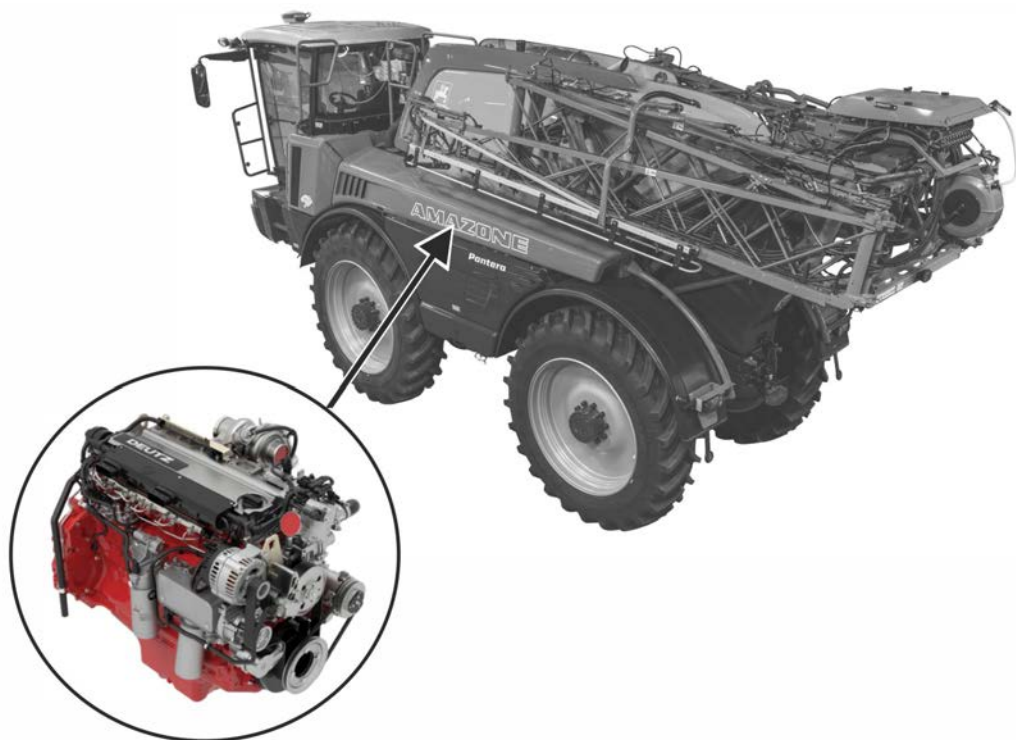


Operating Manual

AMAZONE

Deutz TCD
5 Emission Standard



MG6238
BAG0198.0 07.18
Printed in Germany

Please read this operating
manual before commissioning.
Keep it in a safe place
for future use!

en



TCD 4.1 L4 TCD / TTCD 6.1 L6

Operating manual

EU Stage IV & V / US EPA Tier 4



The engine company.



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 instructions specified by the manufacturer. The engine may only be used, maintained and serviced by persons who are familiar with it and are aware of the hazards.
The relevant rules for the prevention of accidents and other generally recognised safety and occupational medicine rules must be observed.
- When the engine is running there is a danger of injury caused by:
 - rotating and hot components
 - in the case of engines with external ignition (high electrical voltage), contact must be avoided!
- Unauthorised modifications to the engine will exclude the manufacturer from all liability for resulting damage.
- Equally, manipulations to the injection and control system can affect the engine's performance and the exhaust characteristics. In this case, compliance with environmental regulations will no longer be guaranteed.

- Do not change the cooling air feed area to the blower or fan. An unobstructed cooling air supply must be guaranteed.

The manufacturer will accept no liability for damages resulting from this.

- As a general rule, only DEUTZ original parts may be used when carrying out maintenance/repair work on the engine. These have been designed especially for your engine and ensure fault-free operation.

The guarantee will be void in the event of non-compliance!

Maintenance/cleaning work on the engine may only be carried out when the engine is not running and has cooled down. When performing such works, make sure that the electrical system is switched off (remove ignition key).

The rules for the prevention of accidents on electrical systems (e.g. -VDE- 0100/-0101/-0104/-0105 Electrical Protection Measures against Dangerous Live 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 engine hazard zone.

Danger due to high pressure of leaks — Danger to life!

- In case of leaks contact the workshop immediately.
- In the case of works on the fuel system ensure that the engine is not started unintentionally during the repair works — **Danger to life!**

CALIFORNIA PROPOSITION 65 WARNING



WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Always start and operate the engine in a well-ventilated area.

If in an enclosed area, vent the exhaust to the outside.

Do not modify or tamper with the exhaust system.

Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel

Dear customer,

Congratulations on the purchase of your DEUTZ engine.

The liquid-cooled engines made by DEUTZ are developed for a wide variety of applications. A comprehensive range of variants ensures that the respective special requirements are fulfilled.

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 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 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 catalytic converter

Notes

Illustrations and data in this instruction manual are subject to technical changes in the course of further development of the engine.

No parts of this document may be reproduced in any form or by any means without our express approval.

DEUTZ engine registration



DEUTZ AG aims to provide an excellent service worldwide. In order to ensure this, information about the locations of devices with DEUTZ engines is very helpful.

Foreword

DEUTZ engine registration is available for you at www.deutz.com or using the code. You can enter your DEUTZ engine data there directly so that your engine can receive the best possible maintenance from the global DEUTZ Service Network.

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General

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 repairs: Check that all protective equipment is mounted and 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 the prerequisite for the engine satisfying the demands placed on it. Compliance with the specified maintenance intervals and careful execution of service and maintenance work are therefore absolutely necessary.

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. Of course, further developments for the improvement of the engines are also introduced in the original DEUTZ parts. 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. Which is why we have a global network of service branches.

The name DEUTZ means more than just engines created as a result of sophisticated development work, it also stands for a complete service package that guarantees the optimum operation of our engines as well as customer service that you can count on.

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

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

Imprint

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www.deutz.com

Danger



This symbol is used in all safety instructions which, if not observed, present a direct danger to life and limb for the person involved. Pay attention to it carefully. Forward safety instructions to your operating personnel as well. 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



You will find this symbol in all instructions of the general type.

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Engine description

Model

Engine type designation

This manual covers the following engine types

TCD 4.1 L4

TCD 6.1 L6

TTCD 6.1 L6

TCD	
T	Exhaust gas turbocharger
TT	Two-level exhaust turbocharging
C	Charge air cooler
D	Diesel

4.1 / 6.1	
4.1	Displacement in litres
6.1	Displacement in litres

L4 / 6	
L	in a row
4	Number of cylinders
6	Number of cylinders

Emissions legislation



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



They are only certified by the responsible authorities and comply with the permissible exhaust limits in this combination. Operation of the engine with other EAT systems is not allowed.

The engines of these operating instructions fulfill the following exhaust emissions regulations

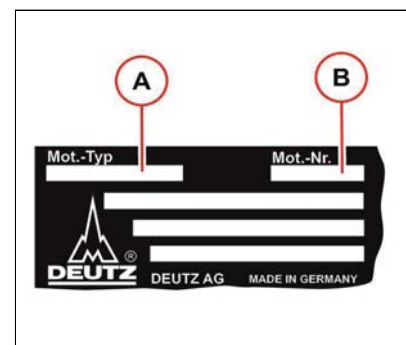
With exhaust aftertreatment system

USA	EPA Tier 4 final
EU	Stage IV
EU	Stage V

The exact certification is printed on the engine rating plate.



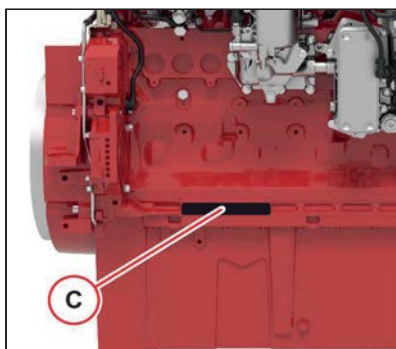
The engines of this operating manual may only be used with a functioning exhaust aftertreatment system (provided this is included in the DEUTZ scope of deliver).



Rating plate

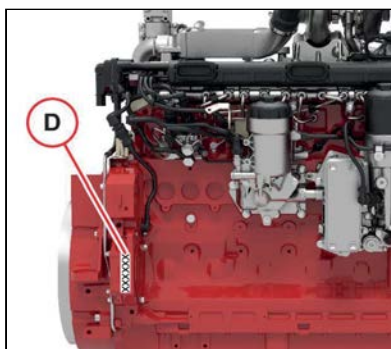
The type (A), engine number (B) and performance data are stamped on the rating plate.

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



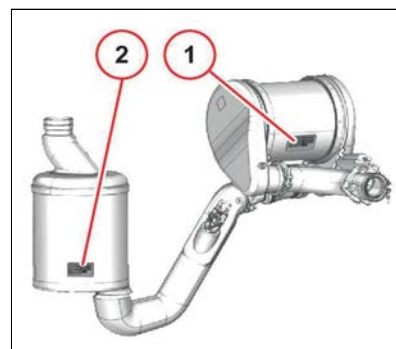
Position of the rating plate

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



Engine number

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

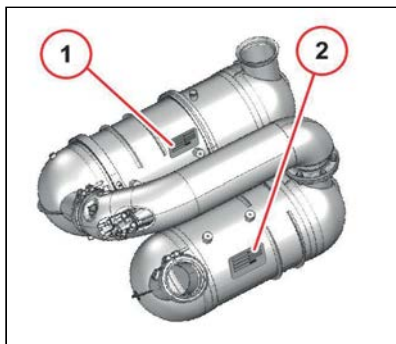


Serial numbers of the exhaust aftertreatment components

- 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.

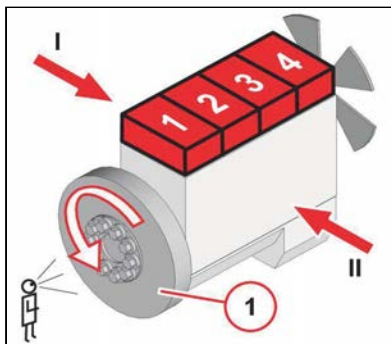
Engine description



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 numeration

- I Left
- II Right

Cylinder arrangement

The cylinders should be counted consecutively starting from the flywheel (1).

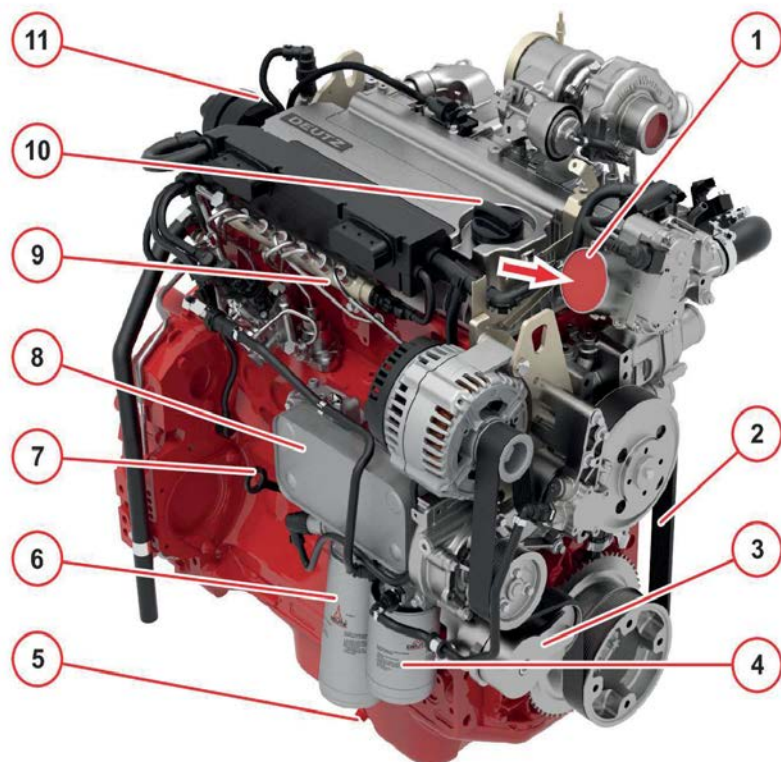
Direction of rotation

Looking onto the flywheel.

Left-hand rotation: anti-clockwise

Engine sides

Looking onto the flywheel.

