



## **Workshop Manual**

# **TCD 2013 2V**

**0312 2904 en**

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**1 Foreword**



- 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



## 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.

### 3 User notes

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## 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 maintenance work described in the operation manual and in the workshop manual must be carried out on schedule and completely. The maintenance personnel must have the necessary technical knowledge to perform the work. Safety and protection devices which are removed during maintenance work must be replaced again afterwards.

**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:
  - Wait 30 seconds after switching off the engine before working on the fuel system.
  - After all work on the fuel system, it must be bled - see the operation manual, chapter "6.2 Fuel system".
  - 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.
  - Injection lines and high pressure pipes must not be deformed.

- Damaged injection lines and high-pressure pipes must be renewed.
- Injection lines and high pressure fuel lines must never be connected when the engine is running.
- Do not place hands near to a leak in the high pressure fuel system.
- Also carefully check all high pressure components visually before performing tests on the running engine. Wear suitable protective clothing (for example protective glasses). Leaks are a potential source of danger for workshop personnel.
- Even if no leaks are discernible on the high pressure fuel system, the workshop personnel should avoid the immediate danger zone or wear suitable protective clothing (such as protective glasses) when performing tests on the running engine and during the first trial run.
- Always stay out of range of a fuel jet, as it could cause severe injury.
- 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.

### 3.2.2 Cleanliness instructions and measures for handling the DEUTZ Common Rail System

The DEUTZ Common Rail system used in the DEUTZ engines consists of high-precision components which are exposed to extreme stress. Great attention must be paid to cleanliness when working on the fuel system due to the high precision technology.

#### 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 jet, first cover up the control unit, the cable plugs, all other electrical plug connections and the generator. Also, the steam jet may not be pointed directly at them.
- 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 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

To structure the information to suit the user, the service documentation is divided into operation manual and 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. Engine conservation
9. Technical data
10. Service

The workshop manual assumes knowledge of the contents of the operation manual. This applies especially for the safety regulations. The workshop manual describes repairs to the engine and components for which more effort and appropriately qualified technicians are required.

### 3.4 Job cards

The job cards are divided in the workshop manual into "W" and "I" job cards.

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

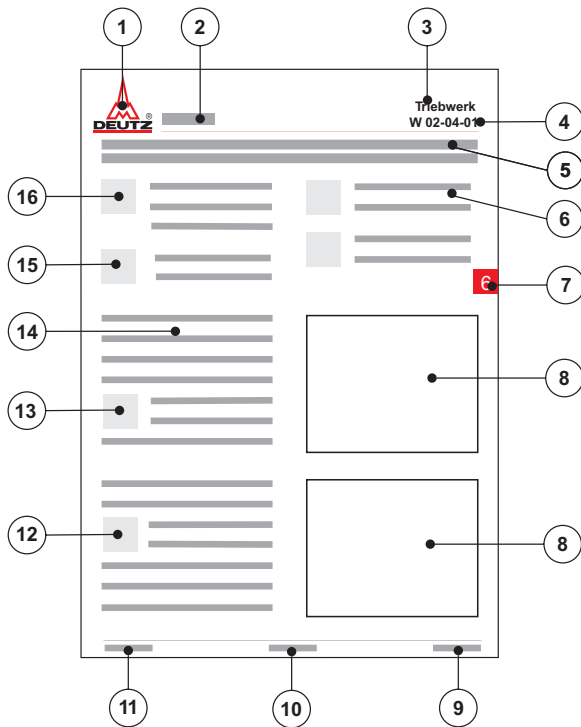
The "I" job card additionally documents the appropriate work procedures for repairing the engine and/or its components. The workshop must satisfy special conditions to perform these work procedures. Special tools and machine tools must be available, for example.

