danger



This symbol is used for all safety instructions which, if not observed, present a direct danger to life and limb for the person involved. Observe these carefully. The attention of operating personnel should be drawn to these safety instructions. Furthermore, the legislation for "general regulations for safety and the prevention of accidents" must be observed.

Caution



This symbol indicates a danger to the part and engine. The relevant instructions must be observed, failure to do so can lead to destruction of the part and the engine.

Notes



This symbol accompanies notes of a general kind.

Engine type designation

This manual covers the following engine types
TCD 7.8 L6

| TCD | |
|-----|--------------------------|
| T | Exhaust gas turbocharger |
| C | Charge air cooler |
| D | Diesel |

| 7.8 | |
|-----|------------------------|
| 7.8 | Displacement in litres |

| L6 | |
|----|------------------|
| L | in series |
| 6 | No. of cylinders |

Emissions legislation

| | |
|---|-------------|
| The engines of these operating instructions fulfill the following exhaust emissions regulations | |
| USA | EPA Tier 4i |
| EU | Stage IIIB |



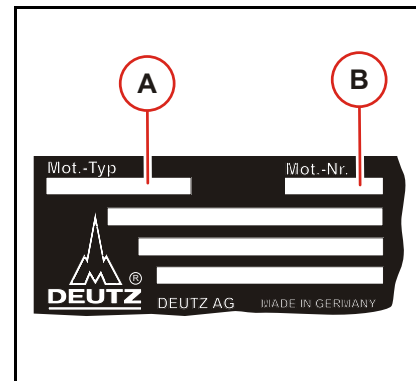
The engine and the corresponding EAT system (**Exhaust After Treatment**) are adapted to each other and linked by an appropriate electronic controller.

They are only certified by the responsible authorities and comply with the permissible exhaust limits in this combination.

Operation of the engine with other EAT systems is not allowed.



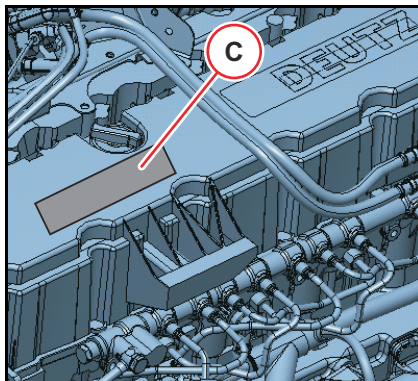
The engines of this operating manual may only be used with a functioning exhaust aftertreatment system.



Rating plate

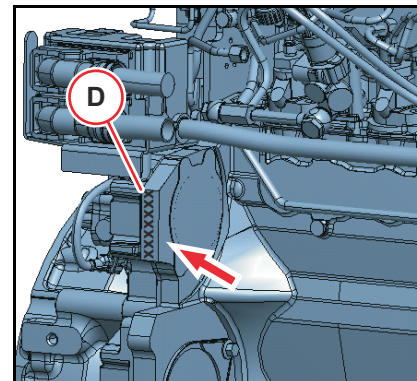
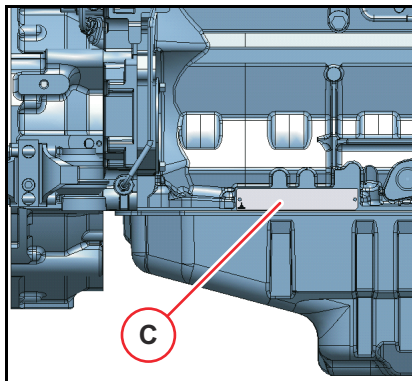
The type (A), engine number (B) and performance data are stamped on the rating plate.

The engine type and number must be stated when purchasing spare parts.



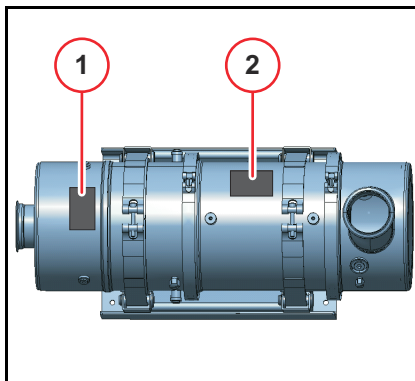
Location of the rating plate

The rating plate (C) is fixed to the cylinder head cover or the crankcase.



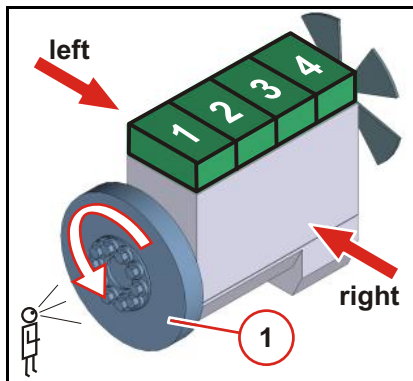
Engine serial number

The engine number (D) is stamped onto the crankcase (arrow) and onto the rating plate.

**EAT serial numbers**

- 1 Rating plate of the diesel oxidation catalytic converter
- 2 Rating plate of the diesel particle filter

The serial numbers of the exhaust aftertreatment components are stamped on the rating plates.

**Cylinder numbering****Cylinder arrangement**

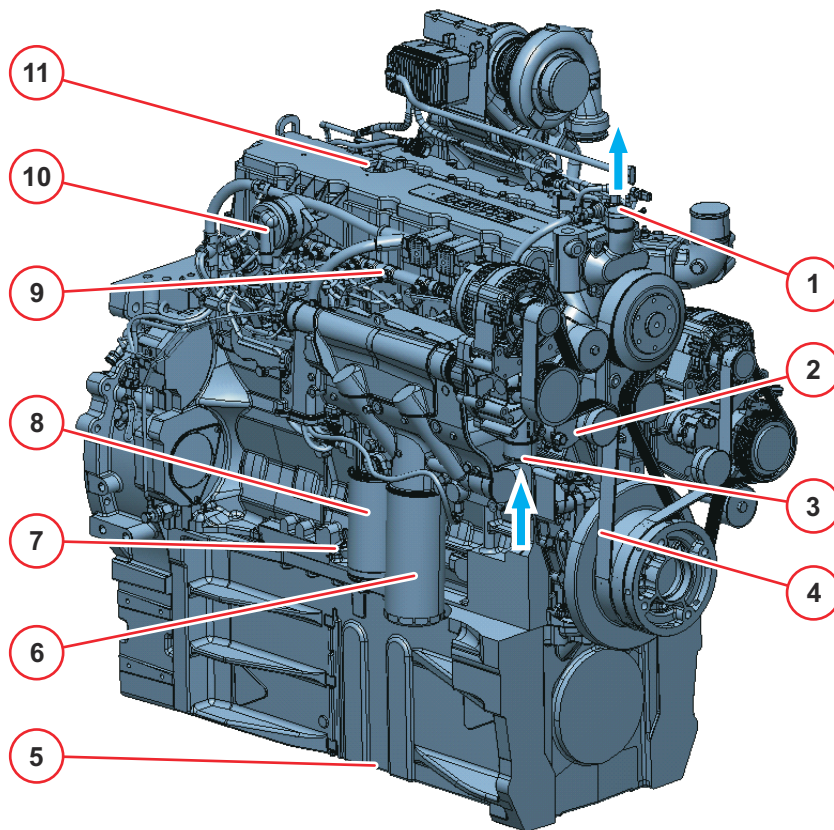
The cylinders are counted consecutively starting from flywheel (1).

Direction of rotation

Looking onto the flywheel.
rotating to the left: counter-clockwise.

Engine sides

Looking onto the flywheel.



TCD 7.8 L6

Agricultural engine

View from right (example)

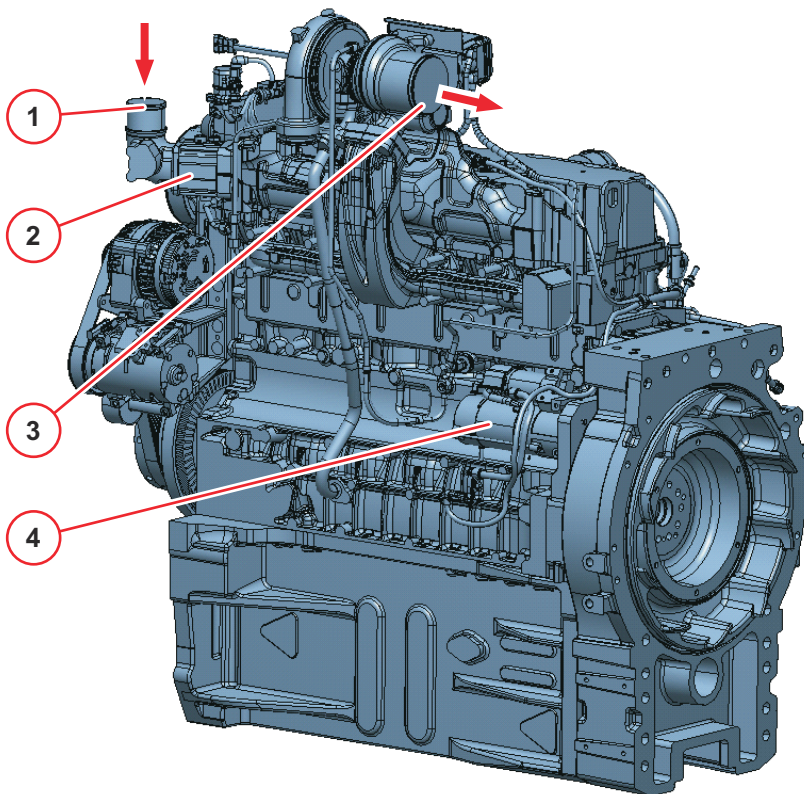
- 1 Coolant outlet
- 2 Tension pulley
- 3 Coolant inlet
- 4 V-rib belt
- 5 Lubricating oil drain plug
- 6 Lube oil replacement filter
- 7 Lubricating oil dipstick
- 8 Exchangeable fuel filter
- 9 Rail
- 10 Crankcase breather
- 11 Lubricating oil filling

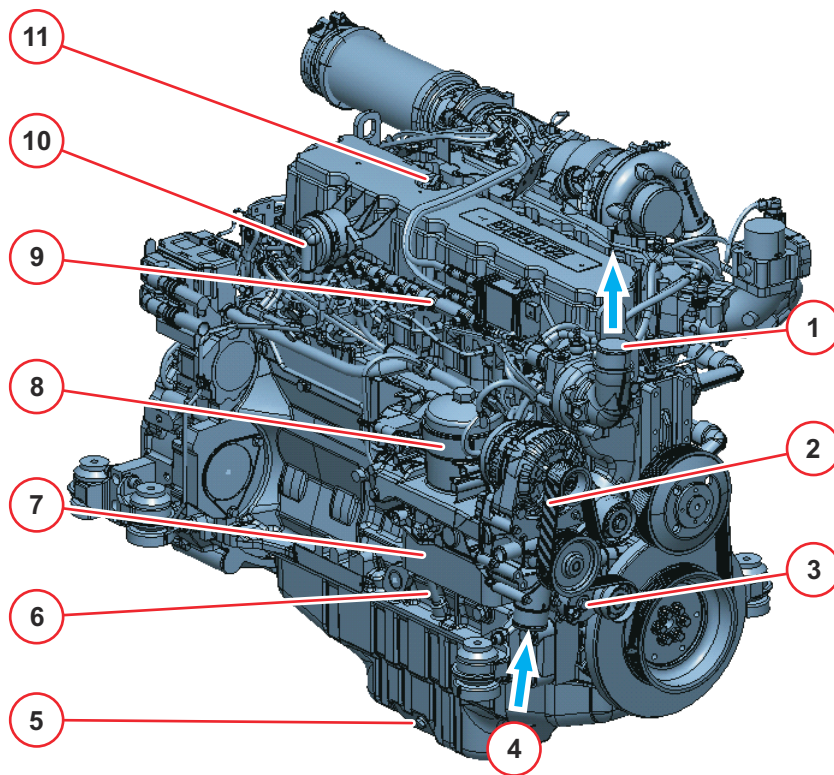
TCD 7.8 L6

Agricultural engine

View from left (example)

- 1 Combustion air inlet
- 2 Heating flange
- 3 Exhaust outlet
- 4 Starter



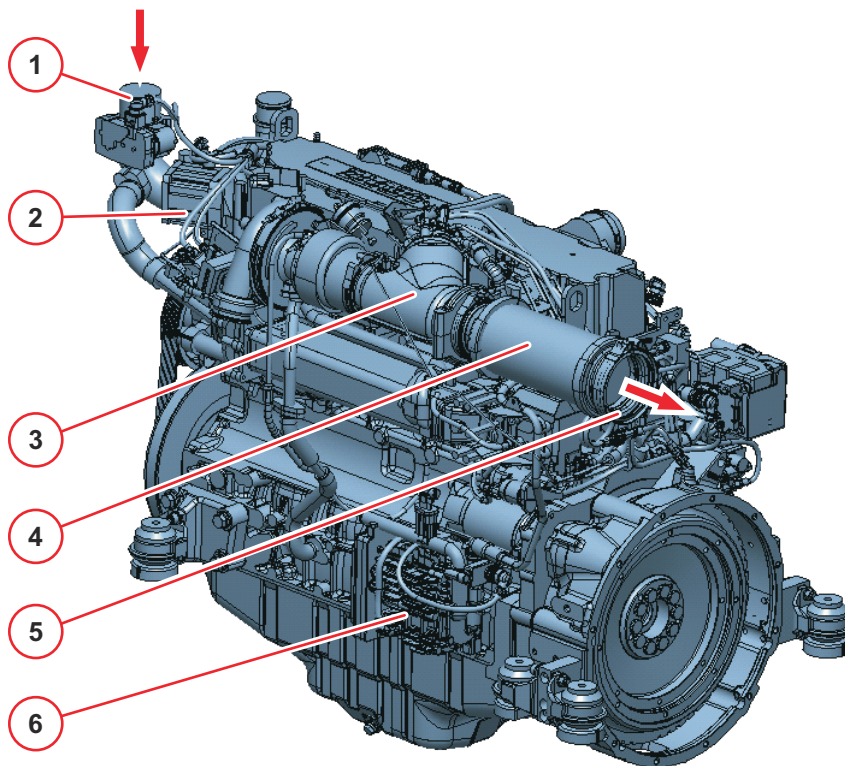


TCD 7.8 L6

Industrial engine with regeneration burner

View from right (example)

- 1 Coolant outlet
- 2 V-rib belt
- 3 Tension pulley
- 4 Coolant inlet
- 5 Lubricating oil drain plug
- 6 Lubricating oil dipstick
- 7 Lube oil cooler
- 8 Lube oil replacement filter
- 9 Rail
- 10 Crankcase breather
- 11 Lubricating oil filling

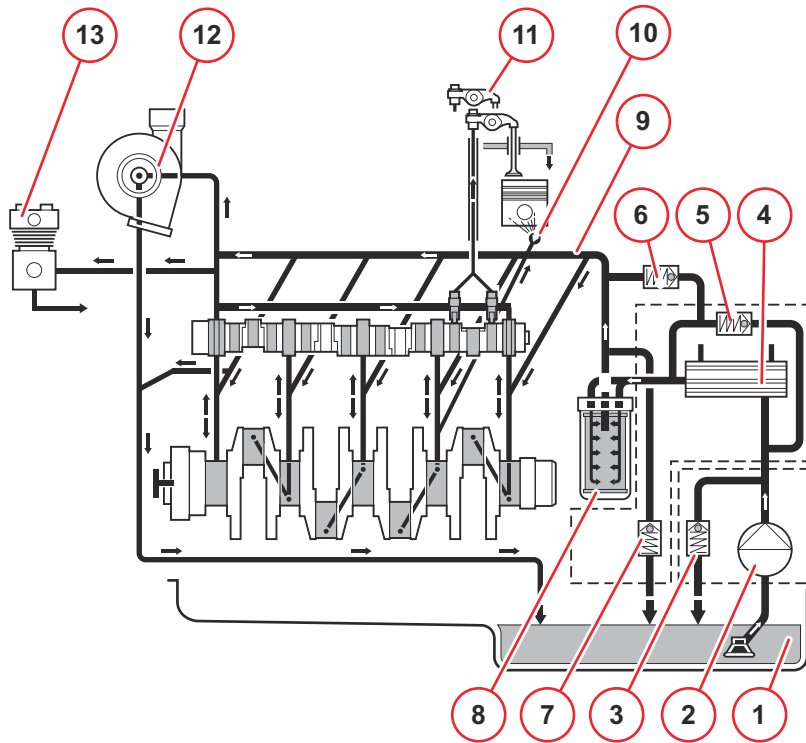


TCD 7.8 L6

Industrial engine with regeneration burner

View from left (example)