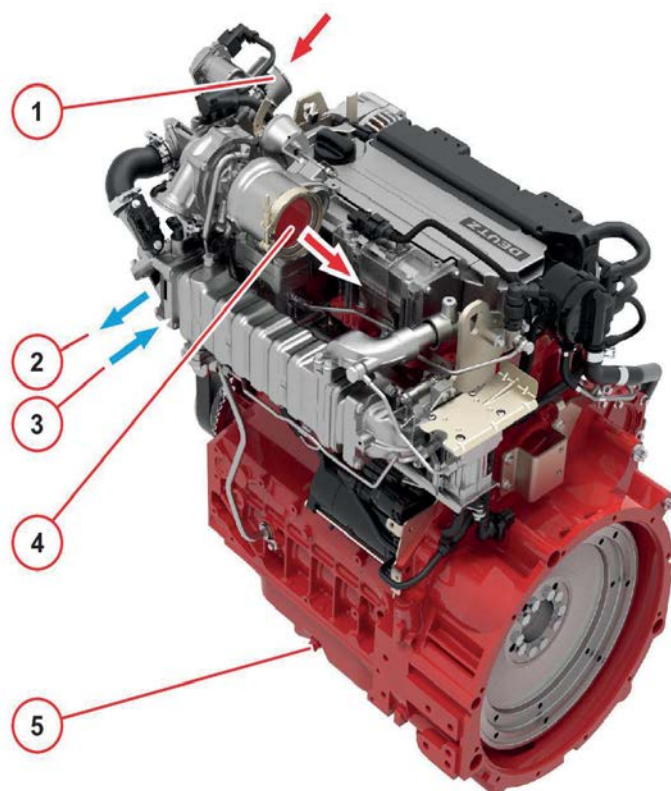


TCD 4.1 L4

Industrial engine

View from right (example)

- 1 Combustion air inlet
- 2 V-rib belts
- 3 Tension pulley
- 4 Fuel spare filter
- 5 Lubricating oil drain plug
- 6 Lube oil spare filter
- 7 Lubricating oil dipstick
- 8 Lubricating oil cooler
- 9 High-pressure storage vessel (rail)
- 10 Lube oil filling
- 11 Crankcase ventilation

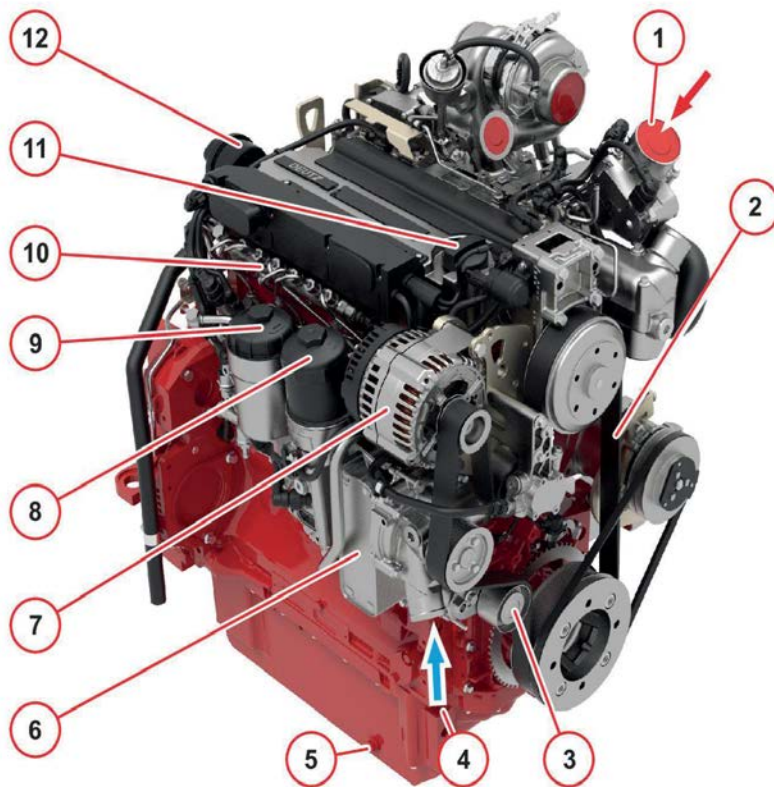


TCD 4.1 L4

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

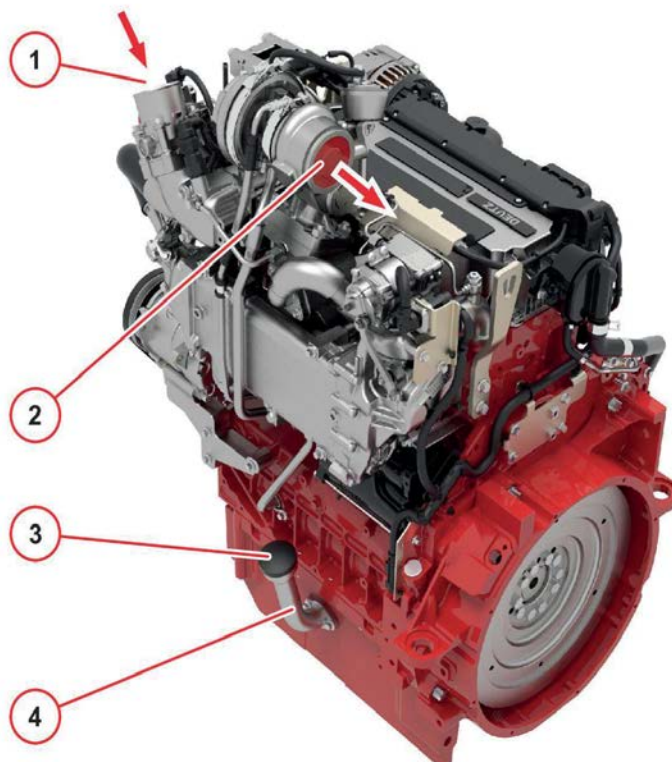
Agricultural engineering

View from right (example)

- 1 Combustion air inlet
- 2 V-rib belts
- 3 Tension pulley
- 4 Coolant inlet
- 5 Lubricating oil drain plug
- 6 Lubricating oil cooler
- 7 Alternator
- 8 Lube oil spare filter
- 9 Fuel spare filter
- 10 High-pressure storage vessel (rail)
- 11 Lube oil filling
- 12 Crankcase ventilation

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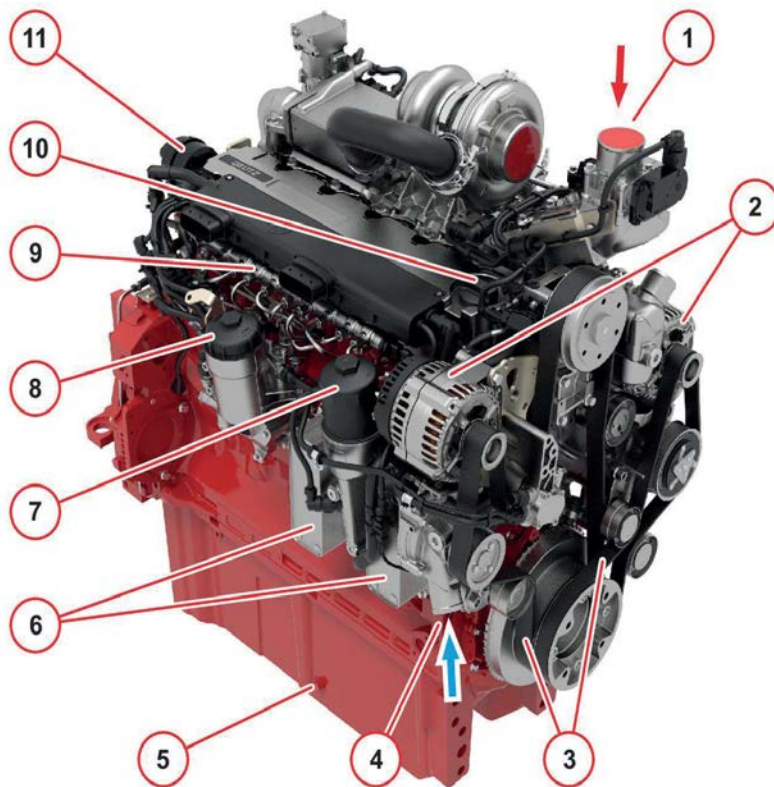


TCD 4.1 L4

Agricultural engineering

View from left (example)

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

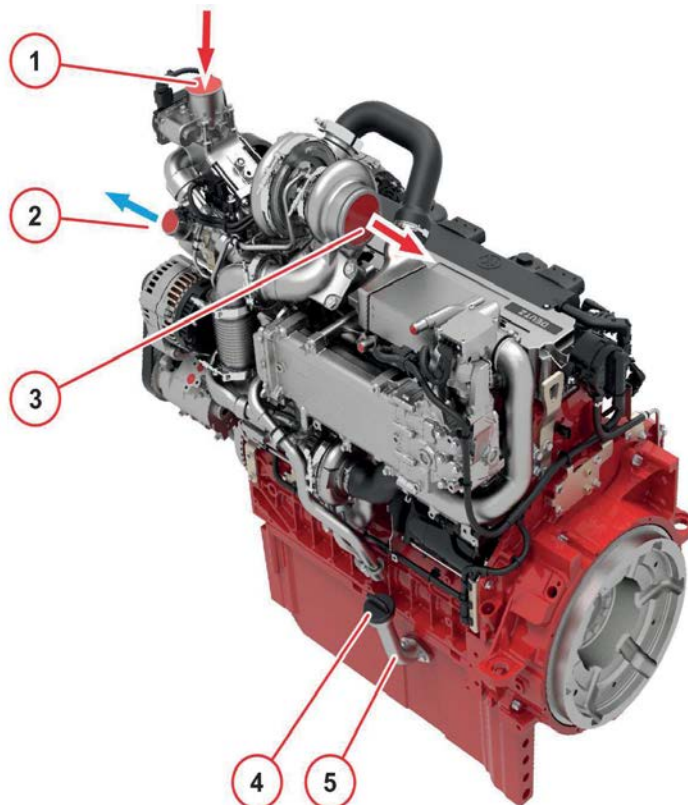


TTCD 6.1 L6

Agricultural engineering

View from right (example)

- 1 Combustion air inlet
- 2 Alternator
- 3 V-rib belts
- 4 Coolant inlet
- 5 Lubricating oil drain plug
- 6 Lubricating oil cooler
- 7 Lube oil spare filter
- 8 Fuel spare filter
- 9 High-pressure storage vessel (rail)
- 10 Lube oil filling
- 11 Crankcase ventilation

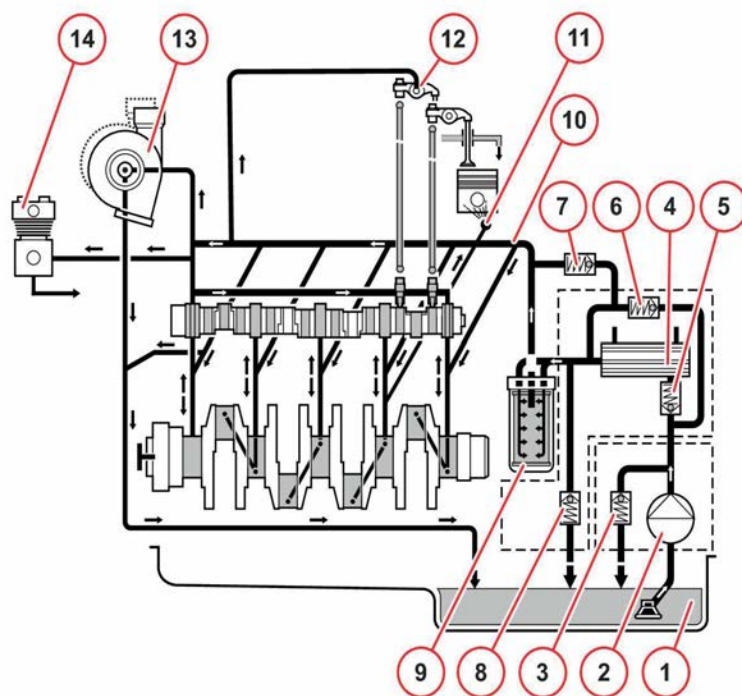


TTCD 6.1 L6

Agricultural engineering

View from left (example)

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



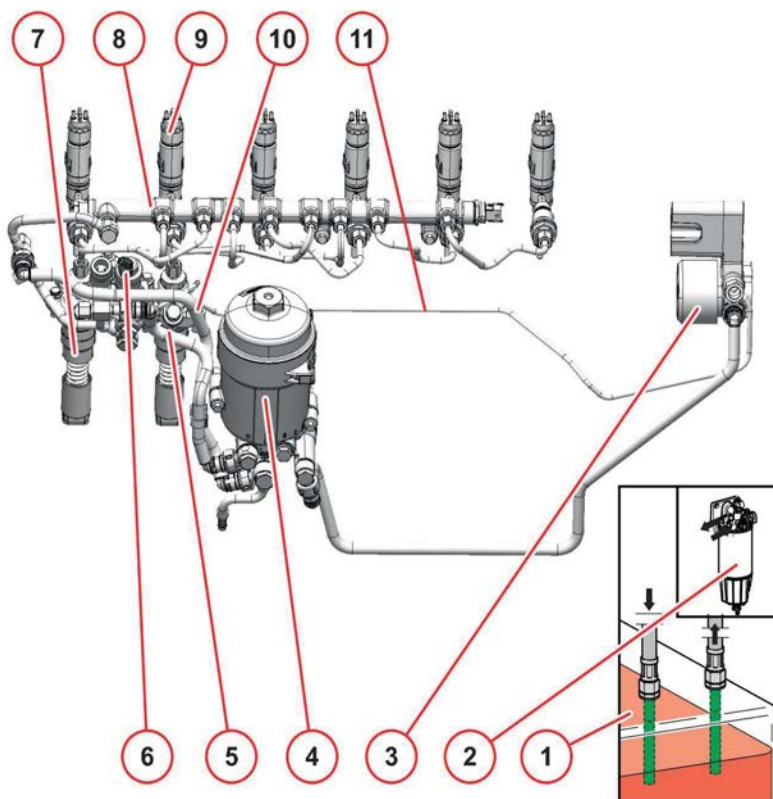
Lubricating oil system

(example)

