TCD 4.1 L4
TCD / TTCD 6.1 L6

Operation Manual

EU Stage IV / US EPA Tier 4

The engine company.

DEUTZ®

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 engine, the use of DEUTZ original parts is prescribed. These are specially designed for your engine and guarantee perfect operation.

  Non-compliance results in the expiry of the warranty!

  Maintenance/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).

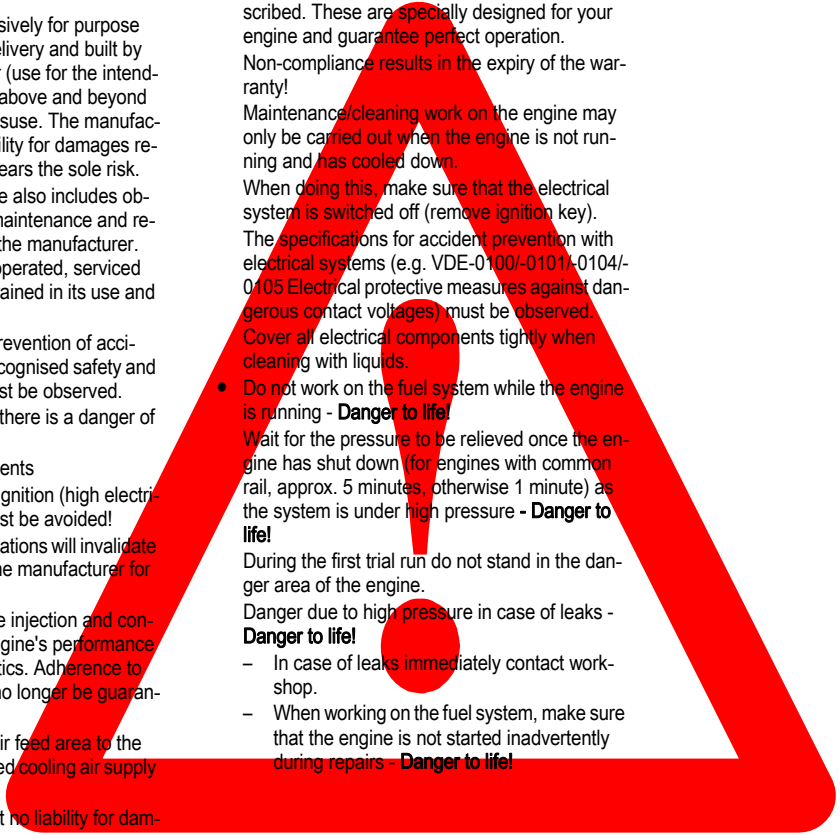
  The specifications for accident prevention with electrical systems (e.g. VDE-0100/-0101/-0104/-0105 Electrical protective measures against dangerous contact voltages) must be observed.

  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 be relieved once the engine has shut down (for engines with common rail, approx. 5 minutes, otherwise 1 minute) as 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.

Table of contents

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 developments 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 sare parts inquiries. Our specially trained personnel will ensure fast, professional repairs using original DEUTZ spare parts in case of damage.

The DEUTZ homepage provides a continuously updated overview of the service partners near you, and information on product areas and services.

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

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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 4.1 L4

TCD 6.1 L6

TTCD 6.1 L6

TCD/TTCD	
T	Exhaust gas turbocharger
TT	dual-stage turbo
C	Charge air cooler
D	Diesel

4.1 / 6.1	
4.1	Displacement in litres
6.1	Displacement in litres

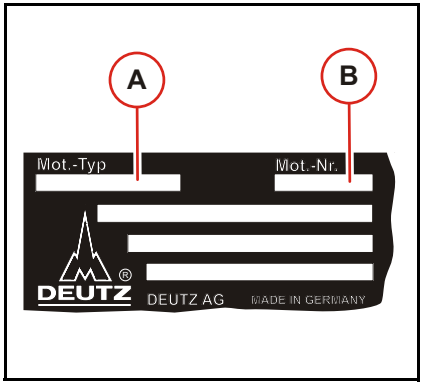
L6	
L	in series
4	No. of cylinders
6	No. of cylinders

Emissions legislation

The engines of these operating instructions fulfill the following exhaust emissions regulations	
With exhaust aftertreatment system	
EU	Stage IV
USA	EPA Tier 4

The engine and the corresponding EAT system (**E**xhaust **A**fter **T**reatment) 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.

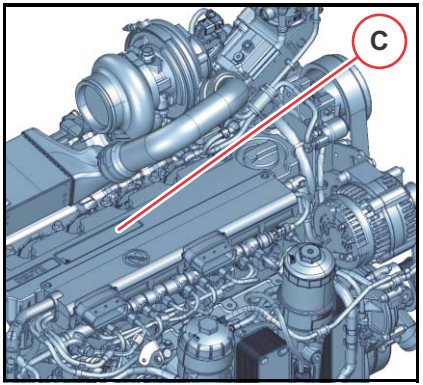
The engines of this operating manual may only be used with a functioning exhaust aftertreatment system.

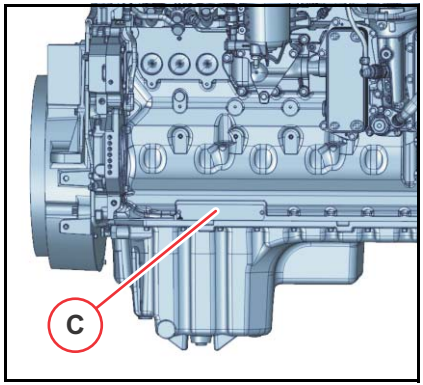


Rating plate

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

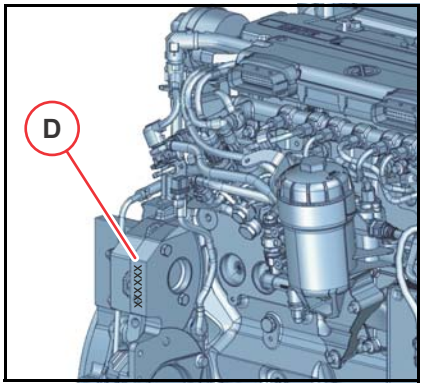
The engine type and number must be stated when purchasing spare parts.





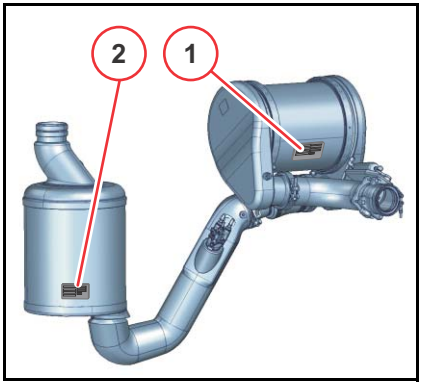
Location of the rating plate

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.

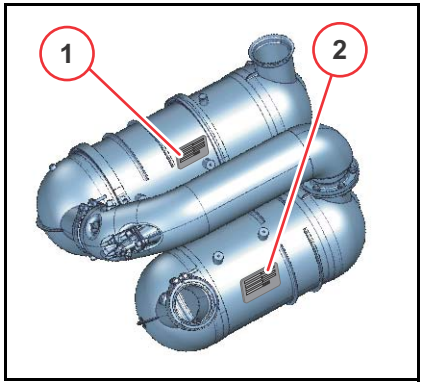


Serial numbers of the exhaust aftertreatment components

1 Rating plate of the diesel particle filter

2 Rating plate of the SCR catalyst

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

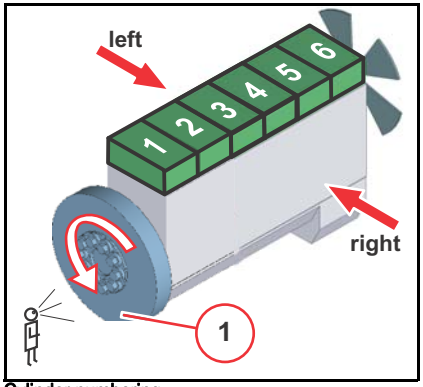


Serial numbers of the exhaust aftertreatment components

1 Rating plate of the diesel particle filter

2 Rating plate of the SCR catalyst

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).

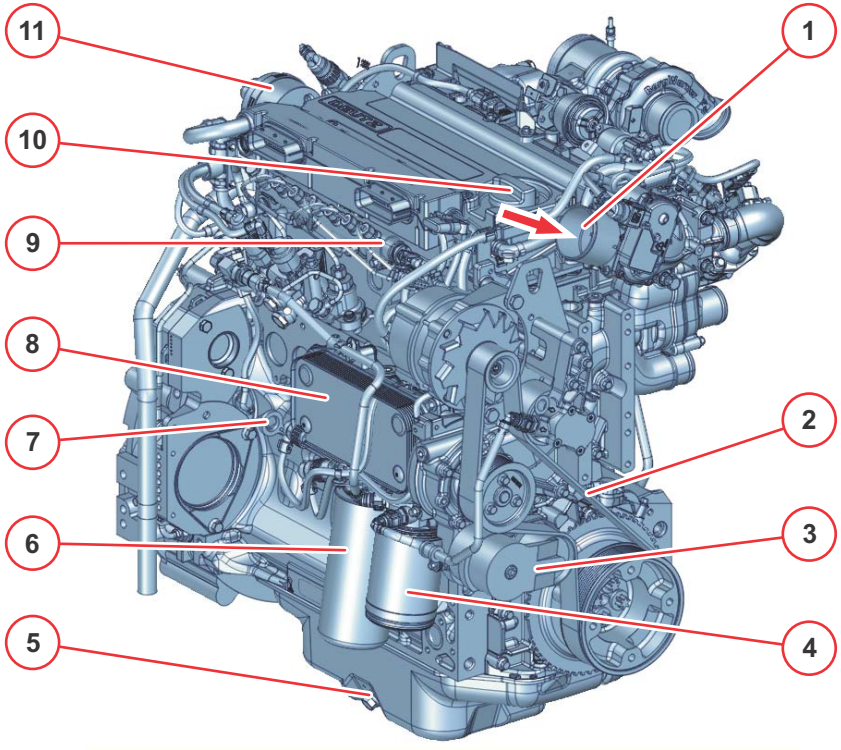
Direction of rotation

Looking onto the flywheel.

rotating to the left: counter-clockwise.

Engine sides

Looking onto the flywheel.

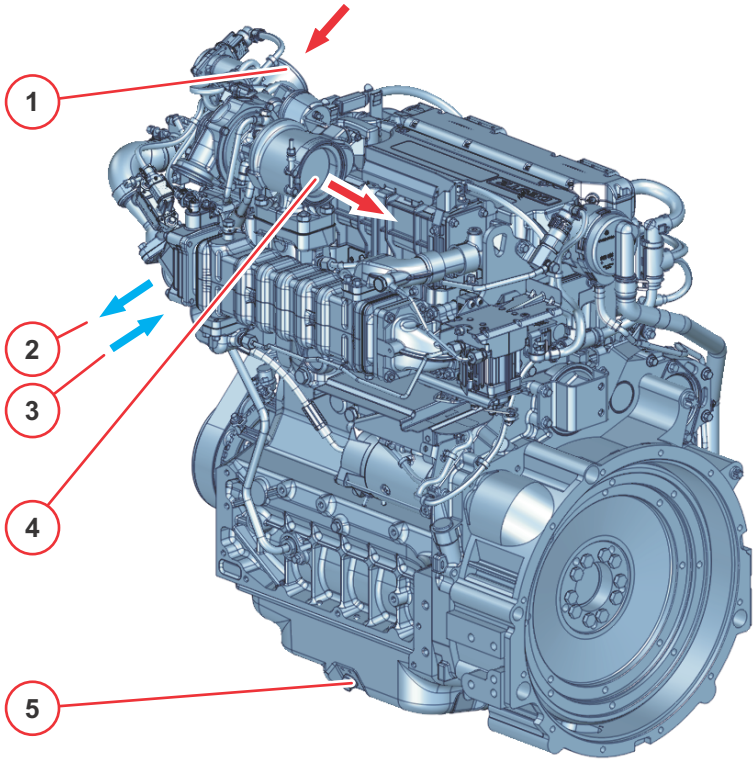


TCD 4.1 L4

Industrial engine

View from right (example)

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

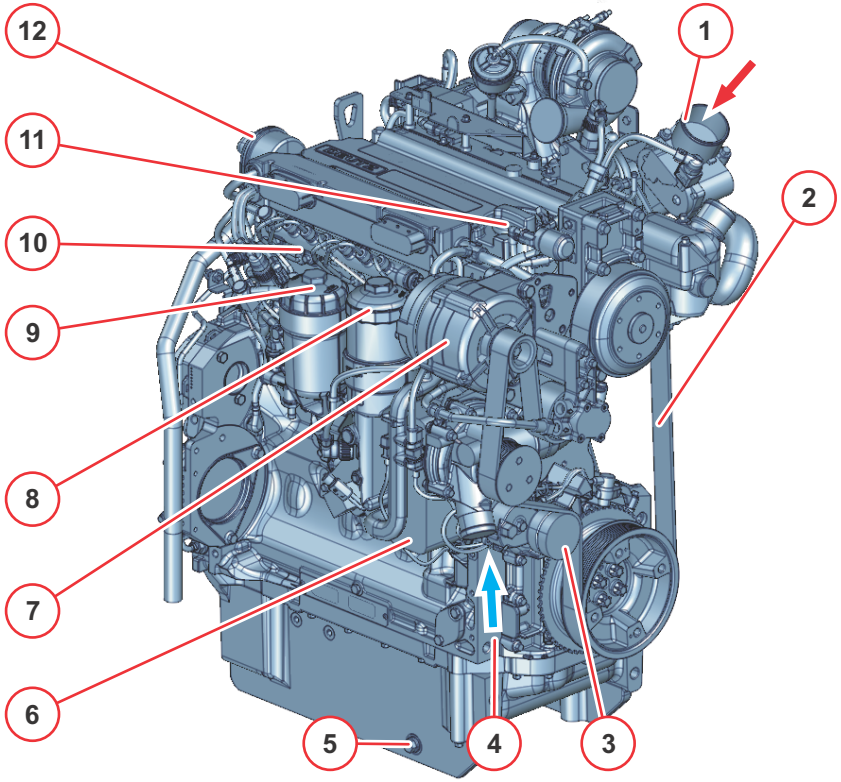


TCD 4.1 L4

Industrial engine

View from left (example)

