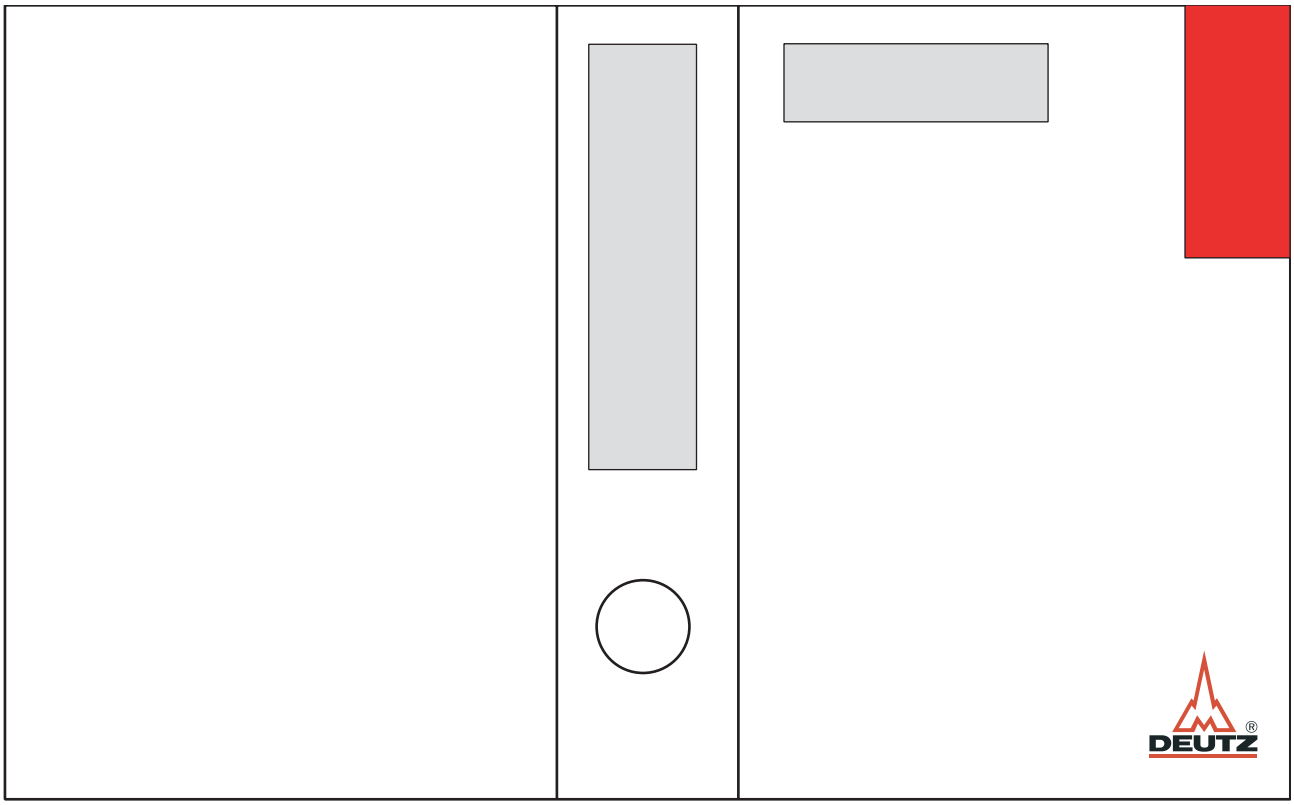

Operating Instructions

TBD 616 OEM

Operating Instructions

TBD 616 OEM

5 Maintenance

6 Troubleshooting

7 Conservation

8 Technical particulars

Designation of the engine sides, cylinder and direction of rotation

The four sides of the engine normally carry the following designations in practice (see Figure 2-3):

The designation used in this operating manual is highlighted respectively in **bold** print and corresponds with DIN ISO 1204.

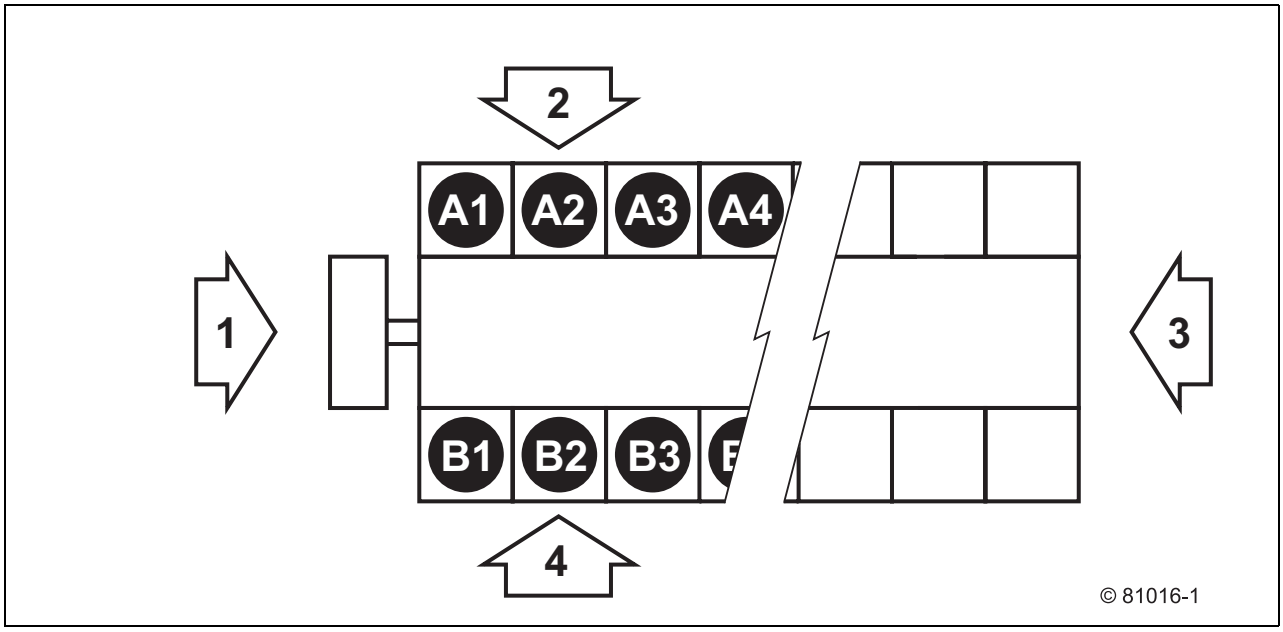

Figure 2-3 Designation of the engine sides and cylinders

Engine sides

1	**Drive side**	Flywheel, clutch side
2	**Left side**	Cylinder side **A**
3	**Free side**	End, damper, fluid pump, clutch opposite side
4	**Right side**	Cylinder side **B**

Cylinder numbering

... counted and labelled from the drive side.