- 1 Combustion air inlet
- 2 Heating flange
- 3 Burner
- 4 Flexible pipe
- 5 Exhaust outlet
- 6 Air compressor



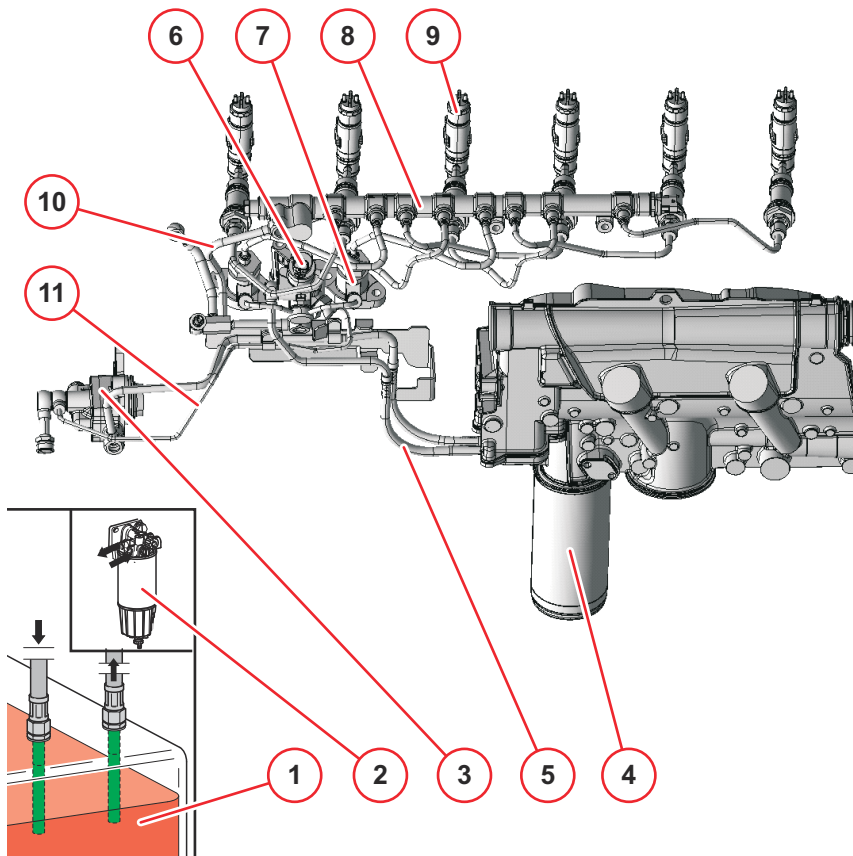
Lubricating oil system

(example)

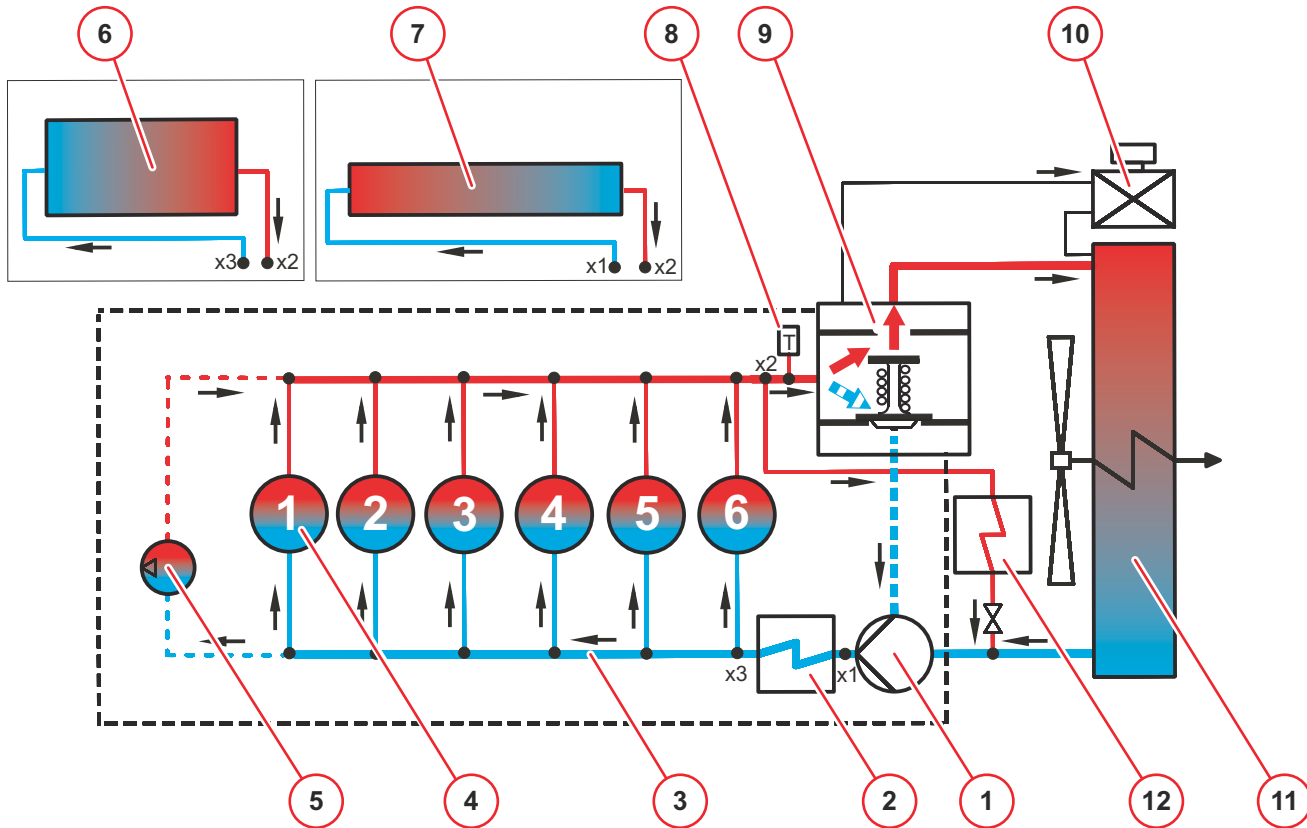
- 1 Lubricating oil sump
 - 2 Lubricating oil pump
 - 3 Overpressure valve
 - 4 Lube oil cooler
 - 5 Bypass valve
 - 6 Bypass valve
 - 7 Pressure control valve
 - 8 Lubricating oil filter
 - 9 Main lube oil channel
 - 10 Piston cooling nozzle
 - 11 Rocker arm
 - 12 Turbocharger
 - 13 Air compressor
- Optional

Fuel schematic (example)

- 1 Fuel tank
- 2 Fuel pre-filter
- 3 Fuel pump
- 4 Exchangeable fuel filter
- 5 Fuel supply line to the control block FCU (Fuel Control Unit)
- 6 Control block FCU (Fuel Control Unit)
- 7 High-pressure pump
- 8 Rail
- 9 Injector
- 10 Return line
- 11 Fuel return to fuel tank



2

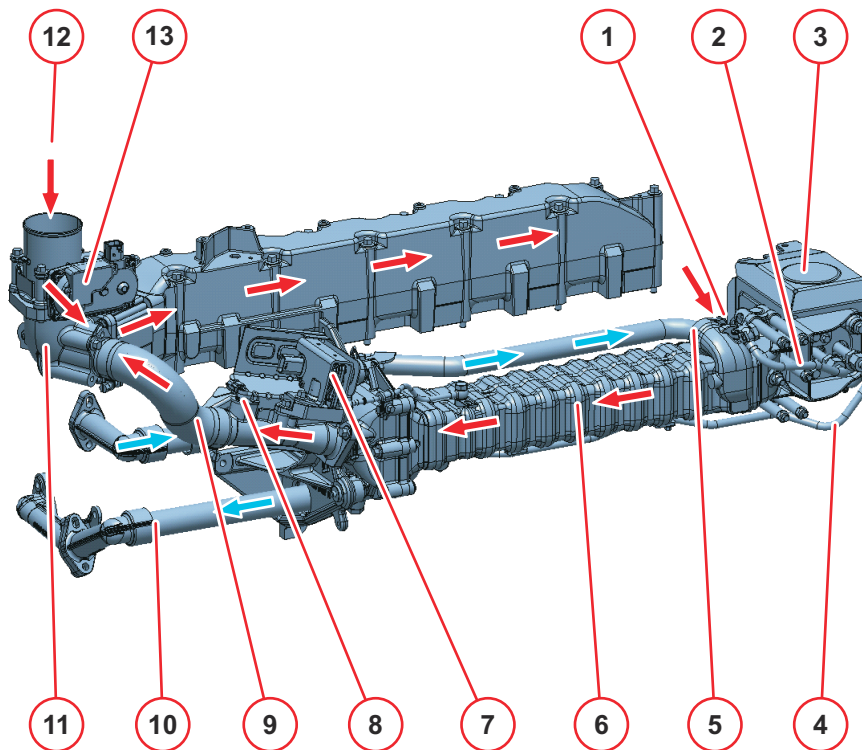


Coolant schematic (example)

- 1 Coolant pump
- 2 Lube oil cooler
- 3 Coolant supply for engine cooling
- 4 Cylinder pipe/head cooling
- 5 Air compressor
Optional
- 6 Pre-heating of the AdBlue® tank
Optional
- 7 Exhaust return cooler
- 8 Temperature transmitter
- 9 Thermostat
- 10 Compensation tank
- 11 Cooler
- 12 Connection possibility for cab heating

External exhaust gas recirculation

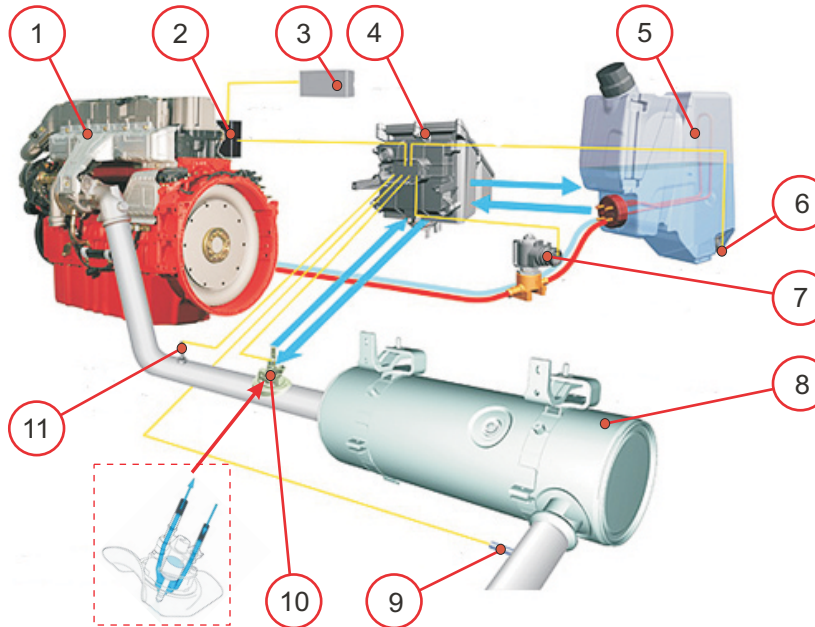
- 1 Exhaust gas partial flow (uncooled)
- 2 Feeder actuator cooling
- 3 Actuator (electrically actuated)
- 4 Return actuator cooling
- 5 Coolant line to the EGR cooler
- 6 Exhaust return cooler
- 7 Pressure sensor
- 8 Temperature transmitter
- 9 Exhaust gas partial flow (cooled)
- 10 Coolant return
- 11 Mixing pipe
- 12 Combustion air inlet
- 13 Throttle valve

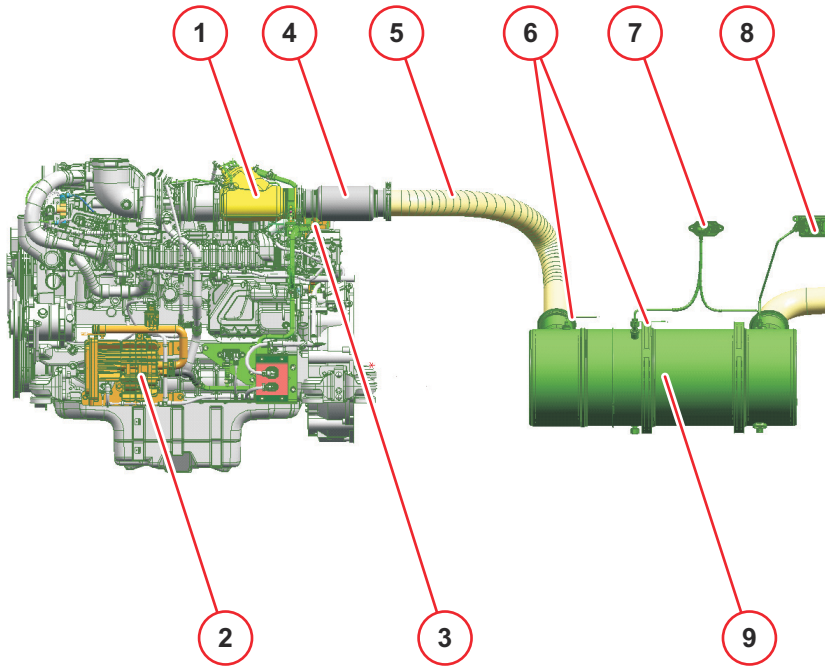


Selective Catalytic Reduction (SCR)

Example:

- 1 Engine (example)
- 2 Engine control unit
- 3 Vehicle control unit VECU (Vehicle Electronic Control Unit)
- Optional
- 4 AdBlue® supply pump
- 5 AdBlue® tank
- 6 Temperature/Filling level sensor
- 7 Coolant valve
- 8 SCR catalytic converter
- 9 NO_x sensor
- 10 Metering module
- 11 Exhaust temperature sensor

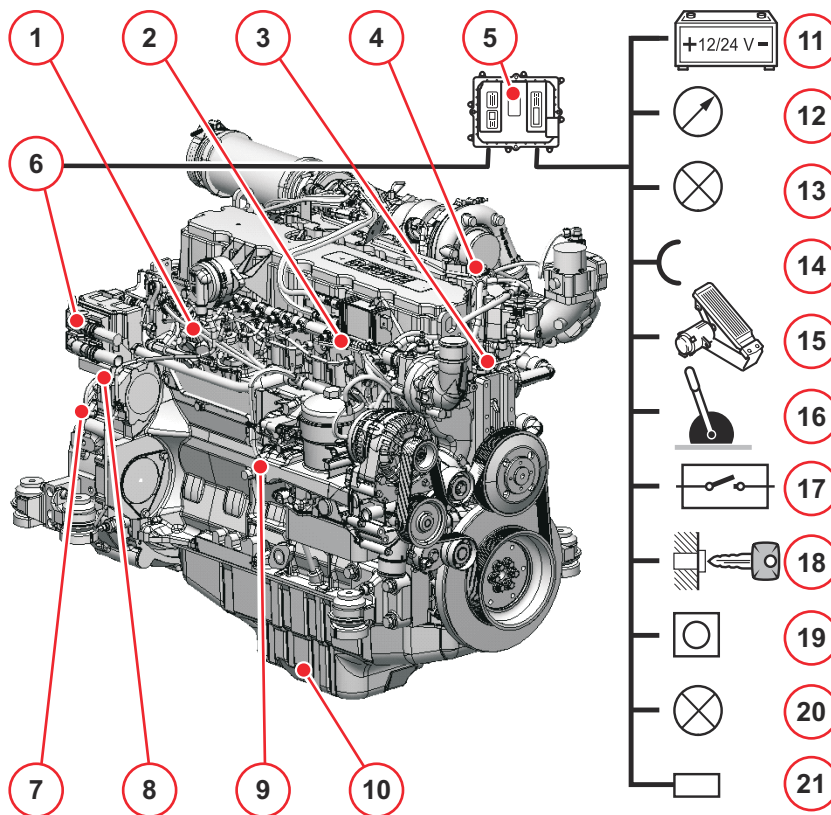




Diesel Particle Filter (DPF)

Example:

- 1 Burner
- 2 Air compressor
- 3 Fuel metering unit
- 4 Flexible pipe
- 5 Exhaust line
- 6 Exhaust temperature sensor
- 7 Differential pressure sensor
- 8 NO_x sensor
- 9 Diesel particle filter

**Electronic engine control****Engine side**

- 1 Fuel transducer
- 2 Rail pressure sensor
- 3 Coolant temperature transmitter
- 4 Charge air pressure transmitter, charge air temperature transmitter
- 5 Engine control unit
- 6 Central plug (for engine control)
- 7 Speed transmitter via crankshaft
- 8 Speed transmitter via camshaft
- 9 Lubricating oil pressure transmitter
- 10 Lubricating oil level transmitter (optional)

Equipment side

- 11 Power supply (battery)
- 12 Multifunction displays
- 13 Signal outputs, e.g. for lamps, torque (PWM), speed, engine operation, etc.
- 14 Inputs (e.g. override button)
- 15 Accelerator
- 16 Hand throttle
- 17 Optional function selector switch, e.g. for P degree, type of controls, maximum curve, fixed speeds, etc.
- 18 Detachable key switch Start/Stop
- 19 Diagnosis button
- 20 Error lamp
- 21 Diagnostic interface/CAN bus

Information about the engine electronics

This engine is equipped with an electric control unit.