1 Combustion air inlet
2 Coolant outlet
3 Coolant inlet
4 Exhaust outlet
5 Lubricating oil drain plug

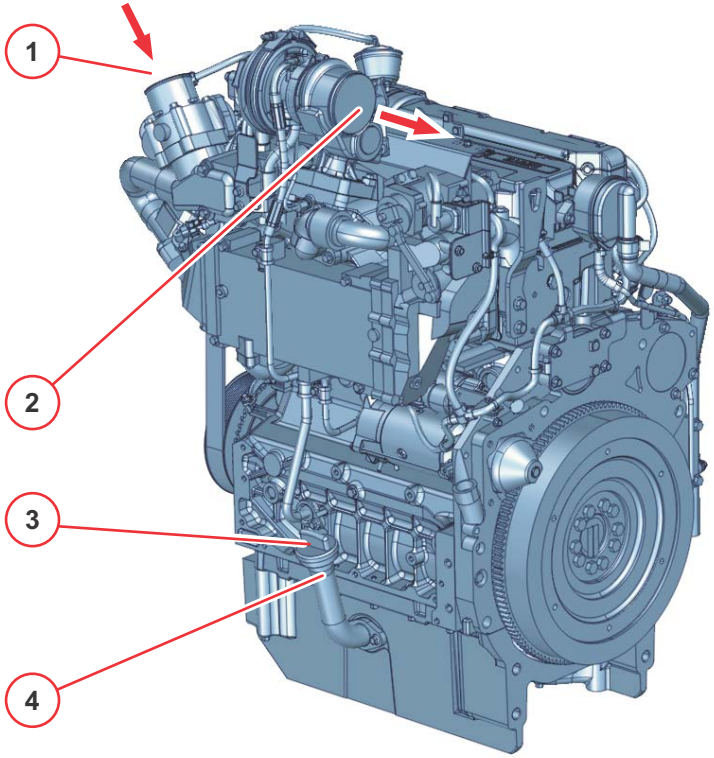


TCD 4.1 L4

Agricultural engine

View from right (example)

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

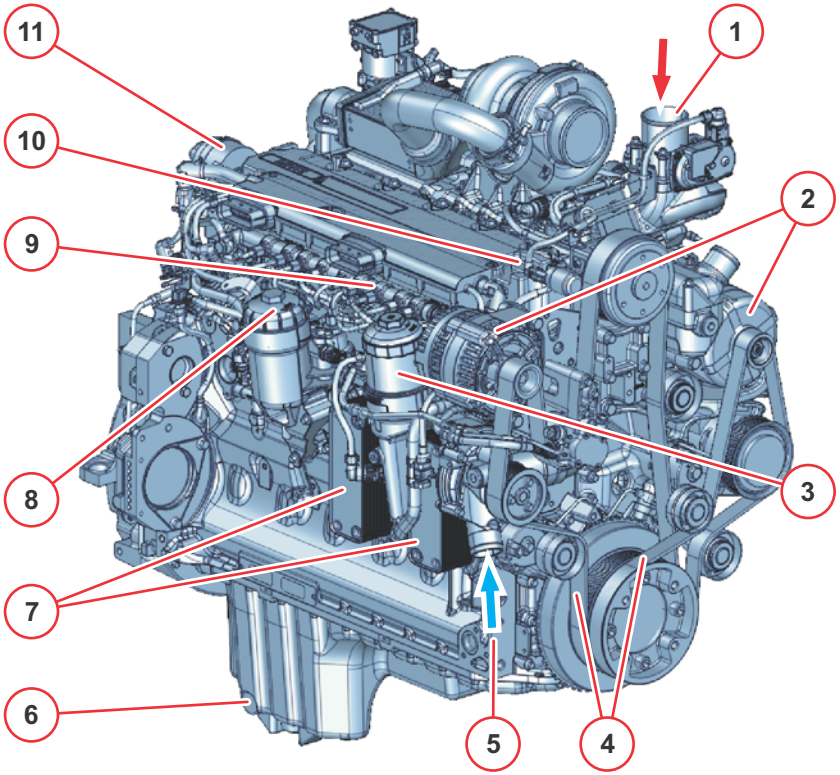


TCD 4.1 L4

Agricultural engine

View from left (example)

1 Combustion air inlet
2 Exhaust outlet
3 Lubricating oil dipstick
4 Lubricating oil filling

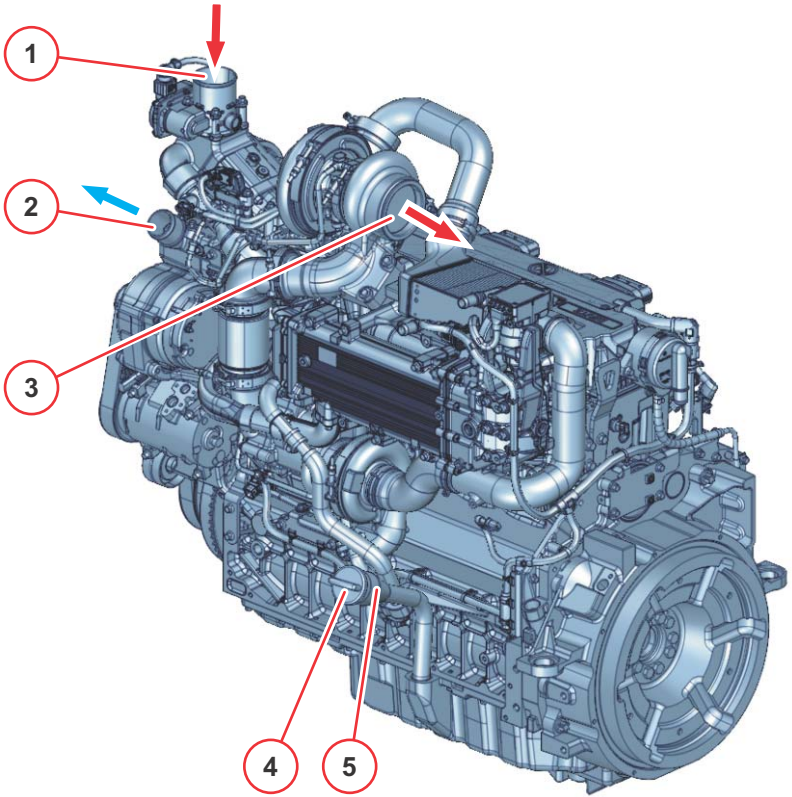


TTCD 6.1 L6

Agricultural engine

View from right (example)

1 Combustion air inlet
2 Generator
3 Lube oil replacement filter
4 V-rib belt
5 Coolant inlet
6 Lubricating oil drain plug
7 Lube oil cooler
8 Exchangeable fuel filter
9 Rail
10 Lubricating oil filling
11 Crankcase breather

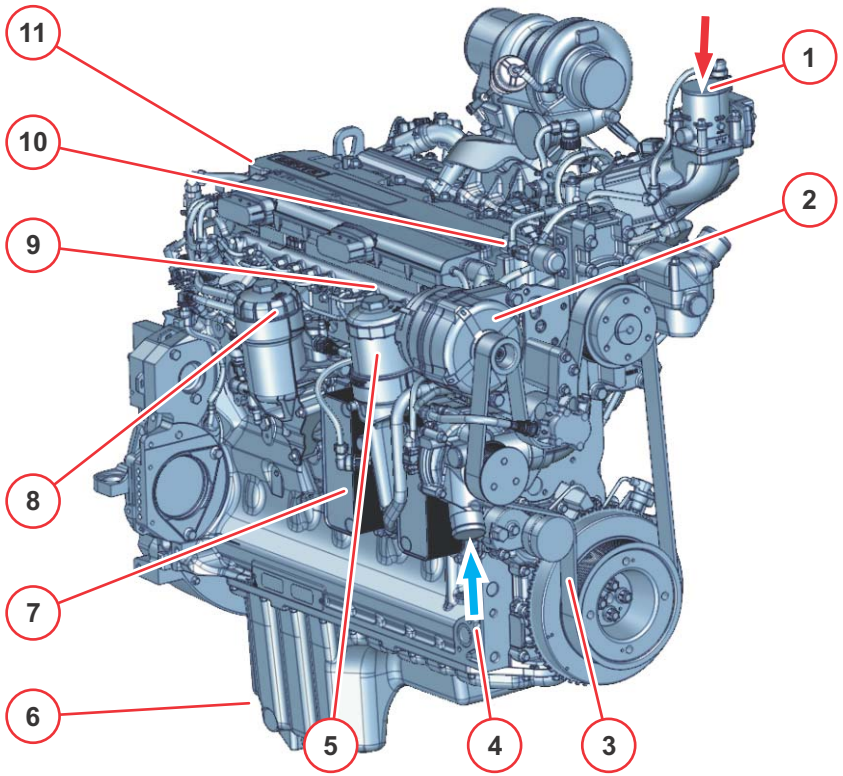


TTCD 6.1 L6

Agricultural engine

View from left (example)

1 Combustion air inlet
2 Coolant outlet
3 Exhaust outlet
4 Lubricating oil dipstick
5 Lubricating oil filling

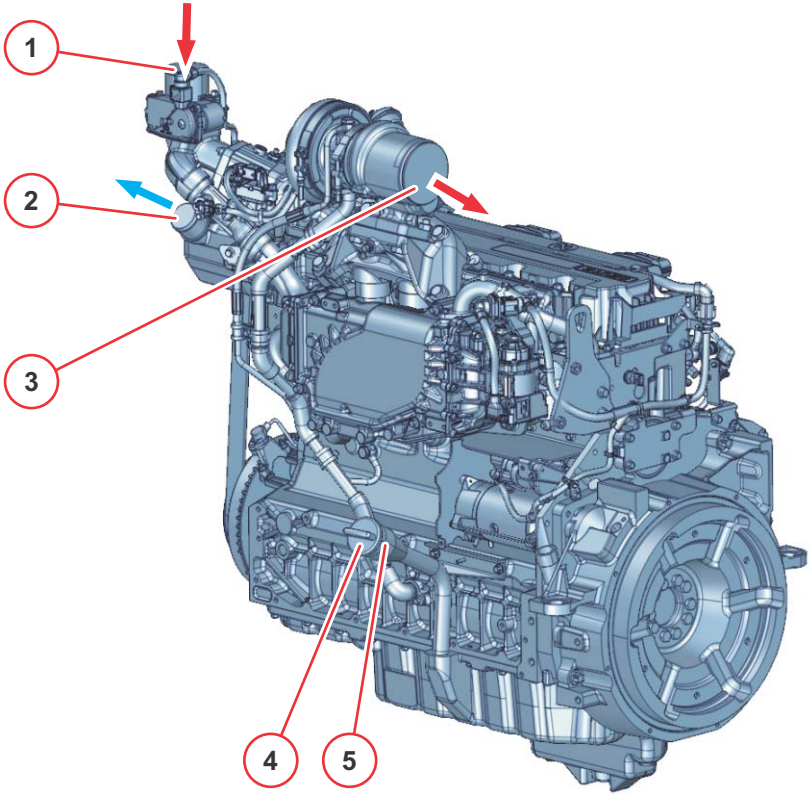


TCD 6.1 L6

Agricultural engine

View from right (example)

1 Combustion air inlet
2 Generator
3 V-rib belt
4 Coolant inlet
5 Lube oil replacement filter
6 Lubricating oil drain plug
7 Lube oil cooler
8 Exchangeable fuel filter
9 Rail
10 Lubricating oil filling
11 Crankcase breather

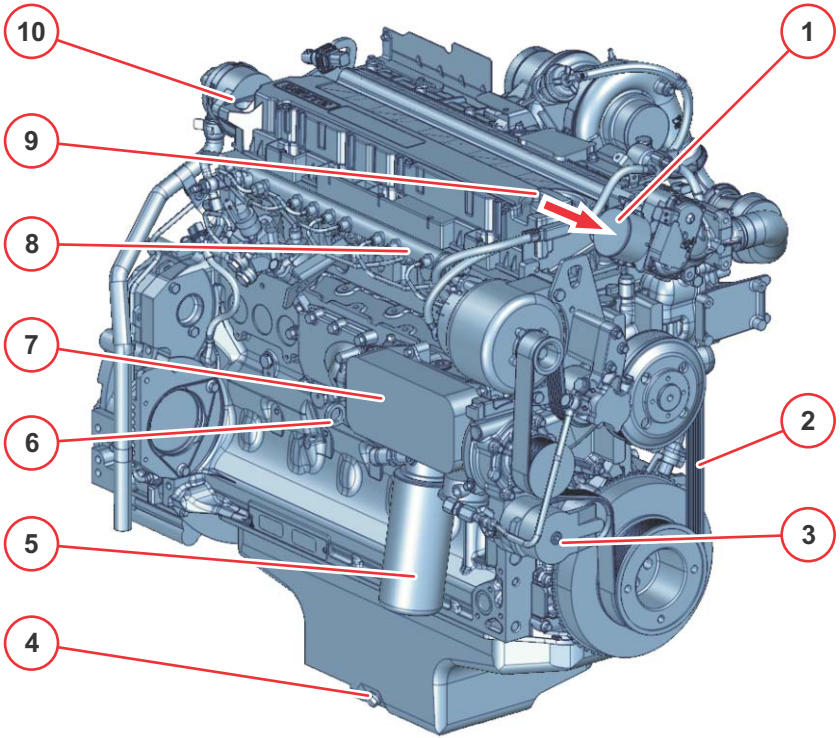


TCD 6.1 L6

Agricultural engine

View from left (example)

1 Combustion air inlet
2 Coolant outlet
3 Exhaust outlet
4 Lubricating oil dipstick
5 Lubricating oil filling

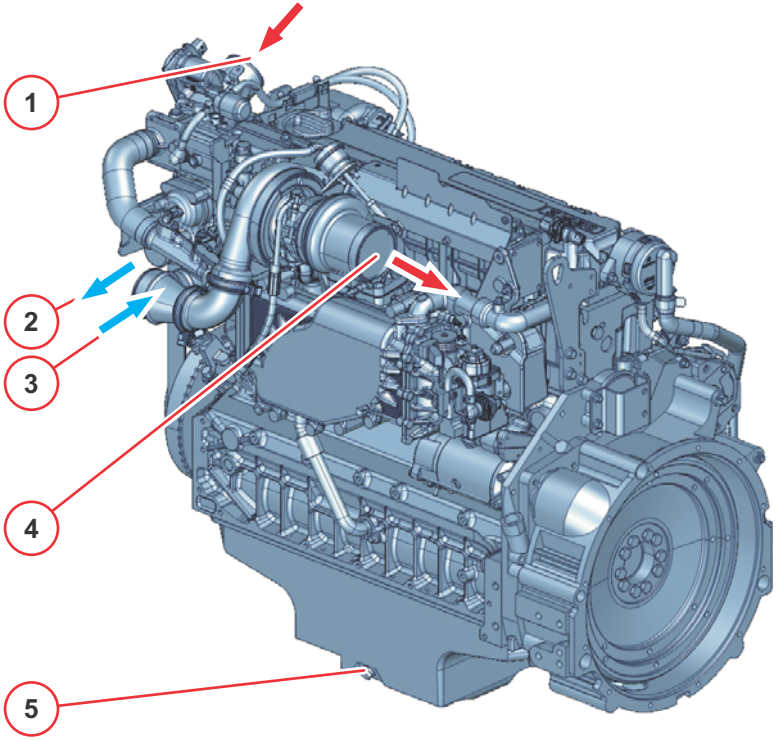


TCD 6.1 L6

Industrial engine

View from right (example)

