DEUTZ®

Workshop Service Manual
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1 Foreword

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- Read and observe the information in this documentation. You will avoid accidents, retain the manufacturer's warranty and possess a fully functional and ready to operate engine.
- This engine is built exclusively for purpose according to the scope of delivery - defined by the equipment manufacturer (use for the intended purpose). Any use above and beyond this is considered improper use. The manufacturer will not be liable 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 repaired by persons who are familiar with this and are aware of the risks involved.
- Make sure that this documentation is available to everyone involved in the operation, maintenance and repair and that they have understood the contents.
- Failure to observe this documentation may lead to malfunctions and engine damage as well as injury to persons for which the manufacturer will not accept any liability.
- Prerequisite for proper maintenance and repair is the availability of all the necessary equipment, conventional and special tools and their perfect condition.
- Engine parts such as springs, clamps, elastic retaining rings etc. pose an increased risk of injury when handled incorrectly.
- The pertinent rules for the prevention of accidents and other generally recognised health and safety regulations must be observed.
- Maximum economy, reliability and long life is only guaranteed when using DEUTZ original parts.
- Repair of the engine must correspond to its use for the intended purpose. Only parts released by the manufacturer for the respective purpose may be used for conversion work. Unauthorised modifications to the engine exclude manufacturer liability for resulting damages. Failure to observe this will void the warranty!
- The engines made by DEUTZ are developed for a wide range of applications. A wide range of variants ensures that the respective special requirements are met.
- The engine is equipped according to the installation case, i.e. not all the parts and components described in this documentation are installed in your engine necessarily.
- We have done our best to highlight the differences so that you can easily find the operating, maintenance and repair instructions relevant to your engine.

We are at your service for any questions you may have in this matter.

Your DEUTZ AG

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2 General

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DEUTZ engines are the product of years of research and development. The profound expertise gained through this, in combination with high demands on quality, attests to the fact that our engines possess all the qualities of long life, high reliability and low fuel consumption. It goes without saying that the high environmental protection requirements are also met.

Maintenance and care are the only way the engine can satisfy the demands you make on it. Compliance with the prescribed maintenance times and the careful execution of maintenance and care work are therefore essential. Difficult operating conditions, deviating from normal operation, must be particularly heeded.

Please consult one of our service representatives responsible for operating faults and spare parts questions. Our trained specialist personnel ensures fast and professional repairs using original DEUTZ spare parts in the event of damage.
Original spare parts from DEUTZ AG are always manufactured according to the state of the art.

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3 Safety information / User information

3.1 General

The documentation of the workshop manual has been created based on the engine available at the time of going to press.
There may be deviations in the descriptions, illustrations and parts due to further developments.

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!

The rules for the prevention of accidents and the safety regulations must be observed during maintenance work.

Reference is made in the workshop manual job cards to the regulations in chapter 3.2. These must be read before working on the engine and must be strictly followed.

The maintenance intervals and the work to be performed are specified in the maintenance schedule of the operation manual. The job cards contain technical documentation on the execution of maintenance work.

3.2 Specifications

3.2.1 Accident prevention and safety regulations

The legally prescribed rules for the prevention of accidents must be observed. These are available from professional associations or from dealers. These are dependent on the application site, operating mode and the operating and auxiliary materials being used.

Special protection measures are specified depending on the work being carried out, and are identified in the job description.

Among other things it generally applies that:

- for the personnel:
  - Only briefed personnel may operate or maintain the engine. Unauthorised persons are prohibited access to the machine room.
  - Wear close-fitting clothing and ear protectors in the machine room when the engine is in operation.
  - Only deploy trained personnel to do repairs and maintenance work.
  - Do not work on the fuel system when the engine is running. The fuel system is under high pressure - danger of death.
  - Go to the workshop immediately in case of leaks in the fuel system.
- for the engine room:
  - Ensure adequate ventilation (do not cover air shafts).
  - Provide first aid kit and suitable fire extinguishers. Check the filling and readiness for operation regularly.
  - Only store inflammable materials in the machine room if they are essential for operation of the system.
  - Smoking and naked flames are prohibited in the machine room.
- for operation, maintenance and repairs on the engine:
  - The common rail systems used work with operating pressures up to approximately 2000 bar. In the case of potential faults, the pressure can even rise to significantly higher values before the pressure reducing valve opens.
  - Ignition must be switched off.
  - Do not start 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.