The equipping of the respective system depends on the desired scope of function and the planned type of engine application.

The resultant wiring with pin assignment can be seen in the appropriate wiring diagram.

The installation regulations of the DEUTZ AG must also be taken into account.

Precautions



The connections of the control units are only dust and water proof when the mating plugs are plugged (protection class IP69K)! The control units must be protected against spray water and moisture until plugging in the mating plugs!

Reverse polarity can lead to failure of the control unit.

To avoid damaging the control units, all the connections on the control unit must be disconnected before electric welding work.

Interventions in the electrical system contrary to the DEUTZ regulations or by unqualified personnel can permanently damage the engine electronics and have serious consequences which are not covered by the manufacturer's guarantee.



It is strictly prohibited:

a) to make changes or connections to the wiring of the electrical control devices and the data transmission cable (CAN lines).

b) to switch control units.

Otherwise guarantee rights will be lost!

Diagnostic and maintenance work may only be carried out by authorised personnel using equipment approved by DEUTZ.

Installation instructions

The control units are calibrated to the respective engine and identified by the engine number. Every engine may only be operated with the appropriate control unit.

Setpoint transmitters (pedal value transmitters) necessary for vehicle operation must be connected to the vehicle side cable harness and calibrated with the DEUTZ diagnostic program SERDIA (SERVICE DIAGNOSIS). Wiring and cable assignment of the vehicle side cable harness must be taken from the connection diagram of the DEUTZ installation consulting.

Supply voltage

12 Volt

24 Volt

It should be ensured that the battery is sufficiently charged. If the supply voltage is interrupted while the engine is running, this can lead to damage to the electrics/electronics. If the supply voltage fails, the engine shuts down.

Voltages above 32 Volt will destroy the control unit.

Diagnostics

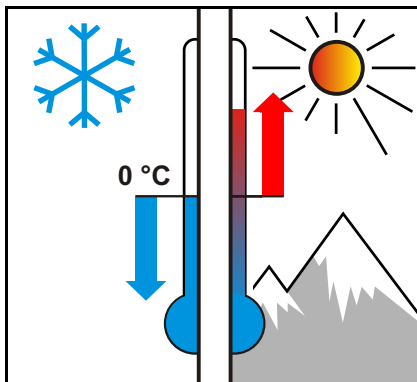
DEUTZ control units are equipped with self-diagnostics. Active and passive error entries are saved in the error memory. Active errors are displayed on error lamps/diagnostics lamps (see 67).

A diagnosis can be made with:

- Error lamp (flash code)
- CAN bus
- DEUTZ electronics display
- Diagnostic socket (SERIDA)

Equipment-side wiring

The DEUTZ AG installation regulations should be adhered to. In particular, the plug contact must be crimped with the appropriate standard tools. If it is necessary to do so, plugged-in contacts may only be removed from the plug housing with the proper tools.



Low ambient temperatures

Lubricating oil

- Select the lubricating oil viscosity according to the ambient temperature.
- If cold starting occurs frequently cut the lube oil changing interval by half.

Fuel

- Use winter fuel below 0 °C (▮37).

Battery

- A good charging condition of the battery (▮60) is the prerequisite for starting the engine.
- Heating up the battery to approx. 20°C improves the starting behaviour of the engine. (Remove and store the battery in a warm room).

Cold start aid

- Depending on the type of engine, glow plugs, heating plugs, heating flange, flame glow system can be used as cold starting aids. (▮27)

Coolant

- Observe the mixing ratio anti-freeze/cooling water. (▮38)

High ambient temperatures, high altitude



This engine is equipped with an electric control unit. Under the operating conditions listed below, the amount of fuel is reduced automatically, controlled by the electronic control unit.

Under the following application and operating conditions, the amount of fuel must be reduced.

- above 1000 m altitude
- above 30 °C ambient temperature

Reason: Air density decreases as altitude or ambient temperature increase. This reduces the amount of oxygen in the engine intake air and the fuel-air mixture would be too rich if the injected amount of fuel were not reduced.

- The results would be:
 - black smoke in the exhaust
 - high engine temperature
 - reduction in engine performance
 - possible impairment of starting behaviour

Consult your equipment supplier or DEUTZ partner if you have any other questions.

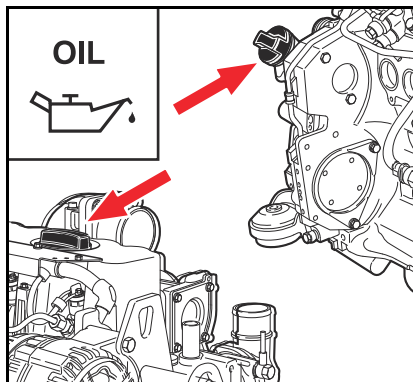
Preparations for initial commissioning

(Maintenance schedule E 10)

- Remove engine corrosion protection
- Remove any transport devices.
- Check the battery and cable connections and mount if necessary.
- Check belt tension (▮57).
- Have the engine monitor or warning system checked by authorised personnel.
- Check the engine mounting.
- Check that all hose unions and clips fit properly.

The following additional work must be carried out on generally overhauled engines:

- Check the fuel pre-filter and main filter and change if necessary.
- Check the intake air cleaner (if available, maintain according to maintenance indicator).
- Drain lubricating oil and condensation water from the charge air cooler.
- Fill with engine lube oil.
- Fill the coolant system (▮72).



Fill with engine lube oil

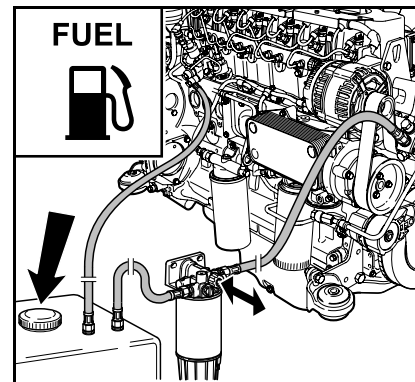


Low lubricating oil level and overfilling lead to engine damage.



The engines are generally supplied without lubricating oil filling. Select lubricating oil quality and viscosity before filling. Order DEUTZ lubricating oils from your DEUTZ partner

- Fill the engine with lubricating oil via the lubricating oil filler neck.
- Observe the lubricating oil filling level (▮72).



Pour in fuel

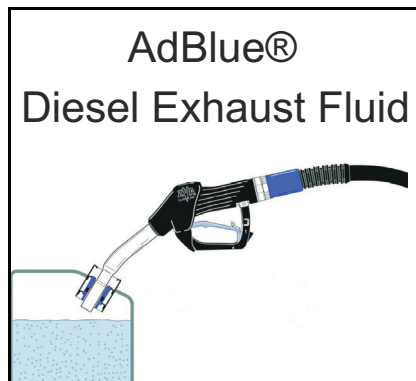


Never fill the fuel tank while the engine is running. Ensure cleanliness. Do not spill fuel. Additional venting of the fuel system by a 5 minute trial run at idle speed or on low load is absolutely essential.

- The fuel low pressure system must be vented before the first start-up after filling with the manual supply pump.

Only use clean commercially available brand diesel fuel. Observe fuel quality (▮37).

Use summer or winter-grade fuel, depending on the ambient temperature.



Filling with AdBlue®

Exhaust aftertreatment systems

| | |
|-----|-------------------------------|
| SCR | Selective Catalytic Reduction |
|-----|-------------------------------|

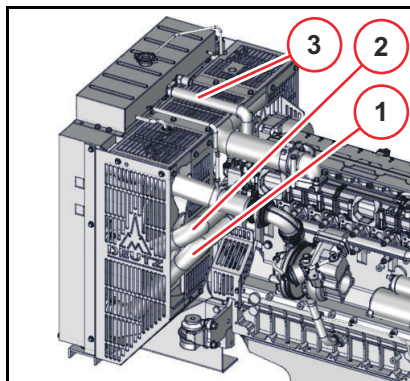


Only re-fuel when the engine is not running. Only fill with AdBlue®! Other media (e.g. diesel), even in the smallest amounts, can cause destruction of the system.

If you have filled with e.g. diesel and this has got into the system, the complete AdBlue® injection system must be re-placed!

If the filled medium (e.g. diesel) has not reached the lines and supply pump/metering module, an emptying and thorough cleaning of the AdBlue® tank will be adequate.

Ensure cleanliness.



Filling the coolant system



The coolant must have a prescribed concentration of cooling system corrosion protection agent!

Never operate the engine without coolant, even for a short time!



Order coolant corrosion protection agent from your DEUTZ partner.

- Connect coolant outlet (2) and coolant inlet (1) to the cooling system. Connect the feed line of the compensation tank to the coolant pump or to the coolant inlet line (3).
- Connect ventilation line from the engine and, if necessary, from the cooler to the compensation tank.
- Fill cooling system via the compensation tank.
- Close compensation tank with valve.

- Start the engine and run up until the thermostat opens (line (2) heats up).
- Engine operation with open thermostat 2 - 3 minutes.
- Check the coolant level and top up coolant if necessary.



Danger of scalding from hot coolant!
Cooling system under pressure! Only open the cap when cool!
Observe safety regulations and national specifications when handling cooling media.

- If required, repeat procedure with engine start.
- Fill up coolant to the MAX mark on the compensation tank and close the cooling system cap.
- Switch on any available heating and set to the highest level so that the heating circuit is filled and vented.
- Observe the filling volume of the cooling system (▮ 72).

3

Trial run

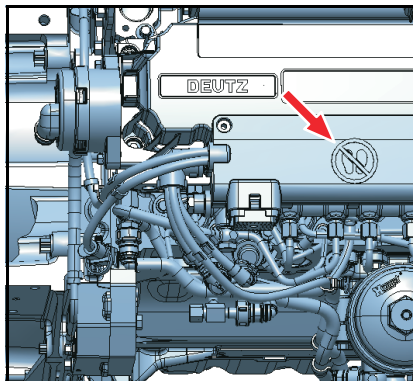


Additional venting of the fuel system by a 5 minute trial run at idle speed or on low load is absolutely essential.

Carry out a brief trial run up to operating temperature (approx. 90 °C) after preparations.

Do not load the engine if possible.

- Work with the engine not running:
 - Check engine for tightness.
 - Check lubricating oil level, if necessary top up.
 - Check the coolant level and top up coolant if necessary.
- Work during the trial run:
 - Check engine for tightness.



Do not subject the covers to loads.

Starting



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

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

When starting with the flame glow plug/ glow plug/heating flange system do not use any other starting aid (e.g. injection with start pilot). Risk of accident!

If the engine does not start properly when the heating flange is automatically actuated (starter does not receive current as a result of a fault in the equipment/customer electrical control system) the starting procedure must be abandoned (set the ignition switch to OFF, disconnect the power supply to the heating flange).



If the engine fails to fire and the error lamp lights, the electronic engine control has activated the start lock to protect the engine. The start lock is released by switching off the system with the ignition key for about 30 seconds.

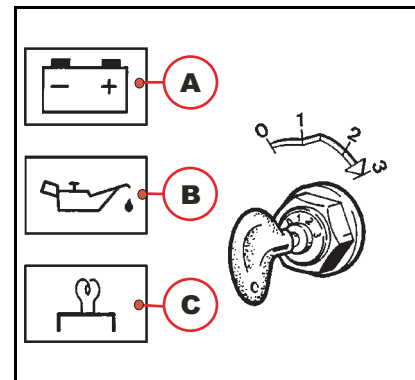
Do not actuate the starter for more than 20 seconds. If the engine does not start up, wait for one minute and then repeat the starting process.

If the engine does not start up after two attempts, determine the cause as per fault table (62).

Do not run up the engine immediately to high idling speed / full load operation from cold.



Disconnect the engine by uncoupling devices to be driven where possible.



with cold starting device

- Insert key.
 - Position 0 = no operating voltage.
- Turn key to the right.
 - Position 1 = operating voltage.
 - Pilot lamps (A), (B) and (C) light up.
- stage 2 = pre-heating
 - Preheat until the glow display goes out; an error has occurred if the preheating indicator flashes; e.g. the preheating relay is stuck, which can discharge the battery completely when at a standstill.
 - Engine is ready for operation.
- Push the key in and turn further clockwise against spring pressure.
 - Level 3 = start.
- release the key as soon as the engine starts up.
 - The pilot lamps will go out.

3

If the starter is controlled by the electronic engine control via a relay:

- the maximum start duration is limited.
- the pause between two start attempts is specified.
 - the start is then continued automatically
- starting while the engine is running is prevented.

If the touch start function is programmed, a short start command with the ignition key in position 2 or a start button, if available, suffices.

Electronic engine control

The statuses are displayed by the error lamp.

The system monitors the condition of the engine and itself.

- Function test
 - Ignition on, error lamp lights up for approx. 2 seconds and then goes out.
 - Check the error lamp if there is no reaction after switching on the ignition.
- The lamp does not light
 - After the lamp test an extinguished lamp indicates an error-free and trouble-free operating state within the scope of the control possibility.
- Continuous light
 - Error in the system.
 - Operation continued with restrictions.
 - The engine must be checked by a DEUTZ partner.
 - If a lamp lights steadily a monitored measuring variable (e.g. coolant temperature, lubricating oil pressure) has left the permissible value range.

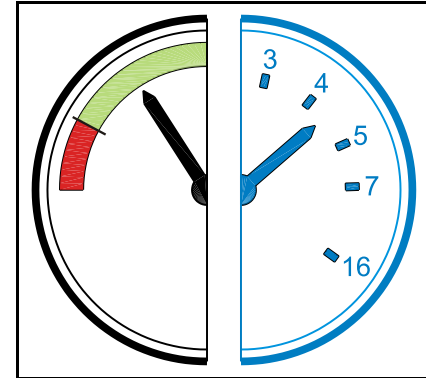
Depending on the fault, the engine power may be reduced by the electronic engine control to protect the engine.

- Flashing
 - Serious error in the system.
 - Switch off prompt for the operator. Attention: Failure to do so will lead to loss of guarantee!
 - The engine has reached switch-off condition.
 - Engine forced to run at low idle speed to cool the engine, with automatic shutdown if nec-

essary.

- The switch-off process has been accomplished.
- There may be a start lock after engine stop.
- The start lock is deactivated by turning off the system with the ignition key for approx. 30s.
- Additional control lamps, e.g. for lubricating oil pressure or lubricating oil temperature, are switched on if necessary.
- The power reduction can be bypassed, the automatic switch-off delayed or a start lock bypassed with the override key on the instrument panel to avoid critical situations. This brief deactivation of the engine protection functions is logged in the control unit.

The engine protection functions are released in co-operation with the equipment manufacturer and the DEUTZ installation consulting and may be designed individually. It is therefore absolutely essential to observe the operating instructions of the equipment manufacturer.















Display instrument

Possible displays:

- Colour scale
 - Display of operating state by coloured areas:
 - green = normal operating state
 - red = critical operating state
Take suitable action.
- Measured value scale
 - Actual value can be read off directly. The nominal value should be taken from the Technical Data (▮ 72).

