



Workshop Service Manual TCD 4.1 L4 (Tier 4f)

FENDT 500 Vario S4

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- DEUTZ engines 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.
- Maintenance and care are the prerequisite for the engine satisfying the demands placed on it. Compliance with the specified maintenance times and careful execution of maintenance and care work are therefore absolutely necessary. In particular, attention must be paid to more difficult operating conditions that deviate from normal operation.
- Please contact one of our assigned service agents 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. Original replacement parts from DEUTZ AG are always manufactured in accordance with the state-of-the-art.
- Please read and take note of the information in this documentation. This will prevent accidents, preserve the manufacturer's guarantee and maintain a functional and operational engine.
- 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.
- Proper intended use also includes compliance with the operating, maintenance and servicing conditions 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.
- Ensure the documentation is available to the relevant persons during operation, maintenance and servicing and that the contents are understood.
- Failure to observe this documentation may lead to malfunctioning and engine damage, as well as injuries to persons, for which the manufacturer bears no liability.
- A prerequisite for proper maintenance and servicing is the availability of all required equipment, standard and special tools in the industry and that they are in proper working order.
- Engine parts such as springs, clamps, elastic fasteners, etc. can pose an increased hazard if not used properly.
- Compliance with the relevant accident prevention regulations and other generally recognized safety and occupational medicine rules is required.
- The highest level of economic efficiency, reliability and a long service life can only be ensured if DEUTZ original parts are used.
- The servicing of the engine must comply with the proper use. Only parts approved for the respective use may be used for retrofitting. Unauthorised modifications to the engine will exclude the manufacturer from all liability for resulting damage. The guarantee will be void in the event of non-compliance!
- The engines from DEUTZ were developed for a wide spectrum 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 and parts described in the documentation are installed in your engine.
- We made every effort to clearly highlight the differences so you can easily find the relevant operating, maintenance and repair instructions for your engine.

We will gladly consult with you if you have questions.

Your DEUTZ AG

General

The documentation of the workshop manual was created on the basis of the engine available on the editorial deadline.

Due to further developments, there may be deviations from descriptions, illustrations and components.

The valid documents published by DEUTZ AG (such as Service Info Technology, Technical Bulletin, Service Bulletins, Installation guidelines etc.) must be observed.

The prescribed tightening specifications as well as the test and setting data must be taken into consideration and adhered to.

The high safety and quality level of our engines is constantly guaranteed due to technical improvements and further developments. As a result, there may be deviations between the documentation and the current state of technological knowledge.

As a result of further developments, changes may be announced at short notice by means of bulletins (Service Info Technology, Technical Bulletin, Service Bulletin).

The maintenance work prescribed in the operating instructions and workshop manual must be carried out properly and completely. The maintenance staff must have the necessary expertise for carrying out the work. Any safety and protection devices which had to be dismantled during maintenance work must be reinstalled.

Caution!

Compliance with the accident prevention and safety regulations is required during servicing work.

The job cards in the workshop manual contain references to the regulations in Chapter , which must be followed prior to and during work on the engine.

The maintenance intervals and the maintenance work to be performed are specified in the maintenance plan in the operating manual. The job cards contain technical documentation of the execution of servicing work.

Regulations

Accident prevention and safety regulations

The statutory accident prevention regulations (available from professional associations or in specialist shops) must be followed. These depend on the location of use, operating mode and operating and auxiliary materials used.

Special protective measures that depend on the respective work are specified and marked in the work description.

In general, the following applies:

- to the personnel

- Only trained personnel may operate or maintain the engine. Access to the engine room by unauthorized persons is prohibited.
- Close-fitting clothing and hearing protection must be worn in the engine room when the engine is running.
- Only trained experts may perform repairs or service work.
- Do not carry out work on the fuel system when the engine is running. The fuel system is under high pressure — danger to life.
- If the fuel system leaks, immediately contact the workshop.
- to the engine room:
 - Sufficient ventilation and aeration must be ensured (do not cover air shafts).
 - Install first-aid kits and suitable fire extinguishers. Regularly check the fill level and operational readiness.
 - Only store flammable materials in the engine room if they are required for the operation of the system.
 - Smoking and open flames are prohibited in the engine room!
- to operation, maintenance and repair work on the engine:
 - The common rail systems used work with operating pressures up to approximately 2000 bar. In the event of faults the pressure can even rise temporarily to much higher values before the pressure limiting valve opens.
 - The ignition must be switched off.
 - Do not start the engine.
 - Depending on version of the common rail system, the electrical fuel supply pump is activated when the ignition is switched or during starting and supplies the fuel directly.
 - Wait at least 30 seconds after shutting off the engine before working on the fuel system.