- After shutting down the engine, wait at least 30 seconds before performing work 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.
- Only start the engine when all the protective devices have been fitted. Make sure no-one is standing in the danger area.
- Cleaning, maintenance and repair work may only be performed with the engine at a standstill and secured against starting.
- Fuel lines, injection lines or fuel high-pressure lines must never be disconnected when the engine is running.
- Danger of injury !
  The fuel jet can deeply penetrate the skin.
- Do not come close to the leakage area in the fuel high-pressure system with any body parts (e.g. hand, head).
- Always carry out an exact visual inspection of all high-pressure carrying components before tests on the running engine. Wear suitable protective clothing (for example goggles, gloves) for this. Leakages entail potential hazard sources for the workshop personnel.
- Even if no leakages can be discerned in the fuel high-pressure 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 range of a fuel jet, as it could cause severe injury.
- Fuel lines, injection lines and high-pressure lines must not be deformed.
- Damaged fuel lines, injection lines and high-pressure lines must be replaced.
- Smoking is strictly prohibited when working on the fuel system.
- Do not work near to sparks and flames.
- Never disconnect an injector when the engine is running.
- Loosen screw connections slowly and not abruptly
- Open screw connections on the fuel system with extreme caution.
- After all work on the fuel system, it must be bleeded - see the operation manual, chapter "6 Fuel system".

3.2.2 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.

Notes and measures to be observed before starting work on the fuel system

- The fuel system must be closed. Make a visual inspection for leaks / damage to the fuel system.
- Clean the whole engine and engine room with the system closed before starting work on the fuel system.
- The engine must be dry when you start working on the fuel system.
- Blowing (dry) with compressed air is only permissible with the fuel system 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 spraying.
- Remove loose parts (for example paint chips from assembly work) with an industrial vacuum cleaner or other suction device. Only suction may be used in assembly work on the open fuel system.
- Only work on the fuel system in a clean environment (no dust, no grinding or welding). Avoid draughts (dust). Clean the workshop floor regularly. No brake or performance test benches may be kept or operated in the same room.
- Air currents which kick up dust, such as those caused by brake repairs or the starting of engines, should be avoided.
- For work such as removal and installation on defective hydraulic components on the Common Rail System it is recommended to partition off a separate workshop area in the factory. This must be separate from other areas in which general vehicle repairs such as brake repairs are carried out.
- No general machine tools may be operated in this room.
- Regular cleaning of the workshop area is mandatory. Draughts, ventilation systems and heating fans should be minimised.
- Areas of the engine room from which particles of dirt could be loosened (for example the bottom

part of the tipped driver cab) must be covered with fresh clean film.

- Working materials and tools must be cleaned before work. Only use tools without damage to the chrome plating or tools which are not chrome-plated.

Notes and measures to be observed during work on the fuel system or with the fuel system open.

- Only work in clean overalls.
- Only lint-free cleaning cloths may be used for work on the fuel system.
- Remove loose parts (for example paint chips from assembly work) with an industrial vacuum cleaner or other suction device. Only suction may be used in assembly work on the open fuel system.
- Working materials and tools must be cleaned before work. Only use tools without damage to the chrome plating or tools which are not chrome-plated.
- Do not use used cleaning fluid or test fluid for cleaning.
- Compressed air must not be used for cleaning on the open fuel system.
- Work on removed components may only be performed at a suitably equipped workbench.
- When removing and installing components, no materials which can leave behind particles or fibres (cardboard, wood, cloths) may be used.
- Removed parts may only be rubbed down with clean, lint-free cloths. No dirt particles may be rubbed into the components.
- Openings on the components and on the engine must be closed immediately with suitable stoppers/caps.
- The stoppers/caps may only be removed immediately before installing.
- Store stoppers/caps free from dust and dirt in the original packaging and dispose of after using once.
- Only remove new parts from the original packaging just before installation.
- Removed components must be kept in new, sealable bags or - if available - in the packaging of the new parts.
- Always use the original packaging of the new part to send back the removed components.