Instruments and symbols

| Instruments/symbols | Designation | Possible display: | Measure |
|---|-------------------------------------|---|--|
|  | Lubricating oil pressure display | Lubricating oil pressure in the red area | Switch off engine |
|  | Coolant temperature | Coolant temperature too high | Switch off engine |
|  | Lubricating oil temperature | Lubricating oil temperature too high | Switch off engine |
|  | Lubricating oil pressure pilot lamp | If the pilot lamp lights up after starting the engine or while the engine is running, the lubricating oil pressure is too low | Switch off engine |
|  | Lube oil level | If the pilot lamp lights up after starting the engine or while the engine is running, the lubricating oil level is too low | Fill up lube oil |
|  | Coolant level | If the control lamp lights up after the engine starts or while the engine is running, the coolant level is too low | Shut down the engine, allow to cool and top up coolant |
|  | Operating hours counter | Indicates the previous operating time of the engine | Observe the maintenance intervals |
|  | Horn | With acoustic signal | See fault table (62). |

| Instruments/symbols | Designation | Possible display: | Measure |
|---|---------------------|--|---|
|  | SCR function lamp | Continuous light Flashing Rapid flashing | AdBlue®/DEF filling level below 15 % AdBlue®/DEF filling level below 10 % AdBlue®/DEF filling level below 5 % Filling AdBlue®/DEF |
|  | Engine warning lamp | Flashing Rapid flashing | In combination with rapid flashing of the SCR function lamp the engine performance is reduced in two steps Filling AdBlue®/DEF |
|  | DPF function lamp | Flashing Continuous light Rapid flashing | Regeneration of the diesel particle filter is started Diesel particle filter is regenerated Regeneration of the diesel particle filter cannot be completed |
|  | Engine warning lamp | Continuous light Flashing | An interruption in the regeneration is shown in combination with the DPF function lamp. The engine performance is reduced when the lamp lights continuously. The engine is stopped when the lamp flashes. |



DEUTZ Electronic Display

In order to show measured values and error messages of the EMR control unit, a CAN display is optionally available, which can be integrated into the dashboard of the driver's position of working machines.

The following data may be displayed if they are sent by the control unit.

- Operation monitoring of the diesel particle filter
- Faults in the exhaust aftertreatment system
- Filling level of the AdBlue® tank
- Battery voltage
- Accelerator position
- Fuel consumption
- Operating hours

Error messages are displayed in clear text and acoustically; the error memory of the control unit can be read out.

For a detailed description, refer to the operating instructions enclosed with the DEUTZ Electronic Display.

- Engine speed
- Engine torque (current)
- Coolant temperature
- Suction intake air temperature
- Exhaust gas temperature
- Lubricating oil pressure
- Coolant pressure
- Charge air pressure
- Fuel pressure
- Status of the regeneration of the diesel particle filter

Regeneration of the diesel particle filter



Temperatures of approx. 600 °C occur on the exhaust pipe during regeneration. These are independent of the actual engine performance, even in engine idling. Danger of burns!

Automatic mode

The DPF system is operated without any operator intervention in the automatic mode.

Regeneration is necessary when the filter charging has reached 100 % of the nominal charging.

The regeneration lamp starts flashing.

The regeneration begins after a delayed start.

The regeneration lamp lights continuously during regeneration.

The regeneration lasts 25 minutes on average.

The regeneration lamp goes out when regeneration has been successfully completed.

If the regeneration has to be prevented or interrupted after it has already been started (e.g. machine is in a hall), the operator must press the regeneration prevention switch.

The regeneration request is still active because regeneration has not taken place.

The regeneration lamp starts flashing.

No regeneration is possible as long as the regeneration prevention switch is actuated.

If the regeneration switch is actuated continuously, the filter is still charged.

The engine warning lamp lights, then the performance is reduced and the engine is finally shut down.

The control unit registers the engine shutdown as a fault.

Manual mode

Regeneration is necessary when the filter charging has reached 100 % of the nominal charging.

The regeneration lamp starts flashing.

The operator must enable regeneration with the enable button.

Regeneration starts immediately after the enable.

The regeneration lamp lights continuously during regeneration.

The regeneration lasts 25 minutes on average.

The regeneration lamp goes out when regeneration has been successfully completed.

If an active regeneration has to be interrupted, the operator can press the button to stop regeneration.

The regeneration request is still active because regeneration has not taken place.

The regeneration lamp starts flashing.

The regeneration start must be re-enabled by the operator.

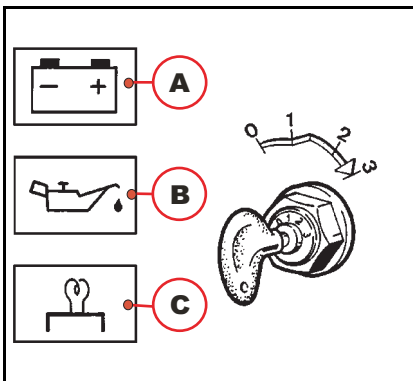
Regeneration starts immediately after the enable.

The regeneration lamp lights continuously during regeneration.

If the button is not pressed for a long time when regeneration is requested, the filter continues to be charged.

The engine warning lamp lights, then the performance is reduced and the engine is finally shut down.

The control unit registers the engine shutdown as a fault.



Shutting off



Avoid switching off from full load (coking/blockage of the remaining lubricating oil in the turbocharger bearing housing). The lubricating oil supply of the turbocharger is then no longer guaranteed! This shortens the life of the turbocharger.

Run the engine in low idling speed for approximately one minute after relieving the load.

The control unit remains active for about another 40 seconds to save the system data (lag) and then switches off automatically.

- Run engine up to idling speed.
- Move the key to position 0.
Control lamps A+B+C go out.

General

Modern diesel engines place very high demands on the lubricating oil to be used. The specific engine performances which have increased constantly over the last few years lead to an increased thermal load on the lubricating oil. The lubricating oil is also more exposed to contamination due to reduced oil consumption and longer oil change intervals. For this reason it is necessary to observe the requirements and recommendations described in this operating manual in order not to shorten the life of the engine.

Lubricating oils always consist of a base oil and an additive package. The most important tasks of a lubricating oil (e.g. wear protection, corrosion protection, neutralisation of acids from combustion products, prevention of coke and soot deposits on the engine parts) are assumed by the additives. The properties of the base oil are also decisive for the quality of the product, e.g. with regard to thermal load capacity.

In principle, all engine oils of the same specification can be mixed. However, mixing of engine oils should be avoided because the worst properties of the mixture are always dominant.

The lubricating oils approved by DEUTZ have been thoroughly tested for all engine applications. The active ingredients they contain are compatible with each other. Therefore, the use of additives for lubricating oils is not permitted in DEUTZ engines.

The **lubricating oil quality** has a considerable influence on the life, performance and thus also on the costs-effectiveness of the engine. It basically applies that: The better the lubricating oil quality, the better these properties.

The **lubricating oil viscosity** describes the way the lu-

bricating oil flows, depending on the temperature. The lubricating oil viscosity only has a small influence and effect on the quality of the oil.

Synthetic lubricating oils are used increasingly and offer advantages. These lubricating oils have better temperature and oxidation stability as well as relatively low cold viscosity. Since some processes which are relevant for determining the lubricating oil change times are largely dependent on the oil quality (e.g. the infiltration of soot and other contamination), the oil change time for synthetic lubricating oils may not be increased in relation to the specifications on lubricating oil change intervals.

Biodegradable lubricating oils may be used in DEUTZ engines if they meet the requirements of this operating manual.

Quality

Lubricating oils are classified by DEUTZ according to their performance and quality class (DQC: DEUTZ Quality Class). Essentially, the following applies: the higher the quality class (DQC I, II, III, IV), the more effective/the better quality the lubricating oil is.

The DQC quality classes are still to be extended by the DQC-LA quality classes which include the modern, low-ash lubricating oils (LA = Low Ash).

Lubricating oils according to other comparable specifications can be used as long as they meet DEUTZ requirements. In regions in which none of these qualities are available, please contact your responsible DEUTZ partner.

or see www.deutz.com

| http://www.deutz.com | |
|---|--|
| de | \\SERVICE \\Betriebsstoffe und Additive\\Deutz Quality Class\\DQC-Freigabeliste |
| en | \\SERVICE \\Operating Liquids and Additives\\Deutz Quality Class\\DQC Release List |

The choice of lubricating oil essentially depends on the exhaust aftertreatment system.

The following lubricating oils are permissible for the engines in this operating manual:

| Permissible quality class | |
|--|-----------------------------------|
| DEUTZ | Others |
| SCR Selective Catalytic Reduction | |
| DQC III | Please contact your DEUTZ partner |
| DQC III LA | |
| DQC IV | |
| DPF Diesel Particle Filter | |
| DQC III LA | Please contact your DEUTZ partner |

For low-ash engine oils released according to the DQC system an appropriate reference is made in the oil release list.

| DEUTZ lubricating oils DQC III TLX - 10W40 FE | |
|--|---------------|
| Not for DPF | |
| Container | Order number: |
| 5 litre container | 0101 6335 |
| 20 litre container | 0101 6336 |
| 209 litre barrel | 0101 6337 |

| DEUTZ lubricating oils DQCIII LA low-ash DEUTZ Oil Rodon 10W40 Low SAPS | |
|--|---------------|
| Container | Order number: |
| 20 litre container | 0101 7976 |
| 209 litre barrel | 0101 7977 |

| DEUTZ lubricating oils DQC IV synthetic DQC IV - 5W30-UHP | |
|--|---------------|
| Not for DPF | |
| Container | Order number: |
| 20 litre container | 0101 7849 |
| 209 litre barrel | 0101 7850 |

Lubricating oil change intervals

- The intervals depend on:
 - lubricating oil quality
 - sulphur content in the fuel
 - type of application of engine
- The lubricating oil change interval must be halved if at least one of the following conditions applies:
 - Constant ambient temperature below -10 °C (14 °F) or lube oil temperature below 60 °C (84 °F).

– Sulphur content in diesel fuel of >0.5 weight % .

- If the lubricating oil change intervals are not reached within a year, the oil should be changed at least once a year.

Viscosity

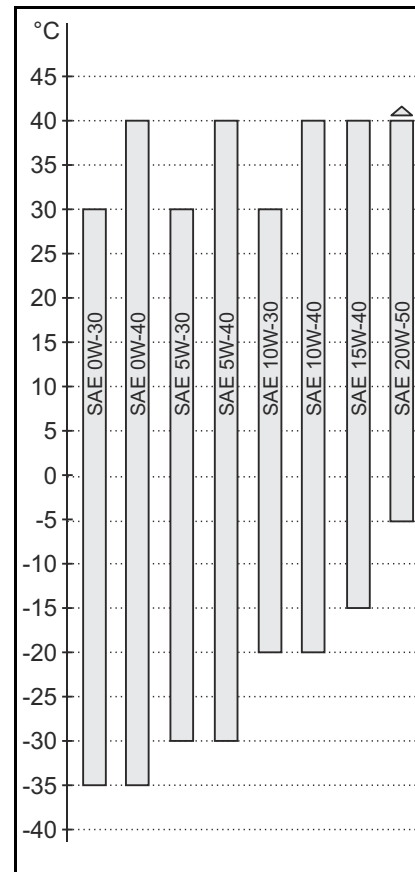
The ambient temperature at the installation site or in the application area of the engine is decisive for choosing the right viscosity class. Too high a viscosity can lead to starting difficulties, too low a viscosity can endanger the lubrication effect and cause a high lubricating oil consumption. At ambient temperatures below -40 °C, the lubricating oil must be pre-heated (e.g. by storing the vehicle or the machine in a hall).

The viscosity is classified according to SAE. Multi-purpose lubricating oils should be used basically. Single-purpose lubricating oils can also be used in enclosed, heated spaces at temperatures >5 °C.



The prescribed lubricating oil quality must be observed when selecting the viscosity class!

Depending on the ambient temperature we recommend the following common viscosity classes:



Permissible fuels

In order to satisfy the exhaust gas legislation, diesel engines that are equipped with an exhaust aftertreatment system may only be operated with a sulphur-free diesel fuel.

The operational reliability and durability of the individual exhaust aftertreatment technologies cannot be assured upon failure to comply.

| Exhaust aftertreatment systems | |
|--------------------------------|--------------------------------------|
| SCR | Selective Catalytic Reduction |
| DPF | Diesel particle filter |
| DOC | Diesel oxidation catalytic converter |

The following fuel specifications / standards are approved:

- Diesel fuels
 - DIN 51628
 - EN 590

Sulphur <10 mg/kg

- ASTM D 975 Grade 1-D S15
- ASTM D 975 Grade 2-D S15

Sulphur <15 mg/kg

- Light heating oils
 - EN 590

Sulphur <10 mg/kg

If other fuels are used which do not meet the requirements of the operating manual, the warranty will be voided.

The certification measurements for compliance with

the legal emission values are made with the test fuels specified in the laws. These correspond to the diesel fuels in accordance with EN 590 and ASTM D 975 described in the operation manual. No emission values are guaranteed with the other fuels described in this operation manual.

The respective fuels prescribed by law must be used to comply with the national emission regulations (e.g. sulphur content).

Please contact your DEUTZ partner

| http://www.deutz.com | |
|---|--|
| de | \SERVICE\Betriebsstoffe und Additive\Kraftstoffe |
| en | \SERVICE\Operating Liquids and Additives\Fuels |

Winter operation with diesel fuel

Special demands are placed on the cold behaviour (temperature limit value of the filtrability) for winter operation. Suitable fuels are available at filling stations in winter.



For engines with DCR® DEUTZ common rail injection, the mixing of petroleum and adding of extra low additives is not permissible.

At low ambient temperatures paraffin discharges can lead to blockages in the fuel system and cause operating faults. Below 0 °C ambient temperature use winter diesel (down to -20 °C) (filling stations provide this in good time before the cold season starts).

- Special diesel fuels can be used for arctic climates to -44 °C.

General



Never operate the engine without coolant, even for a short time!

In liquid-cooled engines, the coolant must be conditioned and monitored, otherwise the engine could be damaged by:

- corrosion
- cavitation
- freezing
- overheating

Water quality

The right water quality is important for conditioning the coolant. Clear, clean water within the following analysis values should always be used:

| Analysis values | | min | max | ASTM |
|-------------------------------------|----------|------|------|-----------------|
| ph value | | 6,5 | 8,5 | D 1293 |
| Chlorine (Cl) | [mg/l] | - | 100 | D 512 D 4327 |
| Sulphate (SO ₄) | [mg/l] | - | 100 | D 516 |
| Total hardness (CaCO ₃) | [mmol/l] | 0,54 | 3,56 | D 1126 |
| | [mg/l] | 54 | 356 | |
| | [°dGH] | 3,0 | 20,0 | - |

Specifications of the water quality are made by the local water board.

The water must be conditioned if it deviates from the analysis values.

- **pH value too low:**
Addition of diluted sodium or potassium lye.
Small trial mixtures are advisable.

- **Total hardness too high:**
Mixing with softened water (pH neutralized condensate or water softened by ion exchanger).
- **Total hardness or carbonate hardness too low:**
Mixing with harder water (harder water is usually available in the form of drinking water).
- **Chlorides and/or sulphates too high:**
Mixing with softened water (pH neutralized condensate or water softened by ion exchanger).

Cooling system corrosion protection agent



Health damaging nitrous amines form when nitrite-based cooling system corrosion protection agents are mixed with amine-based agents!



Cooling system corrosion protection agents must be disposed of in an environmentally friendly way.

The conditioning of the coolant for liquid-cooled DEUTZ compact engines is performed by mixing an anti-freeze with corrosion protection inhibitors based on ethylene glycol into the water.

| DEUTZ cooling system corrosion protection agent | |
|---|---------------|
| Container | Order number: |
| 5 litre container | 0101 1490 |
| 20 litre container | 0101 4616 |
| 210 litre barrel | 1221 1500 |

This cooling system corrosion protection agent is free from nitrite, amine and phosphate and is adapted to the materials in our engines. Order from your DEUTZ partner.

Please contact your DEUTZ partner if the DEUTZ cooling system corrosion protection agent is not available.

or see www.deutz.com

| http://www.deutz.com | |
|---|--|
| de | \\SERVICE\\Betriebsstoffe und Additive\\Kühlsystemschutz |
| en | \\SERVICE\\Operating Liquids and Additives\\Cooling System Conditioner |

The cooling system must be monitored regularly. This also includes checking the coolant system corrosion protection agent concentration in addition to checking the coolant level.

The cooling system corrosion protection agent concentration can be checked with conventional test instruments (e.g. refractometer).

| Cooling system corrosion protection agent percent-age | Water percent-age | Cold protection up to |
|---|-------------------|-----------------------|
| min. 35 % | 65 % | -22 °C |
| 40 % | 60 % | -28 °C |
| max. 45 % | 55 % | -35 °C |

At temperatures below -35 °C, please contact your responsible DEUTZ partner.

It is possible to use other cooling system corrosion protection agents (e.g. chemical corrosion protection agents) in exceptional cases. Consult your DEUTZ partner.

AdBlue® (urea solution AUS 32)



The urea solution AUS 32 is known in the USA and North America by the name Diesel Exhaust Fluid (DEF).



Protective gloves and goggles must be worn when handling AdBlue®.
Do not swallow.
Ensure sufficient ventilation.
Ensure cleanliness.
Residues of AdBlue® must be disposed of in an environmentally friendly manner.