Depending on the version of common rail system, the fuel pressure in the common rail system will still not have dissipated after 30 seconds. The fuel pressure can permanently be several 100 bar.

The fuel pressure here does not drop until the fuel system is opened and the fuel can escape to the outside.
 - Restart the engine when all of the safety equipment has been installed. Make sure no one is in the hazard zone.
 - Only perform cleaning, maintenance and repair work when the engine is shut off and secured against being restarted.

- Fuel lines, injection lines or fuel high-pressure lines must never be disconnected when the engine is running.
- Risk of injury!
The fuel jet can deeply penetrate the skin.
- Do not come close to the leak area in the fuel high-pressure system with any body parts (e.g. hand, head).
- Prior to performing tests on the engine, always perform a visual inspection of all high-pressure components. Wear suitable protective clothing (for example goggles, gloves) for this. Leaks indicate potential hazard sources for the workshop personnel.
- Even if no leaks can be discerned in the high-pressure fuel system, the workshop personnel should avoid the direct hazard zone or wear protective clothing (for example goggles, gloves) during tests when the engine is running and during the first test run.
- Always stay out of the range of a potential fuel jet which might result in severe injuries.
- Fuel lines, injection lines and high-pressure lines may not be deformed.
- Damaged fuel lines, injection lines and high-pressure lines must be replaced.
- Smoking is prohibited when working on the fuel system.
- Do not perform any work near sparks or flames.
- Never clamp off an injector while the engine is running.
- Loosen screw connections slowly and not abruptly.
- Open screw connections on the fuel system with extreme caution.
- Vent the fuel system after doing any work on it
– see chapter 6 “Fuel System” of the operating manual.

Cleanliness instructions and measures for working with common rail systems

The common rail systems used in DEUTZ engines comprise high-precision components subjected to extreme loads. In view of the high-precision technology, ensure utmost cleanliness when working on the fuel system.

References to be observed and measures to be taken prior to working on the fuel system

- The fuel system must be closed. Perform visual check for leaks / damage to the fuel system.
- Prior to starting the works on the fuel system, clean the entire engine and engine compartment with closed system.

- When starting the works on the fuel system, the engine must be dry.
- Blasting (drying) with compressed air is only admissible if the fuel system is closed.
- When using a steam blaster, the components (e.g. cable plugs, all other electrical plug connections, control unit, generator, starter, solenoid valves, transmitters, sensors etc.) must first be covered and must not be directly impacted with the steam blaster.
- Electrical plug connections must be plugged when blasting.
- Loose parts (for example paint chips during installation works) must be removed with an industrial vacuum cleaner or another suction system. Generally, during installation works at the open fuel system, only suction methods are permitted.
- Work at the fuel system only in a clean environment (no dust, no grinding or welding works). Avoid draught (dust). The workshop floor must be regularly cleaned. A brake or power test bench is not permitted in the same room and cannot be operated there.
- Air movements whirling up dust, for example caused by brake repairs or starting of engines, must be avoided.
- For works, for example dismantling and installation of defective hydraulic components on the Common Rail System, it is recommended to section a workshop area within the works; this means, this area must be separated from other areas (where general vehicle repairs are made, for example brake repairs).
- No general machine tools may be operated in this room.
- Regular cleaning of the workshop area is obligatory, draught, ventilation system and heating blower must be minimized.
- Cover areas of the engine compartment, from where dirt particles may come loose (for example, lower section of the tilted driver's cab), with new clean foil.
- Working means and tools must be cleaned before starting the works. Only use tools free from defects on the chromium layer or without chromium plating.

References to be observed and measures to be taken during the works on the fuel system or with open fuel system

- Perform works only in clean working clothes.
- For works at the fuel system, only lint-free cleaning cloths may be used.

- Loose parts (for example paint chips during installation works) must be removed with an industrial vacuum cleaner or another suction system. Generally, during installation works at the open fuel system, only suction methods are permitted.
- Working means and tools must be cleaned before starting the works. Only use tools free from defects on the chromium layer or without chromium plating.
- For cleaning, the use of cleaning or testing liquid is not permitted.
- If the fuel system is open, compressed air must not be used for cleaning.
- Works at dismantled components may only be performed at a suitably equipped working place.
- Upon dismantling and installing components, no materials may be used which can separate particles or fibres (cardboard, wood, cloths).
- If necessary, dismantled parts may be wiped with clean, lint-free cloths. No dirt particles may be wiped into the components.
- Openings at the components and the engine must immediately be closed with suitable locking plugs/caps.
- The locking plugs/caps shall only be removed prior to the installation.
- Store locking plugs/caps free from dust and protected against dirt in their original packing and dispose of them after having used them once.
- Withdraw new parts from their original packing shortly before their installation only.
- Dismantled components must be kept in new closable bags or – if available – in the packings of the new parts.
- For dispatching the dismantled components, always use the original packing of the new part.