Notes and measures for the vehicle workshop area

- For work such as removal and installation on defective hydraulic components on the Common Rail System it is recommended to partition off a separate workshop area in the factory. This must be separate from other areas in which general vehicle repairs such as brake repairs are carried out.
- The workshop floor is sealed or tiled.
- No welding gear, grinders, general machine tools, brakes or performance test benches may be operated in this room.
- Regular cleaning of the workshop area is mandatory. Draughts, ventilation systems and heating fans should be minimised.

Notes and measures for workbench and tools in the vehicle hall

- A special workbench must be set up for work on removed components.
- Clean the removal and installation tools regularly and keep them in a closed tool cabinet.
- Remove loose parts (for example paint chips from assembly work) with an industrial vacuum cleaner or other suction device.
- Working materials and tools must be cleaned before work. Only use tools without damage to the chrome plating or tools which are not chrome-plated.

3.2.3 Additional information and measures for the handling of exhaust aftertreatment systems

- Basically all the same regulations and instructions up to and including chapter 3.2.2 must also be observed for work on exhaust aftertreatment systems!
- Utmost cleanliness must be observed 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 full filter regeneration is 30 minutes on average. High exhaust temperatures occur in the exhaust system/on the end exhaust pipe independently of the actual load state of the engine (i.e. also during engine idling).
- No foreign bodies may get into the exhaust line or the combustion chamber. If this happens, the engine must be "run free" without diesel particle filter.
- Tensions and deformations of the shape of the V-belt clip must be avoided. The DPF module may only be transported using the transport sleeves.
- V-belt clips and seals may not be reused (this also applies as soon as the screw connection has been loosened once).

Ignition system (engines with ignition system)

- Caution! Dangerous high voltage.
  The ignition system operates with ignition voltages up to 10000 Volts.
- The ignition system must not be operated without a secondary load.
- Dirt and moisture on the primary and high voltage connections can cause malfunctions (leakage current, misfiring, high voltage sparks).
- Check the protective caps of the ignition lines for discolouration, deformation and cracks before each usage.

SCR (Selective Catalytic Reduction)

- AdBlue® is a caustic medium which causes heavy corrosion damage when it comes into contact with electronic components or similar.
- Leaks on the AdBlue® pipes, the tank, the supply module and the feeding unit must be fixed immediately to avoid leakage of AdBlue®.
- Make sure the room is well ventilated.
- Contact with the skin should be avoided. Wear latex gloves if possible.
- 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. This means that 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 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.

3.2.4 General information on the electrical system, electrical/electronic components/systems

- Do not touch live parts.
- Ensure correct polarity of the connections.
- When disconnecting the battery, electronically stored data may be lost.
- When disconnecting the battery, always disconnect the minus pole first. Otherwise there is a danger of short circuiting!
- When connecting, connect the plus pole first and then the minus pole. Otherwise there is a danger of short circuiting!
- When carrying out electrical welding work, the earth terminal of the welding device must be connected directly to the part that is to be welded.
- For electrical welding parts, all plug connectors must be disconnected from the control unit to protect the electronics.
- Opening sensors, transmitters, actuators and control units is not permissible. Otherwise, any warranties will be invalidated.
- When the engine is running, do not interrupt the connection between the battery, generator and regulator.
- 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 spraying.
- Store the components in a dry and clean area.
- It is not permitted to: store the components temporarily or stack them without their transport packaging.
- Components may only be stored and transported in the specified packaging.
- Only remove new parts from the original packaging just before installation.
- Incorrectly operated or damaged components or parts that have been dropped must not be installed.
- Do not subject the components to any hard impacts or any other use of force.
- Faulty earthing, cable and plug connections can lead to malfunctions. Electronic components can be destroyed.
- A pressure balance element and the sealing area of the components (e.g. control units) must not be immersed in water. It is not permitted to soak the components with water, especially when cleaning using a high-pressure cleaner or similar.
- Use the fastening points provided for fastening. Tensions must be avoided during assembly.
- Drills or additional fastenings on the control unit housing are impermissible.
- The prescribed tightening specifications for all components (e.g. transmitters, sensors etc.) must be complied with.
- Cable plugs must only be removed or connected when the supply voltage is switched off, where possible at the end of the lag time.
- Cable plugs must be inserted and removed carefully so that metal lugs and plastic retainers are not damaged.