- 1 Lubricating oil pan
- 2 Lubricating oil pump
- 3 Pressure limiting valve
- 4 Lubricating oil cooler
- 5 Check valve
- 6 Bypass valve
- 7 Bypass valve
- 8 Pressure control valve
- 9 Lubricating oil filter
- 10 Main lube oil channel
- 11 Piston cooling nozzle
- 12 Rocker arm
- 13 Exhaust turbocharger
- 14 Compressor
Optional

Engine description

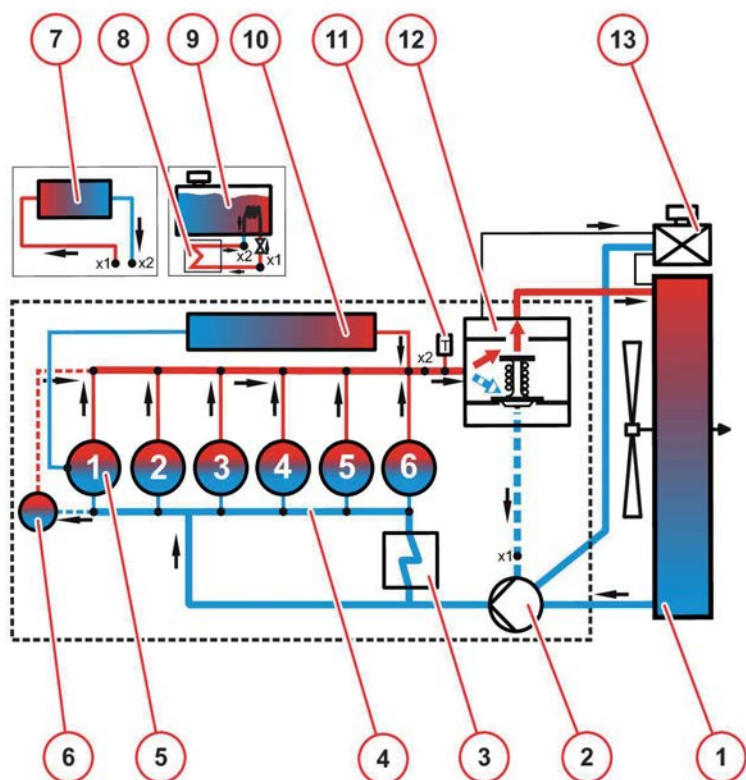
Fuel system plan



Fuel system plan

(example)

- 1 Fuel tank
- 2 Fuel pre-filter
- 3 Fuel supply pump
- 4 Fuel spare 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 High-pressure storage vessel (rail)
- 9 Injector
- 10 Fuel return to the fuel tank
- 11 Return line



Coolant plan

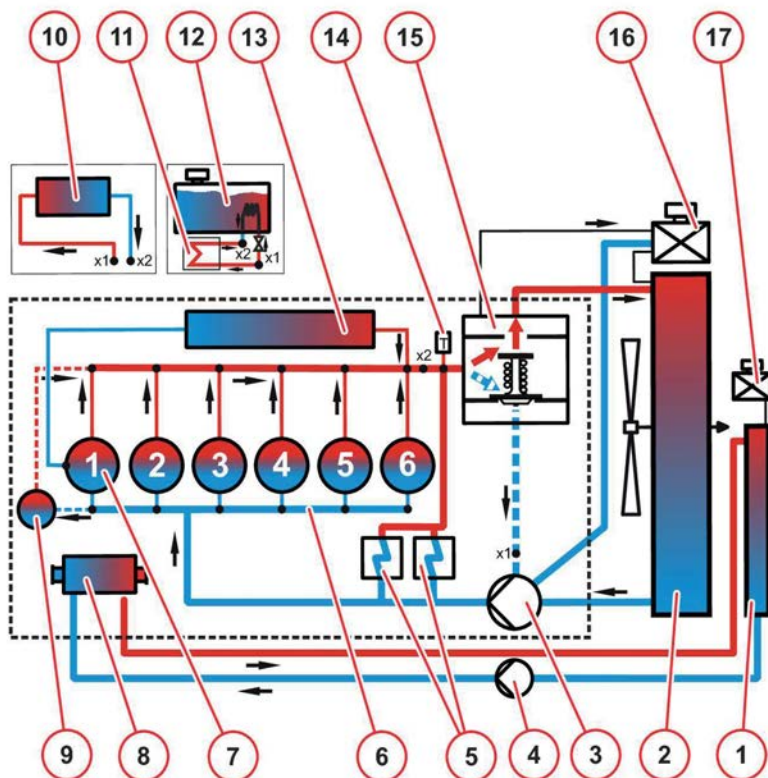
(example)

Industrial engine

- 1 Cooler
- 2 Coolant pump
- 3 Lubricating oil cooler
- 4 Coolant supply for engine cooling
- 5 Cylinder pipe/head cooling
- 6 Compressor
- Optional
- 7 Connection possibility for cab heating
- 8 Metering module
- 9 AdBlue® tank
- 10 Exhaust return cooler.
- 11 Temperature sensor
- 12 Thermostat
- 13 Compensation tank

Engine description

Coolant plan

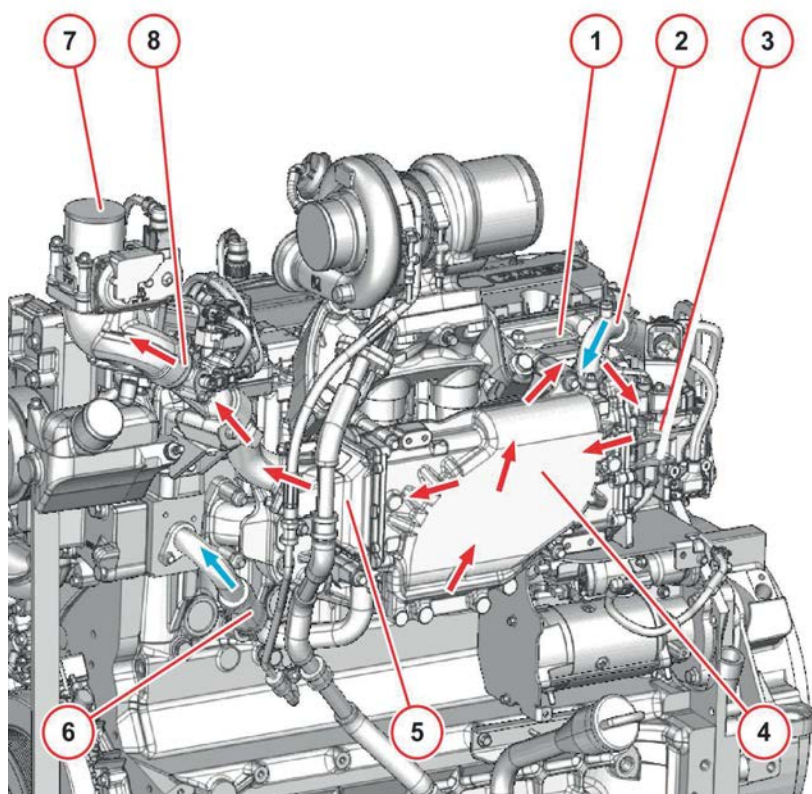


Coolant plan

(example)

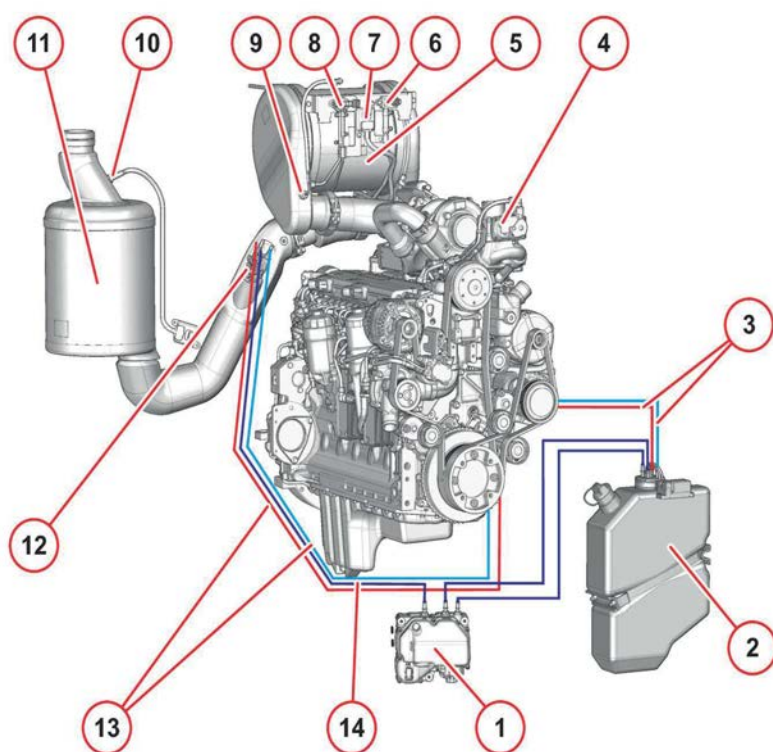
Agricultural engineering

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



External exhaust return

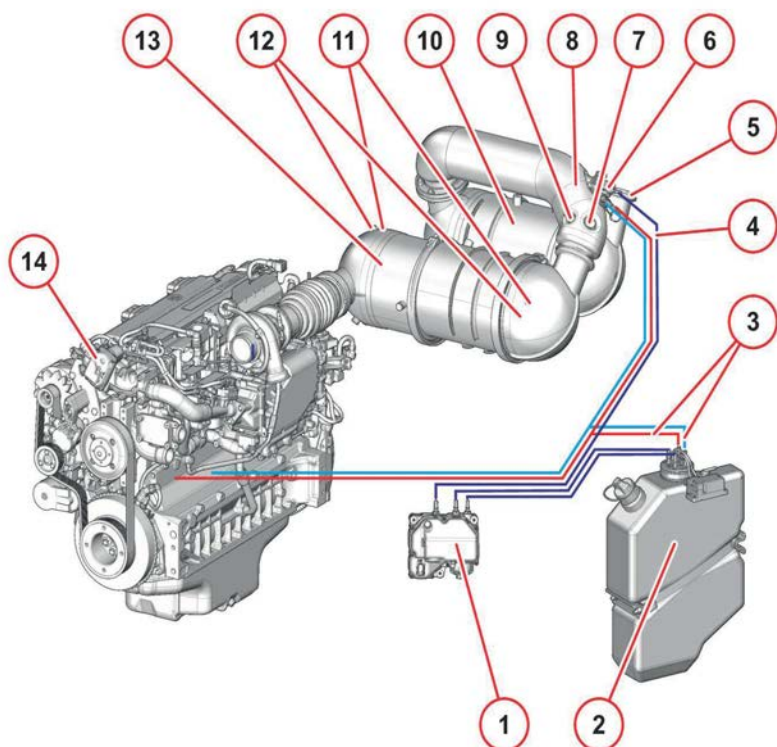
- 1 Exhaust partial flow (uncooled)
- 2 Coolant intake
- 3 Actuator (electric)
- 4 Exhaust return cooler.
- 5 Flutter valve
- 6 Coolant return
- 7 Combustion air inlet
- 8 Exhaust partial flow (cooled)



Exhaust gas aftertreatment system

Agricultural engineering

- 1 SCR supply pump
- 2 SCR tank
- 3 Coolant line for preheating the SCR tank
- 4 Throttle valve
- 5 Diesel particle filter
- 6 Pressure sensor
- 7 NOx sensor
- 8 Differential pressure sensor
- 9 Temperature sensor
- 10 NOx sensor
- 11 SCR catalytic converter
- 12 Metering unit
- 13 Coolant line for cooling the metering unit
- 14 SCR line



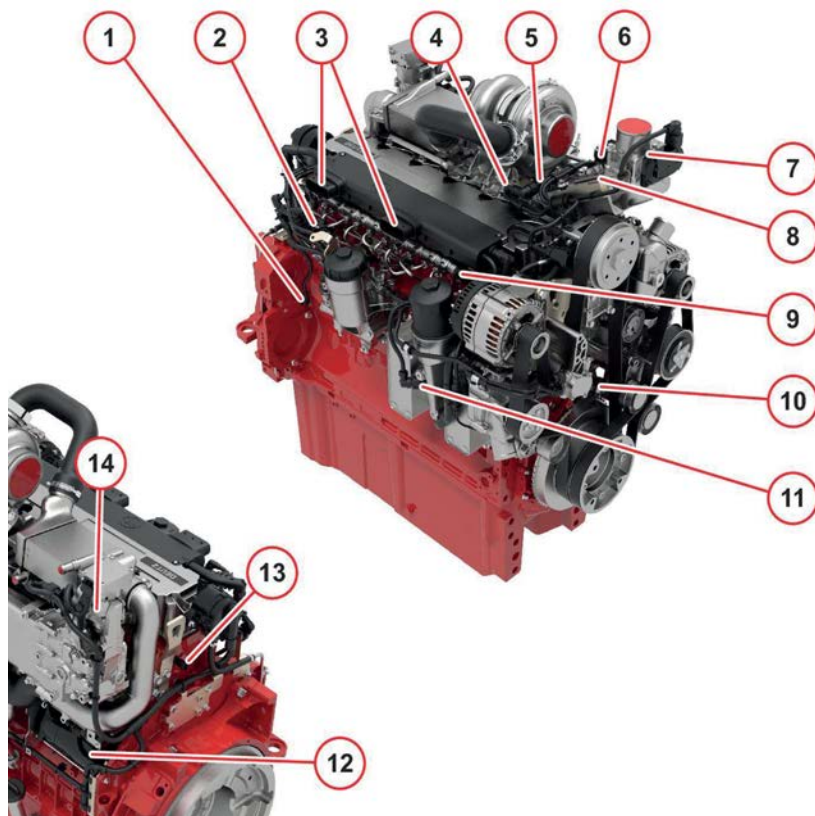
Exhaust gas aftertreatment system

Industrial engine

- 1 SCR supply pump
- 2 SCR tank
- 3 Coolant line for preheating the SCR tank for cooling the metering unit
- 4 SCR line
- 5 NOx sensor
- 6 Metering unit
- 7 NOx sensor
- 8 Temperature sensor
- 9 Pressure sensor
- 10 SCR catalytic converter
- 11 Differential pressure sensor
- 12 Temperature sensor
- 13 Diesel particle filter
- 14 Throttle valve

Engine description

Electrics/Electronics



Electronic engine control

- 1 Speed transmitter via camshaft
- 2 Control block FCU (Fuel Control Unit)
- 3 Central connector (for engine control unit)
- 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 Exhaust gas return 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.