Notes and measures for the vehicle /workshop area

- For works, for example dismantling and installation of defective hydraulic components on the Common Rail System, it is recommended to section a workshop area within the works; this means, this area must be separated from other areas (where general vehicle repairs are made, for example brake repairs).
- The workshop floor is sealed or tiled.
- No welding equipment, grinding machines, general machine tools, brakes and power test benches may be operated in this room.
- Regular cleaning of the workshop area is obligatory, draught, ventilation system and heating blower must be minimized.

References and measures for working place and tools in the vehicle hall

- For works at dismantled components, a special working place must be established.
- Regularly clean tools for dismantling and installation and keep them in a closed tool cabinet.
- Loose parts (for example paint chips during installation works) must be removed with an industrial vacuum cleaner or another suction system.
- Working means and tools must be cleaned before starting the works. Only use tools free from defects on the chromium layer or without chromium plating.

Additional information and measures for the handling of exhaust after-treatment systems

- In principle, compliance with all regulations and instructions up to and including Chapter is required, including when working on exhaust after-treatment systems!
- The utmost cleanliness is required for all work.

DPF (Diesel Particle Filter)

- The filter regeneration must be deactivated or, in systems with a filter regeneration prompt, not activated before performing service work.
- The duration of a complete filter regeneration cycle is, on average, 30 minutes. High exhaust temperatures in the exhaust system/on the exhaust pipe are generated regardless of the actual load on the engine (ergo, even when the engine is idling).
- No foreign substances may penetrate the exhaust line or combustion chamber. If this occurs, the engine must be "run clear" without a diesel particle filter.
- Tension and plastic deformations of the V-belt collar must be avoided. The DPF module may only be transported using the transport bushings.
- V-belt collars and seals may not be reused (this also applies as soon as the screw connection is loosened once).

Ignition system (engines with ignition system)

- Caution! Hazardous high voltage. The ignition system works with ignition voltages of up to 10,000 volts.
- The ignition system may not be operated without a secondary load.
- Dirt and moisture on the primary and high-voltage connections can result in malfunctions (leakage currents, ignition failures, high-voltage flashovers).
- Check the protective caps on the ignition lines for discolouration, deformation and cracks prior to every reuse.

SCR (Selective Catalytic Reduction)

- AdBlue® is used as a NOX reduction agent for SCR exhaust after-treatment.



AdBlue® is a highly pure, aqueous, 32.5% urea solution. The 32.5% urea solution is sold on the market under the brand name AdBlue® or DEF. AdBlue® is a registered trademark of the Verband der Automobilindustrie e.V (VDA - German Association of the Automotive Industry). The product is designated as AdBlue® or AUS 32 (AUS: Aqueous Urea Solution) and corresponds to the ISO 22241-1 NOx reduction agent AUS 32.