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

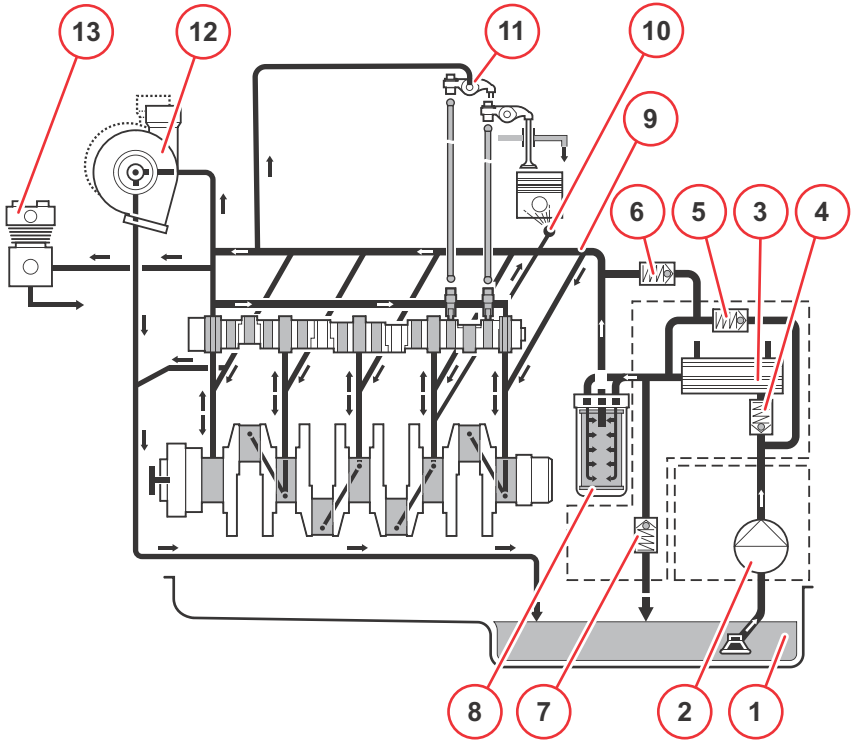


TCD 6.1 L6

Industrial engine

View from left (example)

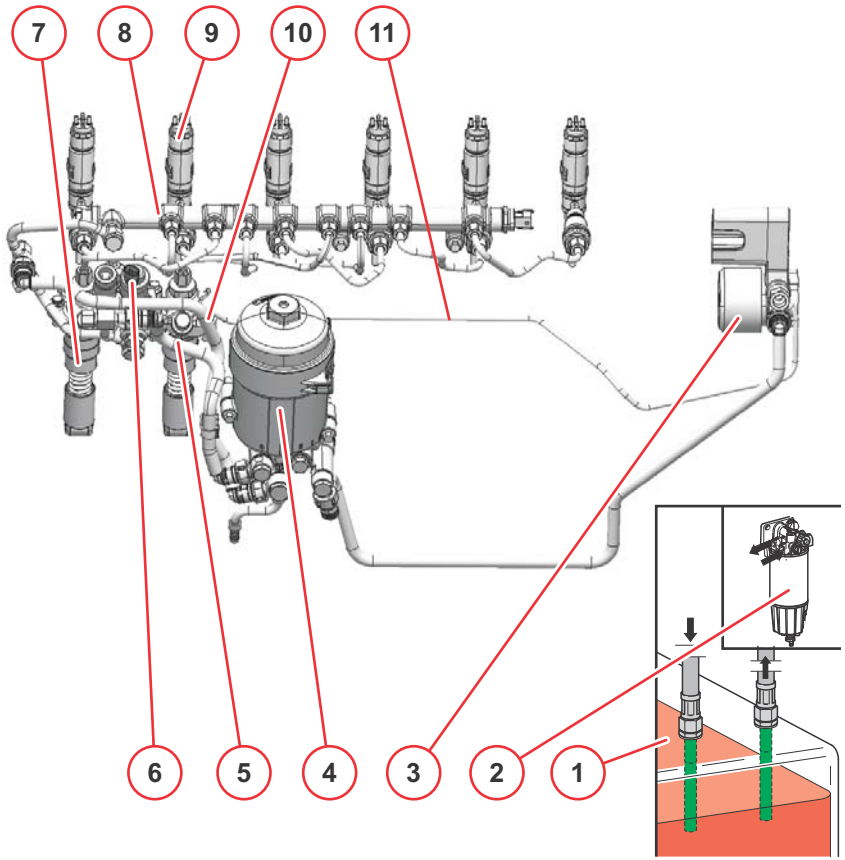
1 Combustion air inlet
2 Coolant outlet
3 Coolant inlet
4 Exhaust outlet
5 Lubricating oil drain plug



Lubricating oil system

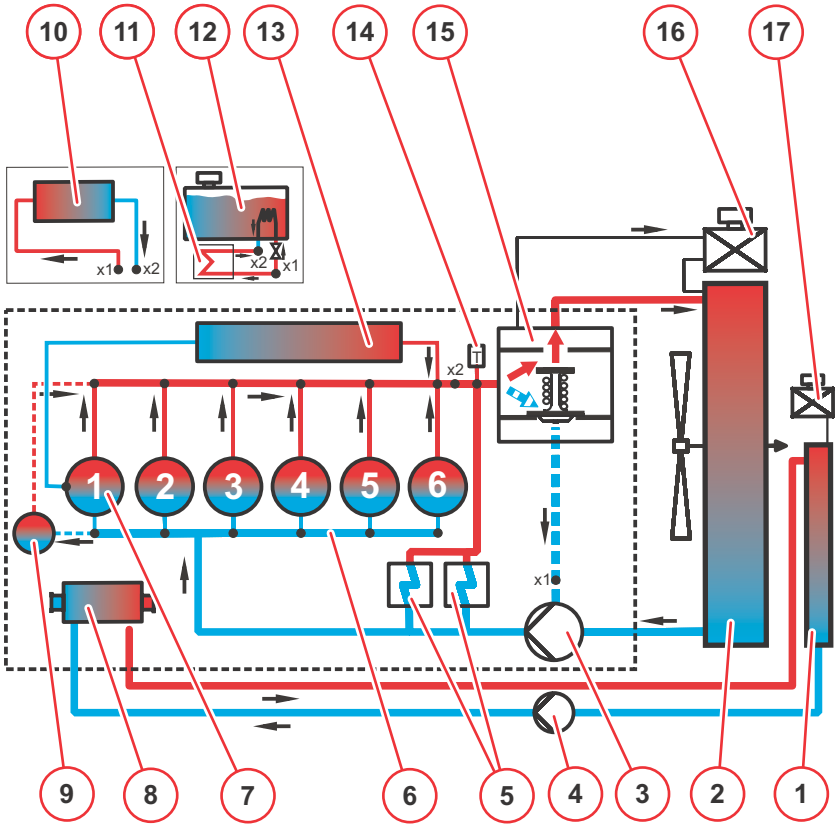
(example)

1 Lubricating oil sump
2 Lubricating oil pump
3 Lube oil cooler
4 Check valve
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)

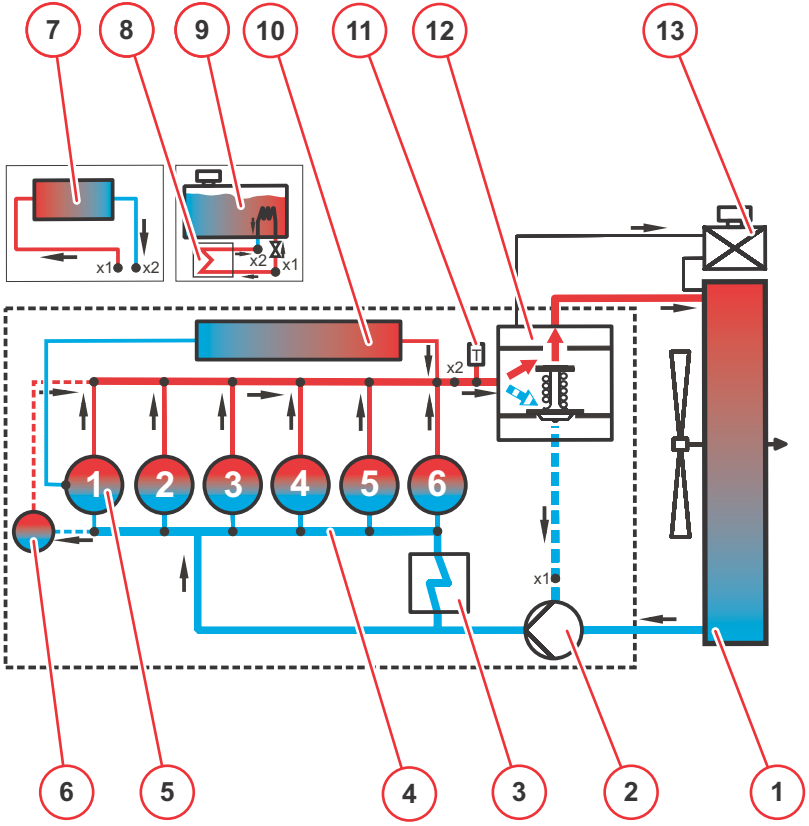
1 Fuel tank
2 Fuel pre-filter
3 Fuel pump
4 Exchangeable fuel filter
5 Fuel supply line to the control block FCU (Fuel Control Unit)
6 Control block FCU (Fuel Control Unit)
7 High-pressure pump
8 Rail
9 Injector
10 Fuel return to fuel tank
11 Return line



Coolant schematic (example)

Agricultural engine

1 Cooler
TTCD 6.1 L6
2 Cooler
3 Coolant pump
4 Electronic coolant pump
TTCD 6.1 L6
5 Lube oil cooler
6 Coolant supply for engine cooling
7 Cylinder pipe/head cooling
8 Charge air cooler
TTCD 6.1 L6
9 Air compressor
Optional
10 Connection possibility for cab heating
11 Metering module
12 AdBlue® tank
13 Exhaust return cooler
14 Temperature transmitter
15 Thermostat
16 Compensation tank
17 Compensation tank
TTCD 6.1 L6



Coolant schematic (example)

Industrial engine

1 Cooler
2 Coolant pump
3 Lube oil cooler
4 Coolant supply for engine cooling
5 Cylinder pipe/head cooling
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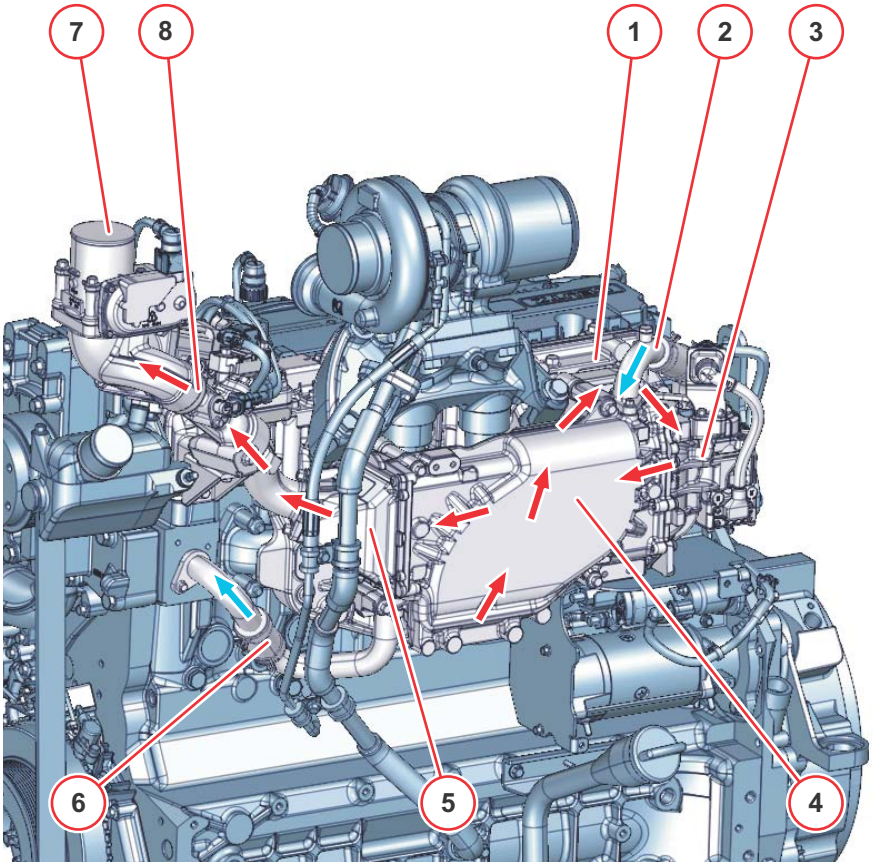
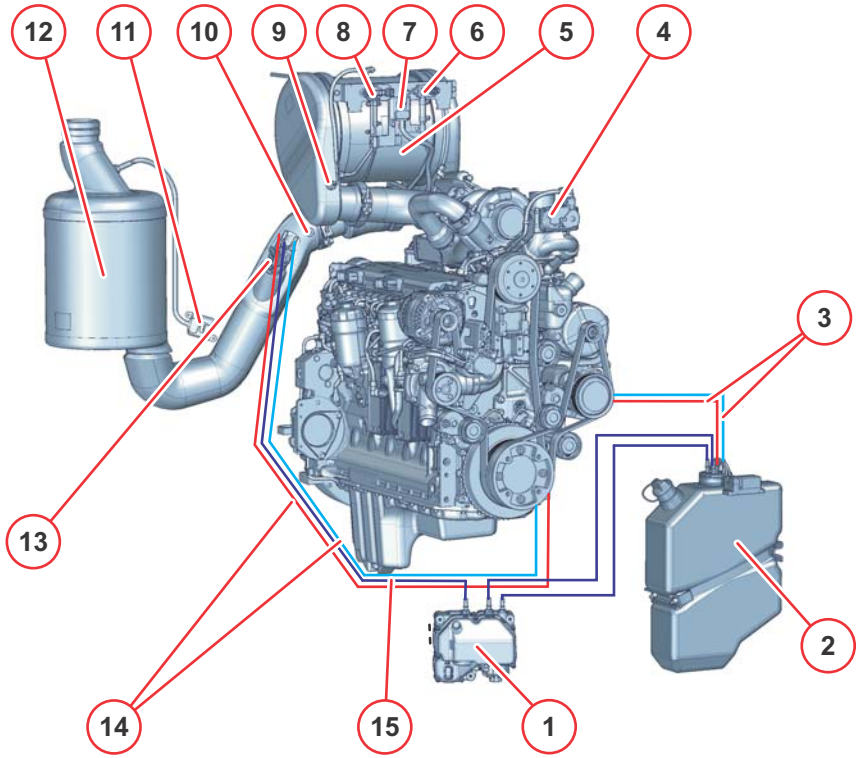