Direction of rotation

Looking towards the drive side in anticlockwise direction ”left-hand rotation”

Mass compensation shaft (V8 engines only)

Because of the number of cylinders, a mass compensation shaft must run as well in order to be able to achieve low-vibration running of the engine. The mass compensation shaft is driven by a separate wheel drive on the drive side.

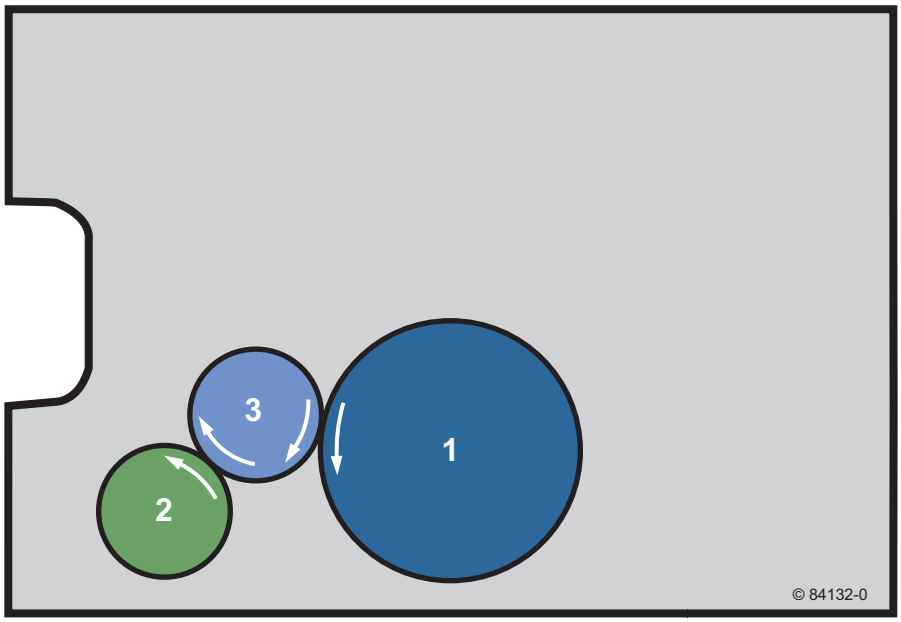

Figure 2-12 Wheel drive of the mass compensation shaft on the drive side

1 Crankshaft
2 Mass compensation shaft
3 Intermediate wheel

Fuel pipe system V12 engine

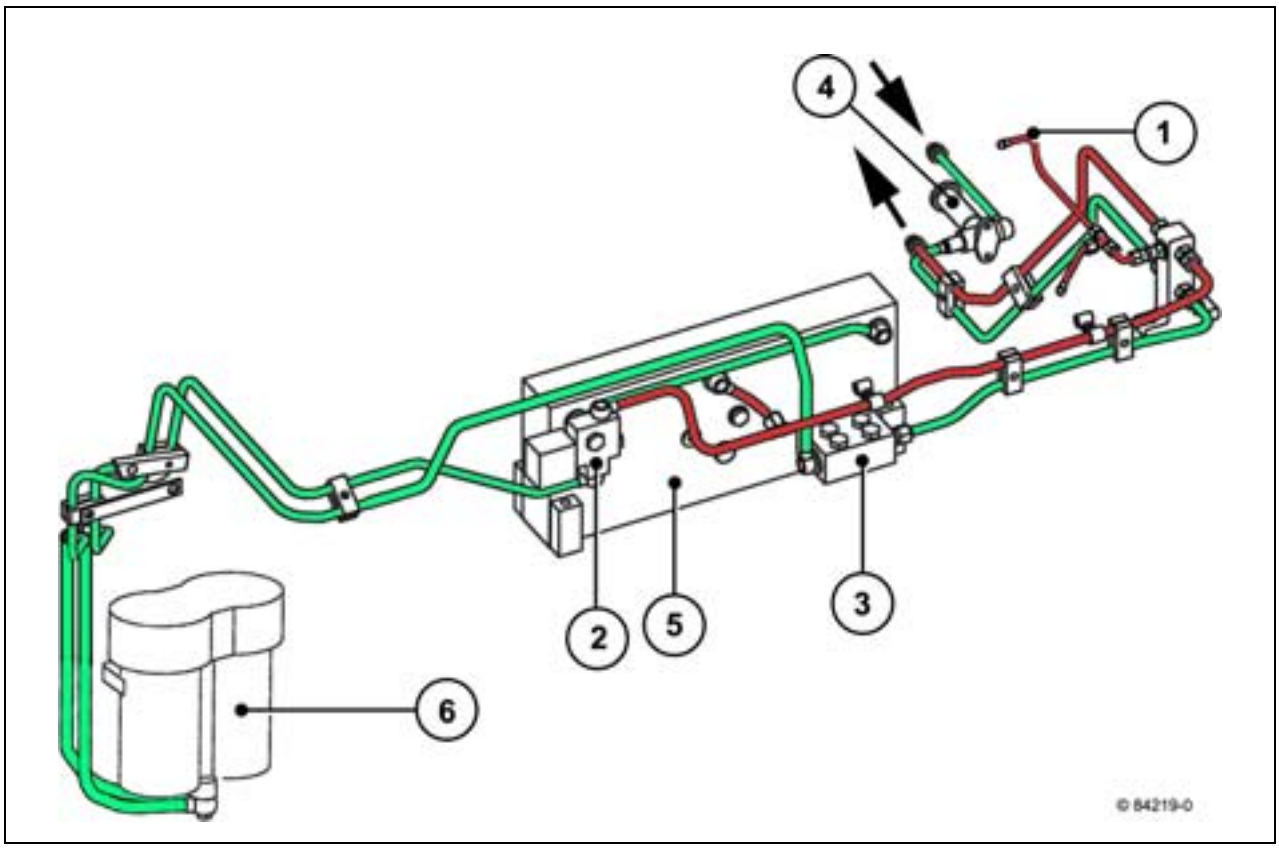

Figure 2-23 Fuel pipes V12 engine

1	Leak fuel pipe	4	Fuel hand pump
2	Solenoid valve engine shutdown	5	Series injection pump
3	Fuel pump	6	Fuel filter

Fuel pipe, supply to series injection pump

Fuel pipe, return from series injection pump

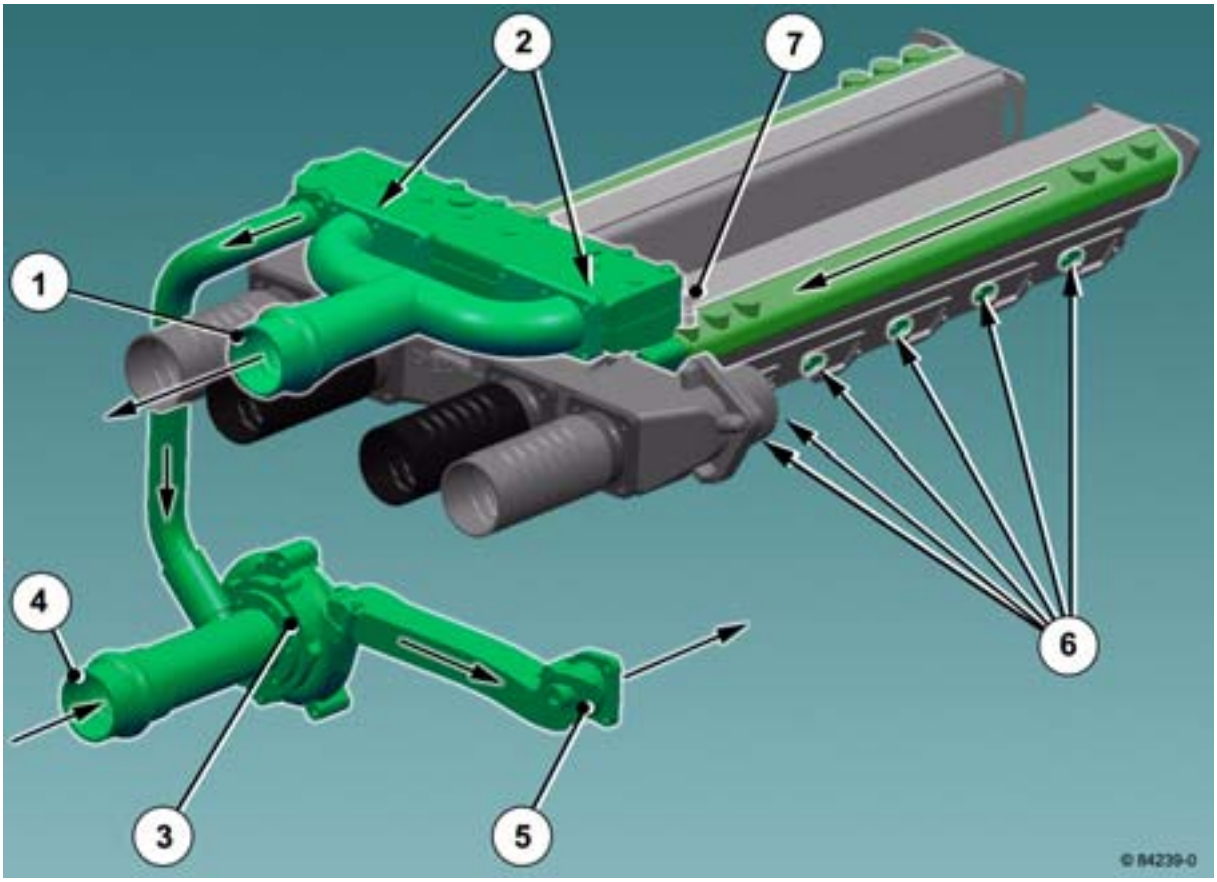

Figure 2-30 Cooling system (air/air)

1 Discharge of hot coolant to the cooler
2 Thermostat housing
3 Coolant pump and inlet of the coolant in cylinder side ”B”
4 Suction intake of cooled coolant to the engine
5 Inlet of coolant to cylinder side ”A”
6 Coolant overflow of cylinder heads
7 Temperature sensor

Coolant circuit for cooling the cylinders and cylinder heads

3 Operation

Work prior to commissioning

General

Work prior to commissioning applies both for commissioning new engines and for overhauled, serviced and maintained engines. Furthermore, the commissioning report must be observed.

The work and inspections described below are necessary for trouble-free operation and prevention of accidents. The perfect functioning of the drive mechanism and speed control is necessary above all for trouble-free operation.

- Clean the lines and tanks for fuel, coolant and lube oil before filling. All lines, screw fittings and connecting elements must be checked for a tight fit, perfect condition and leaks and repaired if necessary.
- Check the alignment of the engine and proper anchoring to the foundation.
- Clean the engine and remove objects which have been placed on the engine. Fit all protective coverings to the engine.

Loose objects (especially on moving parts such as flywheels) can lead to serious damage or accidents.

- Check the electrical wiring for perfect condition and laying, correct if necessary.
- Check the easy action of the control and shut-down mechanism as well as the function of monitoring, shut-down and remote control devices and repair if necessary.

Auxiliary materials

Sealants and securing agents

- Observe storage stability, if any, given on the package!