DEUTZ AG installation regulations 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 units.

To avoid damaging the control units, all the connections on the control unit must be disconnected before electric welding work. Interventions in the electrical system contrary to the DEUTZ regulations or by unqualified personnel can permanently damage the engine electronics and have serious consequences which are not covered by the manufacturer's guarantee. It is strictly prohibited:

- a) to make changes or add 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 notes

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 vehicle side cable harness must be taken from the DEUTZ connection diagram.

Supply voltage

12 Volt

24 Volt

Sufficient charging of the battery must be ensured. Interruption of the power supply while the engine is running can cause damage to the electrics/electronics. If the supply voltage fails, the engine will shut 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 78.

A diagnosis can be made with:

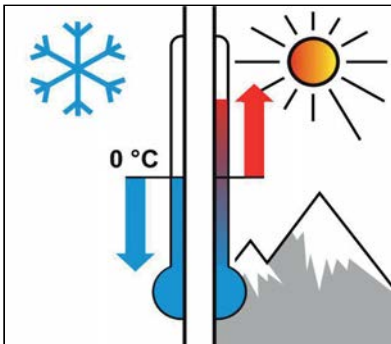
- Error lamp (flash code)
- CAN bus
- DEUTZ electronics display
- Diagnostic socket (SERIDA)

Equipment-side wiring

The DEUTZ AG installation regulations must 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.

Operation

Ambient conditions



Low ambient temperature

The operation of engines under cold or even Arctic climatic conditions requires modifications to the engine during installation, engine operation and maintenance. If these modifications are not taken into account, this can have an impact on the engine starting properties, performance, reliability and the operation of the corresponding exhaust aftertreatment system.



Operating an engine under cold or Arctic climatic conditions without suitable modifications can affect the warranty.

Use of engines in low load operation (engine does not reach the operating temperature) over a long time period under cold climatic conditions results in fuel waste, increased wear and potentially to engine damage. These low temperature conditions result in incomplete combustion and therefore to a build-up of deposits on components within the engine. In addition, operating an engine with low exhaust temperatures and low exhaust gas mass flow can cause premature faults such as engine or the exhaust aftertreatment system failure.

The following measures can be taken by the operator:

Lubricating oil

- Select the lubricating oil viscosity according to the ambient temperature.
- Halve the oil change times in case of frequent cold starts.

Fuel

- Use winter fuel below 0 °C 47.

Battery

- The battery must be well-charged before the engine is started 72.
- Warming the battery to about 20°C improves the engine starting behaviour. (Remove and store the battery in a warm room).

Cold start aid

- The engines in these operating instructions are equipped with glow plugs 31.

Coolant

- Observe the mixing ratio of anti-freeze/cooling water 48.

The following possibilities can be considered by the device manufacturer or retrofitted by authorised specialist personnel:

- Warming the cooling circuit and/or the oil circuit when the engine is not running.
- Maintaining the desired engine operation temperature, particularly in low-load operation, requires:
 - Superimposition of additional load through the application.
 - Use of a device cooler hood or housing.
 - Housing the oil pan and the underside of the engine in order to protect against cold air through the engine fan.
 - If possible, use of a temperature-dependent fan coupling.
- Insulation of fuel lines, filters, pumps or even tanks.
- Warming of the intake air through intake air preheating or diverting the warm engine compartment air.
- Warming the crankcase ventilation.

If you have any additional questions, please contact your equipment supplier or DEUTZ partner.

High ambient temperature, high altitude



These engines are 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.

- Application at high altitude
- Application at high ambient temperatures

Reason: Air density decreases as altitude or ambient temperature increase. This also reduces the quantity of oxygen in the engine intake air resulting in a fuel/air mixture that is too fatty without any reduction in the fuel injection rate.

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

If you have any additional questions, please contact your equipment supplier or DEUTZ partner.

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Operation

Initial commissioning

Preparation for initial commissioning

(maintenance schedule E 10)

- Remove corrosion protection from protected engine.
- Remove and existing transport devices.
- Check battery and cable connections and install if necessary.
- Check the belt tension 66.
- Have the engine monitor or warning system checked by authorised personnel.
- Check engine mounting.
- Check all hose connections and clips for correct fit.

The following actions must be performed additionally for generally overhauled engines:

- Check the fuel pre-filter and main filter and change if necessary.
- Check suction intake air filter (if available, maintain according to maintenance pointer).
- Drain lubricating oil and condensation from the C-intercooler.
- Fill up with engine lubricating oil.
- Filling the coolant system 84.

Fill up with engine lube oil.

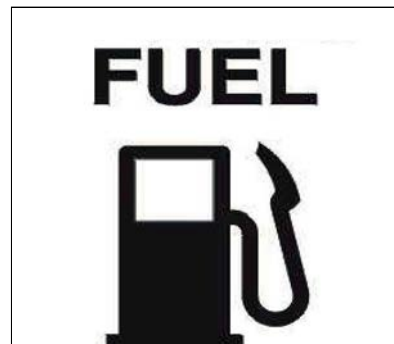


Lack of lube oil or overfilling lead to engine damage.



The engines are generally supplied without lubricating oil filling. Select the engine lubricating oil quality and viscosity before filling. DEUTZ lubricating oils can be ordered from your DEUTZ partner.

- Fill the engine with lubricating oil via the oil filler neck.
- Observe the lubricating oil filling level 84.



Pour in fuel



Never fill the fuel tank while the engine is running. Pay attention to cleanliness. Do not spill any fuel. Additional venting of the fuel system by a 5-minute trial run on no-load or low load is absolutely essential. Only use clean commercially available brand diesel fuel. Observe fuel quality 47. Use summer or winter-grade fuel depending on the ambient temperature.

- Fuel low-pressure system must be vented before initial start-up after filling with the electric fuel supply pump. 57.



Filling with AdBlue®



AdBlue® is known by different names depending on the region: in the USA as DEF (Diesel Exhaust Fluid), in Brazil as ARLA32. The technical designation is AUS32. AdBlue® is a registered trademark of the Verband der Automobilindustrie e.V (VDA - German Association of the Automotive Industry).



Only re-fuel when the engine is not running. Only fill with AdBlue®! Other media (e.g. diesel), even in the smallest amounts, can cause destruction of the system. If you have filled with e.g. diesel and this has got into the system, the complete AdBlue® injection system must be replaced!



If the filled medium (e.g. diesel) has not reached the lines and supply pump/metering module, emptying and thoroughly cleaning the AdBlue® tank is sufficient. Pay attention to cleanliness.

AdBlue® minimum refilling quantity

When fuelling with AdBlue®, the following minimum refilling quantities must be adhered to. Fuelling below the prescribed minimum refill quantity is only permissible if the tank does not have sufficient spare tank volume at the time of fuelling.

Tank volume	Minimum refilling quantity
< 20 litres	5 litres or a full tank
≥ 20 litres	10 litres or a full tank

Filling the coolant system



The coolant must have a prescribed concentration of cooling system corrosion protection agent! Never operate the engine without coolant, not even briefly!



Order coolant corrosion protection agent from your DEUTZ partner.

- Fill cooling system via the compensation tank.
- Close compensation tank with valve.
- Start the engine and warm up until the thermostat opens.

- 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 84.

Trial run



Additional venting of the fuel system by a 5-minute trial run on no-load or 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 re-fill

Operation

Initial commissioning

- Check the coolant level and top up coolant if necessary.
- Work during the trial run:
 - Check engine for tightness.



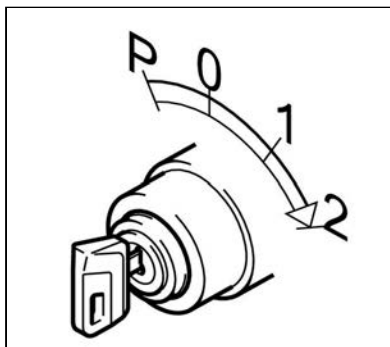
Before starting make sure that there is nobody in the engine/work machine hazard zone.
After repairs: Check that all protective equipment is mounted and all tools have been removed from the engine.
When starting with glow plugs do not use any additional starting devices (e.g. injection with start pilot). Danger of accident!



If the engine fails to fire and the error lamp lights, the electronic engine control has activated the start lock to protect the engine. The start lock is released by switching off the system with the ignition key for about 30 seconds.
Start the engine for a maximum of 20 seconds uninterrupted. 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 starting processes, determine the cause as per fault table. [73](#).
Do not run the engine up to high idling speed/full load operation straight from cold.



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



with cold starting device

- Insert key.
 - Step 0 = no operating voltage.
- Turn key to the right.
 - Step 1 = operating voltage.
 - Engine is ready for operation.
- The electronic engine control activates the current feed to the glow plugs when the engine coolant temperature falls below a certain temperature.
- Push in the key and turn further to the right against the spring pressure.
 - Level 2 = start.
- release the key as soon as the engine starts up.
 - Pilot lamps 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.

Operation

Operation monitoring

Electronic engine control

The system monitors the condition of the engine and itself.

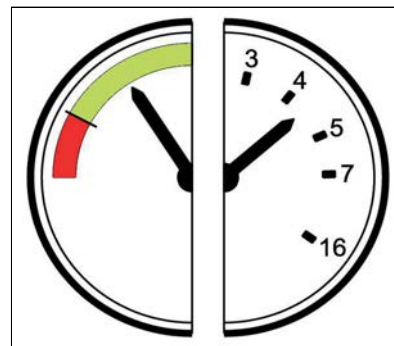
- Function test
 - Ignition on, error lamp lights up for approx. 2 seconds and then goes out.
 - Check the error lamp if there is no reaction after switching on the ignition.
- Error light does not light up.
 - After the lamp test an extinguished lamp indicates an error-free and trouble-free operating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

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

- Flashing
 - Serious error in system.
 - Switch off prompt for the operator. Attention: Failure to do so will lead to loss of guarantee!
 - The engine has reached switch-off condition.

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

The engine protection functions are released in co-operation with the equipment manufacturer and the DEUTZ installation consulting and may be designed individually. 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 operating state
 - Take suitable action.
- Measured value scale
 - Actual value can be seen directly. The target value must be taken from the technical data. [84](#).

Instruments and symbols

Instruments/symbols	Designation	Possible displays	Measure
	Lube oil pressure indicator	Lubricating oil pressure in the red	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 control light	Lubricating oil below minimum	Switch off engine
	Lubricating oil level	Lubricating oil pressure too low	Fill up lubricating oil
	Coolant level	Coolant level too low	Shut down the engine, allow to cool and top up coolant
	Operating time counter	Indicates the engine operating time passed	Observe the maintenance intervals

Operation

Operation monitoring

Instruments/symbols	Designation	Possible displays	Measure
	Horn	With acoustic signal	See fault table 73
	SCR function lamp	Continuous light flashes (0.5 Hz) flashes (1 Hz) flashes (2Hz)	Check AdBlue® filling level Check SCR system
	Ash lamp	Continuous light	The ash lamp indicates, that loading of the diesel particle filter with incombustible residues has reached a critical level and must be replaced. 41
	Regeneration lamp	Continuous light flashes (0.5 Hz) flashes (3 Hz)	Initiate standstill regeneration 41
	Engine warning lamp	Continuous light Flashing	Initiate standstill regeneration in combination with the DPF function lamp 41



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
- 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 SCR tank
- Battery voltage
- Position of accelerator pedal
- 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.

Operation

Exhaust gas aftertreatment system

Selective Catalytic Reduction (SCR)



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

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

The injected volume of SCR 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:

- SCR fill 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 (crystallisation)

As soon as crystallisation is detected, a standstill regeneration request is issued.

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.

SCR filling level

Warnings begin from an SCR filling level below 15 %.