- The urea solution must only be filled in the tank provided for this. Accidentally filling the tank with another operating medium (e.g. diesel fuel) causes irreparable damage to the dosing system.
 - AdBlue® is a corrosive medium that causes severe corrosive damage when it comes into contact with electronic components or the like. The urea solution must never come into contact with copper or zinc, their alloys, or aluminium.
 - Leaks in the AdBlue® lines, the tank, the transport module and the metering unit must be immediately rectified in order to prevent AdBlue® from escaping.
 - Ensure sufficient ventilation.
 - Contact with skin should be avoided. If possible, latex gloves should be worn.
 - Wash hands thoroughly before taking breaks and at the end of shifts.
 - If the substance comes into contact with eyes, rinse thoroughly with water.
 - If swallowed, rinse out mouth with a lot of water, drink plenty of water and seek medical advice.
 - If discomfort or illness continues, seek medical advice.
 - Product can pose danger of slipping if spilled. It is essential to remove spilled liquid. In so doing, ensure that the liquid does not enter the sewage system or ground / surface water, i.e. the contamination should be physically removed and disposed of in suitable containers. Minimal amounts of remaining liquid may be rinsed away with a lot of water.
 - The urea solution must be disposed of properly in accordance with waste recycling and disposal regulations. The waste must be classified according to its origin in accordance with the European Waste List (EWL). Following this regulation, it is recommended to use waste code 06 10 99 (wastes from MFSU of nitrogen chemicals, nitrogen chemical processes and fertiliser manufacture, wastes not otherwise specified).
 - Packaging which has been contaminated with the urea solution and can no longer be used should initially be treated like the substance itself. After it has been emptied properly and cleaned thoroughly, it may be reused, as long as regulations are followed.
 - The so-called lag time is application-dependent and may be up to 2 minutes because the SCR pipes have to be pumped empty in this time.
- General information on the electrical system, electrical/electronic components/systems
- Do not touch live parts.
 - Pay attention to correct polarity of the connections.
 - When clamping off the battery, electronically stored data may be lost.
 - When clamping off the battery, always disconnect the negative pole first. Otherwise there is a risk of a short circuit!
 - When connecting, connect the plus pole first and then the minus pole. Otherwise there is a risk of a short circuit!
 - During electrical welding work, the earthing terminal of the welding device must be directly clamped to the part to be welded.
 - During electrical welding work, all plug connections must be disconnected from the control unit in order to protect the electronics.
 - Opening sensors, encoders, actuators and control units is prohibited. Doing so results in a loss of potential warranty claims.
 - Do not interrupt the connection between the battery, generator and controller while the engine is running.
 - When using a steam blaster, the components (e.g. cable plugs, all other electrical plug connections, control unit, generator, starter, solenoid valves, transmitters, sensors etc.) must first be covered and must not be directly impacted with the steam blaster.
 - Electrical plug connections must be plugged when blasting.
 - Store components in a dry, clean room.
 - The following are not permitted: Temporarily storing or stacking the components without the transport packaging.
 - Components may only be stored and transported in the specified packages.
 - Withdraw new parts from their original packing shortly before their installation only.
 - Incorrectly operated or damaged components or components that have fallen may not be installed.
 - Do not hit or otherwise use force against the components.
 - Incorrect earthing connections, cable and plug connections can result in malfunctions. Electronic components can be destroyed.



- Potentially installed pressure equalization instruments and the sealed area of the components (e. g. control units) may not be immersed in water. Flooding the components with water, in particular cleaning them using a high-pressure cleaner or the like is prohibited.
- The provided attachment points must be used for fastening. Stresses during assembly must be avoided.
- Drilling into or installing additional mounts on the control unit casing is prohibited.
- The specified tightening regulations for all components (e. g. encoders, sensors, etc.).
- Cable plugs may only be connected or disconnected when the power supply is shut off, if necessary, after an after-run period has passed.
- Cable plugs must be plugged in and out so the metal brackets and plastic tabs are not damaged.
- Rubber seals on cable plugs must always be pressed flush with the edges of the casing.

Disposal regulations

The work described in the operating manual and in the workshop manual make the replacement of parts and operating materials necessary. These replaced parts / operating materials must be stored, transported and disposed of in accordance with regulations. The operator is responsible for this.

Disposal includes recycling and the disposal of parts / operating materials, whereby recycling takes precedence.

Regional, national and international laws and directives regulate the details on the disposal and the monitoring thereof, the observation of which is the responsibility of the plant operator.

Operation manual and workshop manual

In order to structure the information layout in a user-friendly way, the service documentation is divided into operating instructions and job cards (workshop manual).

The operating manual contains a general description as well as instructions for necessary maintenance work among other things.

It includes the following chapters:

1. Table of contents, general information
2. Engine description
3. Operation
4. Operating media
5. Maintenance
6. Servicing and maintenance work
7. Faults, causes and remedies

8. Transport and storage, protecting the engine against corrosion

9. Technical data

The use of job cards (workshop manual) presupposes knowledge of the operating instructions content, this applying in particular for the service specifications. Repairs to the engine and components are described in the job cards (workshop manual), for the implementation of which more effort and correspondingly qualified experts are required.

Job cards

The job cards are differentiated into "W" and "I" job cards.

The "W" job card documents the standard repairs to the engine and/or its components. The necessary tools and special tools are also indicated in the "W" job card.

The "I" job card also documents corresponding workflows for repairing the engine and/or its components. Special prerequisites must be fulfilled by the workshops for implementation of these workflows. For example, special tools and machine tools must be available.

Numbering the job cards

The job card numbering uses the format W 08-03-01. The individual parts of this format are explained below:

- W 08-03-01: Documentation type
 - W Workshop manual
 - I Maintenance manual
- W 08-03-01: Module
 - in accordance with module overview
- W 08-03-01: Component grouping
- W 08-03-01: Consecutive number

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