Exhaust aftertreatment systems

| | |
|-----|-------------------------------|
| SCR | Selective Catalytic Reduction |
|-----|-------------------------------|

AdBlue® is a highly-pure, aqueous, 32.5 % urea solution which is used as an NO_x reduction agent for SCR exhaust aftertreatment in vehicles with diesel engines.

The product is designated as AdBlue® or AUS 32 (AUS: Aqueous Urea Solution) and corresponds to the ISO 22241-1 NO_x reduction agent AUS 32.

The length of time that AdBlue® can be kept without losing quality depends on the conditions of its storage.

It crystallises at -11 °C and at over +35 °C a hydrolysis reaction is initiated, i.e. it begins to slowly release ammonia and carbon dioxide.

Direct sunlight on exposed storage containers must always be avoided.

Barrels must not be stored for longer than one year!

Ensure that the materials and storage containers used are resistant to AdBlue®.

AdBlue® freezes below -11 °C ambient temperature.

It will be necessary to preheat the SCR system at ambient temperatures below -11 °C.



AdBlue® tank

The AdBlue® tank may only be filled with AdBlue®. Filling with other media can lead to destruction of the system.

In this case the metering pump must be replaced.

AdBlue® should not remain in the tank for longer than 4 months.

This must be documented.

Empty and clean the AdBlue® tank when decommissioning.


Please contact your DEUTZ partner

<http://www.deutz.com>

E-Mail: info@deutz.com

Assignment of the DEUTZ maintenance and service schedules to maintenance intervals

| Standard maintenance schedule TCD 7.8 L6 | | | |
|---|-------------------------|------------------------|--|
| Stage | Activity | To be carried out by | Maintenance interval every operating hours (oh) |
| E10 | Initial commissioning | Authorised specialists | When commissioning new or overhauled engines |
| E20 | Daily inspection | Operator | 1x daily or every 10 operating hours in continuous operation |
| E30 | Maintenance | Qualified personnel | 500 ¹⁾²⁾⁴⁾ |
| E40 | Extended maintenance I | | 1.000 ³⁾ |
| E50 | Extended maintenance II | | 2.000 ³⁾⁴⁾ |
| E70 | General overhaul | | 10.000 ⁵⁾ |

| Observations | |
|--------------|---|
| 1) | The lubricating oil load may be high depending on the application. The lubricating oil change interval must be halved here ( 35). |
| 2) | Data for lubricating oil change interval, in relation to lubricating oil quality DQC III. |
| 3) | The display of the operating hours should be ensured by the device manufacturer. The engine operating hours are recorded by the control unit. Enquiry via the CAN bus and display in a display or creation/display via electromechanical counter. |
| 4) | Initial setting of the valve clearance after 500 oh must be performed on the engines in this operating manual. |

















| General overhaul | |
|------------------|---|
| 5) | The best time for a general overhaul depends to a great extent on the load, application and ambient conditions and the care and maintenance of the engine during the operating time. Your DEUTZ partner will advise you on determining the best time for a general overhaul. |









EPA-certified engines

The EPA (Environmental Protection Agency) is a US Government organisation for the protection of the environment and human health.

| Deviations from the standard maintenacne schedule for engines subject to EPA certification | | | |
|--|--------------------------|------------------------|---|
| Stage | Activity | To be carried out by | Maintenance interval every operating hours (oh) |
| E55 | Extended maintenance III | Authorised specialists | 4.500 ³⁾ |
| E60 | Intermediate overhaul | | 6.000 |

Maintenance measures

| Stage | Activity | Measure | Page |
|-------|----------|---|---|
| E10 | | The measures are listed in chapter 3. |  24 |
| E20 | Check | Lubricating oil level (if necessary top up) |  43 |
| | | Coolant level (top up if necessary) |  25 |
| | | Engine tightness (visual inspection for leaks) | |
| | | Exhaust system including exhaust aftertreatment components for leaks |  19 |
| | | Suction air filter/dry air filter (maintain in accordance with maintenance indicator) |  56 |
| | | Emptying of the water tank in the fuel pre-filter |  50 |
| E30 | Replace | Lubricating oil An lubricating oil application/change strategy adapted optimally to the individual engine application type can be created, for example, with the DEUTZ oil diagnosis. Ask your DEUTZ partner. |  35 /  43 |
| | | Lubricating oil filter/insert (every time the lubricating oil is changed) |  44 |
| | | Filtercartridge of the AdBlue® supply pump In engines with exhaust aftertreatment system Selective Catalytic Reduction |  51 |
| | Check | Coolant (additive concentration) |  52 |
| | | Intake air pipes for damage | |
| | Clean | Fuel pre-cleaner / fuel pre-filter (change filter insert if necessary) |  50 |
| E40 | Check | Charge air cooler entry area (drain lube oil/condensate) | |
| | | Crankcase breather valve | |
| | | Battery and cable connectors |  60 |
| | | Cold starting device | |
| | | Engine mounting (tighten, replace if damaged when necessary) | |
| | | Fastenings, hose unions / clips (renew if damaged) | |
| | Replace | Fuel filter cartridge |  47 |
| | | Fuel pre-filter with water trap (renew the filter insert if necessary). If the warning system responds (lamp/horn), the water trap bowl must be emptied immediately. |  50 |
| | | Suction air filter/dry air filter (maintain in accordance with maintenance indicator) |  56 |

| Stage | Activity | Measure | Page |
|---------------|----------|---|---|
| E50 | Settings | Valve clearance |  58 |
| | Check | V-rib belt and tensioning pulley |  57 |
| | | Filter element of the diesel particle filter DPF Replace if necessary | |
| | | Spark plug of the DPF burner Replace if necessary | |
| E55 | Replace | Filter element of the diesel particle filter DPF | |
| | | Spark plug of the DPF burner | |
| E60 | Replace | Injector | |
| | | Crankcase breather valve | |
| | | V-rib belt and tensioning pulley |  57 |
| | Clean | Charge air cooler entry area (drain lube oil/condensate) | |
| | | Turbocharger compressor outlet | |
| annually | Check | Engine monitor, warning system Maintenance only to be carried out by authorised service personnel | |
| | Replace | Fuel pre-filter |  50 |
| Every 2 years | Replace | Dry air filter |  56 |
| | | V-belt, V-rib belt and tensioning pulley |  57 |
| | | Coolant |  38  52 |
| | Check | Crankcase breather valve | |

Maintenance work outside the DEUTZ maintenance and service schedules

*If the water level warning system (lamp/siren) responds, the fuel pre-filter must be emptied immediately.

Maintenance profile

A self-adhesive maintenance diagram is delivered with every engine. It should be stuck in a well visible location on the engine or equipment.

Order number: 0312 3794 (TCD 7.8 L6)

Regulations for working on the lubricating oil system



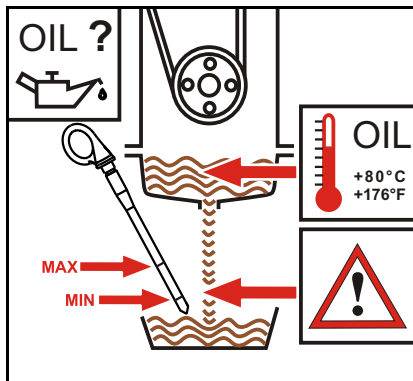
Do not work when the engine is running! Smoking and naked lights prohibited! Be careful of hot lubricating oil. Danger of scalding!



Pay attention to utmost cleanliness when working on the lubricating oil system. Clean the area around the components concerned carefully. Blow damp parts dry with compressed air.

Observe the safety regulations and national specifications for handling lube oils. Dispose of leaking lubricating oil and filter elements properly. Do not allow used oil to seep away into the ground.

Perform a trial run after all work. Pay attention to tightness and lubricating oil pressure and then check the engine oil level.



Checking the lubricating oil level



Low lubricating oil level and overfilling lead to engine damage.

The lubricating oil level may only be checked with the engine in a horizontal position and switched off.

If the engine is warm, switch off the engine and check the lubricating oil level after 5 minutes. If the engine is cold you can check it immediately.



Be careful of hot lubricating oil. Danger of scalding!

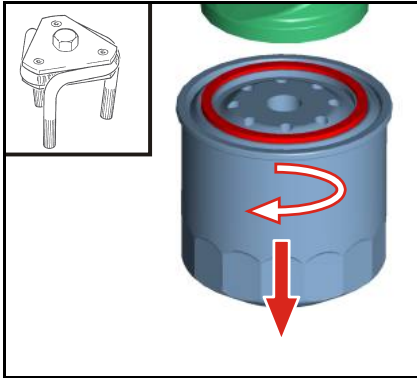
Do not pull out the dipstick while the engine is running. Danger of injury!

- Pull out the lubricating oil dipstick and wipe off with a lint-free, clean cloth.
- Insert the lubricating oil dipstick as far as it will go.

- Extract the lubricating oil dipstick and read off the oil level.
- The oil level must always be between the MIN and MAX marks! Top up to the MAX mark if necessary.

Changing the lubricating oil

- Warm up the engine (lubricating oil temperature > 80 °C).
- Ensure that the engine or vehicle is in a level position.
- Switch off the engine.
- Place a collecting receptacle underneath the lube oil drain screw.
- Unscrew the lube oil drain screw, drain oil.
- Fit a new sealing ring to the lube oil drain screw, insert and tighten. (tightening torque 100 Nm).
- Pour in lube oil.
 - Quality/viscosity data (▮35).
 - Filling volume (▮72).
- Warm up the engine (lubricating oil temperature > 80 °C).
- Ensure that the engine or vehicle is in a level position.
- Check lubricating oil level, if necessary top up.

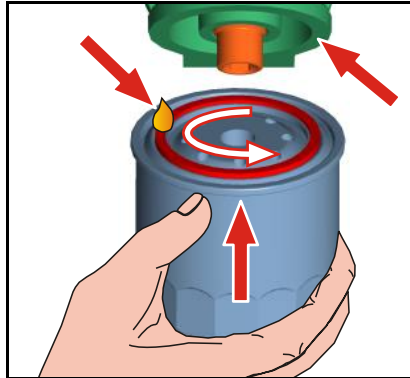


Change lubricating oil filter

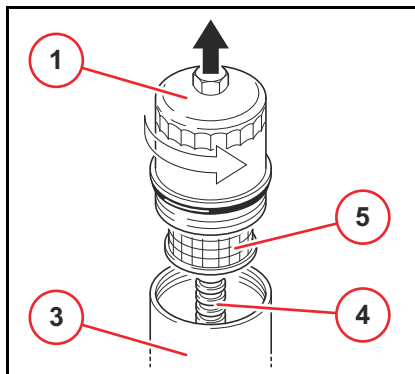


The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

- Remove clamps when twist protection mounted (optional).
- Loosen and unscrew filter cartridge with tool (**order number: 170050**).
- Collect draining lubricating oil
- Clean the sealing surface of the filter support with a lint-free, clean cloth.



- Oil the gasket of the new DEUTZ original filter cartridge lightly.
- Screw on new filter by hand until the gasket is touching and tighten with a torque of: 15-17 Nm
- Fasten clamps of the twist protection (optional).



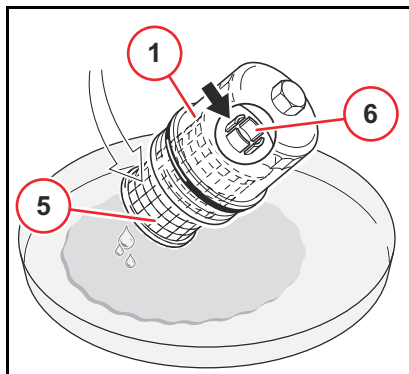
Replace lubricating oil filter cartridge



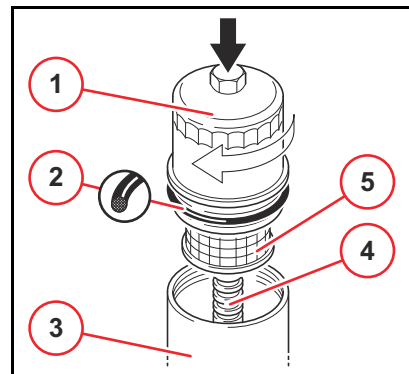
The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

- 1 Cover
- 2 Sealing ring
- 3 Housing
- 4 Guide
- 5 Filter insert
- 6 Bracket

- Switch off the engine.
- Loosen cover by turning 2-3 times and wait for 30 seconds.
- Unscrew cover with filter cartridge anti-clockwise.
- Loosen the filter cartridge carefully out of the guide in the housing and upwards.



- Collect draining lubricating oil
- Bend the filter cartridge in the collecting container slightly to the side until the cartridge comes out of the bracket.
- Clean components.



- Replace gasket and oil lightly.
- Press new filter cartridge into bracket and place them carefully into the guide.
- Screw the cover clockwise (25 Nm).
- Start engine.

Specifications when working on the fuel system



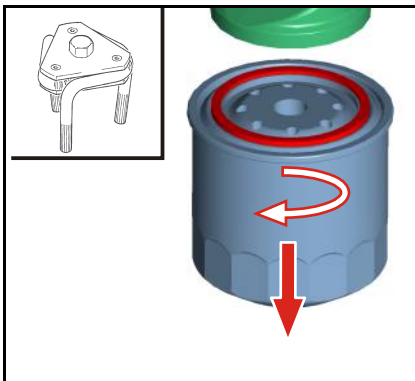
Engine must be switched off!
Smoking and naked lights prohibited!
No injection/high pressure pipes may be disconnected while the engine is running.
Caution when handling hot fuel!
Pay attention to utmost cleanliness when refuelling and working on the fuel system.
Clean the respective affected parts carefully. Blow damp areas dry with compressed air.
Observe the safety regulations and national specifications for handling fuels.
Dispose of leaking fuel and filter elements properly. Do not allow fuel to seep away into the ground.
After all work on the fuel system, the system should be vented, a trial run performed and the tightness checked.
It will be necessary to vent the fuel system when commissioning for the first time, after maintenance work or if the tank has been run dry.



Additional venting of the fuel system by a 5 minute trial run at idle speed or on low load is absolutely essential.
Pay attention to utmost cleanliness due to the high production accuracy of the system!
The fuel system must be tight and closed.
Make a visual inspection for leaks/damage in the system.



Clean and dry the engine and engine compartment thoroughly before beginning work.
Areas of the engine compartment from which dirt could be loosened must be covered with a fresh, clean foil.
Work on the fuel system may only be carried out in an absolutely clean environment.
Contamination of the air such as dirt, dust, moisture etc. must be avoided.

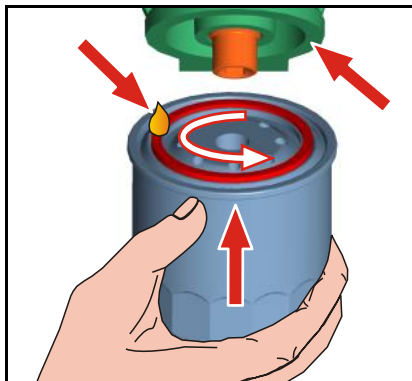


Change the fuel filter cartridge

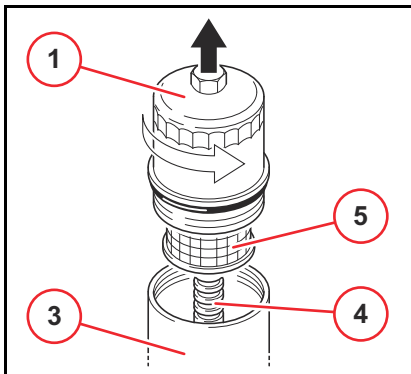


The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

- Remove clamps when twist protection mounted (optional).
- Loosen and unscrew filter cartridge with tool (**order number: 170050**).
- Catch any escaping fuel.
- Clean the sealing surface of the filter support with a lint-free, clean cloth.



- Oil the gasket of the new DEUTZ original filter cartridge lightly.
- Screw on new filter by hand until the gasket is touching and tighten with a torque of: 10-12 Nm
- Fasten clamps of the twist protection (optional).
- Vent the fuel system.