#### 3.4.1 Numbering of job cards

The job card numbers follow the pattern **W 02-04-01**. The individual parts of this pattern are explained below:

- **W 02-04-01**: Documentation type
  - **W**... Workshop manual
  - **I**..... Repair instructions
- **W 02-04-01**: Maintenance group
  - 00 ... General / interdisciplinary activities
  - 01 ... Cylinder head
  - **02** ... Drive system
  - 03 ... Crankcase
  - 04 ... Engine control system
  - 05 ... Speed governing
  - 06 ... Exhaust system / Charging
  - 07 ... Fuel system
  - 08 ... Lube oil system
  - 09 ... Cooling system
  - 10 ... Compressed air system
  - 11 ... Monitoring system
  - 12 ... Other components
  - 13 ... Electrical system
- **W 02-04-01**: Component grouping
- **W 02-04-01**: Consecutive number

3.4.2 Structure of a job card



1. DEUTZ AG, publisher of service documentation
2. Engine type (e.g. TCD 2013 4V)
3. Maintenance group
4. Job card number or topic
5. Title of job card
6. Reference to other job cards
7. Chapter
8. Graphic or photo
9. DEUTZ internal creation number and technical order number
10. Page number
11. Date of issue of job card
12. Note
13. Danger / Important
14. Work sequence
15. Special tools; auxiliary materials
16. Conventional 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 or job cards for the work process.  
For example: Job card W 04-05-05



**Reference**

to a document or a job card within the work process.



**Test and setting data**

The necessary values are specified here. If several values are necessary, a cross reference is given to the Test and Setting Values table.  
For example:  
ID no. P01 61 = valve clearance, inlet



**Tightening specification**

The necessary values are specified here. If several values are necessary, a cross reference is given to the Tightening Specifications table.  
For example:  
ID no. A01 001 = cylinder head screws

## **4 Technical data**

### **4.1 Testing and setting data**





ID no.	Designation	Information	Series	Value	Unit
General engine data					
P00 04	Engine weight according to DIN 70020-A	approx. without cooling system	TCD 2013	L4 2V 450 L6 2V 590	kg
P00 10	Working principle		TCD 2013	2V	Four-stroke with charging
P00 20	Combustion process		TCD 2013	2V	Direct injection
P00 30	Total volume		TCD 2013	L4 2V 4761 L6 2V 7142	cm <sup>3</sup>
P00 31	Bore		TCD 2013	2V	108 mm
P00 32	Stroke		TCD 2013	2V	130 mm
P00 40	Compression ratio		TCD 2013	2V	18
P00 50	Direction of rotation	looking onto the flywheel	TCD 2013	2V	counter-clockwise
P00 71	Ignition sequence		TCD 2013	L4 2V 1-3-4-2 L6 2V 1-5-3-6-2-4	-
Valve guide					
Valve					
P01 31	Valve stem diameter, inlet	Standard, fit h7	TCD 2013	2V	8,98 <sup>0</sup> <sub>-0,05</sub> mm
P01 32	Valve stem diameter, outlet	Standard, fit h7	TCD 2013	2V	8,96 <sup>0</sup> <sub>-0,05</sub> mm
P01 33	Valve stem clearance, inlet		TCD 2013	2V	0,045 - 0,075 mm
P01 34	Valve stem clearance, outlet		TCD 2013	2V	0,065 - 0,105 mm
P01 35	Valve edge thickness, inlet		TCD 2013	2V	2,62 mm
P01 36	Valve edge thickness, outlet		TCD 2013	2V	2,3 mm
P01 37	Valve head diameter, inlet		TCD 2013	2V	48 <sup>+0,1</sup> <sub>-0,1</sub> mm
P01 38	Valve head diameter, outlet		TCD 2013	2V	42 <sup>+0,1</sup> <sub>-0,1</sub> mm