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

Operation

Exhaust gas aftertreatment system

Catalytic converter efficiency/Adblue® quality	SCR function lamp	Engine warning lamp	DEUTZ CAN display	Power reduction
too low	Continuous light Acoustic signal	Continuous light	SCR symbol Text message Acoustic signal	Stage 1 After pre-warning time
too low not remedied	Continuous light Acoustic signal	Flashing	SCR symbol Text message Acoustic signal	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
detected	Continuous light Acoustic signal	Continuous light	SCR symbol Text message Acoustic signal	Stage 1 After pre-warning time
not remedied	Continuous light Acoustic signal	Flashing	SCR symbol Text message Acoustic signal	Stage 2 After pre-warning time

System fault

System faults may be faults of individual SCR components such as an implausible NOx or temperature sensor value. The performance is reduced if the SCR 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

Crystallisation

Crystallisation 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

Operation

Exhaust gas aftertreatment system

Diesel oxidation catalyst (DOC)

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 (DPF)

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 oxide contained in the exhaust, which is first oxidised in the DOC. This process takes place continuously as soon as the exhaust temperature exceeds 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 lubricating 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 independently of the application, for example by:
 - Activating the parking brake.
 - Engaging a specified gear position in the gearbox.

Operation

Passive regeneration

- 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 emissions from the engine 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 (<10 hours) 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 diesel particle filter is overloaded to an impermissible level, then the diesel particle filter can only be regenerated via 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 diesel particle 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●

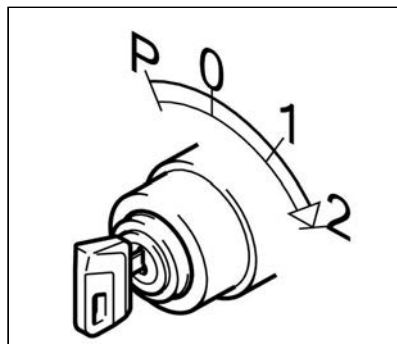
Display of the regeneration control

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

Operation

Stopping process



Shutting down



Avoid switching off from full load (coking/blockage of the remaining lubricating oil in the turbocharger bearing housing). The turbocharger's lube oil supply is no longer ensured! This shortens the life of the turbocharger.
Run the engine in low idling speed for approximately one minute after relieving the load.

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.

- Move the key to position 0.
 - P = gear position: park
 - 0 = gear position: Shut down engine
 - 1 = gear position: Ignition on
 - 2 = gear position: Start engine

General

Modern diesel engines place very high demands on the lubricating oil used. The specific engine performances increased constantly in recent years lead to increased thermal stress of the lubricating oil. In addition, the lubricating oil is subject to heavier contamination due to reduced lubricating oil consumption volumes and increased lubricating 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 lubricating oil and an additive package. The additives perform 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 components). The properties of the base lubricating oil are also decisive for the quality of the product, e.g. with regard to the thermal load.

In principle, all engine lubricating oils of the same specification can be mixed. Mixtures of engine lubricating oils should however be avoided because the worst properties of the mixture always dominate.

The lubricating oils approved by DEUTZ AG 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, efficiency and thus the economy of the engine. As a general principle, 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 viscosity. Since some processes which are relevant for determining the lubricating oil change times are largely dependent on the oil quality (e.g. the infiltration of soot and other contamination), the oil change time for synthetic lubricating oils may not be increased in relation to the specifications on lubricating oil change intervals.

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

Quality

Lubricating oils are classified by DEUTZ according to their efficiency and quality class (DQC: DEUTZ Quality Class). 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).

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

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

Permissible quality class	
DEUTZ	Other
Engines with exhaust aftertreatment system	
DQC III LA *	Please contact your DEUTZ partner or visit www.deutz.com
DQC IV LA *	
* Sulphur content in the fuel < 15 mg/kg	

For low-ash engine oils released according to the DQC system a corresponding note is given in the oil release list.

DEUTZ lubricating oils DQC IV, low ash DEUTZ Oil Rodon 10W40 Low SAPS	
Container	Ordering 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
 - Engine application type
 - Number of standstill regenerations
- The lubricating oil replacement interval must be halved if at least one of the following conditions applies:
 - Ambient temperatures below -10 °C (14 °F) or lubricating oil temperature below 60 °C (140 °F).

Operating media

Lubricating oil

- Sulphur content in the diesel fuel less than 0.5 mass fraction.
- If the prescribed lubricating oil change intervals are not reached within a year, the lubricating oil must be changed at least once a year.

Viscosity

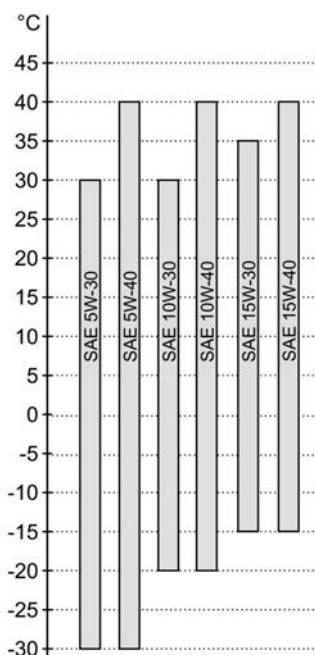
The ambient temperature at the installation site or in the area of application of the engine is decisive for selecting the right viscosity class. Too high a viscosity can lead to starting difficulties, too low a viscosity can endanger the lubricating effect and result in high lubricating oil consumption. 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 gas after-treatment systems	
SCR	Selective catalytic reduction
DOC	Diesel oxidation catalytic converter
DPF	Diesel particle filter

The following fuel specifications 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

The warranty is excluded when using other fuels which do not meet the requirements of this operation manual.

The certification measurements for compliance with the legal emission limit values are carried out with the test fuels specified in the laws. These correspond to the diesel fuels described in this operating manual according to EN 590 and ASTM D 975. With the other fuels described in this operating manual, no emission values are guaranteed.

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 visit www.deutz.com

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 fuel stations in winter.



For engines with 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. Winter diesel fuel must be used at ambient temperatures below 0 °C (up to -20 °C) (this is offered at fuel stations in good time before the start of winter).

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

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Operating media

Coolant

General



Never operate the engine without coolant, not even briefly!

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]		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:
Add diluted caustic soda or potassium soda. It is advisable to make small test mixtures.
- 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 protectants



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 coolant is conditioned for liquid-cooled DEUTZ compact engines by mixing an antifreeze with corrosion protection inhibitors on an ethylene-glycol base with the water.

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

DEUTZ cooling system corrosion protection agent	
Specifications	Remarks
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	Ordering number:
5 litre canister	0101 7990
20 litre canister	0101 7991
210 litre barrel	0101 7992

The DEUTZ cooling system protection agent corresponds to the quality class DEUTZ DQC CB-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.

If the DEUTZ cooling system corrosion protection agent is not available please contact your DEUTZ partner or visit www.deutz.com.

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 inspection of the concentration of cooling system protectant can be carried out with standard testing devices (e.g. refractometers).

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.

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Operating media

SCR reduction agent

AdBlue® (SCR reducing agent)



AdBlue® is known by different names depending on the region: in the USA as DEF (Diesel Exhaust Fluid), in Brazil as ARLA32. The technical designation is AUS32. AdBlue® is a registered trademark of the Verband der Automobilindustrie e.V (VDA - German Association of the Automotive Industry).



Protective gloves and goggles must be worn when handling AdBlue®. Do not swallow. Ensure sufficient ventilation. Pay attention to cleanliness. Residues of AdBlue® must be disposed of in an environmentally friendly manner. Observe the notes on the safety data sheet.

Exhaust gas after-treatment systems	
SCR	Selective catalytic reduction

AdBlue® is a highly-pure, aqueous, 32.5% urea solution which is used as an NOX 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 is necessary to preheat the SCR system at ambient temperatures below -11 °C.

DEUTZ offers its customers an additive reducing agent, DEUTZ SCR Guard.

The patented formula improves the injection pattern of the urea solution and prevents crystallisation and potential blocking of the catalytic converter.

Users with frequent applications in partial load operation, with several starts and stops and at low external temperatures benefit in particular from the additive reducing agent.

DEUTZ SCR Guard	
Container	Ordering number:
10 litre canister	0101 6540
210 litre barrel	0101 6541



SCR tank

The SCR 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 SCR tank when decommissioning.

Please contact your DEUTZ partner or see www.deutz.com

Assignment of the DEUTZ maintenance and service schedules to the maintenance intervals

Routine maintenance work plan TCD 4.1 L4 / TCD 6.1 L6 / TCD 6.1 L6			
Stage	Activity	To be performed by:	Maintenance interval every operating hours (oh)
E10	Initial commissioning	Authorised qualified personnel	When commissioning new or overhauled engines
E20	Daily inspection	Operator	1x daily or every 10 oh in continuous operation
E30	Maintenance	Qualified personnel	500 ^{1) 2) 5)}
E40	Extended maintenance I		1,000 ^{3) 5)}
E50	Extended maintenance II	Authorised qualified personnel	2,000 ⁵⁾
E55	Extended maintenance III		4,000 ⁵⁾
E60	Intermediate overhaul		6,000 ^{4) 5)}
E70	Major overhaul		7,000 ^{5) 6)}
¹⁾	The lubricating oil load may be high depending on the application. The lubricating oil change interval must be halved here  45.		
²⁾	Specification for lubricating oil change interval, based on lubricating oil quality DQC III.		
³⁾	Specifications for lubricating oil change interval related to the lubricating oil quality DQC IV in conjunction with optional engine configuration.		
⁴⁾	Specification for cooling system protective agent change interval, on the basis of the cooling system protective agent specification DQC CB-14 and DQC CC-14.		
⁵⁾	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.		
⁶⁾	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

Maintenance schedule

Maintenance measures

Stage	Activity	Measure
E10		The measures are described in chapter 3.
E20	Check	Lubricating oil level (refill when necessary)  54
		Cooling system protective agent level (refill when necessary)
		Check engine for tightness (visual check for leakage)
		Exhaust system including exhaust aftertreatment components for leaks
		Suction air filter/dry air filter (if available maintain according to maintenance pointer)
		Emptying of the water tank in the fuel pre-filter
E30	Check	V-belts
		Cooling system protective agent (additive concentration)  62
		Intake air pipes for damage  64
	Replace	Lube oil A lube 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  54
E40	Check	Lubricating oil filter  54
		C-intercooler cooler inlet area (drain lube oil/condensation)
		battery and cable connections  72
		Cold starting device
		Engine mounting (tighten if necessary, renew if damaged)
		Fastenings, hose connections/clips (renew if damaged)
		V-rib belt and tensioning pulley  66
	Replace	Lubricating oil ³⁾ A lube 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  54
		Lubricating oil filter 3)  54
		Fuel filter  57
		Fuel pre-filter  57
		Dry air filter  64
		V-belts  66
		SCR-feed pump filter cartridge  57

Stage	Activity	Measure
E50	Set	Valve clearance 68
E55	Replace	V-rib belt and tensioning pulley 66
E60	Replace	Crankcase ventilation
		Cooling system protective agent 62
annually	Clean	Exhaust gas turbocharger compressor inlet
	Check	Engine monitor, warning system To be maintained by authorised service personnel only!
	Replace	Fuel filter 57
		Fuel pre-filter 57
		Lubricating oil 54
		Lubricating oil filter 54
Every 2 years	Replace	Dry air filter 64
		V-belts 66
Every 3 years	Replace	SCR-feed pump filter cartridge 57
Every 4 years	Replace	Cooling system protective agent 62
Status dependent	Change	Dry air filter (if available maintain according to maintenance pointer) 64 Diesel particle filter, the required exchange is displayed by the ash lamp or via an electronic display, depending on the engine version (see DEUTZ exchange programme)
	Empty	Fuel pre-filter with water trap. If the warning system is activated (lamp/horn), the water trap bowl must be emptied immediately 57

Maintenance diagram

A self-adhesive maintenance diagram is provided with every engine. This should be stuck to the engine or device in a prominent position.

Ordering number: 0312 4669 (TCD 4.1 L4 / TCD 6.1 L6 / TTCD 6.1 L6)

Service and maintenance work

Lubricating oil system

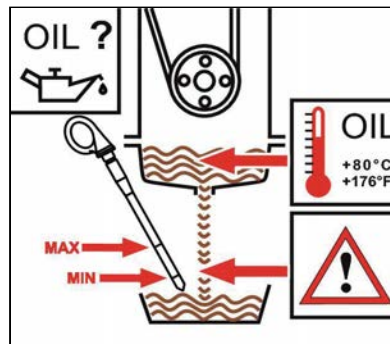
Regulations for working on the lubricating oil system



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



Ensure the highest degree of cleanliness when working on the lubricating oil system. Carefully clean the area around the components concerned. Blow wet parts dry with compressed air. Observe safety regulations and national regulations when working with lube oils! Dispose of leaking lube oil and filter elements according to regulations. Do not allow used lubricating oil to seep into the ground. Do a trial run after all work. Pay attention to leakage and lube oil pressure and then check the engine lube oil level.



Checking the lubricating oil level.



Lack of lube oil or overfilling lead to engine damage.
The lubricating oil level may only be checked when the engine is horizontal and switched off.
Only check lubricating oil level whilst warm, 5 minutes after shutting down.



Be careful with 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 goes.
- Remove the lubricating oil dipstick and read the lubricating oil level.