- Upon transport, storage and disposing of the above-mentioned items, observe Chapter 1, Regulations, of the operating manual, if no according information is given on the package.

Material designation	Type	Standards and specifications	Characteristics	Application examples
DEUTZ DW 43	Sealant		Solvent-free, caoutchouc-based flexibly hardening, rapid skin formation, temperature range 30°C to 100°C	Sealing of small joints
DEUTZ DW 47	Sealant	LV 0161 9672 FV 0160 9610	Silicon caoutchouc, viscously flexible, easily detachable, temperature range max. 180°C, oil max. 150°C	Sealing of rough and uneven surfaces
DEUTZ DW 48	Sealant	LV 0161 9572 FV 0160 9610	Silicon caoutchouc, viscously flexible, strong adhesion, temperature range –65°C to 265°C	Sealing of rough and uneven surfaces
DEUTZ DW 49	Sealant	LV 0161 9571 FV 0160 9607	Mixed polymeride of vinyl- and acryl compositions, strong adhesion permanently elastic, temperature range –40°C to 130°C	Sealing of core hole plugs
DEUTZ DW 50	Sealant		Liquid, hardening artificial resin, compatible with gaskets, temperature range –40°C to 180°C	Sealing of housings
DEUTZ DW 51	Sealant	LV 0161 9573	Physically dry artificial resin, permanently elastic and vibration-free, temperature range –30°C to 150°C	Sealing of surfaces
DEUTZ DW 55	Securing agent	FV 0160 9605	Anaerobic solvent-free single-component substance hardening upon metal contact when excluding oxygen, high strength, fluid, temperature range –55°C to 150°C	Securing and sealing of threads up to M12; joints up to max. gap width of 0.15 mm
DEUTZ DW 56	Securing agent	FV 0160 9605	Anaerobic solvent-free single-component substance hardening upon metal contact when excluding oxygen, high strength, thick-flowing, temperature range –55°C to 150°C	Securing and sealing of threads up to R2"
DEUTZ DW 57	Securing agent	FV 0160 9605	Anaerobic solvent-free single-component substance hardening upon metal contact when excluding oxygen, low strength, liquid, temperature range –55°C to 150°C	Securing and sealing of threads up to M12;
DEUTZ DW 59	Securing agent	FV 0160 9605	Anaerobic solvent-free single-component substance hardening upon metal contact when excluding oxygen, high strength, medium viscous, temperature range –55°C to 150°C	Securing and sealing of threads up to M20; joints up to max. gap width of max. 0.15 mm
DEUTZ DW 60	Securing agent	FV 0160 9605	Anaerobic solvent-free single-component substance hardening upon metal contact when excluding oxygen, medium strength, liquid, temperature range –55°C to 150°C	Securing and sealing of threads up to M56 or R2"
DEUTZ DW 61	Activator	FV 0160 9605	Accelerates and permits the complete hardening of anaerobic substances with passive materials	Only for passive materials