External exhaust gas recirculation

Example:

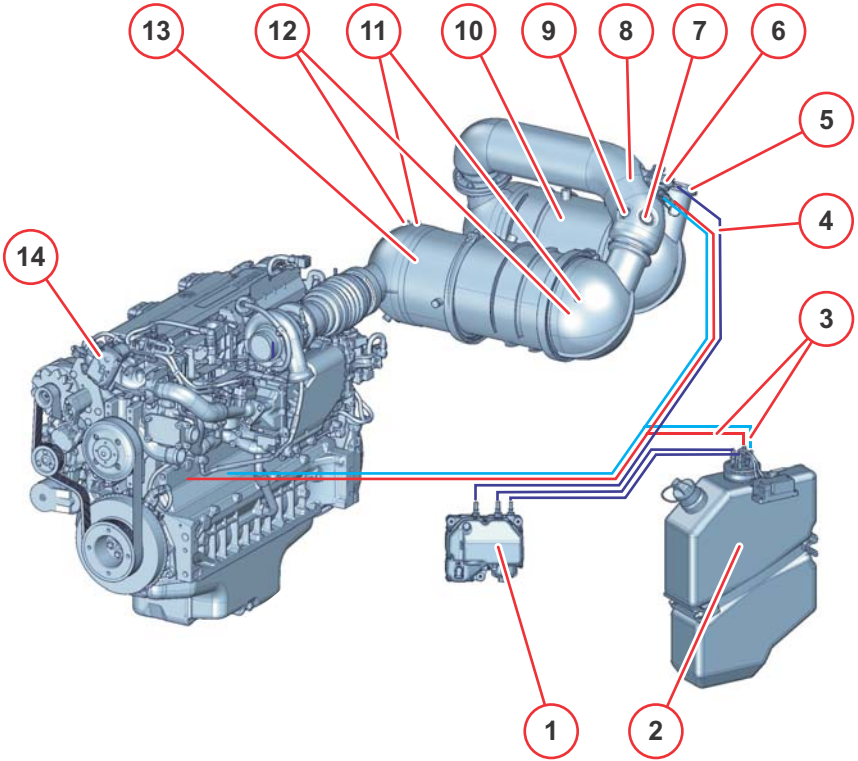
1 Exhaust gas partial flow (uncooled)
2 Coolant line to the EGR cooler
3 Actuator (electrically actuated)
4 Exhaust return cooler
5 Check valve
6 Coolant return to thermostat
7 Combustion air inlet
8 Exhaust gas partial flow (cooled)



Exhaust gas aftertreatment

Agricultural technology

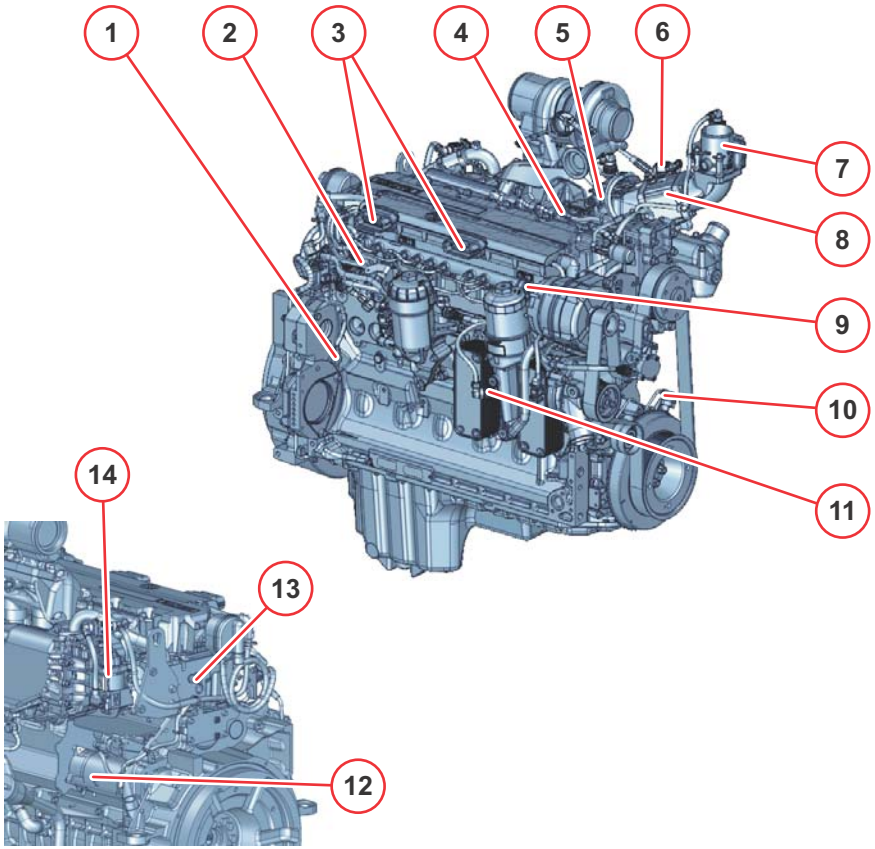
1 AdBlue® supply pump
2 AdBlue® tank
3 Coolant line
to pre-heat the AdBlue® tank
4 Throttle valve
5 Diesel particle filter
6 Pressure sensor
7 NO_X sensor
8 Differential pressure sensor
9 Exhaust temperature sensor
10 Pressure sensor
11 NO_X sensor
12 SCR catalytic converter
13 Dosing device
14 Coolant line
to cool the dosing device
15 AdBlue® line



Exhaust gas aftertreatment

Industrial engine

1 AdBlue® supply pump
2 AdBlue® tank
3 Coolant line
to pre-heat the AdBlue® tank
to cool the dosing device
4 AdBlue® line
5 NO_X sensor
6 Dosing device
7 NO_X sensor
8 Exhaust temperature sensor
9 Pressure sensor
10 SCR catalytic converter
11 Differential pressure sensor
12 Exhaust temperature sensor
13 Diesel particle filter
14 Throttle valve



Electronic engine control

Example:

1 Speed transmitter via camshaft
2 Control block FCU (Fuel Control Unit)
3 Central plug (for engine control)
4 Charge air pressure transmitter, charge air temperature transmitter
5 Exhaust gas backpressure sensor
6 Differential pressure flow meter
7 Throttle valve
8 Heating flange
9 Rail pressure sensor
10 Speed transmitter via crankshaft
11 Lubricating oil pressure transmitter
12 Starter
13 Coolant temperature transmitter
14 EGR actuator

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 permamently 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.

Nominal value sensors (pedal position sensors) required for vehicle operation must be connected to the cable harness on the vehicle side and calibrated using the DEUTZ diagnostic program SERDIA (SERvice DIAgnosis). Wiring and cable assignment of the cable harness on the vehicle side can be taken from the connection diagram of DEUTZ-Application Engineering.

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

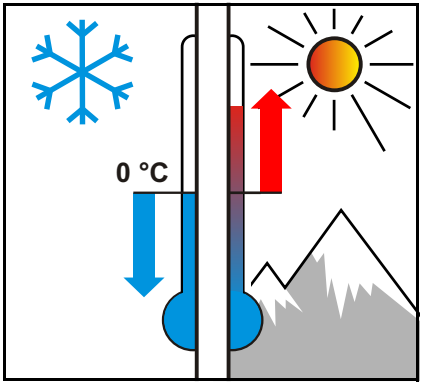
DEUTZ control units are equipped with self-diagnostics. Active and passive error entries are saved in the error memory. Active errors are displayed on error lamps/diagnostics lamps (81).

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 (50).

Battery

- A good charging condition of the battery (74) 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.(33)

Coolant

- Observe the mixing ratio anti-freeze/cooling water. (51)

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.

- Application at high altitude
- Application at high ambient temperatures

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:
  - 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.

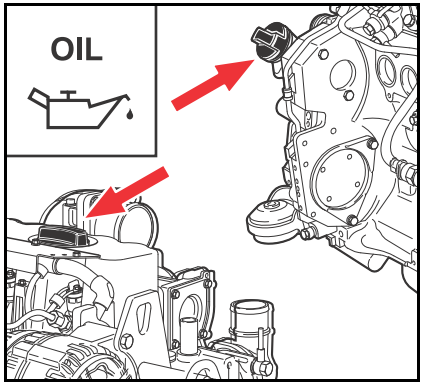
Preparations for initial commissioning

(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 (70).
- 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 (88).

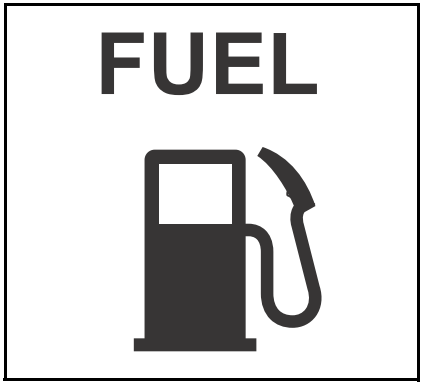


Fill with engine lube oil

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 (88).



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.

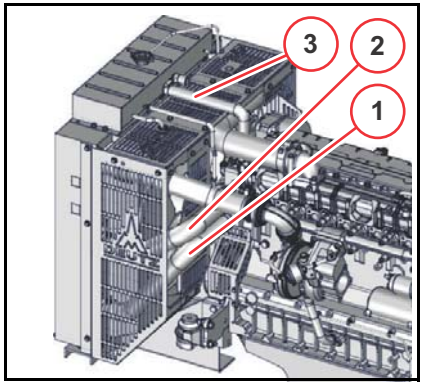
- The fuel low pressure system must be vented before the first start-up after filling with the manualy supply pump.

Only use clean commercially available brand diesel fuel. Observe fuel quality (50).

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

Filling with AdBlue®

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 and a not emmission compliant operation.
If you have filled with e.g. diesel and this has got into the system, the complete AdBlue® injection system must be replaced!
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 the coolant outlet (2) and coolant inlet (1) to the cooling system. Connect lead pipe (3) from the compensation tank to the coolant pump or to the coolant inlet pipe (1).
- 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.
- Switch on any available heating and set to the highest level so that the heating circuit is filled and vented.
- 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 (88).

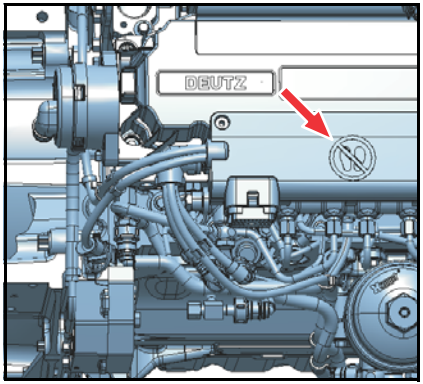
Trial run

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.



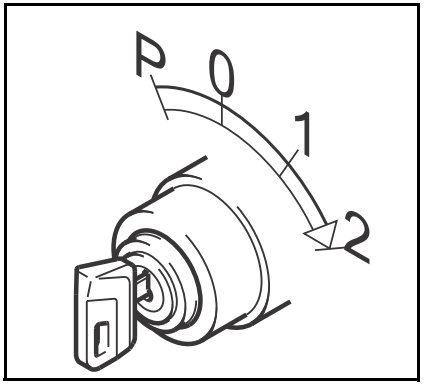
Do not subject the covers to loads.

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 cancelled by switching off the system with the ignition key for approx. 2 min.
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 (76).
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.
  - Engine is ready for operation.
- Below the temperature specified in the electronic engine control, the pre-heating phase begins with turning on the ignition.
- The electronic engine control controls and activates the current feed to the glow plugs via the engine coolant temperatures.
- Push the key in and turn further clockwise against spring pressure.
  - Level 2 = start.
- release the key as soon as the engine starts up.
  - The pilot lamps will go out.

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

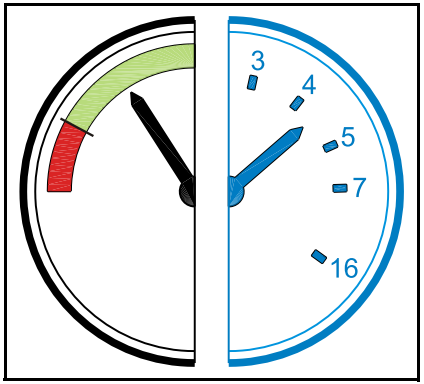
The statuses are displayed by the error lamp.

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 with power reduction 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 switching off the system with the ignition key for approx. 2 min.
  - If necessary, additional indicator lamps are switched on, e.g. for lubricating oil pressure or the coolant temperature.
  - optionally 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 approved in collaboration with the device manufacturer and DEUTZ-Application Engineering and can be individually configured. This is why the operating manual of the device manufacturer must be observed.



Display instrument

Possible displays:

- Colour scale
  - Display of operating state by coloured areas:
  - green = normal operating state
  - red = critical operatng state
    Take suitable action.
- Measured value scale
  - Actual value can be read off directly. The nominal value should be taken from the Technical Data (88).

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	Lubricating oil pressure below minimum	Switch off engine
	Lube oil level	Lubricating oil level too low	Fill up lube oil
	Coolant level	Coolant level 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 (88).

Instruments/symbols	Designation	Possible display:	Measure
	SCR function lamp	Continuous light flashes (0.5 Hz) flashes (1 Hz) flashes (2 Hz)	Check AdBlue® filling level Check SCR system 39
	Regeneration lamp	Continuous light flashes (0.5 Hz) flashes (3 Hz)	Initiate standstill regeneration 39
	Ash lamp	Continuous light	The ash lamp indicates, that the loading of the diesel particle filter with incombustible residues has reached a critical level and must be replaced. 44
	Engine warning lamp	Continuous light Flashing	In combination with the SCR function lamp Check AdBlue® filling level Check SCR system 39 In combination with the DPF function lamp Initiate standstill regeneration 44

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.

- 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
- 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.

Selective Catalytic Reduction (SCR)

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

The DEUTZ SCR system continuously reduces the NOx emissions from the engine (NOx=nitric oxides).

A reduction agent, AdBlue®, injected into the exhaust system reacts in the SCR catalytic converter with the NOx emissions in the exhaust gas and reduces these to nitrogen (N2) and water (H2O).

The injected volume of AdBlue® is controlled by the engine electronics.

Warning strategy SCR system

The display and monitoring of the exhaust aftertreatment system can be executed either with pilot lights or with a CAN interface and a corresponding display, depending on the engine version.
Please see the device manufacturer's operating manual.

In order to comply with the regulations of the European Union (EU) and the Environmental Protection Agency (EPA), the DEUTZ SCR system reacts with a warning strategy to faulty operation of the exhaust gas aftertreatment system.

Emission-relevant faults are:

- AdBlue® filling level
- Catalytic converter efficiency/Adblue® quality
- Manipulation
- System fault

An acoustic signal must sound in case of a fault. If a DEUTZ display is used, this has an appropriate signal.
An acoustic signal transmitter must be installed additionally if an SCR function lamp or customer display is used.