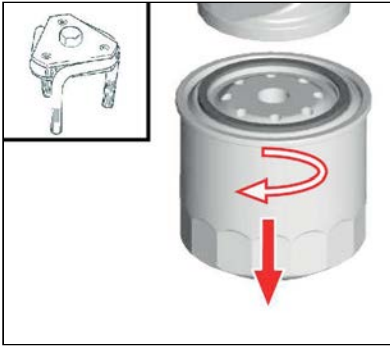
- The lubricating oil level must always be between MIN- and MAX-1 markings! If necessary, fill up to MAX-marking.

Changing the lubricating oil

- Run the engine warm (lubricating oil temperature > 80 °C).
- Position the engine or vehicle so as to be level.
- Shut down engine
- Position a collecting vessel under the lubricating oil drain plug .
- Unscrew the lubricating oil drain plug, drain the lubricating oil.
 - In the case of agricultural technology engines with a separate oil pan, both oil drain plugs must be unscrewed.
- Turn in and tighten lubricating oil drain plug fitted with new sealing ring.

Tightening torque:

55 Nm
- Fill in lubricating oil.
 - Quality/viscosity information [45](#)
 - Filling quantity [84](#)
- Run the engine warm (lubricating oil temperature > 80 °C).
- Position the engine or vehicle so as to be level.
- Check lubricating oil level, if necessary re-fill

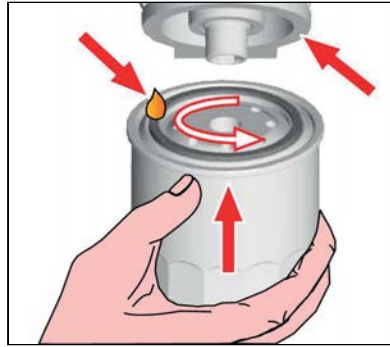


Change lubricating oil filter



Filter may never be pre-filled. Danger of soiling!

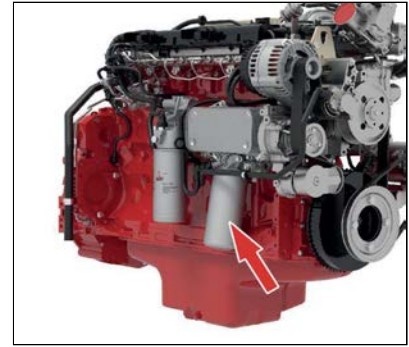
- Loosen and unscrew filter with tool (order no.: 0189 9142)
- Collect escaping lube oil.
- Clean the sealing surface of the filter carrier with a clean, lint-free cloth.



- Oil the seal of the new DEUTZ original spare filter lightly.
- Screw on new filter by hand until the gasket is touching and tighten.

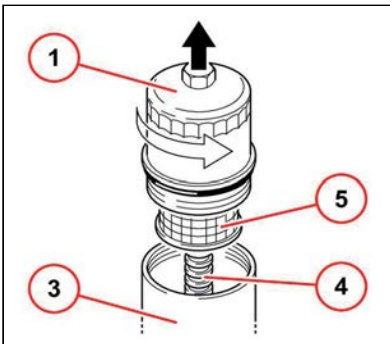
Tightening torque:

15 Nm - 17 Nm



Service and maintenance work

Lubricating oil system



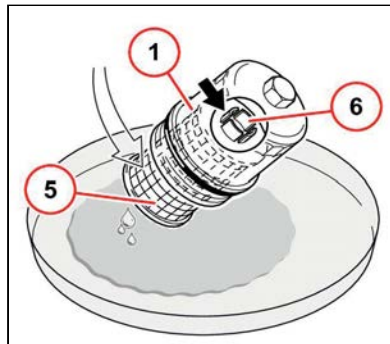
Replace lubricating oil filter cartridge

- 1 Cover
- 2 Sealing ring
- 3 Housing
- 4 Guide
- 5 Filter cartridge
- 6 Clamp

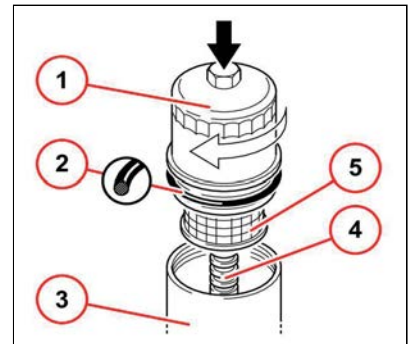


Filter may never be pre-filled. Danger of soiling!

- Shut down 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 escaping lube oil.
- Bend the filter cartridge in the collecting container slightly to the side until the cartridge comes out of the bracket.
- Clean the parts.



- Replace gasket and oil lightly.
- Press new filter cartridge into bracket and place them carefully into the guide.
- Screw the cover clockwise until tight.

Tightening torque:

40 Nm

Specifications when working on the fuel system



Engine must be switched off!
Smoking and naked lights are prohibited!
No injection/high pressure pipes may be disconnected while the engine is running.
Careful with hot fuel.
Ensure the highest degree of cleanliness when refuelling and working on the fuel system.
Carefully clean the area around the components concerned. Blow wet parts dry with compressed air.
Observe safety regulations and national regulations when working with fuels.
Dispose of leaking fuel and filter elements properly. Do not allow fuel to seep into the ground.
After all works on the fuel system, the system should be vented, a trial run performed and the tightness checked.
It is necessary to vent the fuel system when recommissioning, following maintenance work or if the tank has been completely emptied.



Additional venting of the fuel system by a 5-minute trial run on no-load or 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.



Replace fuel change filter



Filter may never be pre-filled. Danger of soiling!

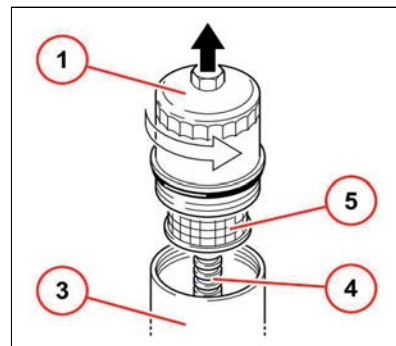
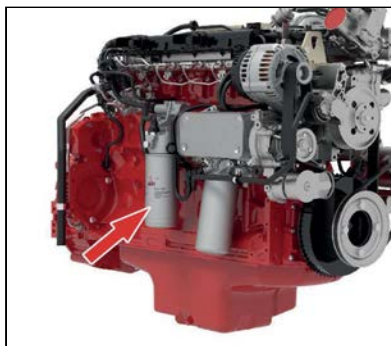
- Loosen and unscrew filter with tool (order no.: 0189 9142).
- Collect escaping fuel.
- Clean the sealing surface of the filter carrier with a clean, lint-free cloth.

Service and maintenance work

Fuel system



- Lightly wet the seal of the new DEUTZ original changeable filter with fuel.
- Screw on new filter by hand until the gasket is touching.
Tightening torque:
10 Nm - 12 Nm
- Vent the fuel system.

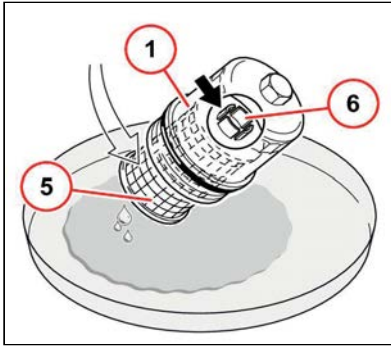


Replace fuel filter cartridge

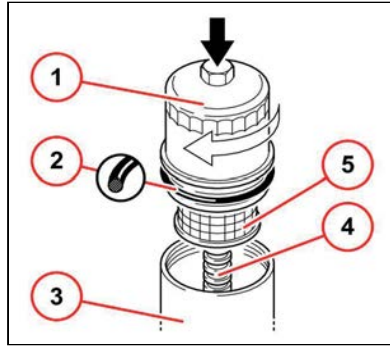
- 1 Cover
- 2 Sealing ring
- 3 Housing
- 4 Guide
- 5 Filter cartridge
- 6 Clamp



Filter may never be pre-filled. Danger of soiling!



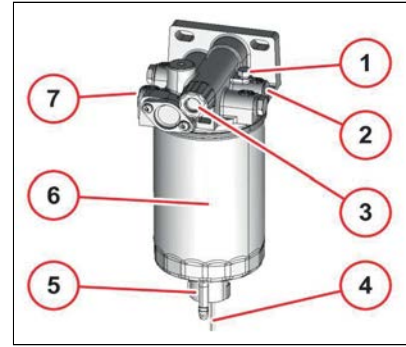
- Collect escaping fuel.
- Bend the filter cartridge in the collecting container slightly to the side until the cartridge comes out of the bracket.
- Clean the parts.



- Replace gasket and oil lightly.
- Press new filter cartridge into bracket and place them carefully into the guide.
- Screw the cover clockwise until tight.

Tightening torque:

40 Nm



Change/vent fuel pre-filter

- 1 Venting screw
- 2 Fuel supply to the fuel supply pump.
- 3 Manual pump for venting
- 4 Electrical connection for water level sensor
- 5 Drain plug
- 6 Filter cartridge
- 7 Fuel supply from the fuel tank.

Empty water tank

- Shut down engine
- Place suitable collecting containers underneath.
- Electrical connection
 - Disconnect cable connections.
- Loosen drain plug.
- Drain fluid until pure diesel fuel runs out.

Service and maintenance work

Fuel system

- Mount drain plug.
Tightening torque:
1.6 Nm $\pm$ 0.3 Nm
- Electrical connection
 - Connect cable connections.

Change the fuel pre-filter

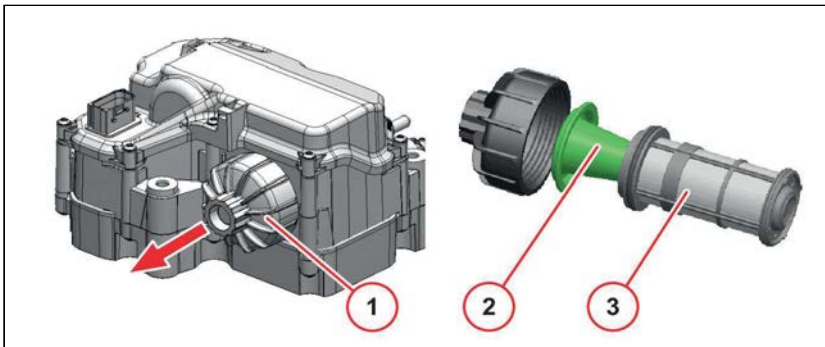
- Shut down engine
- Shut off the fuel supply to the engine (with high lying tank).
- Place suitable collecting containers underneath.
- Electrical connection
 - Disconnect cable connections.
- Loosen drain plug and drain liquid.
- Disassemble filter insert.
- Clean any dirt off the sealing surfaces 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.
Tightening torque:
17 Nm - 18 Nm

- Mount drain plug.
Tightening torque:
1.6 Nm $\pm$ 0.3 Nm
- Electrical connection
 - Connect cable connections.

- Open the fuel shutoff tap and vent the fuel 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 piston is now pressed out through the spring.
- Pump until no more air escapes at the vent screw.
- Tighten vent screw.
Tightening torque:
1.6 Nm $\pm$ 0.3 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 it for 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 SCR supply pump

- 1 Cover
- 2 Compensation body
- 3 Filter cartridge



Protective gloves must be worn when working with components of the SCR system.
Pay attention to cleanliness.

- Insert new filter insert with compensation body.
 - Mount cover.
- Tightening torque:
22.5 Nm $\pm$ 2.5 Nm
- Electrical connection
 - Connect cable connections.
 - Start.

- Shut down 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.

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Service and maintenance work

Cooling system

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, not even briefly!

Checking the coolant level with an external cooler

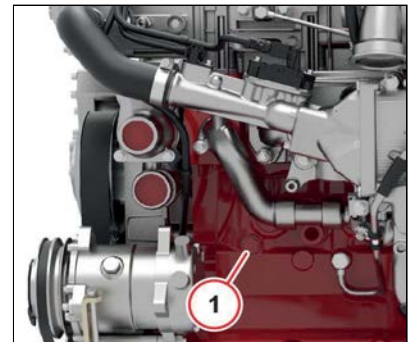
- Fill in new coolant and vent the system according to the specifications of the cooling system manufacturer.
- Open the cooling system cap (1) carefully.
- The coolant level must always be between the MIN and MAX marks of the compensation tank! If necessary, fill up to MAX-marking.



Check coolant additive concentration

- Open the cooling system cap (1) carefully.
- Check the coolant additive mixing ratio in the cooler/compensation tank (2) with a conventional freeze protection measuring instrument (1) (e.g. hydrometer, refractometer).  48.

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



Emptying the cooling system

- Open the cooling system cap (1) carefully.
- Place suitable collecting containers underneath.
- Remove the locking screw (1) in the crankcase.
- Drain the coolant.
- Insert screw again with sealant.
- Close the cooling system sealing cover.



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 the cooling system sealing cover.
- Close the cooler venting screw if necessary.
- Run engine up to operating temperature (opening temperature of the thermostat).
- Shut down engine

- Check coolant level in the cooled engine and top up to the MAX mark or filling level on the compensation tank if necessary.