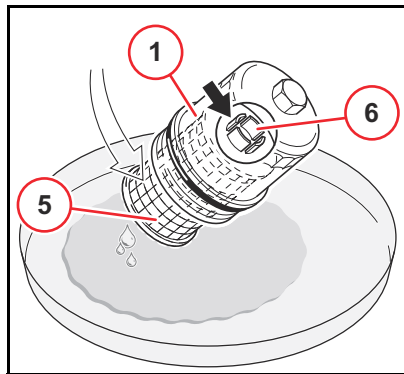
Replace fuel filter cartridge



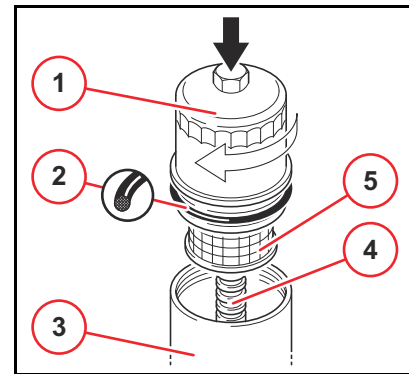
The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

- 1 Cover
- 2 Sealing ring
- 3 Housing
- 4 Guide
- 5 Filter insert
- 6 Bracket

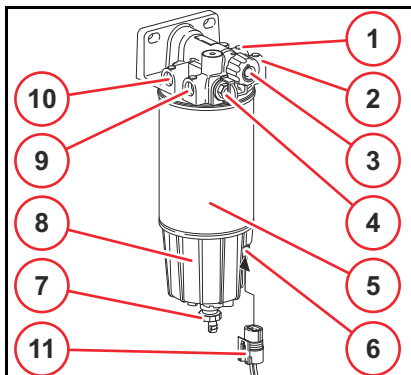
- Switch off the engine.
- Loosen cover by turning 2-3 times and wait for 30 seconds.
- Unscrew cover with filter cartridge anti-clockwise.
- Loosen the filter cartridge carefully out of the guide in the housing and upwards.



- Catch any escaping fuel.
- Bend the filter cartridge in the collecting container slightly to the side until the cartridge comes out of the bracket.
- Clean components.



- Replace gasket and oil lightly.
- Press new filter cartridge into bracket and place them carefully into the guide.
- Screw the cover clockwise (25 Nm).
- Start engine.



Clean/change/vent the fuel pre-filter

Deutz Common Rail (DCR)


- 1 Fuel supply flow to the pump
- 2 Fuel return flow from the control block FCU (Fuel Control Unit)
- 3 Fuel pump
- 4 Thermostat valve with stop lever (optional)
- 5 Filter insert
- 6 Electrical connection for water level sensor
- 7 Water drain tap
- 8 Water collection vessel
- 9 Fuel inlet from the fuel tank
- 10 Fuel return to fuel tank
- 11 Connection for electrical warning lamp/horn

Empty water tank

- Switch off the engine.
- Place suitable collecting containers underneath.
- Open the drain cock and drain liquid.

- Close the drain cock.

Change the fuel pre-filter insert

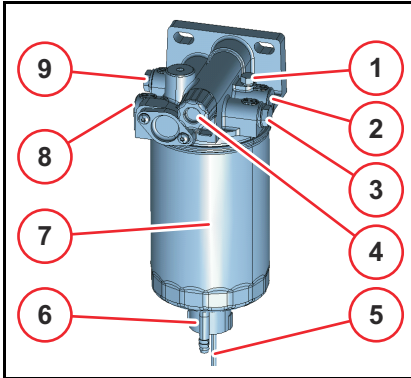
- Shut off the fuel supply to the engine (with high-level tank).
- Place suitable collecting containers underneath.
- Open the drain cock and drain liquid.
- Unscrew the filter cartridge together with the water collection vessel in anticlockwise direction and remove.
- Loosen the water collection vessel from the old filter cartridge by turning anti-clockwise and remove.
 - The special tool can be ordered under part number **8192** ( 74).

- Empty any fuel remaining in the fuel collection vessel and clean the water collection vessel.
- Screw the water collection vessel clockwise onto the new filter cartridge.
- Clean any dirt off the sealing surfaces of the new filter cartridge and opposite side of filter head.
- Wet the sealing surfaces of the filter cartridge slightly with fuel and screw back on to the filter head, clockwise (17-18 Nm).
- Open the fuel shutoff tap and vent the system, see venting the fuel system.

Vent the fuel system

- Unlock the bayonet connection of the fuel supply pump by pressing upwards and simultaneously turning anticlockwise. The pump pistons are now pressed out through the spring.
- Keep pumping until a very strong resistance can be felt and the pumping only progresses very slowly.

- Now continue pumping several times. (The return line must be filled).
- Lock the bayonet connection of the fuel supply pump by pressing upwards and simultaneously turning clockwise.
- Start the engine and operate approx. 5 minutes in idling mode or at low load. Check the pre-filter for leaks while doing this.



Clean/change/vent the fuel pre-filter

Deutz Common Rail (DCR)

- 1 Venting screw
- 2 Fuel supply flow to the pump
- 3 Fuel return flow from the control block FCU (Fuel Control Unit)
- 4 Fuel pump
- 5 Electrical connection for water level sensor
- 6 Drain plug
- 7 Filter insert
- 8 Fuel inlet from the fuel tank
- 9 Fuel return to fuel tank

Empty water tank

- Switch off the engine.
- Place suitable collecting containers underneath.
- Electrical connection
 - Disconnect cable connections.

- Loosen drain plug.
- Drain fluid until pure diesel fuel runs out.
- Mount drain plug.

Tightening torque $1.6 \pm 0.3 \text{ Nm}$

- Electrical connection
 - Connect cable connections.

Change the fuel pre-filter insert

- Switch off the engine.
- Shut off the fuel supply to the engine (with high-level tank).
- Place suitable collecting containers underneath.
- Electrical connection
 - Disconnect cable connections.
- Loosen drain plug and drain liquid.
- Disassemble filter insert.
- Clean any dirt off the sealing surfaces of the new filter cartridge and opposite side of filter head.
- Wet the sealing surfaces of the filter cartridge slightly with fuel and screw back on to the filter head, clockwise ($17\text{--}18 \text{ Nm}$).
- Mount drain plug.

Tightening torque $1.6 \pm 0.3 \text{ Nm}$

- Electrical connection
 - Connect cable connections.

- Open the fuel shutoff tap and vent the system, see venting the fuel system.

Vent the fuel system

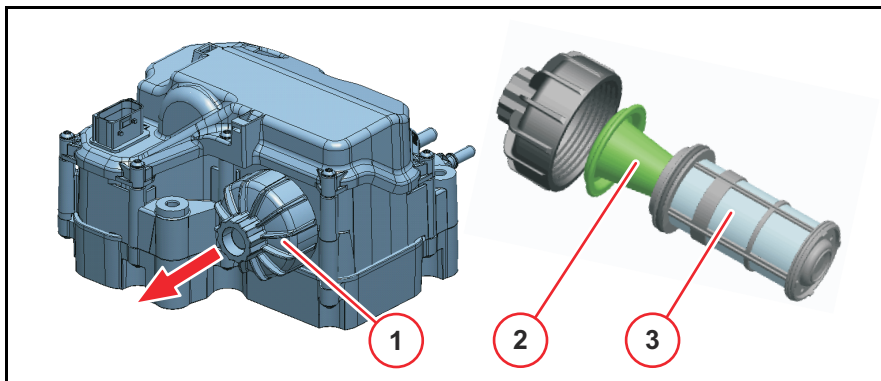
- Loosen vent screw.
- Unlock the bayonet connection of the fuel supply pump by pressing upwards and simultaneously

turning anticlockwise. The pump pistons are now pressed out through the spring.

- Pump until no more air escapes at the vent screw.
- Tighten vent screw.

Tightening torque $6.5 \pm 1.3 \text{ Nm}$

- Lock the bayonet connection of the fuel supply pump by pressing upwards and simultaneously turning clockwise.
- Start the engine and operate approx. 5 minutes in idling mode or at low load. Check the pre-filter for leaks while doing this.



Change the filter cartridge of the AdBlue® supply pump

In engines with exhaust aftertreatment system **Se**lective **C**atalytic **R**eduction



Protective gloves are to be worn when working with Selective Catalytic Reduction (SCR) components. Ensure cleanliness.

- 1 Cover
- 2 Compensation body
- 3 Filter insert

- Switch off the engine.
- Electrical connection
 - Disconnect cable connections.
- Place suitable collecting containers underneath.
- Remove cover.

Socket wrench insert 27 mm

- Pull out filter insert and compensation body.
- Insert new filter insert with compensation body.
- Mount cover.

Tightening torque $22.5 \pm 2.5 \text{ Nm}$

- Electrical connection
 - Connect cable connections.
- Start

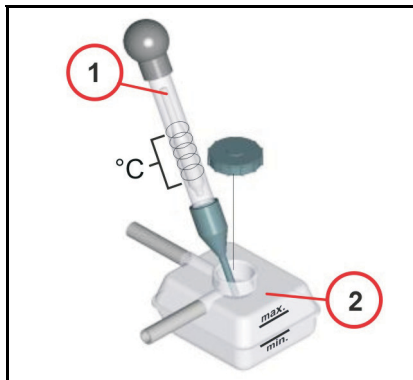
Specifications when working on the cooling system



Danger of scalding from hot coolant!
Cooling system under pressure! Only open the cap when cool!
The coolant must have a prescribed concentration of cooling system corrosion protection agent!
Observe safety regulations and national specifications when handling cooling media.
Observe the manufacturer's specifications for an external cooler.
Dispose of leaking liquids properly and do not allow them to seep into the ground.
Order coolant corrosion protection agent from your DEUTZ partner.
Never operate the engine without coolant, even for a short time!

Checking the coolant level with an external cooler

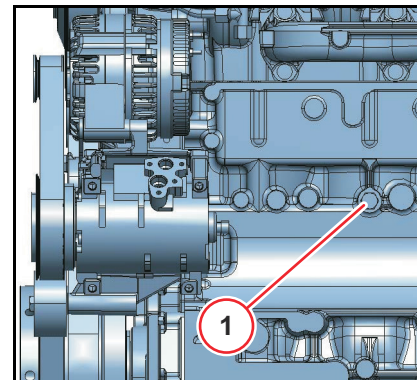
- Fill in new coolant and vent the system according to the specifications of the cooling system manufacturer.
- Open the cooling system cap (1) carefully.
- The coolant level must always be between the MIN and MAX marks of the compensation tank! Fill up to the MAX mark if necessary.



Check coolant additive concentration

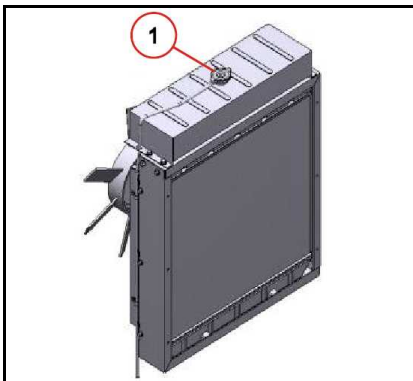
- Open the cooling system cap (1) carefully.
- Check the coolant additive concentration in the cooler/compensation tank (2) with a conventional antifreeze measuring device (1) (e.g. hydrometer, refractometer).
- Necessary coolant additive concentration Coolant mixing ratio (▮ 38).

You can order the appropriate test instrument from your DEUTZ partner under order number 1824.



Emptying the cooling system

- Open cooler locking cap carefully.
- Place suitable collecting containers underneath.
- Remove the locking screw (1) in the crankcase.
- Drain coolant.
- If the locking screw is not accessible, the drainage can be carried out at the engine oil cooler (coolant duct).
- Insert screw again with sealant.
- Close cooler locking cap.

**Fill and ventilate cooling system**

Danger of scalding from hot coolant!
Cooling system under pressure! Only open
the cap when cool!

- Open the cooling system cap (1) carefully.
- Loosen the cooler venting screw if necessary.
- Fill coolant up to the max. mark or filling limit.
- Switch on any available heating and set to the highest level so that the heating circuit is filled and vented.
- Close cooler locking cap.
- Run engine up to operating temperature (opening temperature of the thermostat).
- Switch off the engine.
- Check coolant level in cooled engine and top up to the MAX mark or filling level on the compensation tank if necessary.

Cleaning work



For all cleaning work, make sure that no parts are damaged (e.g. bent cooler mesh). Cover electrical/electronic parts and connections to clean the engine (e.g. control units, generator, solenoid valves etc.). Do not aim the water/steam jet directly at them. Allow engine to warm up.



Only carry out cleaning work on the engine when it is not running!
Remove the engine cover and cooling air cover if available and remount after cleaning.

General

The following causes of soiling make it necessary to clean the engine:

- High dust content in the air.
- Chaff and chopped straw in the area of the engine.
- Coolant leaks
- Lubricating oil leakage
- Fuel leaks

Because of the different application conditions, cleaning depends on the degree of dirt contamination.

Cleaning with compressed air

- Blow dirt off or out. Always blow out the cooler and cooling fins from the exhaust air side to the fresh air side.

Cleaning with cold cleaner

- Spray the engine with cold cleaner and leave it for about 10 minutes to take effect.
- Spray the engine clean with a high pressure water jet.
- Warm up the engine so that the water residues evaporate.

Cleaning with a high pressure cleaner

- Clean the engine with a steam jet (maximum spray pressure 60 bar, maximum steam temperature 90 °C, distance at least 1m).
- Warm up the engine so that the water residues evaporate.
- Always clean the cooler and cooling fins from the exhaust air side to the fresh air side.

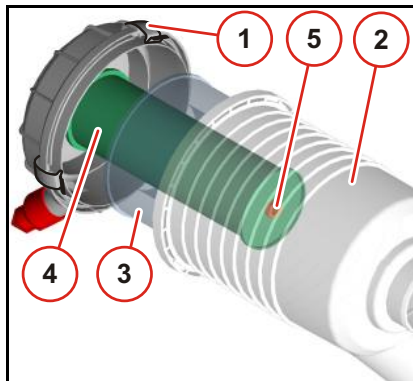
Regulations for working on the intake system



Do not work when the engine is running!



Pay attention to utmost cleanliness when working on the intake system, close intake openings if necessary. Dispose of old filter elements properly.



Maintaining the dry air filter



Do not clean the filter element (3) with petrol or hot liquids!
Renew damaged filter elements.

- Maintain the filter element (3) according to the interval in the maintenance schedule
- Lift up the clamping yoke (1).
- Remove the filter hood (2) and pull out the filter element (3).
- Filter element (3):
 - blow out with dry compressed air (max. 5 bar) from the inside to the outside if soiling is only slight,
 - renew if heavily soiled.

Renewing the safety cartridge of the dry air filter



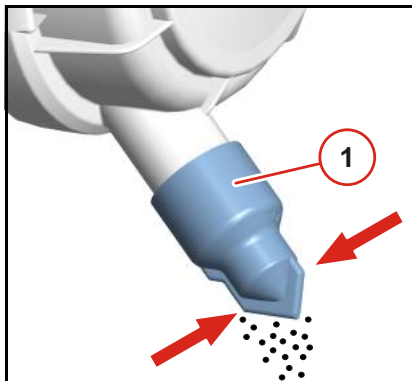
Never clean the safety cartridge (4).

- Renew safety cartridge (4) according to the interval in the maintenance schedule
- To do this:
 - Unscrew hexagon nut (5), pull out safety cartridge (4).
 - Insert new safety cartridge, screw on hexagonal nut.
- Insert filter element (3), mount hood (2) and fix with clamping yoke (1).



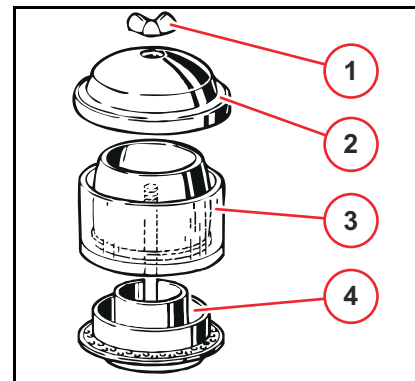
Maintenance indicators for dry air filter

- The dry air filter is maintained according to a maintenance switch or maintenance indicator.
- Maintenance is necessary when:
 - the yellow warning light of the **maintenance switch** lights up when the engine is running.
 - the red field (1) of the **maintenance indicator** is fully visible.
- After carrying out maintenance work, reset the signal by pressing the button on the maintenance indicator. The maintenance indicator is now ready for operation again.



Clean the dust discharge valve of the dry air filter

- Empty the dust discharge valve (1) by pressing together the discharge slit.
- Remove any caked dust by pressing together the upper section of the valve.
- Clean the discharge slit.



Emptying the cyclone precleaner



Never fill the dust container (3) with lubricating oil!

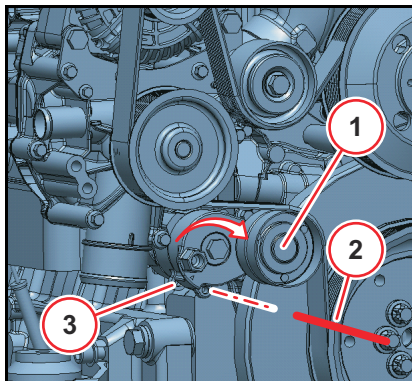
- Loosen wing nut (1) and lift off housing cover (2).
- Remove the dust container (3) from the base (4) and empty it. Clean the container using a brush and clean diesel fuel. Then dry.
- Place the dust container (3) on the base (4) and tighten the housing cover (2) with wing nut (1).