Definition of activities in the maintenance schedule

Adjust	Adjust torques, dimensions, pressures etc.; extra work may be necessary to renew parts.
Drain water	Drain condensed water, for example.
Renew	Renew parts, function groups and liquids.
Finishing work	Material removal within the permitted tolerances to reinstate a nominal condition.
Check	Check according to criteria in the work card. If not all criteria are fulfilled the cause must be found and the nominal condition reinstated.
Clean	Cleaning by hand or machine (automatic), renewal of cleaning parts (e.g. air filters) may be necessary.
Visual inspection	Visual inspection according to criteria in the job card. If not all criteria are fulfilled the cause must be found and the nominal condition reinstated.
Overhaul	Check function groups, rework or renew parts.
Maintain	Maintain according to job card. Check function, reworking or renewal of parts may be necessary.
Change	Change lube oil, for example.

Tab. 4 Definition of activities

Operating hour-dependent maintenance work

On reaching the operating hours specified in the following maintenance schedule the activities prescribed in the description must be performed. Always use the job card referred to in the maintenance schedule.

E10	E20	E23	E25	E30	E40	E50	E60	E70	Description	WC
1x after 50 Oh	every 24 hours (daily)	after every 250 Oh	after every 500 Oh	after every 1,500 Oh	after every 3,000 Oh	after every 6,000 Oh	after every 12,000 Oh	after every 24,000 Oh		
	x								Visual inspection of the system	B 0-1-5
		x	x	x	x	x	x	x	Maintain the battery	B 13-4-1
x		x	x	x	x	x	x	x	Maintain the centrifugal lube oil filter 6)	B 8-13-1
x		x	x	x	x	x	x	x	Lube oil change 1) 2) (engine without centrifugal lube oil filter)	B 8-1-2
x			x	x	x	x	x	x	Lube oil change 1) 2) (engine with centrifugal lube oil filter)	B 8-1-2
x			x	x	x	x	x	x	Renew lube oil filter cartridge	B 8-10-4
			x	x	x	x	x	x	Renew fuel filter cartridge	B 7-10-4
			x	x	x	x	x	x	Maintain the double fuel filter	B 7-10-1
			x	x	x	x	x	x	Check engine shutdown	B 11-0-1
			x	x	x	x	x		Maintain crankcase bleed valve, made by Racor 3)	B 3-1-9

1) Observe the operating media specifications in chapter 4, Operating Media .
2) Change annually if the operating hours are not reached.
3) The crankcase bleed valve must also be maintained when the maintenance indicator is ”RED”.
4) V16 engines only
5) V8 engines only
6) Clean annually if the operating hours are not reached.
MD: Manufacturer Documents

Table 4Note activity definition

Definition of activities in the maintenance schedule

Adjust	Adjust torques, dimensions, pressures etc.; extra work may be necessary to renew parts.
Drain water	Drain condensed water, for example.
Renew	Renew parts, function groups and liquids.
Finishing work	Material removal within the permitted tolerances to reinstate a nominal condition.
Check	Check according to criteria in the work card. If not all criteria are fulfilled the cause must be found and the nominal condition reinstated.
Clean	Cleaning by hand or machine (automatic), renewal of cleaning parts (e.g. air filters) may be necessary.
Visual inspection	Visual inspection according to criteria in the job card. If not all criteria are fulfilled the cause must be found and the nominal condition reinstated.
Overhaul	Check function groups, rework or renew parts.
Maintain	Maintain according to job card. Check function, reworking or renewal of parts may be necessary.
Change	Change lube oil, for example.

Tab. 9 Definition of activities

Operating hour-dependent maintenance work

On reaching the operating hours specified in the following maintenance schedule the activities prescribed in the description must be performed. Always use the job card referred to in the maintenance schedule.

E10	E20	E23	E25	E30	E40	E50	E60	E70	Description	WC
1x after 50 Oh	every 24 hours (daily)	after every 250 Oh	after every 500 Oh	after every 1,500 Oh	after every 3,000 Oh	after every 6,000 Oh	after every 9,000 Oh	after every 18,000 Oh		
	x								Visual inspection of the system	B 0-1-5
		x	x	x	x	x	x	x	Maintain the battery	B 13-4-1
x		x	x	x	x	x	x	x	Maintain the centrifugal lube oil filter [6]	B 8-13-1
x		x	x	x	x	x	x	x	Lube oil change [1] [2] (engine without centrifugal lube oil filter)	B 8-1-2
x			x	x	x	x	x	x	Lube oil change [1] [2] (engine with centrifugal lube oil filter)	B 8-1-2
x			x	x	x	x	x	x	Renew lube oil filter cartridge	B 8-10-4
			x	x	x	x	x	x	Renew fuel filter cartridge	B 7-10-4
			x	x	x	x	x	x	Maintain the double fuel filter	B 7-10-1
			x	x	x	x	x	x	Check engine shutdown	B 11-0-1
			x	x	x	x	x		Maintain crankcase bleed valve, made by Racor [3]	B 3-1-9

1) Observe the operating media specifications in chapter 4, Operating Media .
2) Change annually if the operating hours are not reached.
3) The crankcase bleed valve must also be maintained when the maintenance indicator is ”RED”.
4) V16 engines only
5) V8 engines only
6) Clean annually if the operating hours are not reached.
MD: Manufacturer Documents