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Service and maintenance work

Suction system

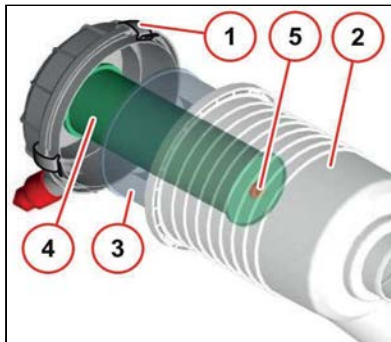
Regulations for working on the intake system



Do not work on the running engine!



Ensure the highest degree of 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



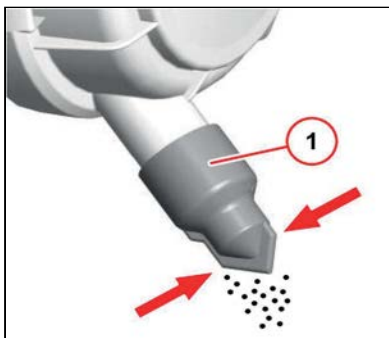
Never clean the safety cartridge (4).

- Renew the safety cartridge (4) at the interval specified 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 filter hood (2) and fix with clamping yoke (1).



Maintenance indicators for dry air filter

- The dry air filter is maintained according to a maintenance indicator or service gauge.
- Maintenance is necessary when:
 - the yellow indicator light of the maintenance switch illuminates when the engine is running.
 - the red field (1) of the maintenance indicator is fully visible.
- After completion of the maintenance work push the reset button on the service gauge. The service gauge is ready for operation again.



Clean the dry air filter dust discharge valve.

- Empty the dust discharge valve (1) by pressing together the discharge slit.
- Remove any stuck on dust residues by squeezing the upper area of the valve.
- Clean the discharge slit.

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Service and maintenance work

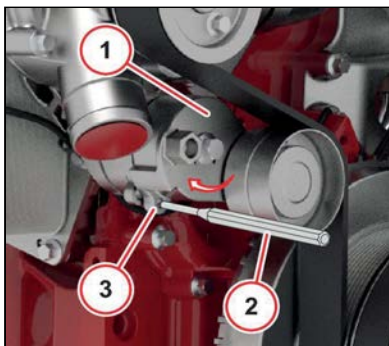
Belt drives

Checking the belt drive



Only carry out work on the belt drive with the engine at a standstill!
After repairs: Check that all protective equipment is mounted and all tools have been removed from the engine.

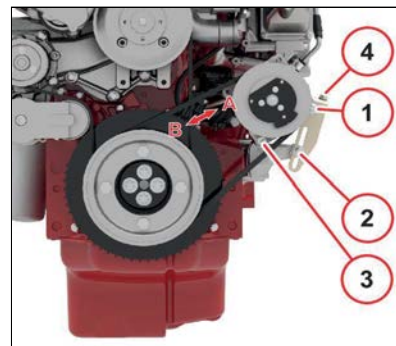
- Check the entire belt drive visually for damage.
- Renew damaged parts.
- Remount protective devices if necessary.
- Pay attention to correct fit of new belts, check the tension after running for 15 minutes.



Replace V-rib belt

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

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

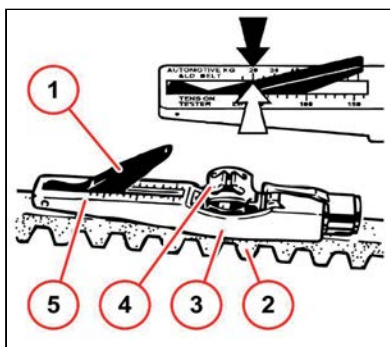


Renewing the V-belt

- 1 Screw
- 2 Screw
- 3 Screw
- 4 Setting screw

- Loosen all screws and lock nuts.
- 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.
- Check belt tension.
- Retighten screws and lock nuts.
 - Screw (1) 30 Nm

- Screw (2) 30Nm
- Screw (3) 42 Nm



Checking V-belt tensioning

- Lower indicator arm (1) into the measuring device.
- Place guide (3) between two belt pulleys on the V-belt (2). The stop must 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).
- Retighten and repeat the measurement if necessary.

Tool

The v-belt tension measurement device (order no.: 0189 9062) is available to order from your DEUTZ partner.

Service and maintenance work

Adjustment work

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 cowl.
- 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.

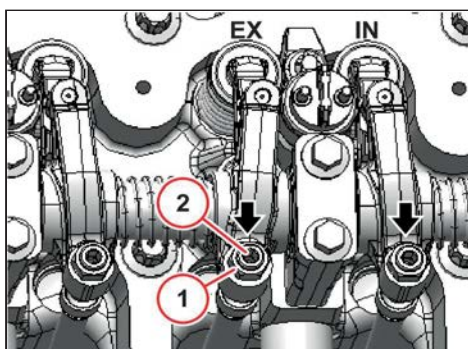
The cylinders to be set can be seen in the setting schematic.

TCD 4.1 L4

Valve overlap	Set
1	4
3	2
4	1
2	3

TCD 6.1 L6

Valve overlap	Set
1	6
5	2
3	4
6	1
2	5
4	3

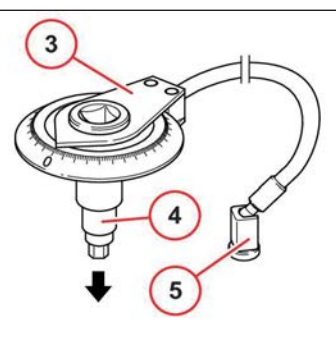


Set the valve clearance

- 1 Lock nut
- 2 Setting screw
- 3 Rotation angle disc
- 4 Socket wrench insert
- 5 Magnet

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

- 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 the scale to zero.



- Turn rotation angle disc anticlockwise until reaching the specified rotation angle:
- Secure the rotation angle disc against twisting.
- Tighten lock 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 cowl (if necessary, with new seal) in reverse order of disassembly.
- Tighten screws.

Tightening torque:

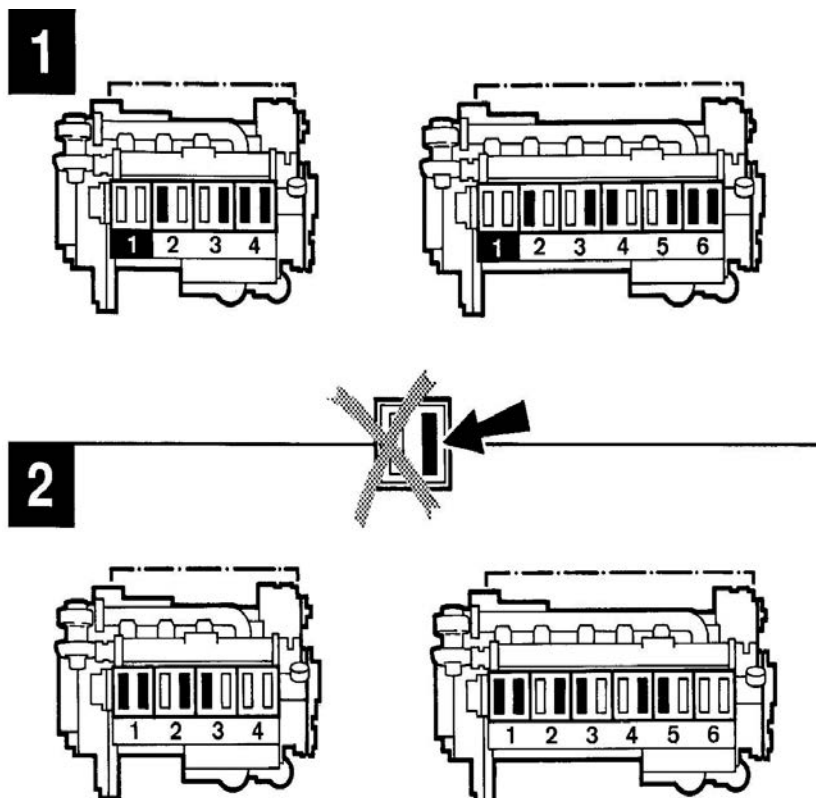
9 Nm

Tool

The rotary angle disc (order no.: 0189 9093) is available to order from your DEUTZ partner.

Service and maintenance work

Adjustment work



Valve clearance setting schematic

- **Crankshaft position 1**
Turn crankshaft until both valves overlap on the cylinder.
Outlet valve is not yet closed, inlet valve begins to open.
Set black marked valves.
Mark the respective rocker arm with chalk to check the setting you have made.
- **Crankshaft position 2**
Turn the crankshaft one turn (360°).
Set black marked valves.

Cleaning work



With all cleaning work it must be ensured that components are not damaged (e.g. bent cooler grille etc.). Cover electrical/electronic parts and connections to clean the engine (e.g. control units, generator, solenoid valves etc.). Do not aim water/steam jet directly at them. Run the engine warm afterwards.



Only carry out cleaning work on the engine when it is not running! Remove the engine cover and cooling air hood if applicable and replace after cleaning. The respective applicable environmental regulations must be observed.

General

The following causes of contamination make cleaning the engine necessary:

- 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 soiling.

Cleaning with compressed air

- Blowing dirt off or out. Always blow 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 engine so that water residues evaporate.
- Always clean the cooler and cooling fins from the exhaust air side to the fresh air side.

Service and maintenance work

Electrical system

Regulations regarding work on the electrical system



Do not touch live parts, replace faulty indicator lamps immediately.



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 water/steam jet directly at them. Warm up the engine. Under no circumstances may the voltage be tested by tapping against the earth cable. During electrical welding work, the earthing terminal of the welding device must be directly clamped to the part to be welded. Three-phase current generator: Do not interrupt the connection between the battery, generator and controller while the engine is running.



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 place tools on top of the battery!

Removing the battery

- When clamping off the battery, always disconnect the negative pole first. Otherwise there is a danger of short-circuiting.
- Remove the fastenings and take out the battery.

Installing the battery

- Insert new or charged battery and attach the fastenings.
- Clean the terminals and battery poles with fine-grained sandpaper.
- When connecting, connect the plus pole first and then the minus pole. Otherwise there is a danger of short-circuiting.
- Make sure the terminals have a good contact. Tighten the clamping screws by hand.
- Grease the assembled terminals with an acid-free, acid-resistant grease.

Battery



When clamping off the battery, electronically stored data may be lost. Keep the battery clean and dry. Make sure that the battery fits correctly and tightly. Dispose of old batteries in an environmentally friendly way.



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

Faults and corrective measures

Faults	Causes	Measures
Engine does not start up or starts up with difficulty	Not disconnected (if possible)	Check coupling
	Fuel tank empty	Tanks
	Fuel suction pipe blocked	Check
	Starting limit temperature not reached	Check
	Cold starting device	Check/replace
	Wrong SAE viscosity class of the engine lubricating oil	Change lubricating oil
	Fuel quality does not comply with operating manual	Change the fuel
	Battery defective or not charged	Check battery
	Cable connections to the starter loose or oxidised	Check cable connections
	Starter defective or pinion doesn't mesh	Check starter
	Air filter soiled/turbocharger defective	Check/replace
	Air in fuel system	Vent the fuel system
	Compression pressure too low	Checking the compression pressure
	Exhaust gas backpressure too high	Check
	High pressure pipe leaking	Check/replace
	High-pressure pump defective	Check/replace
Engines starts up, but runs irregularly or misfires	Exhaust gas backpressure too high	Check
	Compression pressure too low	Checking the compression pressure
	Cold starting device	Check/replace
	Air in fuel system	Vent
	Fuel filter contaminated	Clean
	Fuel quality does not comply with operating manual	Change the fuel
	Injector defective	Change
	High pressure pipe leaking	Check/replace
	Engine cable harness defective	Check/replace

Faults

Fault table

Faults	Causes	Measures
Engine does not start and diagnostic lamp flashes	Engine electronics prevents starting	Check error according to error code and eliminate error if necessary
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 gets too hot. Temperature warning system is activated	Venting line to the coolant compensation tank blocked.	Clean
	Defective lubricating oil cooler	Check/replace
	Lubricating oil filter soiled on the air and/or lubricating oil side	Change
	Lubricating oil level too high	Check lubricating oil level, if necessary drain
	Lubricating oil pressure too low	Fill up lubricating oil
	Injector defective	Change
	Coolant heat exchanger soiled	Clean
	Defective coolant 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/change/tension
	Charge air pipe leaking	Check charge air line
	Charge air pipe soiled	Check/clean
	Air filter soiled/turbocharger defective	Check/replace
	Air filter maintenance indicator / service gauge defective	Check/replace
	Fan defective/V-rib belt torn or loose	Check fan/V-belt, change if necessary
	Exhaust gas backpressure too high	Check
	Throttle valve defective	Check/replace
	Coolant temperature transmitter	Check/replace
	Coolant thermostat defective	Check/replace
	Coolant cover defective	Check/replace