Power reduction

If a serious fault occurs or a fault is not remedied, the system reacts by reducing the engine performance.

There is a one or two-stage performance reduction depending on the type of fault.

Power reduction	
Stage 1	Torque reduction
Stage 2	Torque reduction + Engine speed limitation

Bridging of the power reduction

A separate emergency switch has been provided, in order to temporarily disable power reductions caused by the EAT system.

This function is available for a limited period and is expected to enable the user to move the machine to a safe location.

This function is available for engines with power reduction levels 1 and 2, in accordance with EU legislation, and with power reduction level 1, in accordance with EPA legislation.

Standstill regeneration

Temperatures of approx. 600 °C occur on the exhaust pipe during regeneration.
A special engine operating state becomes active during standstill regeneration and the machine is not allowed to be used during the active standstill regeneration.
Danger of burns!

The SCR system is monitored for possible formation and build-up of crystals (crystalisation)

As soon as crystalisation is detected, a standstill regeneration request is issed.

This is displayed by a flashing regeneration lamp.

The standstill regeneration must be initiated by the operator.

It is recommended that standstill regeneration be undertaken as soon as possible.

If standstill regeneration is not undertaken, the engine control unit will activate the specified engine protection functions.

Every standstill regeneration slightly dilutes the engine oil with fuel. The number of standstill regenerations is therefore monitored..

AdBlue ® filling level

Warnings begin from an AdBlue® filling level below 15 %.

AdBlue® filling level	SCR function lamp	Engine warning lamp	DEUTZ CAN display	Power reduction	
				EU	EPA
<15 %	Continuous light	off	SCR symbol Text message	None	None
<10 %	flashes (0.5 Hz)	off	SCR symbol Text message	None	None
<5%	flashes (0.5 Hz)	Continuous light Acoustic signal	SCR symbol Text message Acoustic signal	None	None
<5% ≥ 10 min	flashes (1 Hz)	Continuous light Acoustic signal	SCR symbol Text message Acoustic signal	Stage 1	None
<5% ≥ 15 min	flashes (2 Hz)	Flashing Acoustic signal	SCR symbol Text message Acoustic signal	Stage 1	None
<5% ≥ 20 min	flashes (2 Hz)	Flashing Acoustic signal	SCR symbol Text message Acoustic signal	Stage 2	Stage 2

Catalytic converter efficiency/Adblue® quality

If the catalytic converter efficiency (conversion rate) is too low, warnings are sent to the SCR function lamp or optionally to the CAN display despite previous refuelling. Warnings are also given due to use of the wrong reduction agent.

Catalytic converter efficiency/Adblue® quality	SCR function lamp	Engine warning lamp	DEUTZ CAN display	Power reduction	
				EU	EPA
too low	Continuous light Acoustic signal	Continuous light	SCR symbol Text message Acoustic signal	Stage 1 After pre-warning time	None
too low not remedied	Continuous light Acoustic signal	Flashing	SCR symbol Text message Acoustic signal	Stage 2 After pre-warning time	Stage 2 After pre-warning time

Manipulation

If the system detects a manipulated part or use of the wrong reduction agent, the performance is reduced. The performance is reduced in stages and depends on the motor performance.

Manipulation	SCR function lamp	Engine warning lamp	DEUTZ CAN display	Power reduction	
				EU	EPA
detected	Continuous light Acoustic signal	Continuous light	SCR symbol Text message Acoustic signal	Stage 1 After pre-warning time	None
not remedied	Continuous light Acoustic signal	Flashing	SCR symbol Text message Acoustic signal	Stage 2 After pre-warning time	Stage 2 After pre-warning time

System fault

System faults may be faults of individual SCR components such as the implausible value of a No_x or temperature sensor. The performance is reduced if the AdBlue® injection is impaired by a system fault.

System fault	SCR function lamp	Engine warning lamp	DEUTZ CAN display	Power reduction
detected	Continuous light Acoustic signal	Flashing	SCR symbol Text message Acoustic signal	None
detected ≥ 10min	Continuous light Acoustic signal	Flashing	SCR symbol Text message Acoustic signal	Stage 2

Crystalisation

Crystalisation results when the engine's workload is too low, or its operating times are too short.

System fault	Regeneration lamp	Engine warning lamp	DEUTZ CAN display	Power reduction
detected Standstill regeneration required	flashes (0.5 Hz)	off	Text message Acoustic signal	None
detected Standstill regeneration required	flashes (0.5 Hz)	Continuous light	Text message Acoustic signal	Stage 1
detected Standstill regeneration required	flashes (3 Hz)	Flashing	Text message Acoustic signal	Stage 2

Diesel oxidation catalytic converter

The diesel oxidation catalytic converter has a catalytic surface which is used to convert the pollutants in the exhaust gas into harmless substances. Here, carbon monoxides and unburned hydrocarbons are made to react with oxygen and converted into carbon dioxide and water. In addition, the nitrogen monoxides are converted to nitrogen dioxides.

Temperatures > 250 °C are necessary for a high degree of efficiency.

Diesel particle filter

The combustion of diesel fuel results in soot, which is separated in the diesel particle filter. This must be regenerated as the contamination with soot increases. That means that the soot in the diesel particle filter is burned.

The regeneration is based on a continuous regeneration process, which is activated as soon as the exhaust temperature of 250 °C is exceeded at the inlet of the exhaust gas aftertreatment system. The filter contamination with soot is monitored continuously by the engine control unit.

Regeneration

The passive particle filter system burns the soot in the filter with the nitrogen oxides in the exhaust which are oxidised in the DOC beforehand. This process runs continuously once the exhaust temperature has exceeded 250°C. The passive particle filter system does not contain a burner. A prerequisite for the passive continuous regeneration is having a sufficient ratio of nitrogen oxides to soot in the raw exhaust gas of the engine.

Normal operation

Under normal operating conditions (exhaust temperature > 250 °C), the filter contamination with soot remains in a permissible range and no actions are necessary.

The regeneration lamp is off.

Support mode

During this operating state, an acoustic change occurs to the running of the engine.

If the operating conditions of the engine do not permit any passive regeneration, the contamination of the diesel particle filter with soot will increase.

A throttle valve controlled via the engine control unit is located in the combustion air inlet. This is used to increase the exhaust gas temperature for regeneration of the diesel particle filter, if this is not reached during normal operation.

This can be the case if:

- The engine only has short operating times.
- The engine workload is not high.

This process is automatically activated by the engine control unit, the operator does not need to perform any actions.

The regeneration lamp is off.

Power reduction

If a serious fault occurs or a fault is not remedied, the system reacts by reducing the engine performance.

There is a one or two-stage performance reduction depending on the type of fault.

Power reduction	
Stage 1	Torque reduction
Stage 2	Torque reduction + Engine speed limitation

Bridging of the power reduction

A separate emergency switch has been provided, in order to temporarily disable power reductions caused by the EAT system.

This function is available for a limited period and is expected to enable the user to move the machine to a safe location.

This function is available for engines with power reduction levels 1 and 2, in accordance with EU legislation, and with power reduction level 1, in accordance with EPA legislation.

Standstill regeneration

Temperatures of approx. 600 °C occur on the exhaust pipe during regeneration.
A special engine operating state becomes active during standstill regeneration and the machine is not allowed to be used during the active standstill regeneration.
Danger of burns!

If the support mode does not attain an adequate reduction of the soot contamination, the filter will continue to become contaminated with soot and a standstill regeneration will be necessary.

This is displayed by a flashing regeneration lamp.

The standstill regeneration must be initiated by the operator.

We recommend carrying out a necessary standstill regeneration as quickly as possible, as otherwise the diesel particle filter will continue to become contaminated with soot.

If the standstill regeneration is not carried out, the engine control unit will activate the specified engine protection functions, depending on the contamination of the diesel particle filter.

Every standstill regeneration slightly dilutes the engine oil with fuel. The number of standstill regenerations is therefore monitored..

Implementation of the standstill regeneration

The engine must be brought into a "safe state" for the regeneration:

- Shut down the engine on an open terrain at a safe distance to flammable objects.
- Warm up the engine; the coolant temperature must reach at least 75°C.
- Operate the engine in idling.
- The engine control unit now requires a signal indicating that the unit is safely parked (stationary signal).
  This occurs,depending on the application, for example by:
  - Activating the parking brake.
  - Engaging a specified gear position in the gearbox.
- Operating the release button.
  Position depends on application, see device manual.

The regeneration lamp lights up continuously.

Once the standstill regeneration has been released, the engine automatically increases the speed level.

Using the device during standstill regeneration is

prohibited.

The regeneration lasts 35 to 40 minutes on average.

The standstill regeneration can be interrupted at any time by pressing the regeneration button again or by removing the regeneration release.

Using the device during standstill regeneration also leads to it being interrupted.

The request for standstill regeneration remains until it is completed without interruption.

Certain engine faults lead to excessive carbon emission which cannot be seen due to the diesel particle filter.

In such cases, the diesel particle filter can be loaded very quickly, among other things, to a level which no longer allows a standstill regeneration by the operator.

Very short intervals between two standstill regenerations (<10h) can be an indication of such a defect.

Please contact the DEUTZ service.

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

If the standstill regeneration request is not observed and the DPF is overloaded to an impermissible level, then the filter can only be regenerated via the DEUTZ service.

Replacing the diesel particle filter

It may be necessary to replace the diesel particle filter after a high filter running time as non-combustible residues accumulate in the filter - so-called ash.

If the ash loading goes beyond a certain level, this will be indicated by the ash lamp.

The diesel particle filter needs to be replaced.

The machine can operate normally until the replacement is carried out by the service.

The time interval between two regeneration requests is shortened in proportion to the run time.

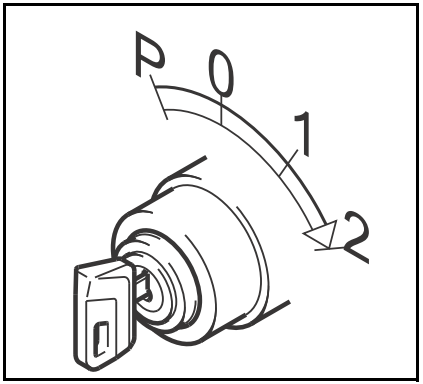
Please contact your DEUTZ partner

DEUTZ particle filters come with a catalysing coating, so require a special cleaning procedure to prevent damage to the coating. The DEUTZ filter replacement programme guarantees that the filter medium is properly cleaned, and the medium fully functions and performs as if it were a new part!

Display of the regeneration control

The display and monitoring of the exhaust aftertreatment system can be executed either with pilot lights or with a CAN interface and a corresponding display, depending on the engine version.

Instruments/symbols			Power reduction	Remark
 Regeneration lamp	 Engine warning lamp	 Ash lamp		
off	off	off		Normal operation
off	off	off		Support mode
flashes (0.5 Hz)	off	off		Standstill regeneration required Approval by the operator required
flashes (0.5 Hz)	Continuous light	off	Stage 1	Standstill regeneration required Approval by the operator required
flashes (3 Hz)	Flashing	off	Stage 2	Please contact your DEUTZ partner
Continuous light	off	off		Standstill regeneration
off	off	Continuous light		100% ash load Please contact your DEUTZ partner
off	off	Flashing		105% ash load Please contact your DEUTZ partner
off	Continuous light	Flashing	Stage 1	110% ash load Please contact your DEUTZ partner



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.

- Move the key to position 0.
  P = gear position: park
  0 = gear position: switch off engine
  1 = gear position: Ignition on
  2 = gear position: start engine

Lag time

The control unit remains active for about another 40 seconds to save the system data (lag) and then switches off automatically.
For engines with an SCR system, this process can take up to 2 minutes as the SCR lines must be pumped until empty.
For this reason, the power supply to the engine must not be suddenly interrupted by the breaker.

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 lubricating 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 vicosity. 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).

or see www.deutz.com

http://www.deutz.com	
de	\SERVICE \Betriebsstoffe und Additive**D**eutz **Q**uality **C**lass**DQC-Freigabeliste**
en	\SERVICE \Operating Liquids and Additives**D**eutz **Q**uality **C**lass**DQC Release List**

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

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

Permissible quality class
DQC III **LA**
DQC IV **LA**

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 LA low-ash DEUTZ Oil Rodon 10W40 Low SAPS	
Container	**Order number:**
20 litre canister	0101 7976
209 litre barrel	0101 7977

Lubricating oil change intervals

- The intervals depend on:
  - lubricating oil quality
  - sulphur content in the fuel
  - type of application of engine
  - Number of standstill regenerations
- 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.

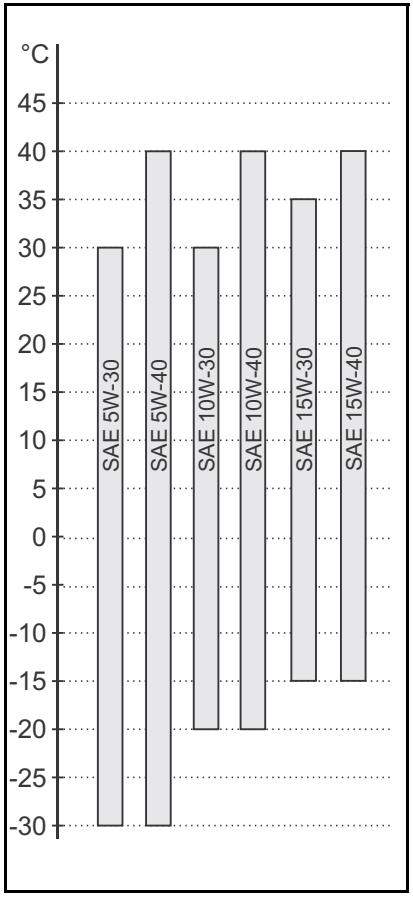
Viscosity

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. Oils suitable for multiple ranges must always be used.

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

The following fuel specifications / standards are approved:

- Diesel fuels
  - 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
  - in EN 590 quality

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

or see www.deutz.com

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] [mg/l]		3,56 356	D 1126
	[°dGH]		20,0	-
	[°e]		25,0	
	[°fH]		35,6	

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).
- **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.
Observe the notes on the safety data sheet.

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.

Products released are recorded according to the following DEUTZ cooling system protection specifications.

DEUTZ cooling system corrosion protection agent	
Specifications	**Observations**
DQC CA-14	siliceous on the basis of MEG
DQC CB-14	free of silicates on the basis of organic acids (OAT) and MEG
DQC CC-14	free of silicates on the basis of organic acids (OAT) and MEG

DEUTZ cooling system corrosion protection agent	
Container	**Order number:**
5 litre container	0101 1490
20 litre canister	0101 6416
210 litre barrel	1221 1500

The DEUTZ cooling system protection agent corresponds to the quality class DEUTZ DQC CA-14

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**

4

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 percentage	Water percentage	Cold protection up to
min. 35 %	65 %	-22 °C
40 %	60 %	-28 °C
45 %	55 %	-35 °C
max. 50 %	50 %	-41 °C

At temperatures below -41 °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.
Observe the notes on the safety data sheet.