- Rubber seals in the cable plug must always be pressed down flat onto the housing edges.

3.2.5 Disposal regulations

The work described in the operation manual and workshop manual necessitates renewal of parts and operating materials among other things. The renewed parts / operating materials must be stored, transported and disposed of according to regulations. The owner himself is responsible for this.

Disposal includes recycling and the scrapping of parts / operating materials, although recycling has priority.

Details of disposal and their monitoring are governed by regional, national and international laws and directives which the system operator must observe on his own responsibility.

3.3 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 operation manual contains a general description and instructions for all other maintenance work.

It contains the following chapters:

1. Contents, General
2. Engine description
3. Operation
4. Operating media
5. Maintenance
6. Care 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.

3.4 Job cards

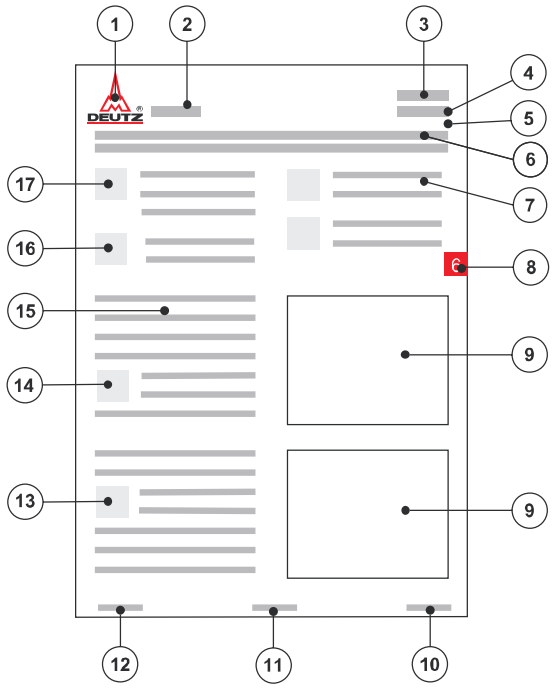
The job cards are differentiated into "W" and "I" job cards.
The "W" job card documents the standard repairs to the engine and/or its components. The necessary tools and special tools are also indicated in the "W" job card.
The "I" job card also documents corresponding workflows for repairing the engine 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.

3.4.1 Numbering of 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** ..... Repair manual
- W **08**-03-01: Module
  according to module list
- W 08-**03**-01: Component group
- W 08-03-**01**: Consecutive number

3.4.2 Structure of a job card



1. DEUTZ AG,
   publisher of service documentation
2. Not occupied
3. Assembly - Designation
4. Numbering of the job cards
5. DEUTZ internal creation number
6. Title of job card
7. References / Notes
8. Chapter
9. Graphic or photo
10. DEUTZ internal designation
11. Page number
12. Date of issue of job card
13. Note
14. Danger / Important
15. Parts list / Workflow
16. Auxiliary materials
17. Standard tools, special tools

3.5 Explanation of symbols

Danger!
of death or to health. Must be observed!
For example: The incorrect use or conversion of the turbocharger can lead to serious injury.

Caution!
Danger to the component/engine. Non-compliance can lead to destruction of the component/engine.
Must be observed!

Note
General notes on assembly, environmental protection etc. No potential danger for man or machine.

Tool
Conventional and special tools required for the work.

Auxiliary materials
Working materials required in addition to the tools for performing the work
(e.g. greases, oils, adhesives, sealants)

References
to important documents

Reference
within the workflow or to assemblies in which further documents or job cards are provided.

Test and setting data
The necessary values are indicated here with link to a table within the job card.

Tightening specifications
The necessary values are indicated here with link to a table within the job card.