Table 4Note activity definition

E10	E20	E23	E25	E30	E40	E60	E70	Description	WC
1x after 50 Oh	every 24 hours (daily)	after every 250 Oh	after every 500 Oh	after every 1,500 Oh	after every 3,000 Oh	after every 6,000 Oh	after every 12,000 Oh		
						x	x	Renew check valve in the leak fuel system	W 7-3-5
						x	x	Renew con-rod bearing	W 2-5-1
						x	x	Check con-rod geometry	W 2-3-5
						x	x	Overhaul injection pump	ME
						x	x	Overhaul dynamo	ME
							x	Check coolant chambers	W 9-0-3
							x	Renew rotary vibration dampers	W 12-1-4
							x	Renew rocker arms, valve bridges	W 1-2-2
							x	Check elastic suspension	ME
							x	Check elastic coupling	ME
							x	Renew main bearing	W 2-7-2
							x	Renew crankcase bleed valve	W 3-1-10
							x	Check crankshaft	W 2-1-7
							x	Renew camshaft and valve lifter	W 4-5-1
							x	Renew camshaft bearing	W 4-1-1
							x	Renew camshaft axial bearing	W 3-8-1
							x	Renew mass compensation shaft bearing [5)]	W 2-8-1
							x	Check stop rods	W 4-2-1
							x	Check intermediate gear wheels and bearing bush of the coolant pump	W 9-7-5
							x	Check lube oil pump	W 8-4-5
							x	Renew cooler cap	-
							x	Renew crankshaft sealing ring (drive side)	W 2-2-2
							x	Renew crankshaft sealing ring (free side)	W 2-2-4
							x	Overhaul starter	ME
							x	Check solenoid valve(s)	ME
							x	Electric sensors, solenoids	ME
								Other connected parts	ME

1) Observe the operating media specifications in chapter 4, Operating Media .
2) Change annually if the operating hours are not reached.
3) The crankcase bleed valve must also be maintained when the maintenance indicator is "RED".
4) V16 engines only
5) V8 engines only
6) Clean annually if the operating hours are not reached.
MD: Manufacturer Documents

Table 4Note activity definition

Overview of operating hour-dependent maintenance work (copy form)

hours	Deutz maintenance and service schedule								Date	Signature
	E10	E23	E25	E30	E40	E50	E60	E70		
50	**1**									
250		**1**								
500			**1**							
750		**2**								
1,000				**1**						
1,250		**3**								
1,500			**2**							
1,750		**4**								
2,000				**2**						
2,250		**5**								
2,500			**3**							
2,750		**6**								
3,000							**1**			
3,050	**2**									
3,250		**7**								
3,500			**4**							
3,750		**8**								
4,000				**3**						
4,250		**9**								
4,500			**5**							
4,750		**10**								
5,000				**4**						
5,250		**11**								
5,500			**6**							
5,750		**12**								
6,000								**1**		

Number of Deutz maintenance and service schedules up to and including complete overhaul								
Total	**2**	**12**	**6**	**4**	**-**	**-**	**1**	**1**

Tab. 21 Overview of operating hour-dependent maintenance work performance group C

6 Troubleshooting

Faults in engine operation which could occur as well as their possible causes are listed.

The causes of the faults are listed in ascending order of effort required to localise them.

The specified job cards contain troubleshooting instructions. Please note that the work described in the workshop manual assumes a higher level of qualification of personnel and appropriate training and knowledge. Please contact your DEUTZ Service if in doubt.

Fault table

Tightening specifications for maintenance work up to E40

Code no.	Screw connection	Type and dimension	Strength	Tightening value	Important notes
08/3	Valve hood on cylinder head	Cylinder head screw M8 x 85	12.9	20 + 5 Nm	Insert all cylinder screws with copper ring A8 x 14.
11/3	Valve clearance setting nuts of the bridge control	Hexagon nut M10 x 1		30 + 3 Nm	
15/3	Lube oil filter on lube oil filter head	Lube oil filter		25 + 2 Nm	Wet the sealing ring of the lube oil filter with lube oil. After the trial run, check the lube oil filter for leaks and tighten if necessary.
19/1	Nozzle holder on cylinder head	Cylinder head screw M8 x 60	10.9	1st step hand tight 2nd step 15 Nm 3rd step 20 Nm	Use new sealing rings. All round sealing rings must be coated with mounting compound part-no. 01016105. When installing, make sure that the sealing rings are not damaged. Pay attention to the correct thickness of the sealing disc. Tighten the fastening screws in three stages.
21/1	Injection lines to injection pump	Sleeve nut M14 x 1.5		20 + 5 Nm	
21/2	Injection lines to injection valve	Sleeve nut M14 x 1.5		20 + 5 Nm	
37/1	V-belt tension arm on the carrier	Cylinder head screw M14 x 65	10.9	110 + 10 Nm	Note when using a new screw or tension arm: all contact surfaces including the thread and the head rest of the clamping screw must be clean and wetted with lube oil. Caution: use of molybdenum disulfide is not permissible.
37/2	Clamping roller on tension arm	Cylinder head screw M14 x 85	8.8	60 + 10 Nm	The thread in the tension arm must be free from adhesive residue and grease. Use new grease-free screw. Stick in screw with DW 59 and poss. with accelerator 12151053 in mixing ratio 1:1.
37/3	Fan on fan flange	Cylinder head screw M10 x 30	10.9	45 Nm	Tighten carefully because the fan flange is made of aluminum. Make sure that the fan is level on the fan flange.
46/1	Engine claw to crankcase	Cylinder head screw M14 x 45 Cylinder head screw M14 x 100 Cylinder head screw M14 x 140	12.9 12.9 10.9	200 Nm 200 Nm 200 Nm	
46/2	Engine suspension to crankcase	Cylinder head screw M14 x 40	10.9	160 Nm	

Arranged by Job Card Numbers

- To refill lube oil open the cap (arrow) and fill in lube oil.

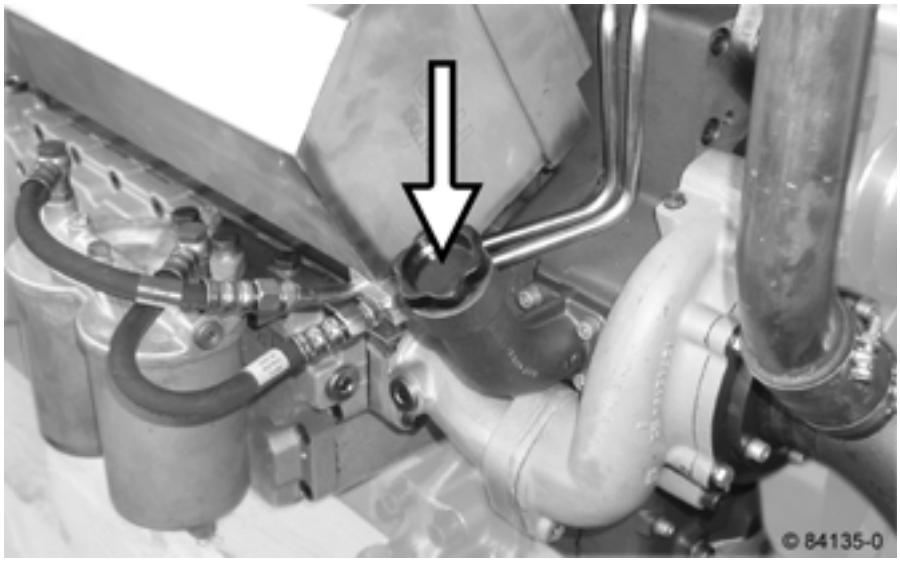

Figure 2 Lube oil filling nozzle (depending on the installation position of the engine, the lube oil filling nozzle is on the side with easier access)

- Check the gasket of the cap for damage and renew if necessary.
- Close the cap.
- Pull out the dipstick and check the lube oil level again.