ID no.	Designation	Information	Series	Value	Unit
Valve seat					
P01 45	Valve lag dimension, inlet		TCD 2013	2V 0,99 <sup>+0,1</sup> <sub>-0,1</sub>	mm
P01 46	Valve lag dimension, outlet		TCD 2013	2V 1 <sup>+0,15</sup> <sub>-0,1</sub>	mm
Valve spring					
P01 51	Valve spring length	untensioned, normal	TCD 2013	64,7	mm
	Valve spring wire diameter			2V	4,5
Valve clearance					
P01 61	Valve clearance, inlet (on cold engine)	Oil temperature < 80 °C, after a cooling time of at least 0.5 h	TCD 2013	2V 90	°
P01 62	Valve clearance, outlet (on cold engine)	Oil temperature < 80 °C, after a cooling time of at least 0.5 h	TCD 2013	2V 150	°
P01 63	Valve clearance setting	Valve overlap as per setting diagram, see: Table T01 63	TCD 2013	2V -	
P01 64	Clearance between control piston and rocker arm	Oil temperature < 80 °C, after a cooling time of at least 0.5 h	TCD 2013	2V 144	°C
Rocker arm/bracket					
P01 72	Rocker arm, bore, diameter, outlet		TCD 2013	2V 21,02 <sup>+0,033</sup> <sub>0</sub>	mm
P01 73	Rocker arm, bore, diameter, inlet		TCD 2013	2V 21,02 <sup>+0,033</sup> <sub>0</sub>	mm
P01 74	Rocker arm pin	Diameter, fit h7	TCD 2013	2V 21 <sup>0</sup> <sub>-0,021</sub>	mm
Main bearing pin					
P02 03	Main bearing pin	Standard, diameter	TCD 2013	2V 85,00 <sup>0</sup> <sub>-0,02</sub>	mm
P02 04	Crankshaft main bearing pin	Underdimension stage	TCD 2013	2V 0,25	mm
P02 05	Limit for undermeasure step		TCD 2013	2V 84,50 <sup>0</sup> <sub>-0,02</sub>	mm
P02 06	Pin roundness	Wear limit	TCD 2013	2V 0,01	mm
P02 07	Crankshaft main bearing pin and lifting journal, hardness	Standard HRC	TCD 2013	2V 53 <sup>±3</sup>	HRC



ID no.	Designation	Information	Series	Value	Unit
Fit bearing pin					
P02 11	Fit bearing pin, width		TCD 2013	2V 38 <sup>+0,06</sup>	mm
P02 12	Fit bearing pin, width	one overdimension stage	TCD 2013	2V 0,4	mm
P02 13	Limit for overmeasure step		TCD 2013	2V 38,46	mm
Lifting journal					
P02 22	Lifting journal, diameter		TCD 2013	2V 68,00 <sup>0</sup> <sub>-0,02</sub>	mm
P02 23	Lifting journal, diameter	Undermeasure per step	TCD 2013	2V 0,25	mm
P02 24	Limit for undermeasure step		TCD 20113	2V 67,50 <sup>0</sup> <sub>-0,02</sub>	mm
P02 25	Pin roundness	Wear limit	TCD 2013	2V 0,01	mm
P02 26	Radial run-out, crankshaft	maximum permissible deviation	L4	2V 0,07	mm
			L6	0,10	mm
Main bearing					
P02 34	Permissible axial clearance of crankshaft	in installed state	TCD 2013	2V 0,1 - 0,3	mm
P02 35	Stop ring, thickness	Standard (upper and lower half)	TCD 2013	2V 2,9 <sup>+0,05</sup> <sub>0</sub>	mm
P02 36	Stop ring, oversize	1. Stage = 0.2 mm	TCD 2013	2V 3,1 <sup>+0,05</sup> <sub>0</sub>	mm
Con-rod					
P02 43	Small end bush, inside diameter	installed, unmachined	TCD 2013	2V 42 <sup>+0,05</sup> <sub>-0,04</sub>	mm
P02 45	Piston bolt clearance between piston bolt and small end bush		TCD 2013	2V 0,034 - 0,056	mm
Big end bearing					
P02 52	Con rod bearing shells, inside diameter	installed	TCD 2013	2V 72,5 <sup>+0,02</sup> <sub>0</sub>	mm
P02 55	Big end bearing, bore in con rod	H6	TCD 2013	2V 72,5	mm
P02 56	Theoretical clearance between the big end bearing / lifting journal		TCD 2013	2V 0,036 - 0,095	mm