Exhaust aftertreatment systems	
SCR	Selective Catalytic Reduction

AdBlue® is a highly-pure, acqueous, 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 must correspond to the DIN 70070, ISO 22241-1 or ATSTM D 7821.

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®	
Container	Order number:
10 litre canister	0101 7982
210 litre barrel	0101 7983

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 4.1 L4 / TCD 6.1 L6 / TCD 6.1 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)] 3)
E40	Extended maintenance I		1.000[3)]
E50	Extended maintenance II	Authorised specialists	2.000[3)]
E55	Extended maintenance III		4.000[3)]
E60	Intermediate overhaul		6.000[3)]
E70	General overhaul		8.000 [3)] 4)

Observations	
1)	The lubricating oil load may be high depending on the application. The lubricating oil change interval must be halved here (48).
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.

General overhaul	
4)	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.

Maintenance measures

Stage	Activity	Measure	Page
E10		The measures are listed in chapter 3.	30
E20	Check	Lubricating oil level (if necessary top up)	57
		Coolant level (top up if necessary)	31
		Check engine for leak tightness and damage (visual inspection)	
		Exhaust system including exhaust aftertreatment components for leaks	39
		Suction air filter/dry air filter (maintain in accordance with maintenance indicator)	69
	Empty	Emptying of the water tank in the fuel pre-filter	63
E30	Check	V-belts	70
		Coolant (additive concentration)	65
	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.	48/57
		Lubricating oil filter/insert (every time the lubricating oil is changed)	58
		Filtercartridge of the AdBlue® supply pump	64
E40	Check	Charge air cooler entry area (drain lube oil/condensate)	
		Battery and cable connectors	74
		V-rib belt and tensioning pulley	70
		Engine mounting (tighten, replace if damaged when necessary)	
		Fastenings, hose unions / clips (renew if damaged)	
	Replace	Fuel filter cartridge	61
		Fuel pre-filter with water trap. If the warning system is activated (lamp/horn), the water trap bowl must be emptied immediately.	63
		Suction air filter/dry air filter (maintain in accordance with maintenance indicator)	69
E50	Settings	Valve clearance	72
E55	Replace	V-rib belt and tensioning pulley	70
E60	Replace	Crankcase breather valve	
	Clean	Turbocharger compressor outlet	

Stage	Activity	Measure	Page
annually	Check	Engine monitor, warning system Maintenance only to be carried out by authorised service personnel	
	Replace	Fuel filter cartridge	61
		Fuel pre-filter	63
		Lubricating oil	57
		Lubricating oil filter/insert (every time the lubricating oil is changed)	58
Every 2 years	Replace	Dry air filter	69
		Coolant	51 65
		V-belts	70
		Filtercartridge of the AdBlue® supply pump	64
Status dependent	Replace	Suction air filter/dry air filter (maintain in accordance with maintenance indicator)	69
		Diesel particle filter, the required replacement is displayed by the ash lamp or via an electronic display, depending on the engine version.	44
	Empty	Fuel pre-filter with water trap. If the warning system is activated (lamp/horn), the water trap bowl must be emptied immediately.	63

Maintenance profile

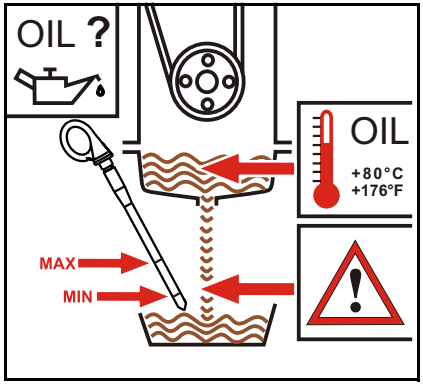
A self-adhesive maintenance diagram is delivered with every engine. It should be stuck in a well visible location on the engine or equipment.

Order number: 0312 4669 (TCD 4.1 L4/TTCD 6.1 L6/TCD 6.1 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!

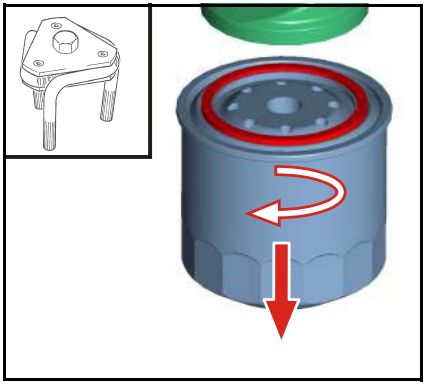
- Pull out the lubricating oil dipstick and wipe off with a lint-free, clean cloth.
- Insert the lubricating oil dipstick as far as it will go.
- Extract the lubricating oil dipstick and read off the oil level.
- The oil level must always be between the MIN and MAX marks! Top up to the MAX mark if necessary.

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.
- Turn in and tighten lubricating oil drain plug fitted with new sealing ring.

  Tightening torque 55 Nm

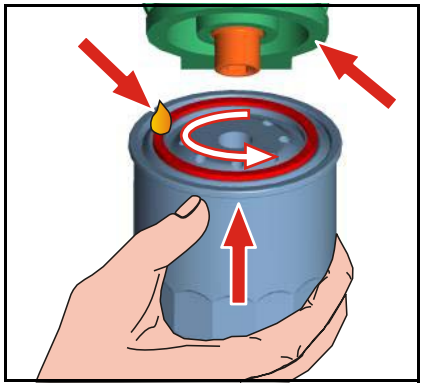
- Pour in lube oil.
  - Quality/viscosity data (48).
  - Filling volume (88).
- Warm up the engine (lubricating oil temperature > 80 °C).
- Ensure that the engine or vehicle is in a level position.
- Check lubricating oil level, if necessary top up.



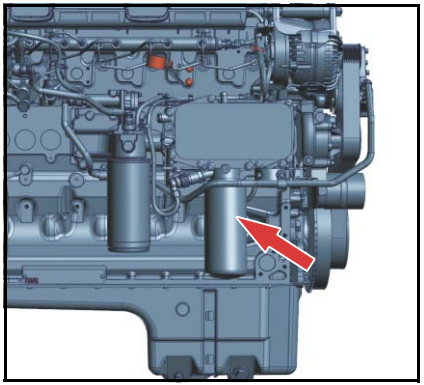
Change lubricating oil filter

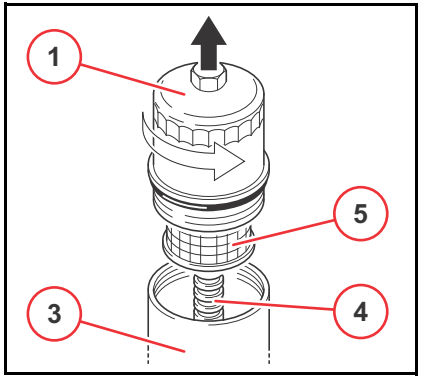
The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

- Remove clamps when twist protection mounted (optional).
- Loosen and unscrew filter with tool **(order no.: 0189 9142)**
- 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).



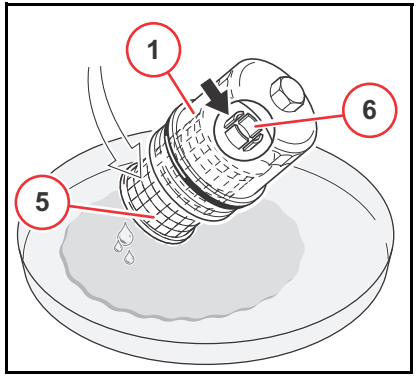


Replace lubricating oil filter cartridge

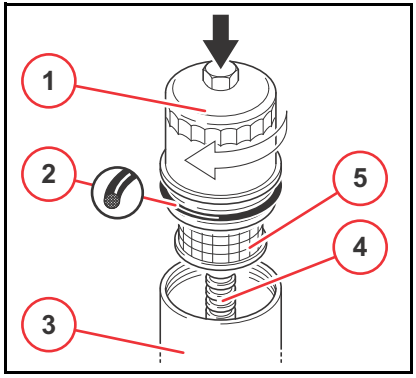
The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

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.



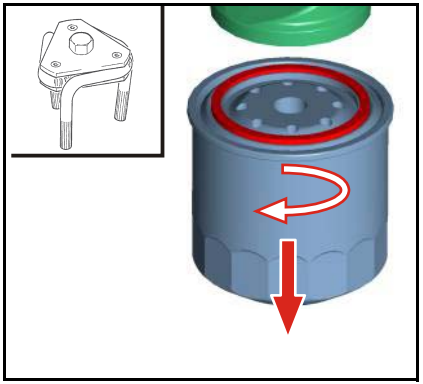
- Replace gasket and oil lightly.
- Press new filter cartridge into bracket and place them carefully into the guide.
- Screw the cover clockwise (25 Nm).
- Start engine.

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.

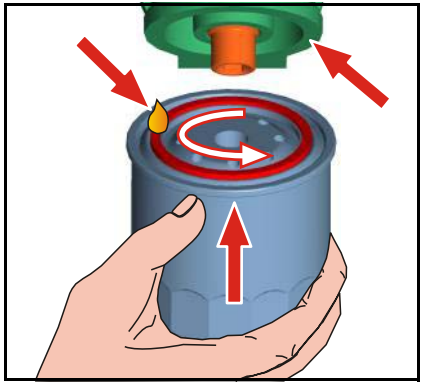
Clean and dry the engine and engine compartment thoroughly before beginning work.
Areas of the engine compartment from which dirt could be loosened must be covered with a fresh, clean foil.
Work on the fuel system may only be carried out in an absolutely clean environment.
Contamination of the air such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



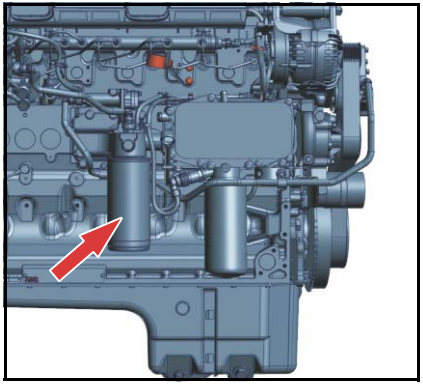
Change the fuel filter cartridge

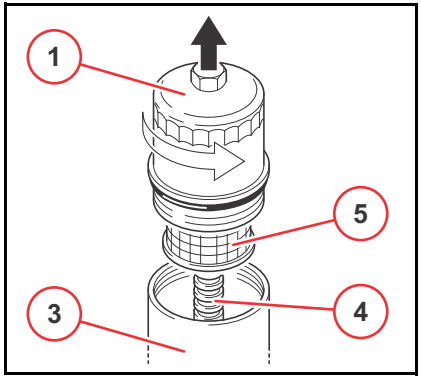
The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

- Remove clamps when twist protection mounted (optional).
- Loosen and unscrew filter with tool **(order no.: 0189 9142)**
- 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.



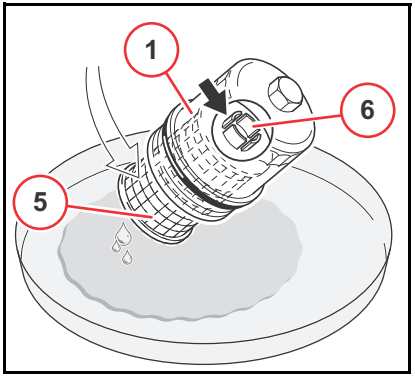


Replace fuel filter cartridge

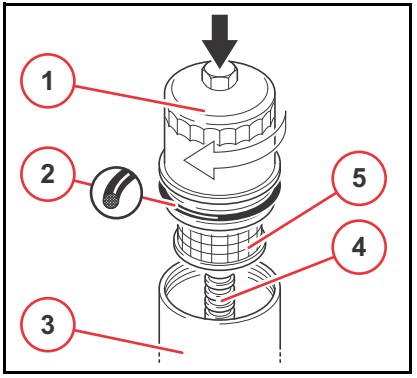
The filter cartridge should never be pre-filled. There is a danger of dirt contamination!

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

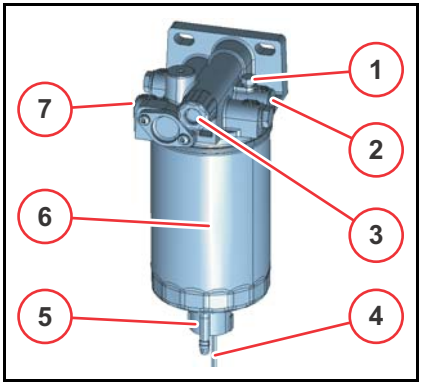
- Switch off the engine.
- Loosen cover by turning 2-3 times and wait for 30 seconds.
- Unscrew cover with filter cartridge anti-clockwise.
- Loosen the filter cartridge carefully out of the guide in the housing and upwards.



- 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.



Change/vent fuel pre-filter

Deutz Common Rail (DCR)

1 Venting screw
2 Fuel supply flow to the pump
3 Manual pump for venting
4 Electrical connection for water level sensor
5 Drain plug
6 Filter insert
7 Fuel inlet from the 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 ±0.3 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 (17-18 Nm).
- Mount drain plug.

Tightening torque 1.6 ±0.3 Nm

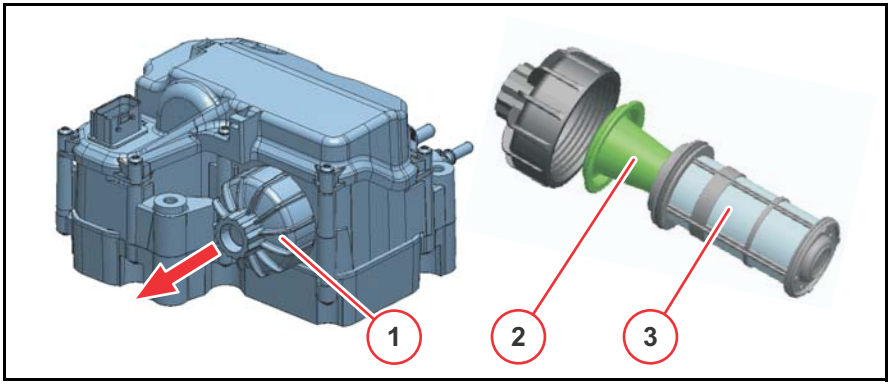
- Electrical connection
  – Connect cable connections.
- Open the fuel shutoff tap and vent the system, see venting the fuel system.