Lube oil circuit

Check for leaks:

- hoses
- hose clips;
- pipe unions;
- flanges;
- compensators;
- and other components connected with the lube oil system.

If leaks are discovered during the inspection, these must be eliminated immediately.

- All other operating values of the lube oil system must be checked by the MKS in connection with the values in the acceptance test report or commissioning log.

Start system

- If the engine is equipped with a compressed air starter, the compressed air bottle must be drained of water and filled, see work card B 10-7-1, Draining water from and filling the air bottle (starter air tank).

Positions of the Figure 4:

1 Drive side

2 Start of 1st crankshaft rotation

3 Start of 2nd crankshaft rotation

Bring valves to overlap one after another according to the ignition order.

Start with cylinder A8.

Ignition dead point	A1 B3 A3 B7 A7 B5 A5 B8 A8 B6 A6 B2 A2 B4 A4 B1
Overlapping	A8 B6 A6 B2 A2 B4 A4 B1 A1 B3 A3 B7 A7 B5 A5 B8

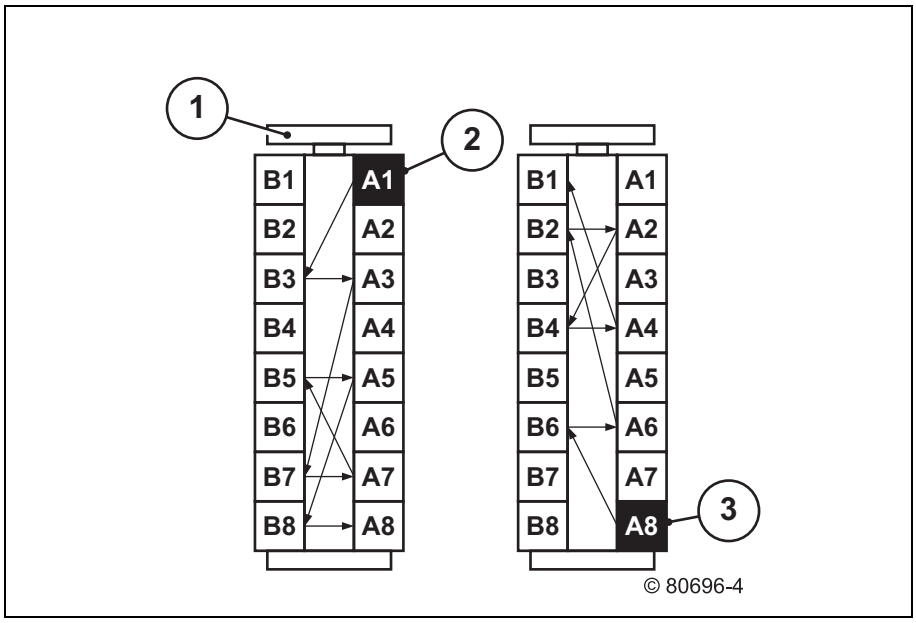

Figure 4 16 cylinder engine

- Remove fastening screws 5 and pull out the charge air pipe in the direction of the arrow.
- Remove the fastening screws 6 and remove the air filter housing carrier.

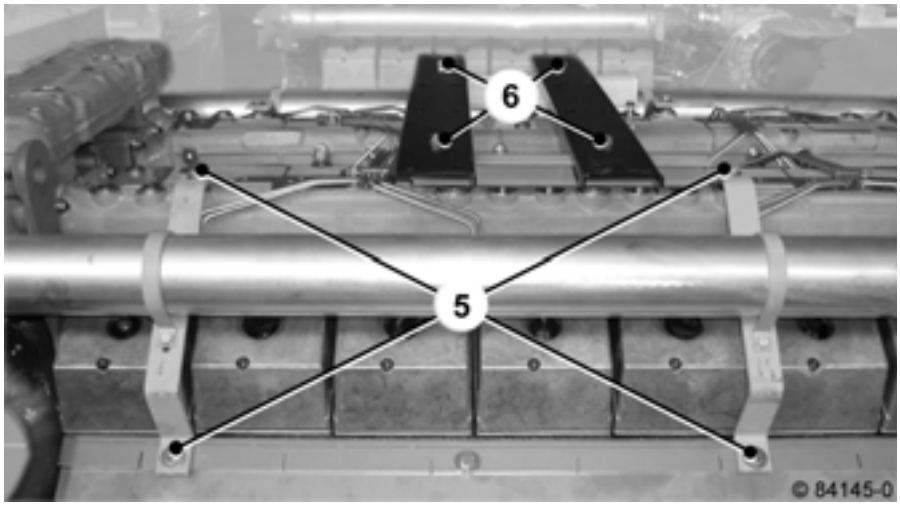

Figure 4 Holders charge air pipe

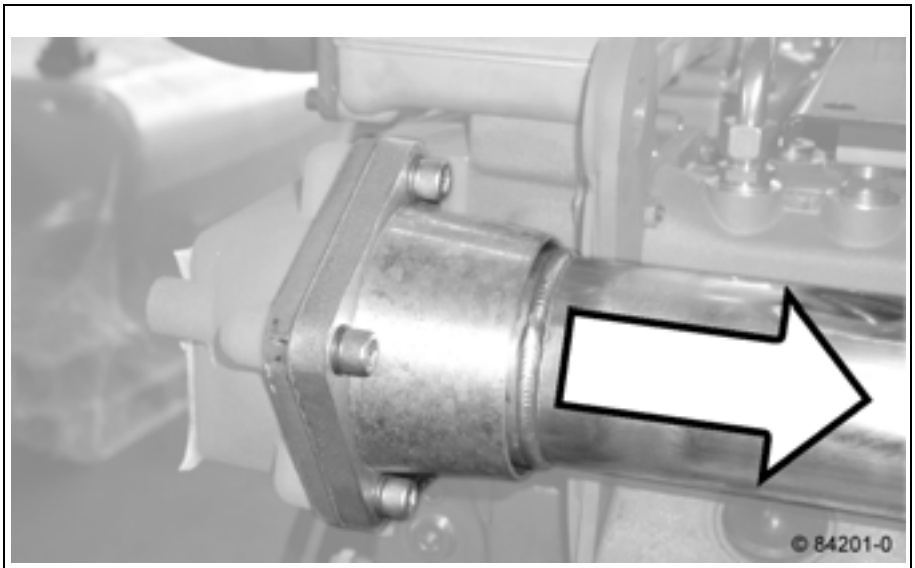

Figure 5 Charge air pipe plug-in system

- Clean the valve seat in the cylinder head.
- Check all the round sealing rings 3 and the round gasket on the injection valve for damage, renew if necessary.
- Coat all round sealing rings with DEUTZ S4 lubricant.