Checking the belt drive



Only carry out work on the belt drive with the engine at a standstill!
After repair work: Check that all guards have been replaced and that all tools have been removed from the engine.

- Check the whole belt drive visually for damage.
- Renew damaged parts.
- Remount protective devices if necessary.
- Pay attention to correct fit of new belts, check the tension after running for 15 minutes.



Replace V-rib belt

- 1 Tension pulley
- 2 Retaining pin
- 3 Assembly bore

- Press tensioning roller with socket wrench in the direction of the arrow until a retaining pin can be fixed in the assembly bore. The V-ribbed belt is now tension free.
- First pull the V-ribbed belt off the smallest roller or off the tensioning roller.
- Mount new V-ribbed belt.
- Retain tensioning pulley using the pin wrench and remove the holding pin.
- Tension V-ribbed belt using the tensioning roller and socket wrench. Check whether the V-ribbed belt is correctly in its guide.

Check valve clearance, adjust if necessary

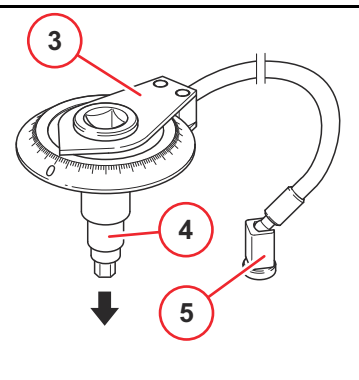
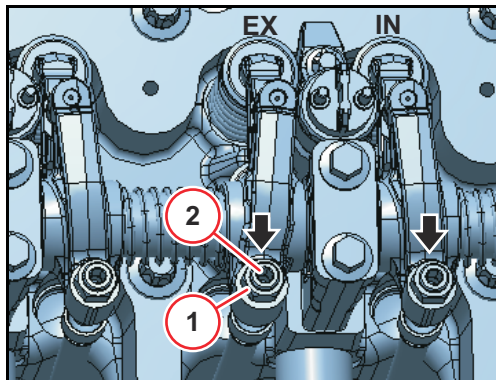
- Let the engine cool down for at least 30 minutes before setting the valve clearance: Lubricating oil temperature below 80 °C.
- Disassemble electric line at the injectors.
- Remove the cylinder head hood.
- Place turning gear over fastening screws of the belt pulleys.
- Turn the crankcase until reaching valve overlap.

Outlet valve is not yet closed, inlet valve begins to open.

The cylinders to be set can be seen in the setting schematic.

TCD 7.8 L6

| Valve overlap | Settings |
|---------------|----------|
| 1 | 6 |
| 5 | 2 |
| 3 | 4 |
| 6 | 1 |
| 2 | 5 |
| 4 | 3 |



Set valve clearance

- 1 Lock nut
- 2 Setting screw
- 3 Rotary angle disc
- 4 Insert
- 5 Magnet

| Valve clearance | | | | |
|-----------------|----|--------------|------------------------------|--|
| TCD 7.8 L6 | IN | Inlet valve | $75^{\circ} \pm 10^{\circ}$ | |
| | EX | Outlet valve | $105^{\circ} \pm 10^{\circ}$ | |

- Fit the rotary angle disc with socket wrench inset on the setting screw.
- Fix magnet of the rotation angle disc.
- Turn rotation angle disc clockwise to the stop (rocker arm without clearance) and set scale to zero.
- Turn rotation angle disc anticlockwise until reaching the specified rotation angle:

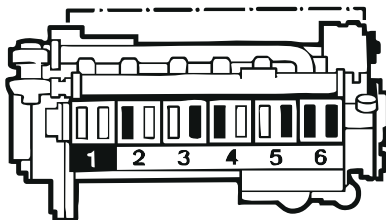
- Secure the rotation angle disc against twisting.
- Turn rotation angle disc clockwise to the stop (rocker arm without clearance) and set scale to zero.
- Tighten locking nut.

Tightening torque 20 Nm

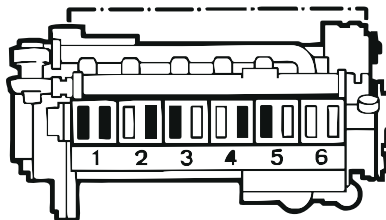
- Now adjust the two other valves at the rocker arm, as described above.
- Perform the setting procedure on every cylinder.
- Remount the cylinder head cover with a new gasket in the reverse order of disassembly.
- Tighten screws.

Tightening torque 22 Nm

1



2

**Valve clearance setting schematic**

- **Crankshaft position 1**

Turn crankshaft until both valves overlap on the cylinder.

Outlet valve is not yet closed, inlet valve begins to open.

Set **black** marked valves.

Mark the respective rocker arm with chalk to check the setting you have made.

- **Crankshaft position 2**

Turn the crankshaft one turn (360 °).

Set **black** marked valves.

Regulations for working on the electrical system



Do not touch the voltage conducting parts, faulty warning lamps should be immediately replaced.



Pay attention to correct polarity of the connections.

Cover electrical/electronic parts and connections to clean the engine (e.g. control units, generator, solenoid valves etc.). Do not aim the water/steam jet directly at them. Allow engine to warm up.

Touching a lead against the frame to check whether it is live must not, under any circumstances, be carried out.

For electrical welding work, the ground terminal of the welding gear must be clamped directly to the part being welded.

Three-phase current generator: Never disconnect the cables between battery, generator and regulator while the engine is running.

Battery



Electronically stored data could be lost if the battery is disconnected.

Keep battery clean and dry.

Make sure the battery is fitted correctly and securely.

Dispose of old batteries in an environmentally friendly way.



Danger of explosion! The gases emitted by the battery are explosive!

Fire, sparks, smoking and naked lights are prohibited!

Danger of acid burns! Wear protective gloves and glasses! Avoid contact with skin and clothing!

Danger of short circuit! Do not rest tools on the battery!

Checking the voltage

- Check the battery voltage with a standard voltmeter. The voltage gives information about the charge status.

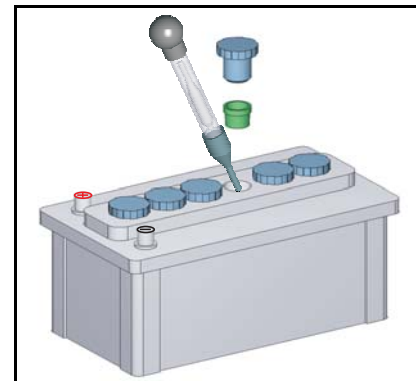
| Battery | Charge status (Volt) |
|---------|----------------------|
| 12 Volt | 12-14,4 |
| 24 Volt | 24-28,4 |

Check acid level

- Unscrew caps.
- Note the manufacturer's specifications concerning the liquid level.

The liquid should normally be 10-15 mm above the top edge of the plate or reach up to any available control device.

- Only use distilled water to top up the battery.
- Screw in caps.



Check acid density

- Unscrew caps.
- Measure the electrolyte density of individual cells with a commercial hydrometer. Hydrometer reading indicates battery's state of charge. The acid temperature when measuring should be 20 °C if possible.
- Check the acid level before recharging.
- Screw in caps.

| Acid density [kg/ l] | | Charge status | Measure |
|----------------------|----------|---------------|---------|
| Normal | Tropical | | |
| 1,28 | 1,23 | good | none |
| 1,20 | 1,12 | half | charge |
| 1,12 | 1,08 | empty | charge |

Removing the battery

- Always disconnect the minus pole first when removing the battery. Otherwise there is a danger of short-circuit!
- Remove the fastenings and take out the battery.

Charging the battery

- Unscrew caps.
- Charge the battery with a conventional battery charger. Observe the manufacturer specifications!
- Screw in caps.

Installing the battery

- Insert new or charged battery and attach the fastenings.
- Clean the terminals and battery poles with fine emery paper.
- Connect the plus pole first and then the minus pole. Otherwise there is a danger of short-circuit! Make sure the terminals have good contact. Tighten clamp bolts hand-tight.
- Grease the assembled terminals with an acid-free, acid-resistant grease.

Faults and remedies

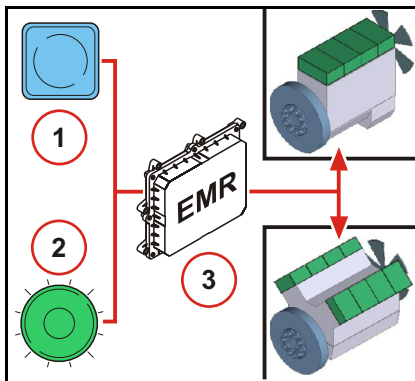
| Faults | Causes | Measures |
|---|---|--|
| Engine does not start or is difficult to start | Not disconnected (if possible) | Check coupling |
| | Fuel tank empty | Vent fuel system |
| | Fuel suction pipe blocked | Check |
| | Below starting limit temperature | Check |
| | Cold starting device | Check/replace |
| | Wrong SAE viscosity class of the engine lubricating oil | Change the lubricating oil |
| | Fuel quality does not comply with operating manual | Change the fuel |
| | Battery defective or discharged | Check battery |
| | Cable connection to starter loose or oxidized | Check cable connections |
| | Starter defective or pinion does not engage | Check starter |
| | Incorrect valve clearance | Check valve clearance and set if necessary |
| | Air filter clogged / turbocharger defective | Check/replace |
| | Air in fuel system | Vent fuel system |
| | Compression pressure too low | Check compression pressure |
| | Exhaust gas backpressure too high | Check |
| Engine does not start and diagnostic lamp flashes | Injection line leaks | Check injection line |
| | Engine electronics prevents starting | Check error according to error code and eliminate error if necessary |

| Faults | Causes | Measures |
|--|--|--|
| Engine starts, but runs irregularly or fails | Belt/V-rib belt (fuel pump in belt drive) | Check whether torn or loose |
| | Incorrect valve clearance | Check valve clearance and set if necessary |
| | Compression pressure too low | Check compression pressure |
| | Cold starting device | Check/replace |
| | Air in fuel system | Vent |
| | Fuel filter contaminated | Clean |
| | Fuel quality does not comply with operating manual | Change the fuel |
| | Injector defective | Change |
| | Injection line leaks | Check injection line |
| | Exhaust gas backpressure too high | Check |
| Speed changes are possible and diagnostic lamp lights up | Engine electronics has detected a system error and activates an equivalent speed | Check error according to error code and eliminate error if necessary |

| Faults | Causes | Measures |
|---|---|---|
| Engine becomes excessively hot. Temperature warning system activates | Vent line blocked | Clean |
| | Wrong SAE viscosity class of the engine lubricating oil | Change the lubricating oil |
| | Lube oil cooler defective | Check/replace |
| | Lube oil filter contaminated on the air or lube oil side | Change |
| | Lube oil level too high | Check lube oil level, if necessary drain off. |
| | Lubricating oil level too low | Fill up lube oil |
| | Incorrect valve clearance | Check valve clearance and set if necessary |
| | Injector defective | Change |
| | Coolant heat exchanger soiled | Clean |
| | Defective cooling water pump (torn or loose V-belt) | Check whether torn or loose |
| | Low coolant | Fill up |
| | Resistance in cooling system is too high / flow volume too low | Check the cooling system |
| | Cooling fan or exhaust thermostat defective, V-belt torn or loose | Check/replace/tension |
| | Charge air line leaking | Check charge air line |
| | Charge air cooler soiled | Check/clean |
| | Air filter clogged / turbocharger defective | Check/replace |
| | Air filter maintenance switch / maintenance indicator defective | Check/replace |
| | Fan defective/V-rib belt torn or loose | Check fan/V-belt, change if necessary |
| | Exhaust gas backpressure too high | Check |

| Faults | Causes | Measures |
|--|---|---|
| Engine output is deficient | Lube oil level too high | Check lube oil level, if necessary drain off. |
| | Lubricating oil cooler fins soiled | Clean |
| | Fuel suction temperature too high | Check the system |
| | Fuel quality does not comply with operating manual | Change the fuel |
| | Air filter clogged / turbocharger defective | Check/replace |
| | Air filter maintenance switch / maintenance indicator defective | Check/replace |
| | Fan defective/V-rib belt torn or loose | Check fan/V-belt, change if necessary |
| | Charge air line leaking | Check charge air line |
| | Charge air cooler soiled | Clean |
| | Resistance in cooling system is too high / flow volume too low | Check the cooling system |
| | Injection line leaks | Check injection line |
| | Injector defective | Change |
| Engine performs poorly and diagnostic lamp lights | Engine electronics reduce performance | Please contact your DEUTZ partner |
| Engine does not run on all cylinders | Injection line leaks | Check injection line |
| | Injector defective | Change |
| | Charge air line leaking | Check charge air line |
| | Lube oil level too high | Check lube oil level, if necessary drain off. |
| Engine lubricating oil pressure is non-existent or excessively low | Lubricating oil level too low | Fill up lube oil |
| | Excessive inclination of engine | Check engine mounting / reduce inclination |
| | Wrong SAE viscosity class of the engine lubricating oil | Change the lubricating oil |
| Engine lubricating oil consumption excessive | Lube oil level too high | Check lube oil level, if necessary drain off. |
| | Excessive inclination of engine | Check engine mounting / reduce inclination |
| | Crankcase breather | Check/replace |
| Lubricating oil in the exhaust system | Engine operated continuously with too low a load (< 20-30%) | Check load factor |
| Engine producing blue smoke | Lube oil level too high | Check lube oil level, if necessary drain off. |
| | Excessive inclination of engine | Check engine mounting / reduce inclination |

| Faults | Causes | Measures |
|---|---|---|
| Engine producing white smoke | Below starting limit temperature | Check |
| | Cold starting device | Check/replace |
| | Incorrect valve clearance | Check valve clearance and set if necessary |
| | Fuel quality does not comply with operating manual | Change the fuel |
| | Injector defective | Change |
| Engine producing black smoke | Air filter clogged / turbocharger defective | Check/replace |
| | Air filter maintenance switch / maintenance indicator defective | Check/replace |
| | Charge air pressure-dependent full load stop defective | Check |
| | Incorrect valve clearance | Check valve clearance and set if necessary |
| | Charge air line leaking | Check charge air line |
| | Injector defective | Change |
| Error in the SCR system | AdBlue® tank empty/display full | Check tank sensor |
| | SCR not working | Check plug connection of the lines at the pump and injector |
| | SCR not working (cold) | Lines frozen, clean lines |
| | Implausible sensor signal | Check NO _x sensor |
| No regeneration in the diesel particle filter | Power supply of the air compressor interrupted | Check fuse and supply line, replace lock |
| | Air compressor defective | Check air compressor, replace lock |
| | Air filter blocked | Clean/Replace air filter, check air compressor, if necessary replace lock |
| | Fuel supply interrupted | Check lines, check metering unit |
| | Implausible sensor signal | Check exhaust backpressure sensor, check differential pressure sensor in the particle filter, check pressure sensors in the metering unit |
| | Swirl plate sooted up | Clean, determine reason for the sooting |



Engine protection function of the electronic engine control

- 1 Diagnosis button
- 2 Error lamp
- 3 Electronic engine control (EMR)



The error lamp goes out when all the errors have been eliminated. For some errors, it is necessary to switch off the ignition, wait 30 s and only then switch back on the ignition. The appropriate monitoring functions are switched off when a sensor fails. Only the sensor failure is documented in the error memory.

Depending on the design of the monitoring functions, the electronic engine control can protect the engine in certain problematical situations by monitoring important limit values during operation and checking the correct function of the system components.

Depending on the seriousness of a recognised fault, the engine can continue to operate with limitations, during which the error lamp lights up continuously or indicates a serious system error by flashing. In this case, the engine should be switched off as soon as safely possible.

Error lamp

The error lamp is located in the vehicle drive stand.

The error lamp can release the following signals:

- Function test
 - Ignition on, error lamp lights up for approx. 2 seconds and then goes out.
 - Check the error lamp if there is no reaction after switching on the ignition.
- The lamp does not light
 - After the lamp test an extinguished lamp indicates an error-free and trouble-free operating state within the scope of the control possibility.
- Continuous light

Error in system.

 - Operation continued with restrictions.
 - The engine must be checked by a DEUTZ partner.
 - If a lamp lights steadily a monitored measuring variable (e.g. coolant temperature, lubricating oil pressure) has left the permissible value range.