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 ±1.3 Nm

- Keep pumping until a very strong resistance can be felt and the pumping only progresses very slowly.
- 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

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 ±2.5 Nm

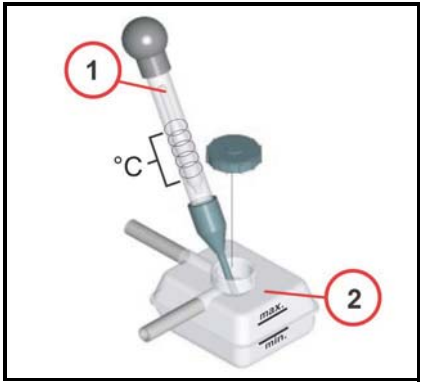
- Electrical connection
  – Connect cable connections.
- Start

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

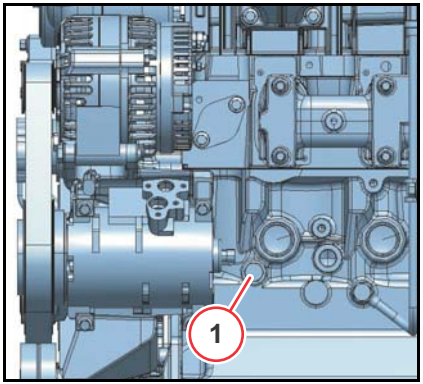
- Fill in new coolant and vent the system according to the specifications of the cooling system manufacturer.
- Open the cooling system cap (1) carefully.
- The coolant level must always be between the MIN and MAX marks of the compensation tank! Fill up to the MAX mark if necessary.



Check coolant additive concentration

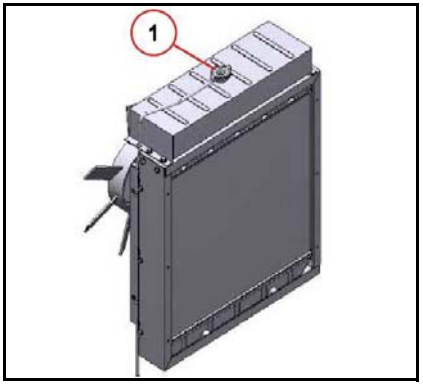
- Open the cooling system cap (1) carefully.
- Check the coolant aditive concentration in the cooler/compensation tank (2) with a conventional antifreeze measuring device (1) (e.g. hydrometer, refractormeter).
- Necessary coolant additive concentration Coolant mixing ratio (51).

The corresponding test device can be ordered from your DEUTZ partner under the order no.: 0293 7499.



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.
The respective environmental regulations must be observed.

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.

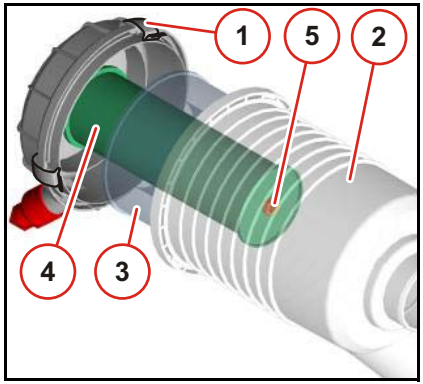
Cleaning with a high pressure cleaner

- 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.

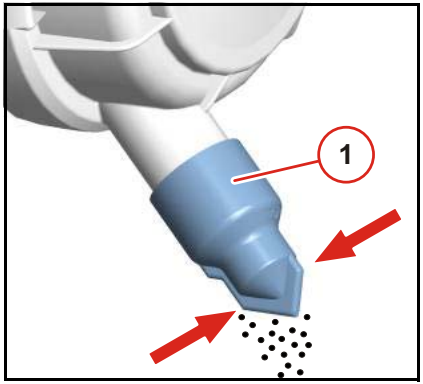
Renewing the safety cartridge of the dry air filter

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.



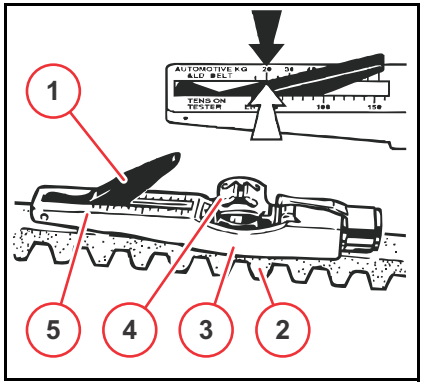
Clean the dust discharge valve of the dry air filter

- 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.

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.

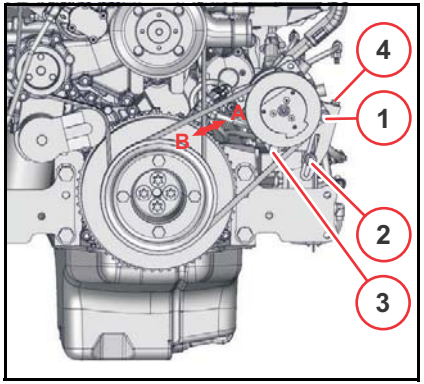


Checking the belt tension

- Lower indicator arm (1) into the measuring device.
- Place guide (3) between two belt pulleys on the V-belt (2). The stop have to be at the side.
- Press the button (4) at right angles to the V-belt (2) evenly until you hear or feel the spring snap in.
- Lift the measuring device carefully without altering the position of the indicator arm (1).
- Read the measured value at the point of intersection (arrow), scale (5) and indicator arm (1).
- If necessary, re-tension belt and measure again.

Tools

The belt tension measurement device **(order no.: 0189 9062)** can be ordered from your DEUTZ partner.

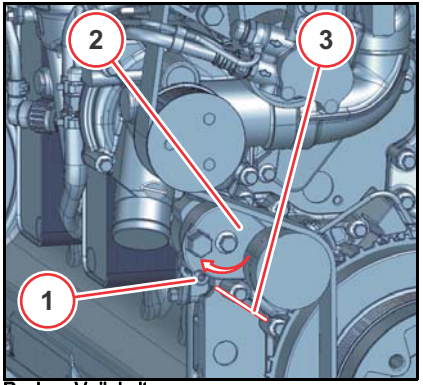


Renew the V-belts

1 Screw
2 Screw
3 Screw
4 Setting screw

- Remove screw and lock nut.
- Move the air-conditioning system compressor over the setting screw in direction (B) until the V-belt is slack.
- Remove belt and fit new one.
- Move the air-conditioning system compressor over the setting screw in direction (A) until the V-belt has attained the correct tension.
- Checking the belt tension (70).
- Tighten screw and lock nut again.

Tightening torque 30 Nm



Replace V-rib belt

1 Assembly bore
2 Tension pulley
3 Retaining pin

- 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.
- Hold tensioning pulley in the direction of the arrow using a socket wrench and remove the retaining pin.
- Slowly relieve the tensioning pulley until the belt is automatically tensioned.
- Check whether the V-belt is lying correctly on all pulleys.

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.

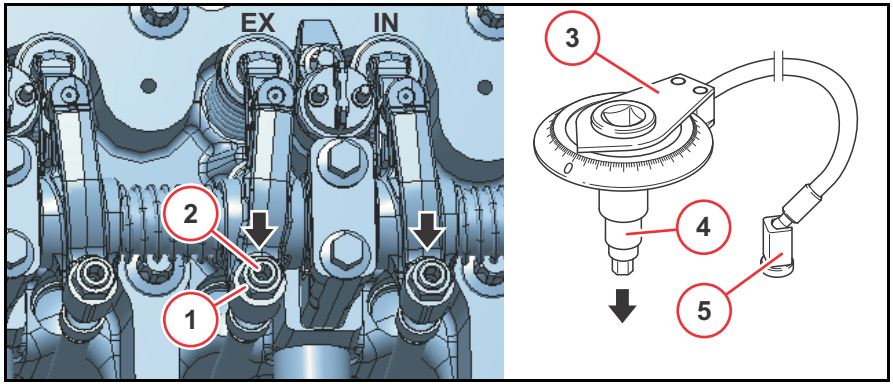
The cylinders to be set can be seen in the setting schematic.

TCD 4.1 L4

Valve overlap	Settings
1	4
3	2
4	1
2	3

TCD 6.1 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 4.1 L4 TCD 6.1 L6 TTCD 6.1 L6	**IN** **EX**	Inlet valve Outlet valve	75° ± 15° 120° ± 15°

- 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.
- Tighten locking nut.

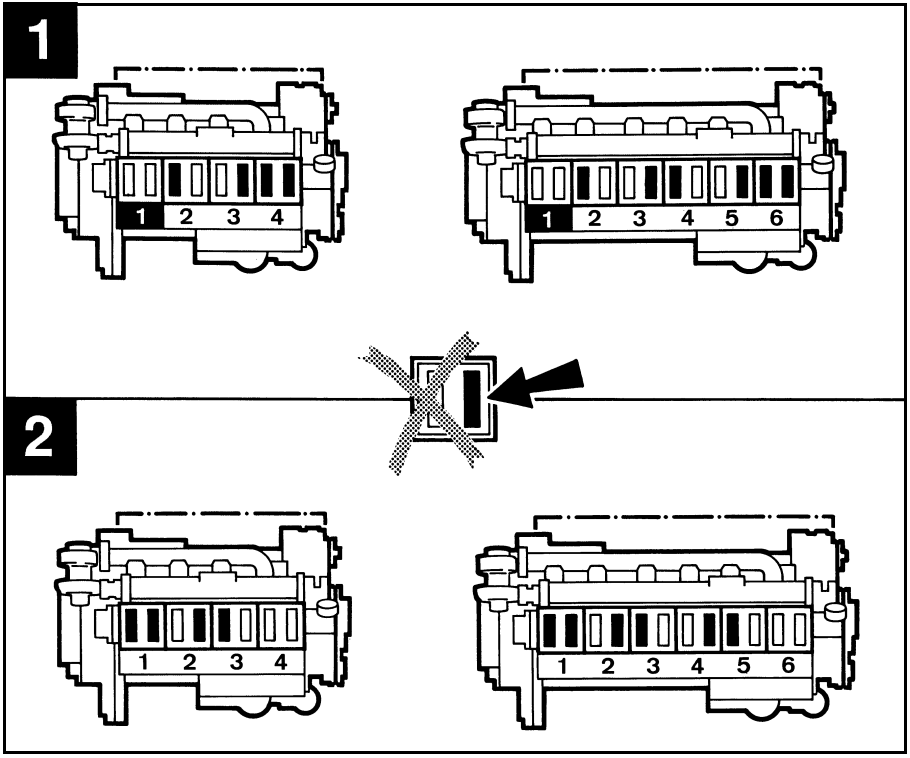
Tightening torque 20 Nm

- Now adjust the two other valves at the rocker arm, as described above.
- Perform the setting procedure on every cylinder.
- Reassemble cylinder head cowling (if necessary, with new seal) in reverse order of disassembly.
- Tighten screws.

Tightening torque 9 Nm

Tools

The rotary angle disc **(order no.: 0189 9093)** can be ordered from your DEUTZ partner.



Valve clearance setting schematic

- **Crankshaft position 1**
  Turn crankshaft until both vaalves 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!

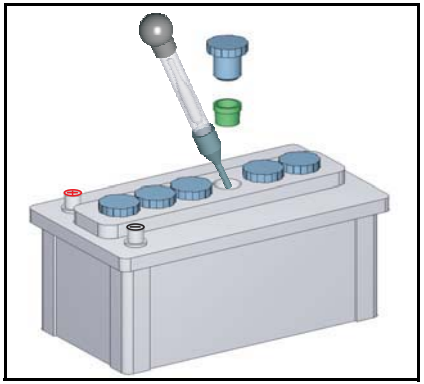
Checking the voltage

- 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

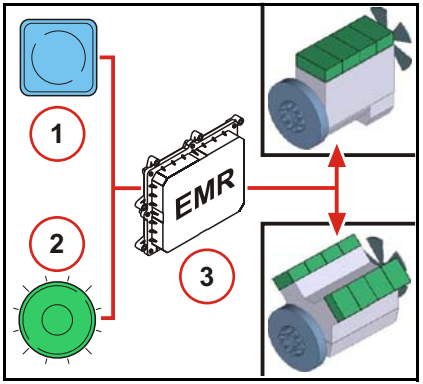
Faults	Causes	Measures
Engine does not start or is difficult to start	Not disconnected (if possible)	Check coupling
	Fuel tank empty	Vent fuel system
	Fuel suction pipe blocked	Check
	Below starting limit temperature	Check
	Cold starting device	Check/replace
	Wrong SAE viscosity class of the engine lubricating 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
	Injection line leaks	Check injection line
	High-pressure pump defective	Check/replace
Engine does not start and diagnostic lamp flashes	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	Change
	Fuel quality does not comply with operating manual	Change the fuel
	Injector defective	Change
	Injection line leaks	Check injection line
	Engine cable harness defective	Check/replace
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
Engine becomes excessively hot. Temperature warning system activates	Vent line blocked	Clean
	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
	Fan / viscous coupling defective, V-belt torn or loose	Check/replace/tension
	Charge air cooler soiled	Check/clean
	Air filter clogged / turbocharger defective	Check/replace
	Throttle valve defective	Check/replace
	Coolant temperature transmitter	Check/replace
	Coolant thermostat defective	Check/replace
	Coolant cover defective	Check/replace

Faults	Causes	Measures
Engine output is deficient	Lube oil level too high	Check lube oil level, if necessary drain off.
	Throttle valve defective	Check/replace
	Exhaust gas recirculation, actuator defective	Check/replace
	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
	Exhaust gas backpressure too high	Check/clean
	Injection line leaks	Check injection line
	Injector defective	Change
	Exhaust gas turbocharger 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
	Incorrect valve clearance	Check valve clearance and set if necessary
	Compression pressure too low	Check compression pressure
	Engine cable harness defective	Check/replace
Engine lubricating oil pressure is non-existant 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
	Lubricating oil pressure sensor defective	Check/replace
	Lubricating oil control valve jammed	Check/clean
	Lubricating oil suction pipe blocked	Check/clean

Faults	Causes	Measures
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
	Wrong SAE viscosity class of the engine lubricating oil	Change the lubricating oil
	Valve shaft seals defective	Check/replace
	Piston rings worn	Check/replace
	Exhaust gas turbocharger defective	Check/replace
Lubricating oil in the exhaust system	Engine operated continuously with too low a load (< 20-30%)	Check load factor
	Valve shaft seals defective	Check/replace
	Exhaust gas turbocharger defective	Check/replace
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
	Crankcase breather	Check/replace
	Wrong SAE viscosity class of the engine lubricating oil	Change the lubricating oil
	Valve shaft seals defective	Check/replace
	Piston rings worn	Check/replace
	Exhaust gas turbocharger defective	Check/replace
Engine producing white smoke	Coolant in the exhaust gas	Check
	Condensation	Warm up engine so that water residues evaporate
Engine producing black smoke	Diesel particle filter defective	Check/replace

Faults	Causes	Measures
Error in the SCR system	AdBlue® tank empty/display full	Check tank sensor
	SCR not working	Check plug connections and lines at the supply pump and injector. Check plugs and lines of supply pump, Nox sensor and exhaust temperature sensor.
	SCR not working (cold)	Lines frozen, lines to be cleaned, heating to be checked AdBlue® Tank frozen, heating to be checked
Frequent standstill regenerations	Air filter clogged / turbocharger defective	Check/replace
	Incorrect valve clearance	Check valve clearance and set if necessary
	Charge air line leaking	Check charge air line
	Injector defective	Change
	Differential pressure of flow meter defective	Change
	Nox sensor defective	Change
	Differential pressure sensor of diesel particulate filter is issuing an implausible signal	Change
	Differential pressure line added	Clean



Engine protection function of the electronic engine control

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

When all errors are rectified, the error lamp goes out. For some errors, it is possible to switch off the ignition, wait 2 minutes and then switch the ignition back on again. 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 with power reduction 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 switching off the system with the ignition key for approx. 2 min.
  - optionally 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 sare 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.