Figure 2 Round sealing rings

Install the injection valve

- Install the injection valve carefully in the sleeve. Do not damage round sealing ring.
- Renew the lower sealing ring.
- Install sleeve 1 with injection valve. Tighten fastening screws 2. Tightening torque:
  - 1st step hand tight
  - 2nd step 15 Nm
  - 3rd step 20 Nm

Pay attention to the toggle lever and valve bridges 6 so that the round sealing rings of the injection valve sleeve 1 are not damaged during installation.

Changing the lube oil

Tools
- Normal tools

Auxiliary material
- Container for waste oil

Spares
- lube oil
- Sealing rings

References
- B 8-10-4, Renew the lube oil filter cartridge
- Chapter 4, Expendables

Carry out this work only when the engine has been shut down.

When draining off hot lube oil:

Risk of scalding!

Collect the used oil,do not allow it to seep into the soil.

Dispose of in accordance with the relevant regulations.

Model with hinged screws

Dismantle the centrifugal lube oil filter

- Remove the housing cover 1 and remove rotor in the assembly, 2 to 8, from the housing.

Do not damage the bearing and bearing journal.

Do not use clamps on the bearing journal.

- Loosen the nut 2 and remove the rotor cap 3.
- Clamp the rotor carefully in a vice at floor height of the rotor bottom part 7.
- Remove the paper sleeve 4 with layer of dirt.

Clean the centrifugal lube oil filter

- Clean sieves 5, stand pipe 6 and nozzles 8 with compressed air or hard brush.

Assemble the centrifugal lube oil filter

- Insert new paper sleeve 4 in the bottom rotor part 7.
- Assembly the rotor.
- Insert the rotor and housing cover and tighten with the hinged screws.
- Check for leaks.

Checking corrosion protection agent or antifreeze in coolant

Tools

- Test case order no. 12158292

Cross references

- Chapter 4, Expendables

Corrosion protection agent is added to the coolant to protect the coolant areas from corrosion. However, this protection is only given when a certain minimum content of corrosion protection agent is not exceeded. If there is more corrosion protection agent than necessary in the coolant, the cooling effect is reduced.

If an antifreeze is added to the coolant, this should also have corrosion protection properties. A corrosion protection agent does not need to be added in this case. The antifreeze percentage must be dosed accordingly for the above mentioned reasons.

If the cooling system needs refilling, the percentage of antifreeze or corrosion protection agent in the coolant must be measured. Then the coolant should be corrected according to the following description.

Check the corrosion protection agent and antifreeze percentage

- Remove the coolant sample from the cooler, compensation tank or draining tap.
- Check the percentage additive with the measuring instrument.
- Setpoint according to Chapter 4, Expendables.

Percentage additive too low:

Correct the corrosion protection agent and antifreeze percentage

$$\text{quantity of additiv required additionally} = \frac{\text{total filling quantity} \times (\text{nominal value - measured value})}{100}$$

To refill, drain coolant, mix well with the amount of additive to be refilled and then pour in the mixture again.

Percentage additive too high:

Drain the amount of coolant and fill up with pure water (quality according to Chapter 4, Expendables).

$$\text{coolant to be drained} = \left(1 - \frac{\text{nominal value}}{\text{measured value}}\right) \times \text{total filling quantity}$$

- Bleed the cooling system.

Checking engine shutdown

Carry out this work only when the engine has been shut down.

To avoid damage in the lubricating or cooling system in the event of malfunctions for example, the engine is monitored by a control system. The solenoid valve interrupts the fuel flow to the injection pump as soon as it is triggered. Check the solenoid valve.

Check the solenoid valve

- Switch off the engine.
- Press the emergency stop switch.
- The solenoid valve 1 must be released when the emergency stop switch is pressed. A clicking must be audible.
- If the solenoid valve 1 has not released, the cause must be found and eliminated.