Depending on the fault, the engine power may be reduced by the electronic engine control to protect the engine.
- Flashing

Serious error in system.

- Switch off prompt for the operator. Attention: Failure to do so will lead to loss of guarantee!
 - The engine has reached switch-off condition.
 - Engine forced to run at low idle speed to cool the engine, with automatic shutdown if necessary.
 - The switch-off process has been accomplished.
 - There may be a start lock after engine stop.
 - The start lock is deactivated by turning off the system with the ignition key for approx. 30s.
 - The power reduction can be bypassed, the automatic switch-off delayed or a start lock bypassed with the override key on the instrument panel to avoid critical situations. This brief deactivation of the engine protection functions is logged in the control unit.
- Please contact your DEUTZ-partner in case of malfunctions and spare parts inquiries. Our specially trained personnel will ensure fast, professional repairs using original DEUTZ spare parts in case of damage.

Diagnosis button

The diagnosis button allows the errors currently saved in the error memory of the electronic engine control to be visualised in the form of a flash code. The flash codes permit:

- Errors that may occur can be classified.
- Clear display of the error as visual signal.
 - The blink codes can only be interpreted by a DEUTZ partner.

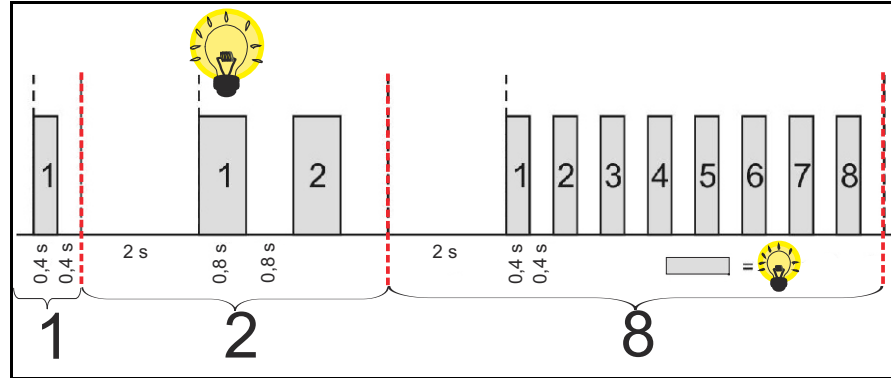
Use of the diagnostic key

The flash code displays all errors in the error memory, this means active as well as passive ones.

The control unit must be switched off to start the enquiry (ignition off). Then the diagnosis button should be pressed for approx. 1s during the start (ignition on).

Then the next error (i.e. the following one in the error memory) can be displayed by pressing the diagnostic key again. If the last error was displayed, the first error is displayed again on pressing the diagnostic key again.

After the display of the error flash code, the error lamp goes out for five seconds.



Display system error by flash code

Example:

Flash code 1-2-8

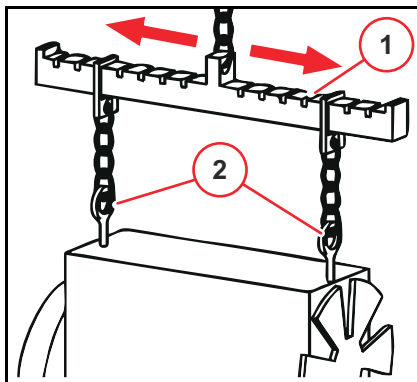
1 x short flash

2 x long flash

8 x short flash

This flash code indicates a break or short circuit in the wiring of the charge air temperature sensor. The temporal sequence of the flash signals is shown in the illustration.

- The blink codes can only be interpreted by a DEUTZ partner.

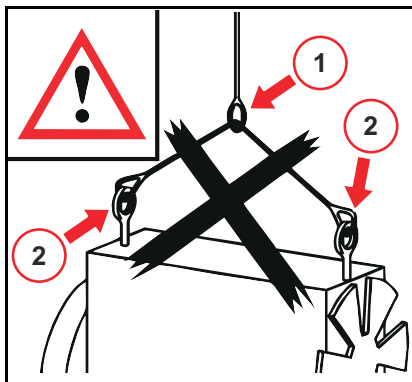


Suspension equipment



The transport devices mounted on this engine are adapted to the engine weight. If the engine is transported with add-on components, the transport devices must be designed accordingly.

- Always use proper suspension equipment when transporting the engine.
- The suspension device (1) must be adjustable for the engine's centre of gravity.
- After transportation and before commissioning of engine: remove attachment eyes (2).



Danger to life!
The engine may tip over or fall down if suspended incorrectly!

- The fastening attachment cannot be fixed securely above the centre of gravity (1).
- The fastening attachment can slip, the engine swings backwards and forwards (1).
- Too short a fastening attachment causes bending torques in the transport device (2) and can damage it.

General

Engines contain the following types of corrosion protection:

- Interior corrosion protection
- Exterior corrosion protection



Your DEUTZ partner has the right corrosion protection agent for your needs.

The following measures for corrosion protection **after taking the engine out of operation** meet the requirements for 12 months corrosion protection.

The following corrosion protection work may only be carried out by persons familiar with it and instructed in the potential dangers.

If these measures are deviated from by exposing the corrosion-protected engines or parts to unfavourable conditions (installation outdoors or storage in damp, badly aired places) or damage to the corrosion protection layer, a shorter corrosion protection duration is to be expected.

The engine corrosion protection should be checked about every 3 months by opening the covers. If corrosion is detected, the corrosion protection should be renewed.

At the end of the corrosion protection work the crank drive may no longer be turned so that the corrosion protection agent in the bearings, bearing liners and cylinder liners is not scraped off.

Before operating a corrosion protected engine, the corrosion protection must be removed.

Interior corrosion protection

- Interior corrosion protection is always provided by wetting of the walls with the implemented cor-

rosion protection agent in a corrosion protection run of the engine.

- The corrosion protection run can be performed once to protect the different systems:

Fuel system



Close the fuel/tank/supply line to the engine so that the system is protected against dirt and dust. Protect the electronics against moisture and corrosion.

- Fill the fuel tank with a mixture of:
 - 90 % distilled fuel
 - 10 % corrosion protection oil.
- Perform a corrosion protection run with no load for at least 5 minutes.

Lubricating oil system

- Drain lubricating oil from warm engine.
- Thoroughly clean lube oil tray, cylinder head with rocker arms, valves, valve springs with diesel fuel or cleaning agent.
- Fill the engine with corrosion protection oil up to the MAX mark and perform a corrosion protection run for at least 5 minutes so that all the components of the lubricating oil system are wetted or wet all accessible parts with corrosion protection oil and pump corrosion protection oil through the engine with a separate pump until all bearings and bearing liners are wetted.

Cooling system

- Depending on the series the engines are equipped with cooling air, cooling oil or cooling fluid system (cooling water with cooling system protection agent).

- Cooling air system, see the Exterior corrosion protection section.
- In engines of the oil-cooled series the circulating lubricating oil serves simultaneously for cooling. The cooling chambers are protected automatically against corrosion with the lube oil system.
- If a coolant with corrosion protection properties is poured into liquid-cooled engines, no further action is necessary after draining.
- If not, the coolant must be drained and, to ensure the formation of a covering layer on the inside surfaces of the cooling system, a corrosion protection run performed with a mixture of:
 - 95 % treated water
 - 5 % corrosion protection agent
- The duration of the corrosion protection run and the concentration of the corrosion protection agent are specified by the manufacturer of the corrosion protection agent.
- Then drain the coolant.

Air intake pipes

- After the corrosion protection run, remove the cylinder head cover and deinstall injectors. The respective piston must be set to LT.
- The accessible part of the cylinder liner should be coated with corrosion protection oil with a spray lance through the opening.
- Spray corrosion protection lubricating oil into the suction intake pipe.

Exterior corrosion protection

- The engine must be cleaned thoroughly with a cleaning agent before exterior corrosion protection. Any signs of corrosion and damage to the paintwork must be removed.

Bare exterior surfaces and parts

- Coat or spray all bare exterior parts and surfaces (e.g. flywheel, flange faces) with corrosion protection agent.

Rubber parts

- Rubber parts (e.g. mufflers) which are not painted over must be rubbed down with talcum powder.

Belt drive

- Remove V-belts and V-rib belts and store packed.
- Spray V-belt pulleys and tension rollers with corrosion protection agent.

Engine openings

- All engine openings must be fitted with air-tight, water-tight covers to delay the vapourisation process of the corrosion protection agents.
- With installed air compressor, the suction and pressure connection must be sealed by a cap.
- Air should be excluded to avoid ventilation of the engine (chimney effect) for the suction from an air supply pipe.

Storage and packaging

- After being protected against corrosion, the engine must be stored in a dry, ventilated hall and suitably covered.
- The cover must be placed loosely over the engine so that the air can circulate around it to prevent condensation from forming. Use a desiccant if necessary.

Removal of corrosion protection

- The corrosion protection must be removed from the corrosion protected engine before starting.
- The packaging and all covers over the closed openings must be removed.
- Any corrosion deposits and paint damage should be remedied.

Fuel system

If there is a mixture of diesel fuel/corrosion protection oil in the fuel tank, drain it.

- Connect fuel/tank/supply line to the engine. Pay attention to cleanliness.
- Fill the fuel tank and fuel system with the proper fuel.

Lubricating oil system

- Unscrew the lube oil drain screw, drain oil.
- Fill the engine with lubricating oil via the lubricating oil filler neck.

Coolant system

- If the implemented corrosion protection agent is compatible with the intended cooling system protection agent, this can be filled directly into the coolant system as specified.
- If it is uncertain whether the implemented corrosion protection agent is compatible with the cooling system protection agent, the cooling system should be purged with fresh water for about 15 minutes before filling.

Removal of exterior corrosion protection

- All areas and components coated with corrosion protection agent must be washed off with dis-

tilled fuel or a suitable cleaning agent.

- Wash out grooves of V-belt pulleys if necessary.
- Mount V-belts or V-rib belts as specified.
- Fill with coolant.

Corrosion protection agent / cleaning agent

Please ask your DEUTZ partner for reference products for the corrosion protection agents/cleaning agents to be used which meet DEUTZ requirements.

or see www.deutz.com

| http://www.deutz.com | |
|---|---|
| de | \\SERVICE\\Betriebsstoffe und Additive\\Motorkonservierung |
| en | \\SERVICE\\Operating Liquids and Additives\\Engine Corrosion Protection |

General technical data

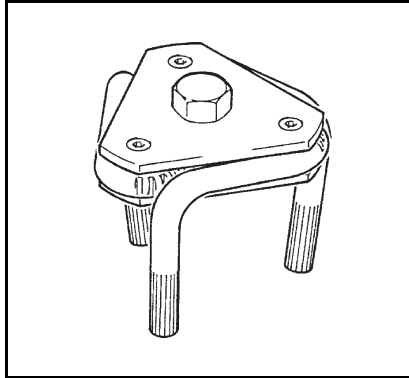
| Engine type | Dimension | TCD 7.8 L6 |
|---|----------------------|---|
| Working principle | | Four-stroke diesel engine |
| Charging | | Turbocharger with charge air cooling |
| Type of cooling | | water-cooled |
| Cylinder arrangement | | in series |
| No. of cylinders | | 6 |
| Bore/stroke | [mm] | 110/136 |
| Total displacement | [cm ³] | 7755 |
| Combustion process | | Direct injection |
| Injection system | | Deutz Common Rail (DCR) |
| Exhaust gas recirculation | | without or external |
| Exhaust gas aftertreatment | | Selective Catalytic Reduction SCR or Diesel particle filter DPF |
| Valves per cylinder | | 4 |
| Setting with rotary angle disc | [°] | 75°±10° / 105°±10° |
| Firing order of the engine | | 1-5-3-6-2-4 |
| Direction of rotation looking onto the flywheel | | left |
| Engine power rating according to ISO 3046 | [kW] | see engine rating plate |
| Speed (nominal revolutions) | [min ⁻¹] | see engine rating plate |
| Injection timing | [°BTDC] | see engine rating plate |
| Coolant volume (only engine content without cooler / hoses and pipes) | | 14,8/10,8 |
| Industrial engines/Agricultural technology | ≈ [l] | |
| Permissible continuous coolant temperature | [°C] | max. 105 |
| Temperature difference between coolant inlet/outlet | [°C] | 4 - 8 |

| Engine type | Dimension | TCD 7.8 L6 |
|--|-----------|--|
| Start of thermostat opening | [°C] | 86 |
| Thermostat fully open | [°C] | 102 |
| Lubricating oil change volume (with filter) | ≈ [l] | 26,5* |
| Lube oil temperature in the lube oil tray, maximum | [°C] | 125 |
| Lubricating oil pressure minimum (low idle, engine warm) | [kPa/bar] | 80/0,8 |
| Permissible maximum combustion air temperature after charge air cooler | [°C] | 50 |
| V-rib belt tensioning | | Automatic tensioning spring-loaded clamping roller |
| Weight without cooling system according to DIN 70020-A | ≈ [kg] | 705 |
| *specified lubricating oil filling volumes apply for standard versions. In engines which deviate from the standard, for example different lubricating oil pans/dipstick variants and/or special inclined versions, the lubricating oil volume may vary. The lubricating oil dipstick mark is always decisive. | | |

Tool ordering

The special tools described in this chapter can be ordered from:

Please contact your DEUTZ partner

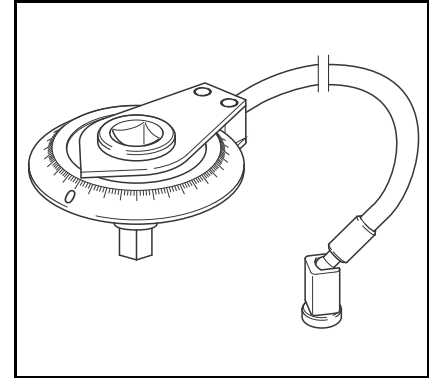


Special wrench for loosening exchangeable filters

Order number:

170050

For loosening changeable filters.

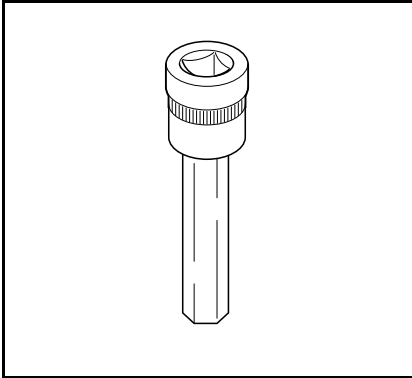


Rotation angle disc

Order number:

8190

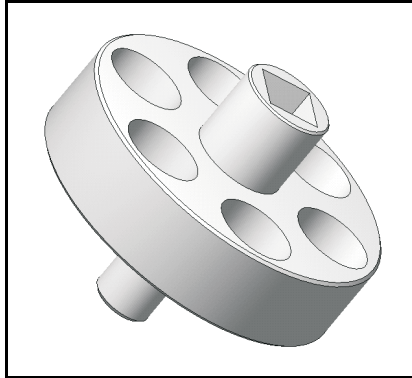
For setting the valve clearance

**Pin wrench insert**

Order number:

8193

For setting the valve clearance

**Turning gear**

Order number:

100 500

For turning over the engine as an attachment for the torsional vibration damper

**Refractometer**

Order number:

0293 7499

The following operating media can be evaluated with this test device:

- Coolant
- Battery acid
- AdBlue®

The test device can be ordered via the relevant DEUTZ partner.

DEUTZ Operating Fluids



SCR/DPF

| DEUTZ Oil Rodon 10W40 low SAPS (DQC III-10 LA) | |
|--|-----------|
| 5 L | - |
| 20 L | 0101 7976 |
| 209 L | 0101 7977 |

SCR

| DEUTZ Oel TLX-10W40FE (DQC III-10) | |
|------------------------------------|-----------|
| 5 L | 0101 6335 |
| 20 L | 0101 6336 |
| 209 L | 0101 6337 |

| DEUTZ Oel DQC4-5W30-UHP (DQC IV-10) | |
|-------------------------------------|-----------|
| 5 L | - |
| 20 L | 0101 7849 |
| 209 L | 0101 7850 |

DEUTZ Cooling System Conditioner

| | |
|-------|-----------|
| 5 L | 0101 1490 |
| 20 L | 0101 6416 |
| 210 L | 1221 1500 |



The engine company.

DEUTZ AG

Information Systems Sales & Service

Ottostraße 1

51149 Köln

Germany

Phone: +49 (0) 221-822-0

Fax: +49 (0) 221-822-3525

E-Mail: info@deutz.com

www.deutz.com

Printed in Germany

© 04/2011

All rights reserved

Order number:

0312 3790 en

Original operating instructions