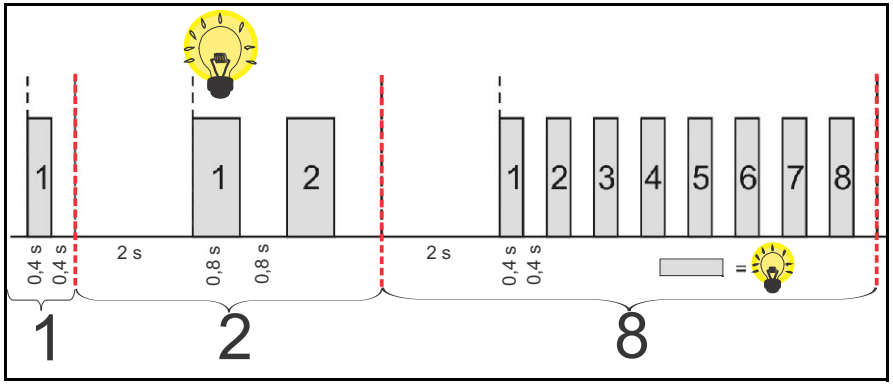
Use of the diagnostic key

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

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

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

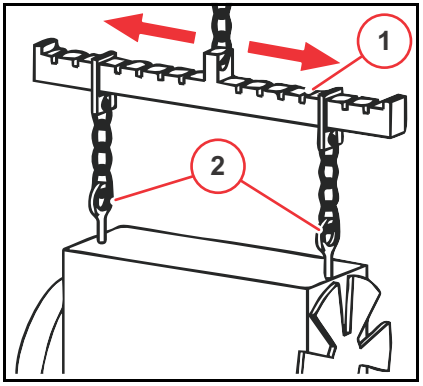
1 x short flash

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.

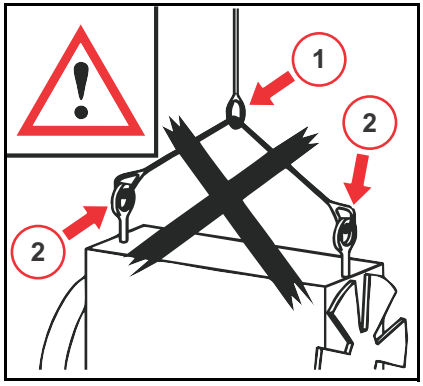
- The blink codes can only be interpreted by a DEUTZ partner.



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.

Exhaust aftertreatment system

Selective Catalytic Reduction

The SCR system can be taken out of operation for up to 4 months after completely shutting down (includes all lag functions) and the following conditions:

- The vehicle or engine should be stored in a covered place, e.g. garage or hall, for longer shutdowns.
- AdBlue® fill tank completely.
  Evaporation of water as part of the AdBlue® must be avoided.
- Do not disconnect electrical or hydraulic connections.
- Maximum storage time at -40 °C to 40 °C
  2 months.
- Maximum storage time at -40 °C to 25 °C
  4 months.

If the shutdown time of 4 months mentioned above has been exceeded, proceed as follows:

- AdBlue®
  - Empty the tank completely.
  - Fill the tank completely with new AdBlue®.
  - Renew the filter insert of the supply pump.
- Warm up the engine to operating temperature and load so that pressure builds up and AdBlue® is injected.

If a fault is detected:

- Shut down engine.
  Wait for the end of the lag time of the EDC (Electronic Diesel Control).
- Repeat the process several times if necessary.

Please contact your DEUTZ partner if the fault cannot be remedied.

Corrosion protection of engines which have already been in operation

Internal corrosion protection

The internal corrosion protection is always effected by wetting the walls with the corrosion protection agent by running the engine. The corrosion protection run can be carried out 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. Standstill times of longer than 4 weeks must always be avoided with biodiesel.

- Fill fuel tank with according to biodiesel-free fuel EN590 or ASTM D975 grade 1-D S15
- 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 engine with preservation oil and carry out corrosion protection run (together with corrosion protection run for fuel system), then warm up the engine to approx. 60 °C, duration at least 5 minutes so that all components of the lubricating oil system are wet,

  or

  all accessible components are wet with preservation oil, and then, using a separate pump, pump warm preservation oil (at approx. 60 °C) through the engine until all bearings and bearing liners are wet.

Air compressor

- If a compressor is installed, a corrosion protection agent must be sprayed into the compressor suction system after shutting down the engine until it emerges visibly from the pressure nozzle.

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).
- In liquid-cooled engines, the coolant must be drained and the cooling system cleaned
- In cooling system not contaminated by lubricating oil, fill with clean water, start engine and flush the cooling system.
- Then carry out a corrosion protection run so that a coating forms on the inside surfaces of the cooling system. With a mixture consisting of:
  - Treated water
  - Corrosion protection agent

  or
  - Treated water
  - Corrosion protection agent with light antifreeze
- 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.

Intake air lines

- Spray corrosion protection oil or preservation oil into the intake air pipe.

External corrosion protection

The engine must be cleaned thoroughly with cleaning agent before external corrosion protection.

Bare outside surfaces and parts

- Coat or spray all bare exterior parts and surfaces (e.g. flywheel, flange faces) with corrosion protection agent.
- Under extreme conditions, e.g. sea transport or military specifications, a long-term corrosion protection oil should be used.

Rubber parts

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

Belt drives

- 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 packing

- 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.

Re-application of engine corrosion protection

If the max. protection duration of the corrosion protection is reached or damaged corrosion protection is detected and the engine is to stay in storage, new corrosion protection must be applied. The new corrosion protection protects the engine or spare parts for another 12 months.

The new corrosion protection is applied in the same way as for the initial corrosion protection with a corrosion protection run. If a corrosion protection run is not possible (engine is removed from the device or system for example), certain special conditions must be observed for application of new corrosion protection which we describe below.

Internal corrosion protection

Fuel system

- DEUTZ recommends using diesel fuel containing polycyclic aromatic hydrocarbons ≤ 8.0 %(m/m), a lubricity of ≤ 400 micrometers in the HFRR test (EN ISO 12156-1) and biodiesel (FAME) ≤ 0.1 %(V/V).

  Pump fuel with a separate pump or a fuel hand pump until the fuel system is full Then drain the fuel mixture.

Lubricating oil system

- Press warm preservation oil (at approx. 60 °C) into the lubricating oil circuit with a separate pump, or with the prelubricating hand pump. Turn over the engine by hand or with the electric turning gear so that all bearings and bearing liners are wet. The engine can also be turned over with the starter without starting the engine.
- Remove the cylinder head cover and spray valves, valve springs and rocker arms with pres-

ervation oil.

Cooling system

- The corrosion protection does not normally need to be renewed up to 24 months. If necessary, the coolant system can be filled with a mixture of corrosion protection agents and circulated by an external pump, so that a new coating can form on the inside surfaces of the cooling system.
- 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.

Removal of corrosion protection

Removal of internal corrosion protection

Fuel system

- Fill the fuel tank and fuel system with the proper fuel.

Lubricating oil system

- Fill the engine with lubricating oil via the lubricating oil filler neck.

Cooling 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 distilled 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 4.1 L4	TCD 6.1 L6	TTCD 6.1 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		4	6	
Bore/stroke	[mm]	101/126		
Total displacement	[cm^3]	4038	6057	
Combustion process		Direct injection		
Injection system		**D**eutz **C**ommon **R**ail (**DCR**)		
Exhaust gas recirculation		external		
Exhaust gas aftertreatment		Selective Catalytic Reduction SCR and Diesel particle filter DPF		
Valves per cylinder		4		
Valve clearance: Inlet/outlet	[mm]	0,3 / 0,5		
Setting with rotary angle disc	[°]	$75°^{\pm 15°}$ / $120°^{\pm 15°}$		
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		
Coolant volume (only engine content without cooler / hoses and pipes)	≈ [l]	5,9	11,5	12
Permissible continuous coolant temperature	[°C]	max. 110		
Temperature difference between coolant inlet/outlet	[°C]	4 - 8		
Start of thermostat opening	[°C]	87		

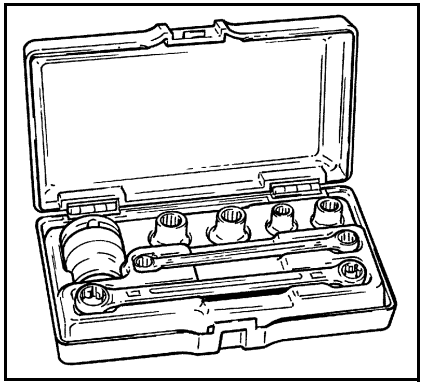
Engine type	Dimension	TCD 4.1 L4	TCD 6.1 L6	TTCD 6.1 L6
Thermostat fully open	[°C]	102		
Lubricating oil change volume (with filter) Industrial engines/Agricultural technology	≈ [l]	11,5*	15,5* / 26,5*	26,5*
Lube oil temperature in the lube oil tray, maximum	[°C]	125		
Lubricating oil pressure minimum (low idle, engine warm)	[kPa/bar]	80/0,8		
Permissible maximum combustion air temperature after charge air cooler	[°C]	50		
V-belt tension		Pre-tensioning/Re-tensioning		
V-belts AVX 13 (width: 13 mm)	[N]	650±50/400±50		
V-rib belt tensioning		Automatic tensioning spring-loaded clamping roller		
Weight without cooling system according to DIN 70020-A Industrial engines/Agricultural technology	≈ [kg]	400 / 450	621 / 641	680

*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



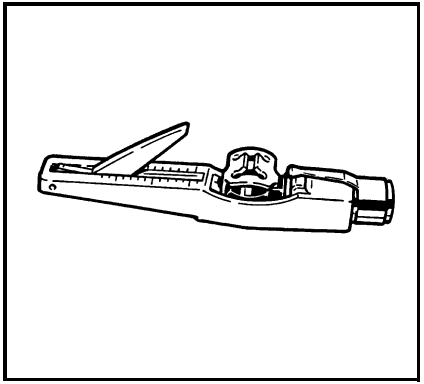
Torx tool

Order number:

0189 9092

The Torx screw system is used in engines in this series among other things. This system was introduced for a number of reasons:

- Excellent accessibility
- High force transmission when loosening and tightening
- Slipping or breaking of the key and risk of injury are practically excluded.

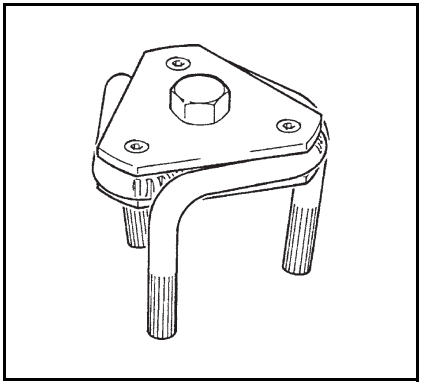


V-belt tension measuring instrument

Order number:

0189 9062

Measuring instrument for checking the specified V-belt tensions.

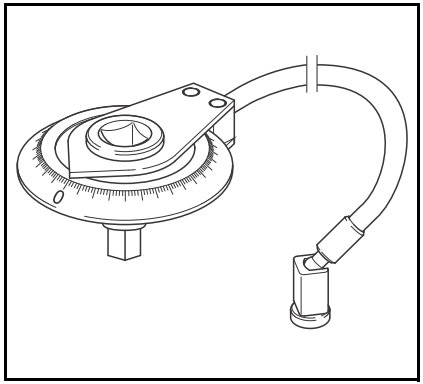


Special wrench for loosening exchangeable filters

Order number:

0189 9142

For loosening changeable filters.

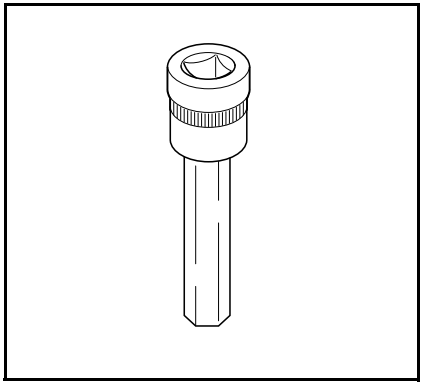


Rotaqtion angle disc

Order number:

0189 9093

For setting the valve clearance

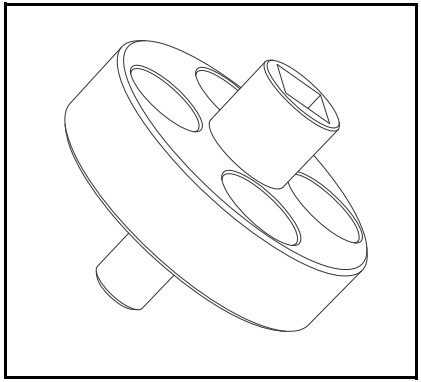


Pin wrench insert

Order number:

0189 9096

For setting the valve clearance

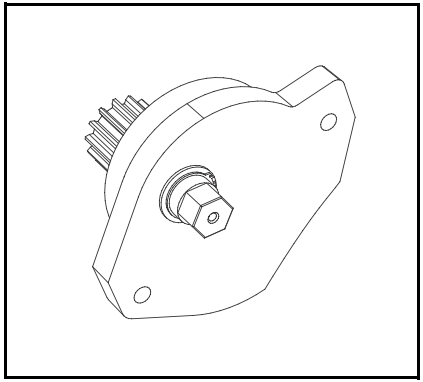


Turning gear

Order number:

0299 2028

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

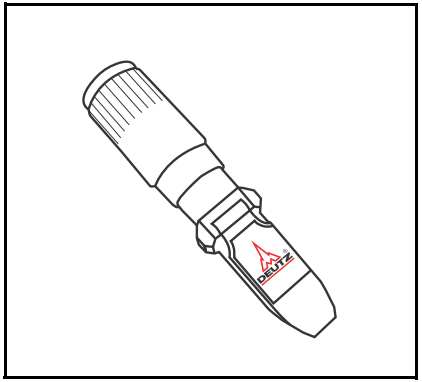


Turning gear

Order number:

0299 2029

For turning over the engine on the gear case.



Refractometer

Order number:

0293 7499

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

- Coolant
- Battery acid
- AdBlue®

DEUTZ Operating Fluids

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

DEUTZ Cooling System Conditioner	
5L	0101 1490
20L	0101 6416
210L	1221 1500

The engine company.

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Original operating instructions