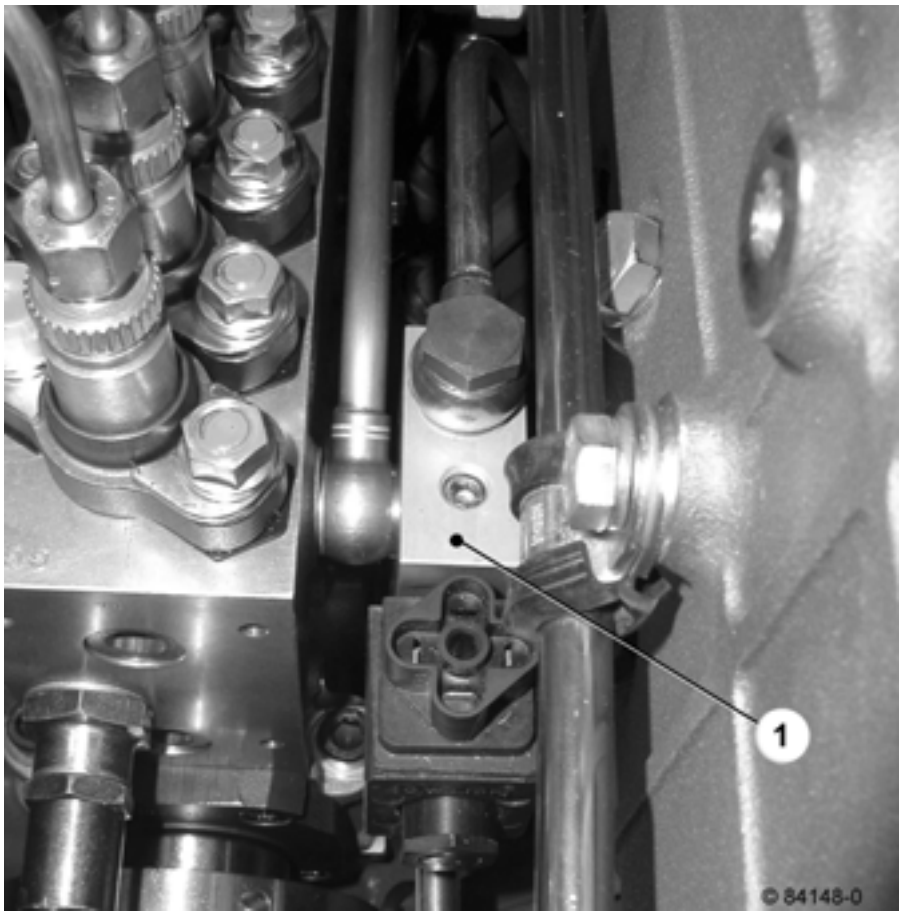

Figure 1 Solenoid valve

Fault group	Fault no. (in SERDIA)	Fault location / Fault description	Flashing code short 0.4 s	Flashing code long 0.8 s	Flashing code short 0.4 s	Cause	Remark	Remedy
Communication	70	CAN-bus controller	2	7	1	CAN controller for CAN bus supplies fault. Fault cannot be eliminated permanently despite re-initialization.	Application-dependent	Check CAN connection, check terminating resistor (see system description EMR2, chap. 12.4), check control device.
	71	CAN interface SAE J1939				Overflow in input buffer or a transmission cannot be placed on the bus.		
	74	Cable break, short-circuit or serious bus fault.						Check CAN connection, cable connection. Check and replace sensor if necessary.
Memory	76	Parameter programming (write EEPROM)	2	8	1	Error in parameter programming to the controller memory.	Emergency shut-off. Engine cannot be started.	Switch ignition off and back on. Check again. Inform DEUTZ Service in case of error.
	77	Cyclic program test				Continuous monitoring of the program memory reveals an error (so-called "flash test").		
	78	Cyclic RAM test				Continuous monitoring of the RAM reveals an error.		Note the values of the parameters (3895 and 3896). Switch ignition off and back on. Check again. Inform DEUTZ Service in case of error.
Hardware control device	80	Power supply (actuator)	2	9	1	Power supply for controller not in permissible range.	Fault message (disappears when current is back in normal range).	Switch ignition off and back on. Check again. Inform DEUTZ Service in case of error.
	83	Reference voltage 1	2	8	2	Reference voltage for controller not in permissible range.	Fault message (disappears when voltage is back in normal range). Substitute value 5 V	Check power supply. Switch ignition off and back on. Check again. Inform DEUTZ Service in case of error.
	84	Reference voltage 2						
	85	Reference voltage 4						
	86	Internal temperature	2	9	2	Internal temperature for control device not in the permissible range.	Fault message (disappears when temperature is back in normal range).	Switch ignition off and back on. Check again. Inform DEUTZ Service in case of error.
	87	Atmospheric pressure				Atmospheric pressure is not in the permissible range.	Fault message (disappears when pressure is back in normal range). Atmospheric pressure monitoring function deactivated.	

Renew the V-belt of the fan drive (V16 engine)

- Remove the V-belt of the three-phase current generator, see above.
- Remove the fastening screws of the fan 3 and remove the fan.

Place the fan on a soft base. The fan may never be placed on its blades.

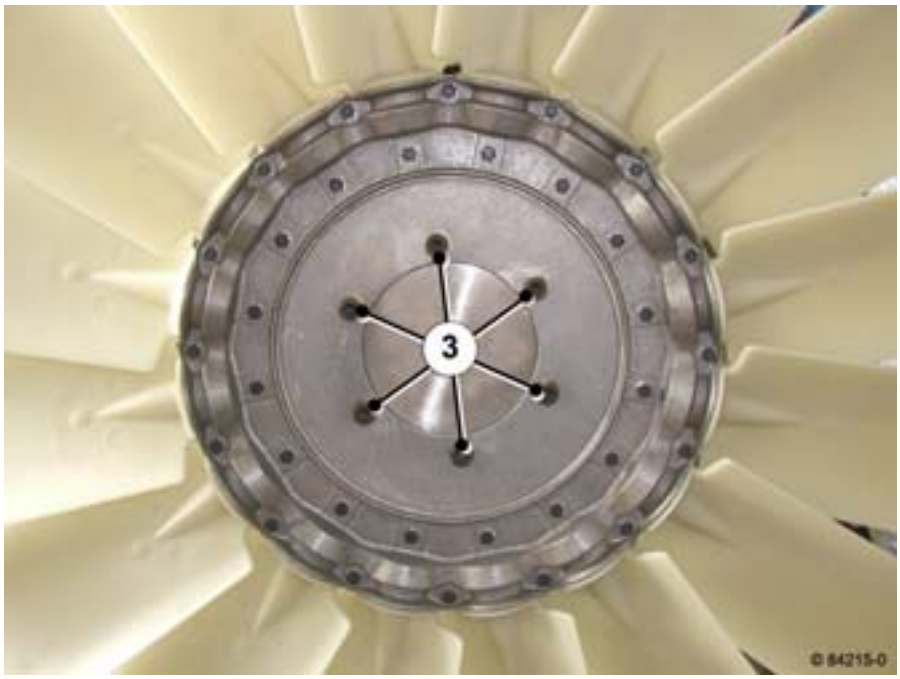

Figure 7 Fan

- Loosen the fastening screws 10 of the V-belt clamping device.

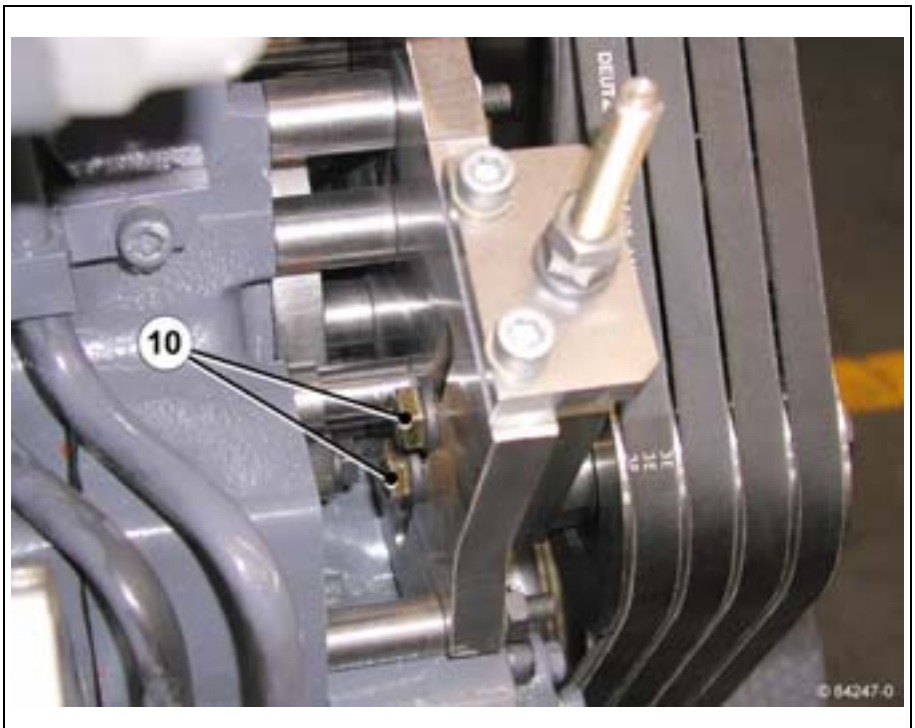

Figure 8 V-belt clamping device