Faults	Causes	Measures
Engine lacks power	Lubricating oil level too high	Check lubricating oil level, if necessary drain
	Throttle valve defective	Check/replace
	Exhaust gas recirculation, actuator defective	Check/replace
	Fuel suction temperature too high	Check system
	Fuel quality does not comply with operating manual	Change the fuel
	Air filter soiled/turbocharger defective	Check/replace
	Air filter maintenance indicator / service gauge defective	Check/replace
	Fan defective/V-rib belt torn or loose	Check fan/V-belt, change if necessary
	Charge air pipe leaking	Check charge air line
	Charge air pipe soiled	Clean
	High pressure pipe leaking	Check/replace
	Injector defective	Change
	Throttle valve defective	Check/replace
	Exhaust gas recirculation, actuator defective	Check/replace
	Exhaust gas backpressure too high	Check/clean
	Exhaust gas turbocharger defective	Change
Engine performs poorly and diagnostic lamp lights	Engine electronics reduce performance	Please contact your DEUTZ partner
Engine doesn't work on all cylinders	High pressure pipe leaking	Check/replace
	Injector defective	Change
	Compression pressure too low	Checking the compression pressure
	Engine cable harness defective	Check/replace
Engine has no, or too little, lubricating oil pressure	Lubricating oil pressure too low	Fill up lubricating oil
	Engine is tilted too far	Check engine mounting / reduce inclination
	Wrong SAE viscosity class of the engine lubricating oil	Change lubricating oil
	Lubricating oil pressure sensor defective	Check/replace
	Lubricating oil control valve jammed	Check/clean

Faults

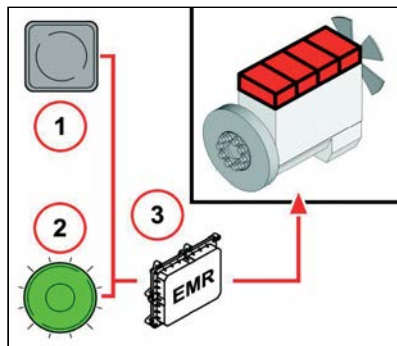
Fault table

Faults	Causes	Measures
Wrong SAE viscosity class of the engine lubricating oil	Lubricating oil suction pipe blocked	Check/clean
Engine lubricating oil consumption too high	Lubricating oil level too high	Check lubricating oil level, if necessary drain
	Engine is tilted too far	Check engine mounting / reduce inclination
	Crankcase ventilation	Check/replace
	Wrong SAE viscosity class of the engine lubricating oil	Change 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 emits blue smoke	Lubricating oil level too high	Check lubricating oil level, if necessary drain
	Engine is tilted too far	Check engine mounting / reduce inclination
	Crankcase ventilation	Check/replace
	Wrong SAE viscosity class of the engine lubricating oil	Change lubricating oil
	Valve shaft seals defective	Check/replace
	Piston rings worn	Check/replace
	Exhaust gas turbocharger defective	Check/replace
Engine emits white smoke	Fuel quality does not comply with operating manual	Change the fuel
	Injector defective	Change
	Condensation	Warm up engine so that water residues evaporate
	Coolant in the exhaust gas	Check
Engine emits black smoke	Diesel particle filter defective	Check/replace

Faults	Causes	Measures
Fault in 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, clean lines, check heating AdBlue® tank frozen, check heating
Frequent standstill regenerations	Air filter soiled/turbocharger defective	Check/replace
	Charge air pipe 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

Faults

Engine management



Engine protection function of the electronic engine control

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



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

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

Depending on the seriousness of a recognised fault, the engine can continue to operate with limitations, during which the diagnostics 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.

Diagnostics lamp

The diagnostics lamp is located in the vehicle drive stand.

The diagnostics lamp can release the following signals:

- Function test
 - Ignition on, diagnostics lamp lights up for approx. 2 seconds and then goes out.
 - Check the diagnostics lamp if there is no reaction after switching on the ignition.
- The lamp does not light up
 - 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!
 - Engine forced to run at low power to cool the engine, with automatic shutdown if necessary.
 - The engine has reached switch-off condition.
 - The switch-off process has been accomplished.
 - There may be a start lock after engine stop.
 - The start lock is deactivated by turning off the system with the ignition key for approx. 30 seconds.
 - In order to avoid critical situations the power reduction can be bypassed, automatic switch-off delayed or a start lock bypassed using the optional emergency key on the instrument panel. This brief deactivation of the engine protection functions is logged in the control unit.

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

Diagnosis button

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

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

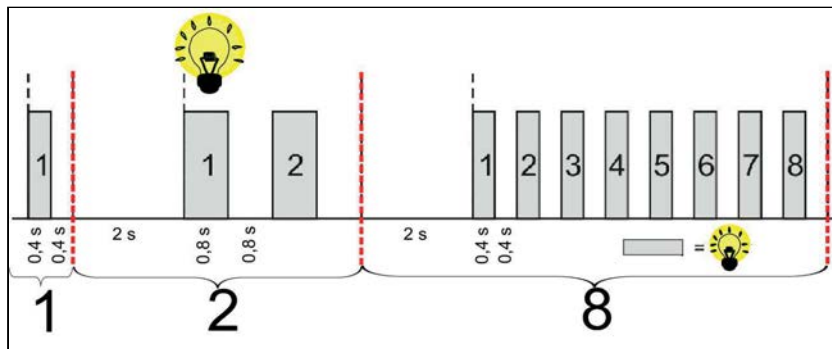
Use of the diagnostic key

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

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

The next error (i.e. the following one in the error memory) can then be displayed by pressing the diagnostic key again. If the last existing fault has been shown the first fault will be shown again by pressing the diagnosis button once more.

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



Displaying system errors by blink code

Example:

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.

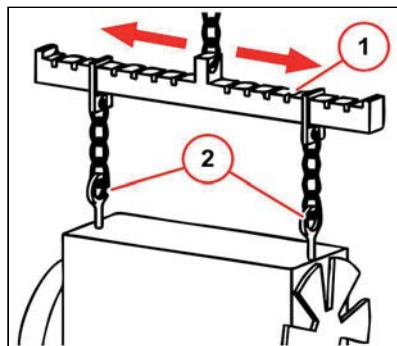
- The blink codes can only be interpreted by a DEUTZ partner.

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Transport and storage

Transport

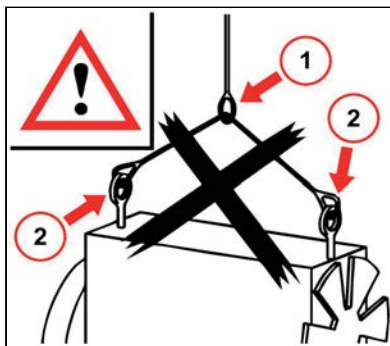


Suspension equipment



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.

- Only use the correct suspension equipment for engine transportation.
- The suspension device (1) must be adjustable for the engine's centre of gravity.
- Following transport/before commissioning the engine: Remove the transport equipment (2).



Mortal danger!
The engine may tip or crash 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:

- Internal corrosion protection
- External 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.

A shorter corrosion duration is to be expected in case of deviation from the measures by exposure of the corrosion protected engines or parts to unfavourable conditions (installation outdoors or storage in damp, unventilated places) or damage to the corrosion protection coating.

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

After completion of the corrosion protection work, the crank drive may no longer be turned in order to prevent the corrosion protection agent from being scraped off in the bearings, bearing liners and cylinder liners.

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

Exhaust gas aftertreatment system

Selective Catalytic Reduction (SCR)

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.
- Completely fill the SCR tank.
- 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:

- Completely empty the SCR tank.
- Completely fill the SCR tank with new AdBlue®.
- Replace the filter cartridge of the SCR 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

- 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.



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.

Lubricating oil system

- Drain the lubricating oil from the engine at operating temperature.

Transport and storage

- Fill the engine with preservation oil and perform a corrosion protection run (together with corrosion protection run for the fuel system). For this, run the engine to reach a temperature of 60 °C, duration of at least 5 minutes, so that all components of the lubricating oil system are wet, or wet all accessible components with preservation oil and pump preservation oil at a temperature of around 60 °C through the engine until all bearings and bearing liners are wet.
- Clean the lubricating oil pan, cylinder head with rocker arms, valves, valve springs thoroughly with diesel fuel or cleaning agent.

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 a cooling air, cooling lubricating oil or coolant system (cooling water with cooling system protection agent).
- In liquid-cooled engines, the coolant must be drained and the cooling system cleaned
- 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 parts and surfaces

- 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. mufflers) which are not painted must be rubbed with talcum powder.

Belt drives

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

Engine corrosion protection

Engine openings

- All engine openings must be fitted with airtight, watertight covers to delay the evaporation processes of the corrosion protection agent. With installed air compressor, the suction and pressure connection must be sealed by a cap.

Air should be locked out 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 lie loosely on the engine so that air can circulate around the engine to prevent condensation from forming. Use 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 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 are described below:

Internal corrosion protection

Fuel system

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

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 preservation 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 oil filler neck.

Cooling system

- If the implemented corrosion protection agent is compatible with the intended coolant 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 coolant system protection agent, the cooling system should be purged with fresh water for about 15 minutes before filling.

Removal of corrosion protection from external parts

- 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-belts if necessary.
- Fit V-belts and V-rib belts according to specifications.
- Fill up the 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

Technical data

Engine and setting data

General technical data

Engine type	Unit	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 a row		
Number of cylinders		4	6	
Bore/stroke	[mm]	101/126		
Engine swept volume	[cm ³]	4038	6057	
Combustion method		Direct injection		
Injection system		Deutz CommonRail (DCR)		
Exhaust gas recirculation		external		
Exhaust aftertreatment		Selective Catalytic Reduction SCR and Diesel Particle Filter DPF		
Valves per cylinder		4		
Valve clearance: Inlet/outlet	[mm]	0,3 ^{±0,05} / 0,5 ^{±0,05}		
Setting with rotation angle disc	[°]	75° ±15° / 120° ±15°		
Ignition sequence of the engine		1-5-3-6-2-4		
Direction of rotation looking onto the flywheel		left		
Engine power according to ISO 3046	[kW]	See engine rating plate		
Speed (nominal speed)	[rpm]	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		

Engine type	Unit	TCD 4.1 L4	TCD 6.1 L6	TTCD 6.1 L6
Start of thermostat opening	[°C]	87		
Thermostat fully open	[°C]	102		
Lube oil change volume (with filter) Industrial engines/Agricultural technology	≈[l]	11.5*	15.5* / 25.0*	25.0*
Lube oil temperature in the lube oil pan, maximum	[°C]	125		
Lube oil pressure minimum (low idle speed, engine warm)	[kPa/bar]	80/0.8		
Permissible maximum combustion air temperature after charge air cooler	[°C]	50		
V-belt tension		Pre-tighten/retighten		
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

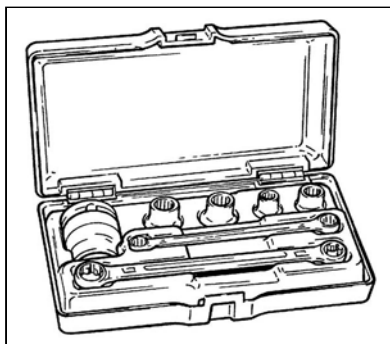
*specified lube oil filling volumes apply for standard versions. The lubricating oil filling volume may vary in engines which deviate from the standard, e.g. different lubricating oil pan/lubricating oil dipstick variants and/or special inclined versions. The lubrication oil dipstick mark is always decisive

Technical data

Tools

Tool ordering

The special tools described in this chapter are available to order from your DEUTZ partner.

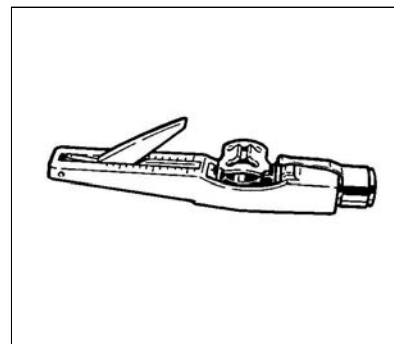


Hexalobular tool kit

Ordering number:

0189 9092

Tool kit for loosening and tightening hexalobular screws.

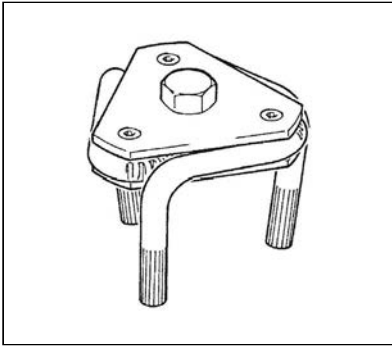


V-belt tension meter

Ordering number:

0189 9062

Measuring device for testing the specified v-belt tension.

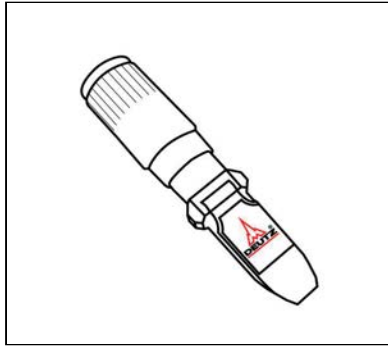


Special wrench for loosening exchangeable filters

Ordering number:

0189 9142

For loosening interchangeable filters.



Refractometer

Ordering number:

0293 7499

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

- Coolant
- Battery acid
- SCR reduction agent

DEUTZ Operating Fluids



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



DEUTZ Clean-Diesel InSyPro	
1 L	0101 7967
5 L	0101 7968



DEUTZ Cooling System Conditioner	
5 L	0101 7990
20 L	0101 7991
210 L	0101 7992



WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area
- If in an enclosed area, vent the exhaust to the outside
- Do not modify or tamper with the exhaust system
- Do not idle the engine except as necessary

For more information go to www.P65warnings.ca.gov/diesel

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Original operating instructions



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